Syllabus *(BENGALI)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BBNGMAJ01T**
Course Title: **বাংলা সাহিত্যের ইতিহাস (১০ম - ১৮শ শতাব্দী পর্যন্ত)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **বাংলা সাহিত্যের ইতিহাসের যুগবিভাগ, যুগবিভাগের তাৎপর্য ও গুরুত্ব সম্পর্কে অবহিত হওয়া এবং বিভিন**
Learning Outcome: **এরফলে প্রাচীন ও মধ্যযুগের বাংলা সাহিত্য বুঝতে ও বিশ্লেষণ করতে সুবিধা হবে।**

COURSE CONTENT:

১. যুগবিভাগ – কালসীমা ও নিদর্শন। যুগবিভাগের তাৎপর্য। প্রাচীন যুগ – চর্যাগীতি : আবিষ্কার, ধর্মীয়, সামাজিক ও সাহিত্যগত ঐতিহাসিক প্রেক্ষিত (Class hours- 05)

২. আদি-মধ্যযুগ । (Class hours- 20)

বিশেষ গুরুত্ব : তুর্কি আক্রমণের প্রভাব । শ্রীকৃষ্ণকীর্তন কাব্য।

মঙ্গলকাব্যের উদ্ভব, লক্ষণ ও বৈশিষ্ট্য । মনসামঙ্গল - বিজয় গুপ্ত ।

অনুবাদ সাহিত্য- ভাগবত, রামায়ণ ও মহাভারত।

পদাবলী সাহিত্য – বিদ্যাপতি ও চণ্ডীদাস।

৩. অন্ত্য-মধ্যযুগ । (Class hours- 25)

বিশেষ গুরুত্ব : শ্রীচৈতন্য ও বাংলা সাহিত্য ; চৈতন্যজীবনীকাব্য ;

বৈষ্ণব পদাবলি সাহিত্য – জ্ঞানদাস , গোবিন্দদাস, বৃন্দাবনের ষড়গোস্বামী।

অনুবাদ সাহিত্য- কাশীরাম দাস ও তাঁর মহাভারত।

মনসামঙ্গল কাব্য ও কবি (কেতকাদাস), চন্ডীমঙ্গল কাব্য ও কবি (মুকুন্দ চক্রবর্তী), ধর্মমঙ্গল কাব্য ও কবি (ঘনরাম চক্রবর্তী)

ভারতচন্দ্র ও তাঁর অন্নদামঙ্গল কাব্য।

সপ্তদশ শতাব্দীর মুসলমান কবি ও কাব্য।

৪. প্রাক-আধুনিক পর্ব (১৭৬০- ১৮০০) । (Class hours- 10)

বিশেষ গুরুত্ব : মহারাষ্ট্র পুরাণ, বাউল গান, গাথা ও গীতিকা সাহিত্য, কবিগান ও কবিওয়ালা, টপ্পা, পাঁচালী ।

Reference Books/ সহায়ক গ্রন্থ

১. বাঙ্গালা সাহিত্যের ইতিহাস – সুকুমার সেন
২. বাংলা সাহিত্যের সম্পূর্ণ ইতিবৃত্ত – অসিতকুমার বন্দ্যোপাধ্যায়
৩. বাংলা সাহিত্যের সমগ্র ইতিহাস- ক্ষেত্র গুপ্ত
৪. বাংলা সাহিত্যের ইতিকথা – ভূদেব চৌধূরী
৫. বাংলা সাহিত্যের রূপরেখা – গোপাল হালদা

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification

- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)
(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution
(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes
Disaster management: Floods, Earthquake, Cyclone and Landslides
Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non- communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(BENGALI)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BBNGMAJ02T**
Course Title: **মধ্যযুগের সাহিত্য**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **মধ্যযুগের বাংলা সাহিত্যের আখ্যানকাব্য, পদাবলি সাহিত্য ও মঙ্গলকাব্য পাঠের মধ্য দিয়ে বাঙালির সা**
Learning Outcome: **মধ্যযুগের বাংলা সাহিত্যের আখ্যানকাব্য, পদাবলি সাহিত্য ও মঙ্গলকাব্য পাঠের মধ্য দিয়ে বাঙালির সা**
MAJOR- 2 , CREDIT- 6

COURSE TITLE : মধ্যযুগের সাহিত্য

Course objectives and learning outcome:
মধ্যযুগের বাংলা সাহিত্যের আখ্যানকাব্য, পদাবলি সাহিত্য ও মঙ্গলকাব্য পাঠের মধ্য দিয়ে বাঙালির সামাজিক-সাংস্কৃতিক ঐতিহ্য সম্পর্কে অবহিত হওয়া।

COURSE CONTENT:
১. শ্রীকৃষ্ণকীর্তন কাব্য (বংশী খণ্ড ও রাধাবিরহ) (Class hours- 14)
২. বৈষ্ণব পদাবলি : (নির্বাচিত পদ- ৮টি) (Class hours- 16)

ক. আজু হাম কি পেখলুঁ নবদ্বীপ চন্দ।খ. নীরদ নয়নে নীর ঘন সিঞ্চনে। গ. আমার শপতি লাগে না ধাইও ধেনুর আগে।ঘ. ঘরের বাহিরে দণ্ডে শতবার।ঙ. মন্দির বাহির কঠিন কপাট। চ. কন্টক গাড়ি কমলসম পদতল। ছ. সুখের লাগিয়া এঘর বাঁধিনু। জ. এ সখি হামারি দুখের নাহি ওর। ঝ. তাতল সৈকত বারি বিন্দু সম ।

৩. চণ্ডীমঙ্গল (আখেটিক খণ্ড): মুকুন্দ চক্রবর্তী (Class hours- 18)

৪. শাক্ত পদাবলি : (নির্বাচিত পদ- ৭ টি) (Class hours- 12)

ক. আমার উমা সামান্য মেয়ে নয়। খ. গিরি, এবার আমার উমা এলে, আর উমা পাঠাব না। গ. আমি কি হেরিলাম নিশি-স্বপনে। ঘ.ওরে নবমী-নিশি, না হইও রে অবসান। ঙ. যেয়ো না রজনী আজি লয়ে তারাদলে। চ. মা আমায় ঘুরাবে কত। ছ. মন রে কৃষি কাজ জান না।

Reference Books/ সহায়ক গ্রন্থ

১. শ্রীকৃষ্ণকীর্তন- তারাপদ মুখোপাধ্যায়
২. শ্রীকৃষ্ণকীর্তন- সম্পা. অমিত্রসূদন ভট্টাচার্য
৩. শ্রীকৃষ্ণকীর্তন - সম্পা. অচিন্ত্য বিশ্বাস
৪. পদাবলী সাহিত্য- শ্রীকালিদাস রায়
৫. বৈষ্ণব সাহিত্য- ত্রিপুরাশঙ্কর সেনশাস্ত্রী
৬. মধ্যযুগের কবি ও কাব্য- শংকরীপ্রসাদ বসু
৭. বৈষ্ণব পদাবলী পরিচয় – নীলরতন সেন
৮. বাংলা মঙ্গলকাব্যের ইতিহাস – আশুতোষ ভট্টাচার্য
৯. চণ্ডীমঙ্গল - সম্পা. সুকুমার সেন
১০. কবিকঙ্কন মুকুন্দ বিরচিত চণ্ডীমঙ্গল- রবিরঞ্জন চট্টোপাধ্যায়, পরিমার্জন- তপতী মুখোপাধ্যায়
১১. কবিকঙ্কন মুকুন্দের অভয়ামঙ্গল - সম্পা. দেবনাথ বন্দ্যোপাধ্যায়
১২. শাক্ত পদাবলী – সম্পা. অমরেন্দ্রনাথ রায়
১৩. শাক্ত পদাবলী ও শক্তিসাধনা – জাহ্নবীকুমার চক্রবর্তী
১৪. ভারতের শক্তিসাধনা ও শাক্তসাহিত্য – ড. শশীভূষণ দাশগুপ্ত

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.
In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(BENGALI)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BBNGMAJ03T**
Course Title: **বাংলা সাহিত্যের ইতিহাস (উনিশ শতক ও বিশ শতকের প্রথমার্ধ)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **বাংলা সাহিত্যের আধুনিক যুগ সম্পর্কে সম্যক ধারণা লাভ। উনিশ শতক ও বিশ শতকের প্রথমার্ধের সামাজিক,**
Learning Outcome: **এরফলে এইসময় কালের বাংলা সাহিত্য বুঝতে ও বিশ্লেষণ করতে সুবিধা হবে।**

MAJOR- 3 , CREDIT- 6

COURSE TITLE : বাংলা সাহিত্যের ইতিহাস (উনিশ শতক ও বিশ শতকের প্রথমার্ধ)

Course objectives and learning outcome:

বাংলা সাহিত্যের আধুনিক যুগ সম্পর্কে সম্যক ধারণা লাভ। উনিশ শতক ও বিশ শতকের প্রথমার্ধের সামাজিক, রাজনৈতিক, সাংস্কৃতিক ও সাহিত্যিক আন্দোলনের প্রেক্ষিতে সাহিত্যের বিভিন্ন পর্যায়ের সাহিত্যিক ও সাহিত্য সম্পর্কে অবহিত হওয়া। এরফলে এইসময় কালের বাংলা সাহিত্য বুঝতে ও বিশ্লেষণ করতে সুবিধা হবে।

COURSE CONTENT:

১. উনিশ শতকের প্রথমার্ধ (Class hours- 07)

বাংলা গদ্যের বিকাশ- শ্রীরামপুর মিশন, ফোর্ট উইলিয়াম কলেজ, রামমোহন রায়।

সাময়িক পত্র – দিগদর্শন থেকে তত্ত্ববোধিনী।

ঈশ্বর গুপ্ত।

২. উনিশ শতকের দ্বিতীয়ার্ধ (Class hours- 25)

গদ্যভাষা ও সাহিত্য –বিদ্যাসাগর, অক্ষয়কুমার দত্ত, বঙ্কিমচন্দ্র চট্টোপাধ্যায়

আখ্যান কাব্য ও মহাকাব্যের ধারা - রঙ্গলাল বন্দ্যোপাধ্যায়, মধুসূদন দত্ত, হেমচন্দ্র বন্দ্যোপাধ্যায়, নবীনচন্দ্র সেন।

গীতিকাব্য- বিহারীলাল চক্রবর্তী, সুরেন্দ্রনাথ মজুমদার, অক্ষয়কুমার বড়াল, গোবিন্দচন্দ্র দাস, মানকুমারী বসু, কামিনী রায়, স্বর্ণকুমারী দেবী।

প্রহসন ও নাটক – বাংলা নাটকের উন্মেষ পর্ব, মধুসূদন দত্ত, দীনবন্ধু মিত্র, জ্যোতিরিন্দ্রনাথ ঠাকুর, গিরিশচন্দ্র ঘোষ

উপন্যাস – উদ্ভব ও বিকাশ, প্যারীচাঁদ মিত্র, ভূদেব মুখোপাধ্যায়, বঙ্কিমচন্দ্র চট্টোপাধ্যায়, রমেশচন্দ্র দত্ত।

সাময়িক পত্র – মাসিক পত্রিকা, বঙ্গদর্শন, ভারতী, হিতবাদী , সাহিত্য, সাধনা।

৩. রবীন্দ্র সাহিত্য (Class hours- 10)

কাব্য, ছোটগল্প, উপন্যাস, নাটক, প্রবন্ধ ।

৪. বিশ শতকের প্রথমার্ধ (Class hours- 18)

রবীন্দ্রসমসাময়িক কবি – যতীন্দ্রমোহন বাগচী, কুমুদরঞ্জন মল্লিক, কালিদাস রায়, সত্যেন্দ্রনাথ দত্ত, যতীন্দ্রনাথ সেনগুপ্ত
মোহিতলাল মজুমদার, কাজী নজরুল ইসলাম।

রবীন্দ্রোত্তর আধুনিক কবি – বুদ্ধদেব বসু, প্রেমেন্দ্র মিত্র, জীবনানন্দ দাশ, সুধীন্দ্রনাথ দত্ত, অমিয় চক্রবর্তী, বিষ্ণু দে, সমর সেন।

কথা সাহিত্য – শরৎচন্দ্র চট্টোপাধ্যায়, তারাশঙ্কর বন্দ্যোপাধ্যায়, মানিক বন্দ্যোপাধ্যায়, বিভূতিভূষণ বন্দ্যোপাধ্যায়।

নাটক – ক্ষীরোদপ্রসাদ বিদ্যাবিনোদ, দ্বিজেন্দ্রলাল রায়, মন্মথ রায়, বিজন ভট্টাচার্য।

সাময়িক পত্র – প্রবাসী, সবুজপত্র, ভারতবর্ষ, নারায়ণ, কল্লোল, শনিবারের চিঠি, প্রগতি, কালি-কলম, বিচিত্রা, পরিচয়, দেশ, কবিতা

Reference Books/ সহায়ক গ্রন্থ

১. বাঙ্গালা সাহিত্যের ইতিহাস – সুকুমার সেন

২. বাংলা সাহিত্যের সম্পূর্ণ ইতিবৃত্ত – অসিতকুমার বন্দ্যোপাধ্যায়

৩. বাংলা সাহিত্যের সমগ্র ইতিহাস- ক্ষেত্র গুপ্ত

৪. বাংলা সাহিত্যের ইতিকথা – ভূদেব চৌধূরী

৫. বাংলা সাহিত্যের রূপরেখা – গোপাল হালদার

৬. দুই শতকের বাংলা সংবাদ সাময়িক পত্র- স্বপন বসু, মুনতাসীর মামুন

৭. বাংলা সাহিত্যের ইতিবৃত্ত, আধুনিক যুগ – মুহম্মদ আবদুল হাই, সৈয়দ আলী আহসান

৮. বিশ শতক- অলোক রায়

৯. উনিশ শতকের বাঙালি জীবন ও সংস্কৃতি- সম্পা. স্বপন বসু ও ইন্দ্রজিৎ চৌধুরী

Syllabus *(BENGALI)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BBNGMAJ04T**
Course Title: **ভাষাতত্ত্ব**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **সাধারণ ভাষাবিজ্ঞান, বাংলা ভাষার উদ্ভব, বিবর্তন, বৈশিষ্ট্য ও বাংলা ভাষার স্বরূপ সম্পর্কে ধারণা ল**
Learning Outcome: **সাধারণ ভাষাবিজ্ঞান, বাংলা ভাষার উদ্ভব, বিবর্তন, বৈশিষ্ট্য ও বাংলা ভাষার স্বরূপ সম্পর্কে ধারণা ল**

MAJOR- 4 , CREDIT- 6

COURSE TITLE : ভাষাতত্ত্ব

Course objectives and learning outcome:

সাধারণ ভাষাবিজ্ঞান, বাংলা ভাষার উদ্ভব, বিবর্তন, বৈশিষ্ট্য ও বাংলা ভাষার স্বরূপ সম্পর্কে ধারণা লাভ।

COURSE CONTENT:

১. বাংলা ভাষার উদ্ভবের পটভূমিকা। (Class hours-18)

ক. প্রাচীন ভারতীয় আর্য, মধ্য ভারতীয় আর্য, নব্য ভারতীয় আর্য ভাষার সাধারণ বৈশিষ্ট্য।

খ. বাংলা ভাষার ইতিহাস। প্রাচীন , মধ্য ও আধুনিক বাংলা ভাষা।

গ. উপভাষা ও সমাজভাষা বিষয়ে সাধারণ ধারণা।

ঘ. বাংলা লিপির উদ্ভব ও বিকাশ।

২. বাগ্‌যন্ত্রের গঠন ও কার্যাবলি (Class hours-17)

বাংলা ধ্বনি – সংজ্ঞা , স্বরূপ ও শ্রেণিকরণ।

আন্তর্জাতিক ধ্বনিমূলক বর্ণমালা।

৩. বাংলা ধ্বনি পরিবর্তনের কারণ, ধারা, বিচার ও বিশ্লেষণ। (Class hours-10)

৪. শব্দার্থ তত্ত্ব – (Class hours-15)

ক.শব্দার্থ পরিবর্তনের কারণ ও ধারা ।
খ. শব্দের অর্থগত শ্রেণি বিভাগ- যৌগিক , রূঢ় ও যোগরূঢ়।
শব্দভাণ্ডার-
ক. শব্দের ব্যুৎপত্তিগত শ্রেণি বিভাগ- প্রত্যয় ও অনুষঙ্গ নিষ্পন্ন।
খ. শব্দের উৎসগত শ্রেণি বিভাগ ।

Reference Books/ সহায়ক গ্রন্থ

১. ভাষার ইতিবৃত্ত – সুকুমার সেন
২. সাধারণ ভাষাবিজ্ঞান ও বাংলাভাষা – রামেশ্বর শ
৩. বাংলা ভাষা পরিক্রমা- পরেশচন্দ্র মজুমদার
৪. ভাষাবিদ্যা পরিচয়- পরেশচন্দ্র ভট্টাচার্য
৫. ভাষা প্রকাশ বাঙ্গালা ব্যাকরণ – সুনীতিকুমার চট্টোপাধ্যায়
৬. বাঙ্গালা ভাষাতত্ত্বের ভূমিকা - সুনীতিকুমার চট্টোপাধ্যায়
৭. ভাষা জিজ্ঞাসা – পবিত্র সরকার
৮. ভাষা ও সমাজ – মৃণাল নাথ

Syllabus *(BENGALI)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BBNGMAJ05T**
Course Title: **ছন্দ ও অলংকার**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **বাংলা ছন্দশাস্ত্র ও বাংলা ছন্দের বিভিন্ন রূপ ও বিবর্তন সম্পর্কে ধারণা লাভ। সাহিত্যে অলংকারের গ**
Learning Outcome: **ছন্দ ও অলংকার নির্ণয় ও প্রয়োগে দক্ষতা অর্জন।**

MAJOR-5 , CREDIT- 6

COURSE TITLE : ছন্দ ও অলংকার

Course objectives and learning outcome:

বাংলা ছন্দশাস্ত্র ও বাংলা ছন্দের বিভিন্ন রূপ ও বিবর্তন সম্পর্কে ধারণা লাভ।
সাহিত্যে অলংকারের গুরুত্ব ও বাংলা অলংকার সম্পর্কে ধারণা লাভ।
ছন্দ ও অলংকার নির্ণয় ও প্রয়োগে দক্ষতা অর্জন।

COURSE CONTENT:

১. ছন্দ – (Class hours-30)

- সংজ্ঞা , স্বরূপ ও বিভিন্ন পরিভাষা ।
- বাংলা ছন্দের রীতি – নাম বৈচিত্র্য, বৈশিষ্ট্য ও রূপ বৈচিত্র্য
- বাংলা ছন্দ চর্চার ইতিহাস। (সংক্ষিপ্ত পরিচয়- রবীন্দ্রনাথ ঠাকুর, সত্যেন্দ্রনাথ দত্ত, মোহিতলাল মজুমদার, প্রবোধচন্দ্র সেন ও অমূল্যধন মুখোপাধ্যায়)
- ছন্দ নির্ণয় ।

২. অলংকার – (Class hours-30)

- শব্দালংকার – অনুপ্রাস, যমক, শ্লেষ, বক্রোক্তি ।
- অর্থালংকার – উপমা, রূপক, উৎপ্রেক্ষা, সন্দেহ, অপহ্নুতি, নিশ্চয়, ভ্রান্তিমান, সমাসোক্তি, ব্যতিরেক, বিরোধাভাস, বিভাবনা, বিশেষোক্তি, বিষম, ব্যাজস্তুতি।
- অলংকার নির্ণয় ।

Reference Books/ সহায়ক গ্রন্থ

১.বাংলা ছন্দ পরিক্রমা- প্রবোধচন্দ্র সেন
২. বাংলা ছন্দের মূলসূত্র – অমূল্যধন মুখোপাধ্যায়
৩. ছন্দতত্ত্ব ছন্দরূপ – পবিত্র সরকার
৪. আধুনিক বাংলা ছন্দ – নীলরতন সেন
৫. ছন্দ মীমাংসা ও অলংকার জিজ্ঞাসা – পরেশচন্দ্র ভট্টাচার্য
৬. অলংকার চন্দ্রিকা- শ্যামাপদ চক্রবর্তী

Syllabus *(BENGALI)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BBNGMAJ06T**
Course Title: **উনিশ শতকের সাহিত্য**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **উনিশ শতকের বাংলা সাহিত্য পাঠ। উনিশ শতকের গীতি কবিতার স্বরূপ ও প্রকৃতি, পত্রকাব্য, আখ্যানকাব্য ও**

Learning Outcome: **উনিশ শতকের বাংলা সাহিত্য পাঠ। উনিশ শতকের গীতি কবিতার স্বরূপ ও প্রকৃতি, পত্রকাব্য, আখ্যানকাব্য ও**

MAJOR-6 , CREDIT- 6

COURSE TITLE : উনিশ শতকের সাহিত্য

Course objectives and learning outcome:

উনিশ শতকের বাংলা সাহিত্য পাঠ। উনিশ শতকের গীতি কবিতার স্বরূপ ও প্রকৃতি, পত্রকাব্য, আখ্যানকাব্য ও নক্সা সাহিত্য সম্পর্কে ধারণা লাভ। উনিশ শতকে বাংলায় পাশ্চাত্য শিক্ষার বিস্তার, নবজাগরণ, জাতীয়তাবাদ, সামাজিক ও সাংস্কৃতিক প্রেক্ষিতের সঙ্গে বাংলা সাহিত্যের যোগ সম্পর্কে ধারণা লাভ।

COURSE CONTENT:

১. উনিশ শতকের নির্বাচিত কবিতা- (Class hours-20)

- সুরবালা- বিহারীলাল চক্রবর্তী
- বঙ্কিম বিদায়- গোবিন্দচন্দ্র দাস
- বেলাশেষে- মানকুমারী বসু
- মানব বন্দনা- অক্ষয়কুমার বড়াল
- নির্ঝরের স্বপ্নভঙ্গ – রবীন্দ্রনাথ ঠাকুর
- মেঘদূত - রবীন্দ্রনাথ ঠাকুর
- নিরুদ্দেশ যাত্রা - রবীন্দ্রনাথ ঠাকুর

২. বীরাঙ্গনা – মধুসূদন দত্ত (নির্বাচিত ৫টি পত্র) (Class hours-15)
শকুন্তলা, তারা, শূর্পনখা, কেকয়ী, জনা পত্রিকা
৩. হুতোম প্যাঁচার নকসা- (নির্বাচিত অংশ) - কালীপ্রসন্ন সিংহ
কলিকাতার বারোইয়ারি-পূজা, মিউটীনি, মরা-ফেরা, রমাপ্রসাদ রায়, দুর্গোৎসব (Class hours-15)
৪. পদ্মিনী উপাখ্যান –(নির্বাচিত অংশ) - রঙ্গলাল বন্দ্যোপাধ্যায়
(সৈন্য-সেনাপতি ও অন্যান্য ক্ষত্রিয় রাজাদের যুদ্ধে উৎসাহ দেবার জন্য ভীমসিংহের আহ্বান পর্যন্ত) (Class hours-20)

Reference Books/ সহায়ক গ্রন্থ

১. উনিশ শতকের গীতিকবিতা - অরুণকুমার মুখোপাধ্যায়
২. রবীন্দ্রকাব্য প্রবাহ – প্রমথনাথ বিশী
৩. রবীন্দ্র কাব্য পরিক্রমা- উপেন্দ্রনাথ ভট্টাচার্য
৪. কবি রবীন্দ্রনাথ – বুদ্ধদেব বসু
৫. রবীন্দ্র প্রতিভার পরিচয় – ক্ষুদিরাম দাস
৬. মধুসূদনের কবি আত্মা ও কাব্য শিল্প – ক্ষেত্র গুপ্ত
৭. কবি শ্রীমধুসূদন- মোহিতলাল মজুমদার
৮. উনিশ শতকের বাঙালী জীবন ও সংস্কৃতি- সম্পা. স্বপন বসু ও ইন্দ্রজিৎ মিত্র
৯. উনিশ শতক- অলোক রায়
১০. বাংলা সাহিত্যের নানারূপ – শুদ্ধসত্ত্ব বসু
১১. বাংলা সাহিত্যে সামাজিক নক্সা : পটভূমি ও প্রতিষ্ঠা – ড. আবুল কাশেম চৌধুরী
১২. বাঙ্গালা সাহিত্যের ইতিহাস (৩য় খণ্ড)– সুকুমার সেন
১৩. বাংলা সাহিত্যের সম্পূর্ণ ইতিবৃত্ত (৬ষ্ঠ-৯ম খণ্ড) – অসিতকুমার বন্দ্যোপাধ্যায়
১৪. বাংলা সাহিত্যের ইতিকথা (২য় পর্যায়)– ভূদেব চৌধুরী

Syllabus *(BENGALI)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BBNGMAJ07T**
Course Title: **বাংলা নাটক ও প্রহসন**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **নাটকের বিভিন্ন সংরূপ ও তত্ত্ব সম্পর্কে ধারণা লাভ। বাংলা সাহিত্যের বিভিন্ন শ্রেণির নাটক সম্পর্**
Learning Outcome: **নাটকের বিভিন্ন সংরূপ ও তত্ত্ব সম্পর্কে ধারণা লাভ। বাংলা সাহিত্যের বিভিন্ন শ্রেণির নাটক সম্পর্**

MAJOR-7 , CREDIT- 6

COURSE TITLE : বাংলা নাটক ও প্রহসন

Course objectives and learning outcome:

নাটকের বিভিন্ন সংরূপ ও তত্ত্ব সম্পর্কে ধারণা লাভ।
বাংলা সাহিত্যের বিভিন্ন শ্রেণির নাটক সম্পর্কে ধারণা লাভ।
নাট্য সাহিত্য পাঠ ও বিশ্লেষণী ক্ষমতার বিকাশ।

COURSE CONTENT:

১ . মাইকেল মধুসূদন দত্ত – একেই কি বলে সভ্যতা (Class hours-12)
২ . গিরিশচন্দ্র ঘোষ – জনা (Class hours-15)
৩. দ্বিজেন্দ্রলাল রায়- সাজাহান (Class hours-18)
৪ . রবীন্দ্রনাথ ঠাকুর – অচলায়তন (Class hours-15)

Reference Books/ সহায়ক গ্রন্থ

১. বাংলা নাটকের ইতিহাস- অজিত কুমার ঘোষ
২. বাংলা নাট্যসাহিত্যের ইতিহাস – আশুতোষ ভট্টাচার্য
৩. নাট্যকার মধুসূদন- ক্ষেত্র গুপ্ত
৪. গিরিশ নাট্য-সাহিত্য পরিচিতি – প্রফুল্লকুমার দাশগুপ্ত
৫. বাংলা সাহিত্যে পৌরাণিক নাটক – রবীন্দ্রনাথ বন্দ্যোপাধ্যায়
৬. বাংলা নাটকের বিবর্তন- সুরেশচন্দ্র মৈত্র
৭. রবীন্দ্রনাথের রূপকনাট্য – শান্তিকুমার দাশগুপ্ত
৮. রবীন্দ্রনাট্য পরিক্রমা – উপেন্দ্রনাথ ভট্টাচার্য
৮. রবীন্দ্রনাট্য প্রবাহ – প্রমথনাথ বিশী
৯. দ্বিজেন্দ্রলাল রায় কবি ও নাট্যকার- রথীন্দ্রনাথ রায়
১০. দ্বিজেন্দ্রলাল রায় – নবকৃষ্ণ ঘোষ
১১. দ্বিজেন্দ্রলাল – দেবকুমার রায়চৌধুরী
১২. নাট্যতত্ত্ব মীমাংসা- সাধন কুমার ভট্টাচার্য
১৩. নাট্যতত্ত্ব বিচার- দুর্গাশঙ্কর মুখোপাধ্যায়

Syllabus *(BENGALI)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BBNGMAJ08T**
Course Title: **বাংলা কথাসাহিত্য (পর্ব-১)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **উপন্যাস ও ছোটগল্পের সংজ্ঞা, স্বরূপ ও শ্রেণি সম্পর্কে ধারণা লাভ। উপন্যাস ও ছোটগল্পের বিস্তৃত প**
Learning Outcome: **কথাসাহিত্য পাঠের মধ্য দিয়ে বিচার ও বিশ্লেষণী ক্ষমতার বিকাশ।**

MAJOR-8, CREDIT- 6

COURSE TITLE : বাংলা কথাসাহিত্য (পর্ব-১)

Course objectives and learning outcome:

উপন্যাস ও ছোটগল্পের সংজ্ঞা, স্বরূপ ও শ্রেণি সম্পর্কে ধারণা লাভ।
উপন্যাস ও ছোটগল্পের বিস্তৃত পাঠ সম্পর্কে ধারণা লাভ ।
কথাসাহিত্য পাঠের মধ্য দিয়ে বিচার ও বিশ্লেষণী ক্ষমতার বিকাশ।

COURSE CONTENT:

উপন্যাস
১. বঙ্কিমচন্দ্র চট্টোপাধ্যায়- কৃষ্ণকান্তের উইল (Class hours-15)
২. রবীন্দ্রনাথ ঠাকুর- চার অধ্যায় (Class hours-15)
৩. বিভূতিভূষণ বন্দ্যোপাধ্যায়- ইছামতি (Class hours-15)
৪. ছোটগল্প - (নির্বাচিত ৮টি) (Class hours-20)
রবীন্দ্রনাথ ঠাকুর- অতিথি, একরাত্রি, নিশীথে
পরশুরাম – বিরিঞ্চিবাবা
প্রভাতকুমার মুখোপাধ্যায় – দেবী
মানিক বন্দ্যোপাধ্যায় – হারানের নাতজামাই
শরৎচন্দ্র চট্টোপাধ্যায় - মহেশ
তারাশঙ্কর বন্দ্যোপাধ্যায় – জলসাঘর

Reference Books/ সহায়ক গ্রন্থ

১. সাহিত্যকোষ কথাসাহিত্য- সম্পা. অলোক রায়
২. বঙ্গসাহিত্যে উপন্যাসের ধারা- শ্রীকুমার বন্দ্যোপাধ্যায়
৩. বাংলা কথাসাহিত্য জিজ্ঞাসা- অরুণকুমার মুখোপাধ্যায়
৪. বাংলা উপন্যাসের ইতিহাস- ক্ষেত্র গুপ্ত
৫. বাংলা উপন্যাসের কালান্তর- সরোজ বন্দ্যোপাধ্যায়
৬. আধুনিকতা ও বাংলা উপন্যাস- অশ্রুকুমার শিকদার
৭. কালের প্রতিমা- অরুণকুমার মুখোপাধ্যায়
৮. বাংলা সাহিত্যে ছোটগল্প ও গল্পকার- ভূদেব চৌধুরী
৯. ছোটগল্পের কথা- রথীন্দ্রনাথ রায়
১০. বাংলা ছোটগল্প- শিশির কুমার দাশ
১১. ছোটগল্পের বিষয়-আশয় – সুমিতা চক্রবর্তী
১২. কালের পুত্তলিকা- অরুণকুমার মুখোপাধ্যায়
১৩. ছোটগল্পের সীমারেখা – নারায়ণ গঙ্গোপাধ্যায়
১৪. বাংলা ছোটগল্প: প্রসঙ্গ ও প্রকরণ – বীরেন্দ্র দত্ত
১৫. বঙ্কিম মানস- অরবিন্দ পোদ্দার
১৬. রবীন্দ্রনাথের কথাসাহিত্য – বুদ্ধদেব বসু

১৭. রবীন্দ্র উপন্যাসের নির্মাণ শিল্প – গোপিকানাথ রায়চৌধুরী
১৮. বিভূতিভূষণ : মন ও শিল্প - গোপিকানাথ রায়চৌধুরী

Syllabus *(BENGALI)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BBNGMAJ09T**
Course Title: **বাংলা প্রবন্ধ**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **প্রবন্ধ সাহিত্যের সংজ্ঞা ও শ্রেণি সম্পর্কে ধারণা লাভ। বাংলা প্রবন্ধ সাহিত্যের উদ্ভব ও ধারা সম্**
Learning Outcome: **নির্বাচিত প্রবন্ধের নিবিড় পাঠের মধ্য দিয়ে বিচার-বিশ্লেষণ, যুক্তি ও কল্পনা শক্তির বিকাশে সহায়তা**

COURSE TITLE : বাংলা প্রবন্ধ (Class hours-60)

Course objectives and learning outcome:

প্রবন্ধ সাহিত্যের সংজ্ঞা ও শ্রেণি সম্পর্কে ধারণা লাভ।
বাংলা প্রবন্ধ সাহিত্যের উদ্ভব ও ধারা সম্পর্কে ধারণা লাভ।
নির্বাচিত প্রবন্ধের নিবিড় পাঠের মধ্য দিয়ে বিচার-বিশ্লেষণ, যুক্তি ও কল্পনা শক্তির বিকাশে সহায়তা করা।
অর্জিত জ্ঞানের প্রকাশ ক্ষমতাকে বৃদ্ধি করা।

COURSE CONTENT:

১. বঙ্কিমচন্দ্র চট্টোপাধ্যায়- মনুষ্যফল
২. স্বামী বিবেকানন্দ- বাঙ্গালা ভাষা
৩. হরপ্রসাদ শাস্ত্রী- নতুন কথা গড়া
৪. প্রমথ চৌধুরী- ভারতচন্দ্র
৫. রামেন্দ্র সুন্দর ত্রিবেদী- নিয়মের রাজত্ব
৬. অবনীন্দ্রনাথ ঠাকুর – শিল্পে অধিকার
৭. রবীন্দ্রনাথ ঠাকুর – শকুন্তলা
৮. সুনীতিকুমার চট্টোপাধ্যায়- সংস্কৃতি
৯. অন্নদাশঙ্কর রায়- ভারতীয় সংস্কৃতির স্বরূপ
১০. বুদ্ধদেব বসু- রবীন্দ্রনাথ ও উত্তর সাধক
১১. আবু সয়ীদ আইয়ূব – অমঙ্গলবোধ ও আধুনিক কবিতা
১২. সুধীর কুমার করণ- অভিনব বিদ্যাপতি দর্শন

Reference Books/ সহায়ক গ্রন্থ

১. আধুনিক বাংলা প্রবন্ধসাহিত্যের ধারা (১ম-৪র্থ খণ্ড) – ড. অধীর দে
২. বাংলা গদ্যের শিল্পীসমাজ - অরুণকুমার মুখোপাধ্যায়
৩. বাঙালীর ধর্ম, সমাজ ও সংস্কৃতি – রমাকান্ত চক্রবর্তী

Syllabus *(BENGALI)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BBNGMAJ10T**
Course Title: **বিশ শতকের বাংলা কবিতা**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **বিশ শতকের বাংলা কবিতার স্বরূপ ও প্রকৃতি সম্পর্কে ধারণা লাভ। বিশ শতকের সাংস্কৃতিক, রাজনৈতিক, সাম**
Learning Outcome: **কবির অনুভূতি, কল্পনা, কবিবাণীর অন্তর্নিহিত রস ও কাব্য সৌন্দর্য উপলব্ধিতে সাহায্য করা। কবিতা পা**

MAJOR-10 , CREDIT- 6

COURSE TITLE : বিশ শতকের বাংলা কবিতা

Course objectives and learning outcome:

বিশ শতকের বাংলা কবিতার স্বরূপ ও প্রকৃতি সম্পর্কে ধারণা লাভ।
বিশ শতকের সাংস্কৃতিক, রাজনৈতিক, সামাজিক ও সাহিত্যিক আন্দোলনের প্রেক্ষিতে বাংলা কবিতার গতিপ্রকৃতি সম্পর্কে ধারণা লাভ।
কবির অনুভূতি, কল্পনা, কবিবাণীর অন্তর্নিহিত রস ও কাব্য সৌন্দর্য উপলব্ধিতে সাহায্য করা।
কবিতা পাঠের মাধ্যমে সুকুমার আবেগ ও প্রক্ষোভের সাত্ত্বিক বিগলনের দ্বারা কল্পনা ও সৌন্দর্যবোধকে উদ্‌বুদ্ধ করা।

COURSE CONTENT:

দুই মহাযুদ্ধ মধ্যবর্তী কবিতা (১০টি) (Class hours- 30)

১. রবীন্দ্রনাথ ঠাকুর - পৃথিবী
২. কাজী নজরুল ইসলাম- নারী
৩. সত্যেন্দ্রনাথ দত্ত – চম্পা
৪. জীবনানন্দ দাশ – বোধ
৫. অমিয় চক্রবর্তী - সংগতি

৬. সুধীন্দ্রনাথ দত্ত – শাশ্বতী
৭. বিষ্ণু দে – তুমি শুধু পঁচিশে বৈশাখ
৮. সমর সেন – মহুয়ার দেশ
৯. প্রেমেন্দ্র মিত্র – বেনামী বন্দর
১০. অজিত দত্ত – প্রার্থনা

দ্বিতীয় মহাযুদ্ধের সমকালীন ও পরবর্তী কবিতা (১০টি) (Class hours-30)

১১. সুভাষ মুখোপাধ্যায় – ফুল ফুটুক না ফুটুক
১২. সুকান্ত ভট্টাচার্য – প্রিয়তমাসু
১৩. মঙ্গলাচরণ চট্টোপাধ্যায় – জননী যন্ত্রণা
১৪. বীরেন্দ্র চট্টোপাধ্যায় – অন্নদেবতা
১৫. নীরেন্দ্রনাথ চক্রবর্তী - উলঙ্গ রাজা
১৬. শক্তি চট্টোপাধ্যায় – যেতে পারি কিন্তু কেন যাব ?
১৭. শঙ্খ ঘোষ – বাবরের প্রার্থনা
১৮. সুনীল গঙ্গোপাধ্যায়- উত্তরাধিকার
১৯. শামসুর রাহমান- রাজকাহিনী
২০. কবিতা সিংহ – হরিণা বৈরী

Reference Books/ সহায়ক গ্রন্থ

১. আধুনিক বাংলা কাব্য পরিচয়- দীপ্তি ত্রিপাঠী
২. বাংলা কবিতার কালান্তর – সরোজ বন্দ্যোপাধ্যায়
৩. আধুনিক কবিতার চালচিত্র – সুমিতা চক্রবর্তী
৪. আমার কালের কবি ও কবিতা- মনীন্দ্র রায়
৫. লোকাভরণ : আধুনিক কবিতার শৈলী – বিপ্লব চক্রবর্তী
৬. আধুনিক বাংলা কবিতা : বিচার বিশ্লেষণ – জীবেন্দ্র সিংহ রায়
৭. আধুনিক বাংলা কাব্য – তারাপদ মুখোপাধ্যায়
৮. আধুনিক কবিতার ইতিহাস – সম্পা. অলোকরঞ্জন দাশগুপ্ত, দেবীপ্রসাদ বন্দ্যোপাধ্যায়
৯. আধুনিক কবিতার দ্বিতীয় পর্যায় – সুমিতা চক্রবর্তী
১০. কালের পুতুল- বুদ্ধদেব বসু
১১. আধুনিক বাংলা কবিতার রূপরেখা- বাসন্তীকুমার মুখোপাধ্যায়
১২. আধুনিক বাংলা ছন্দ – নীলরতন সেন

Syllabus *(BENGALI)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BBNGMAJ11T**
Course Title: **পুরুলিয়ার সাহিত্য-সংস্কৃতি**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **স্থানীয় সাহিত্য-সংস্কৃতি বিষয়ে ধারণা লাভ। স্থানীয় সাহিত্য-সংস্কৃতি চর্চায় উদ্‌বুদ্ধ করা ও গবেষ**
Learning Outcome: **স্থানীয় সাহিত্য-সংস্কৃতি বিষয়ে ধারণা লাভ। স্থানীয় সাহিত্য-সংস্কৃতি চর্চায় উদ্‌বুদ্ধ করা ও গবেষ**

MAJOR-11 , CREDIT- 6

COURSE TITLE : পুরুলিয়ার সাহিত্য-সংস্কৃতি

Course objectives and learning outcome:

স্থানীয় সাহিত্য-সংস্কৃতি বিষয়ে ধারণা লাভ।
স্থানীয় সাহিত্য-সংস্কৃতি চর্চায় উদ্‌বুদ্ধ করা ও গবেষণায় আগ্রহী করে তোলা।

COURSE CONTENT:

১. পুরুলিয়ার লোকসংস্কৃতি – (Class hours-16)
টুসু- উদ্ভব, স্বরূপ , সমাজ ও সংস্কৃতি ।
ভাদু- উদ্ভব, বৈশিষ্ট্য, লোকজীবন ও ঐতিহ্য ।
ঝুমুর- উৎস, বিবর্তন, প্রকারভেদ, সাহিত্যমূল্য ।
ছো- উৎস, স্বরূপ ও বিবর্তন ।
২. কাব্য-কবিতা – (নির্বাচিত - ৮টি) (Class hours-16)
ক. কবিচন্দ্র শঙ্কর চক্রবর্তী – কপিলার মর্তে আগমন (কপিলামঙ্গল : ১ম চরণ থেকে 'স্বর্গ ছাড়িয়া গাই মর্ত্তকে নাম্ভিল।।' পর্যন্ত)
খ. চৈতন্যদাস মণ্ডল – বেহুলার গোদাঘাটায় গমন এবং বেহুলার সহিত গোদার প্রসঙ্গ (বৃহৎ মনসামঙ্গল, তৃতীয় ভাগ)
গ. মোহিনীমোহন গঙ্গোপাধ্যায় - মাড়ভাতের লড়াই
ঘ. সুবোধ বসুরায় – খেড়িয়ানার
ঙ. নির্মল হালদার – বনমালী
চ. অশোক দত্ত - অসুখ
ছ. মুকুল চট্টোপাধ্যায়- তুমি
জ. অসিত সিংহ- মাটি পৃথিবীর টানে (৭ সংখ্যক কবিতা)

৩. ছোটগল্প – (নির্বাচিত - ৭টি) (Class hours-14)
পরিতোষ বন্দ্যোপাধ্যায় - অগ্নিগর্ভ
অরুন প্রকাশ সিংহ – সেতার
সিরাজুল হক- নাবাল
শুদ্রক (রবিলোচন মুখোপাধ্যায়) - হুল
সত্য গুপ্ত – ঝুমুর
কমল চক্রবর্তী – ইঁদুর-মানুষ
জ্যোৎস্না কর্মকার – মেনকার সাবান
৪. উপন্যাস – (Class hours-14)
সৈকত রক্ষিত – মদন ভেরি

Reference Books/ সহায়ক গ্রন্থ

১. ঝাড়খণ্ডের লোকসাহিত্য – বঙ্কিমচন্দ্র মাহাত
২. সীমান্ত বাংলার লোকযান – সুধীরকুমার করণ
৩. লোকভূমি মানভূম- সম্পা. শ্রমিক সেন, কিরীটি মাহাত
৪. পুরুলিয়া – তরুণদেব ভট্টাচার্য
৫. আদি রসকলা ঝুমুর পদাবলী – হারাধন মাহাত
৬. ঝুমুর : লোকজীবনের সন্ধান- সম্পা. নাড়ুগোপাল দে, কিরীটি মাহাত, সাধন মাহাত
৭. ঝুমুর ও নানা প্রসঙ্গ – ক্ষীরোদ চন্দ্র মাহাতো
৮. ঝুমুরের ধারা ও বিবর্তন- রমানাথ দাস
৯. লোক নৃত্য ছৌ – শান্তি সিংহ
১০. সৈকত রক্ষিত : অনুরাগে অনুভবে - সম্পা. অরূপ পলমল
১১. অহল্যাভূমি পুরুলিয়া (১ম-৪র্থ)- সম্পা. দেবপ্রসাদ জানা
১২. ঝাড়খণ্ডের লোকসংস্কৃতি – শ্রীরাধাগোবিন্দ মাহাত
১৩. ভাদুগীতির ইতিকথা- যুধিষ্ঠির মাজী
১৪. ভাদু – সুব্রত চক্রবর্তী
১৫. রাজানুকুল্য ও পুরুলিয়ার সাহিত্য সংস্কৃতি – প্রবীর সরকার
১৬. পুরুলিয়ার ঝুমুর: উৎস বিকাশ ও পরিণতি – সুভাষ রায়
১৭. মানভূঁইঞা ছো- সম্পা. ক্ষীরোদ চন্দ্র মাহাতো ও শিবশঙ্কর সিং
১৮. মানভূম সংস্কৃতি- ক্ষীরোদ চন্দ্র মাহাতো

Syllabus *(BENGALI)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BBNGMAJ12T**
Course Title: **সাহিত্য তত্ত্ব ও সাহিত্য চিন্তা**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **সাহিত্যতত্ত্ব ও মতবাদ এবং বিভিন্ন সাহিত্য আন্দোলন সম্পর্কে ধারণা লাভ। বাংলা সাহিত্যের সাহিত্**
Learning Outcome: **সাহিত্যতত্ত্ব ও মতবাদ এবং বিভিন্ন সাহিত্য আন্দোলন সম্পর্কে ধারণা লাভ। বাংলা সাহিত্যের সাহিত্**

MAJOR-12 , CREDIT- 6

COURSE TITLE : সাহিত্য তত্ত্ব ও সাহিত্য চিন্তা

Course objectives and learning outcome:

সাহিত্যতত্ত্ব ও মতবাদ এবং বিভিন্ন সাহিত্য আন্দোলন সম্পর্কে ধারণা লাভ।
বাংলা সাহিত্যের সাহিত্যতত্ত্ব সম্পর্কিত রচনার সঙ্গে পরিচিত হওয়া।
আধুনিক সাহিত্য অনুধাবনে সক্ষমতা অর্জন।

COURSE CONTENT:

১. অতুলচন্দ্র গুপ্ত – কাব্য জিজ্ঞাসা ('ধ্বনি' ও 'রস' প্রবন্ধ) (Class hours-15)
২. রবীন্দ্রনাথ ঠাকুর- সাহিত্য ও সাহিত্যের পথে (নির্বাচিত প্রবন্ধ)
সাহিত্যের তাৎপর্য , সাহিত্যের সামগ্রী, সাহিত্যের বিচার, আধুনিক কাব্য, সাহিত্যের ধর্ম । (Class hours-20)
৩. সাহিত্যের রূপরীতি : ট্রাজেডি, কমেডি, ফার্স, এপিক, লিরিক, ব্যালাড । (Class hours-12)
৪. সাহিত্য মতবাদ : ক্লাসিসিজম, রোমান্টিসিজম, সিম্বলিজম, মার্কসিজম, সুররিয়ালিজম, ফেমিনিজম। (Class hours-13)

Reference Books/ সহায়ক গ্রন্থ

১. কাব্য মীমাংসা – বিষ্ণুপদ ভট্টাচার্য
২. কাব্যতত্ত্ব – শিশিরকুমার দাশ
৩. সাহিত্যবিচার তত্ত্ব ও প্রয়োগ – বিমলকুমার মুখোপাধ্যায়
৪. সাহিত্য বিবেক - বিমলকুমার মুখোপাধ্যায়
৫. বিশ শতকের সাহিত্যতত্ত্ব – আফজালুল বাসার
৬. সাহিত্য জিজ্ঞাসায় রবীন্দ্রনাথ – অসিতকুমার বন্দ্যোপাধ্যায়
৭. পাশ্চাত্য সাহিত্যতত্ত্ব ও সাহিত্যভাবনা – নবেন্দু সেন

৮. সাহিত্য বীক্ষা- নীরেন্দ্রনাথ রায়
৯. পাশ্চাত্য সাহিত্যের সমালোচনার ধারা- এস. পি. সেনগুপ্ত
১০. A History of Modern Criticism – R. Wellel
১১. Feminist Literary Theory – Janet Todd

Syllabus *(BENGALI)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BBNGMAJ13T**
Course Title: **গবেষণা - প্রকরণ ও পদ্ধতি**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **গবেষণার উদ্দেশ্য, প্রকরণ ও পদ্ধতি সম্পর্কে সম্যক ধারণা লাভ এবং পদ্ধতি মেনে গবেষণা করতে পারা।**
Learning Outcome: **গবেষণার উদ্দেশ্য, প্রকরণ ও পদ্ধতি সম্পর্কে সম্যক ধারণা লাভ এবং পদ্ধতি মেনে গবেষণা করতে পারা।**

MAJOR-13 , CREDIT- 6

COURSE TITLE : গবেষণা - প্রকরণ ও পদ্ধতি

Course objectives and learning outcome:

গবেষণার উদ্দেশ্য, প্রকরণ ও পদ্ধতি সম্পর্কে সম্যক ধারণা লাভ এবং পদ্ধতি মেনে গবেষণা করতে পারা।

COURSE CONTENT:

১. গবেষণার লক্ষ ও পরিচিতি। (উদ্দেশ্য, গুরুত্ব, প্রকারভেদ- মৌলিক গবেষণা, ব্যবহারিক গবেষণা, তথ্যনির্ভর গবেষণা, সামাজিক গবেষণা, ঐতিহাসিক গবেষণা, বর্ণনামূলক গবেষণা ও ক্ষেত্র সমীক্ষা) (Class hours-20)
২. গবেষণার প্রস্তাবপত্র- (পূর্ববর্তী গবেষণার পর্যালোচনা, শিরোনাম ও অধ্যায় বিভাজন, উদ্‌ধৃতি প্রদানের পদ্ধতি, তথ্যসূত্র নির্দেশ) (Class hours-20)
৩. গ্রন্থপঞ্জি নির্মাণ। (**MLA, APA, CHIKAGO** পদ্ধতি) (Class hours-10)
৪. একটি আদর্শ গবেষণাপত্রের খসড়া রচনা। (Class hours-10)

Reference Books/ সহায়ক গ্রন্থ:

১. গবেষণার তত্ত্ব তালাশ – সম্পা. শ্রাবণী পাল, বেলা দাস
২. গবেষণা তথ্য ও প্রয়োগ – তারকনাথ ভট্টাচার্য
৩. গবেষণাপত্র অনুসন্ধান ও রচনা – জগমোহন মুখোপাধ্যায়
৪. বাংলা পুথির কথা – অচিন্ত্য বিশ্বাস
৫. Research Methods – Ram Ahuja, Rawat pub. , Delhi,2001
৬. Research Methodology: Methods and Techniques – C. R. Kothari, New Age, Delhi,2004

Syllabus *(BENGALI)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BBNGMAJ14T**
Course Title: **প্রাগাধুনিক বাংলা সাহিত্য**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **মধ্যযুগের বাংলা সাহিত্যের আখ্যানকাব্য, চৈতন্য জীবনচরিত কাব্য, মঙ্গলকাব্য ও লোকসাহিত্য পাঠের মধ্য দিয়ে বাঙালির সামাজিক-সাংস্কৃতিক ঐতিহ্য সম্পর্কে অবহিত হওয়া।**
Learning Outcome: **মধ্যযুগের বাংলা সাহিত্যের আখ্যানকাব্য, চৈতন্য জীবনচরিত কাব্য, মঙ্গলকাব্য ও লোকসাহিত্য পাঠের মধ্য দিয়ে বাঙালির সামাজিক-সাংস্কৃতিক ঐতিহ্য সম্পর্কে অবহিত হওয়া।**

MAJOR-14 , CREDIT- 4

COURSE TITLE : প্রাগাধুনিক বাংলা সাহিত্য

Course objectives and learning outcome:

মধ্যযুগের বাংলা সাহিত্যের আখ্যানকাব্য, চৈতন্য জীবনচরিত কাব্য, মঙ্গলকাব্য ও লোকসাহিত্য পাঠের মধ্য দিয়ে বাঙালির সামাজিক-সাংস্কৃতিক ঐতিহ্য সম্পর্কে অবহিত হওয়া।

COURSE CONTENT:

১. রামায়ণ – (লঙ্কা কাণ্ড) – কৃত্তিবাস ওঝা (Class hours- 12)
২. শ্রীশ্রীচৈতন্যচরিতামৃত (আদিলীলা- চতুর্থ পরিচ্ছেদ) – কৃষ্ণদাস কবিরাজ (Class hours- 12)
৩. লোরচন্দ্রাণী – দৌলত কাজী (Class hours- 12)
৪. ময়মনসিংহ গীতিকা- মহুয়া ও মলুয়া পালা (Class hours- 12)

Reference Books/ সহায়ক গ্রন্থ:

১. বাঙ্গালা সাহিত্যের ইতিহাস (১ম ও ২য় খণ্ড)– সুকুমার সেন
২. বাংলা সাহিত্যের সম্পূর্ণ ইতিবৃত্ত (১ম ও ২য় খণ্ড) – অসিতকুমার বন্দ্যোপাধ্যায়
৩. রামায়ণ : (সম্পাদনা ও ভূমিকা) – সুখময় মুখোপাধ্যায়
৪. চৈতন্য চরিতের উপাদান- বিমান বিহারী মজুমদার

৫. শ্রীশ্রীচৈতন্যচরিতামৃত - (সম্পাদনা ও ভূমিকা) – অশোক চট্টোপাধ্যায়
৬. লোরচন্দ্রাণী- (সম্পাদনা ও ভূমিকা) – দেবনাথ বন্দ্যোপাধ্যায়
৭. রাজসভার কবি ও কাব্য - দেবনাথ বন্দ্যোপাধ্যায়
৮. সতীময়না ও লোরচন্দ্রাণী (সম্পাদনা ও ভূমিকা)- সত্যেন্দ্রনাথ ঘোষাল
৯. প্রাগাধুনিক বাংলা সাহিত্য: বিষয় ও প্রসঙ্গ- ধ্রুবকুমার মুখোপাধ্যায়
১০. মৈমনসিংহ-গীতিকা - (সম্পাদনা ও ভূমিকা) – দীনেশচন্দ্র সেন
১১. আরাকান রাজসভার বাংলা সাহিত্য- মহম্মদ এনামুল হক ও আবদুল করিম
১২. মানবধর্ম ও বাংলা কাব্যে মধ্যযুগ- অরবিন্দ পোদ্দার
১৩. ইসলামী বাংলা সাহিত্য- সুকুমার সেন
১৪. মৈমনসিংহ গীতিকার কথা – দেবনাথ বন্দ্যোপাধ্যায়

Syllabus *(BENGALI)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BBNGMAJ15T**
Course Title: **বাংলা কথাসাহিত্য (পর্ব-২)**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **বিশ শতকের উপন্যাস ও ছোটগল্পের বিষয়, আঙ্গিক ও প্রকৃতি সম্পর্কে ধারণা লাভ।**
Learning Outcome: **বিশ শতকের উপন্যাস ও ছোটগল্পের বিষয়, আঙ্গিক ও প্রকৃতি সম্পর্কে ধারণা লাভ।**

MAJOR-15 , CREDIT- 4

COURSE TITLE : বাংলা কথাসাহিত্য (পর্ব-২)

Course objectives and learning outcome:

বিশ শতকের উপন্যাস ও ছোটগল্পের বিষয়, আঙ্গিক ও প্রকৃতি সম্পর্কে ধারণা লাভ।
উপন্যাস ও ছোটগল্পের বিস্তৃত পাঠ সম্পর্কে ধারণা লাভ।
কথাসাহিত্য পাঠের মধ্য দিয়ে বিচার ও বিশ্লেষণী ক্ষমতার বিকাশ।

COURSE CONTENT:

১. ছোটগল্প (নির্বাচিত- ৬টি) (Class hours-18)
নরেন্দ্রনাথ মিত্র - রস
নারায়ণ গঙ্গোপাধ্যায় - টোপ
সুবোধ ঘোষ - চতুর্থ পানিপথের যুদ্ধ
আশাপূর্ণা দেবী – ছিন্নমস্তা
সৈয়দ ওয়ালীউল্লাহ - একটি তুলসী গাছের কাহিনী
সেলিনা হোসেন – বাঁচা
২. মানিক বন্দ্যোপাধ্যায় – পদ্মানদীর মাঝি (Class hours- 14)
৩. সমরেশ বসু – শাস্ব (Class hours- 14)
৪. মহাশ্বেতা দেবী - অরণ্যের অধিকার (Class hours- 14)

Reference Books/ সহায়ক গ্রন্থ :

১. সাহিত্যকোষ কথাসাহিত্য- সম্পাদনা অলোক রায়
২. বঙ্গসাহিত্যে উপন্যাসের ধারা- শ্রীকুমার বন্দ্যোপাধ্যায়
৩. বাংলা কথাসাহিত্য জিজ্ঞাসা- অরুণকুমার মুখোপাধ্যায়
৪. বাংলা উপন্যাসের ইতিহাস- ক্ষেত্র গুপ্ত
৫. বাংলা উপন্যাসের কালান্তর- সরোজ বন্দ্যোপাধ্যায়
৬. আধুনিকতা ও বাংলা উপন্যাস- অশ্রুকুমার শিকদার
৭. মধ্যাহ্নে থেকে সায়াহ্নে- অরুণকুমার মুখোপাধ্যায়
৮. বাংলা সাহিত্যে ছোটগল্প ও গল্পকার- ভূদেব চৌধুরী
৯. ছোটগল্পের কথা- রথীন্দ্রনাথ রায়
১০. বাংলা ছোটগল্প- শিশির কুমার দাশ
১১. ছোটগল্পের বিষয়-আশয় – সুমিতা চক্রবর্তী
১২. কালের পুত্তলিকা- অরুণকুমার মুখোপাধ্যায়
১৩. ছোটগল্পের সীমারেখা – নারায়ণ গঙ্গোপাধ্যায়
১৪. বাংলা ছোটগল্প- নরেন্দ্রনাথ চক্রবর্তী
১৫. বাংলা ছোটগল্প : প্রসঙ্গ ও প্রকরণ – বীরেন্দ্র দত্ত
১৬. কালকূট সমরেশ – নিতাই বসু
১৭. মানিক বন্দ্যোপাধ্যায় : জীবনদৃষ্টি ও শিল্পরীতি – গোপীকানাথ রায়চৌধুরী
১৮.মানিক বন্দ্যোপাধ্যায়ের জীবন ও সাহিত্য- সরোজমোহন মিত্র
১৯. বাংলা কথাসাহিত্যের একাল- বীরেন্দ্র দত্ত
২০. মহাশ্বেতা দেবীর উপন্যাসে ইতিহাস ও রাজনীতি- পম্পা মুখোপাধ্যায়
২১. সমাজ রূপান্তরে রাঢ় বাংলা : তারাশঙ্কর থেকে মহাশ্বেতা দেবী – কেয়া সামন্ত

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BBNGMAJ16T**
Course Title: **বিশ শতকের বাংলা নাটক**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **নাটকের বিভিন্ন সংরূপ ও তত্ত্ব সম্পর্কে ধারণা লাভ। বিশ শতকের বাংলা নাট্যসাহিত্যের বিভিন্ন শ্রেণির নাটক সম্পর্কে ধারণা লাভ।**
Learning Outcome: **নাট্য সাহিত্য পাঠ ও বিশ্লেষণী ক্ষমতার বিকাশ।**

MAJOR-16 , CREDIT- 4

COURSE TITLE : বিশ শতকের বাংলা নাটক

Course objectives and learning outcome:

নাটকের বিভিন্ন সংরূপ ও তত্ত্ব সম্পর্কে ধারণা লাভ।
বিশ শতকের বাংলা নাট্যসাহিত্যের বিভিন্ন শ্রেণির নাটক সম্পর্কে ধারণা লাভ।
নাট্য সাহিত্য পাঠ ও বিশ্লেষণী ক্ষমতার বিকাশ।

COURSE CONTENT:

১. শম্ভু মিত্র – চাঁদ বণিকের পালা (Class hours- 18)
২. বুদ্ধদেব বসু – প্রথম পার্থ (Class hours- 10)
৩. বাদল সরকার – বাকি ইতিহাস (Class hours- 16)
৪. অরুণ মুখোপাধ্যায় – মারীচ সংবাদ (Class hours- 16)

Reference Books/সহায়ক গ্রন্থ :

১. বাংলা নাটকের ইতিহাস- অজিতকুমার ঘোষ
২. বাংলা নাট্যসাহিত্যের ইতিহাস (১ম ও ২য় খণ্ড)- আশুতোষ ভট্টাচার্য
৩. বাংলা নাটকের বিবর্তন- সুরেশচন্দ্র মৈত্র
৪. বাংলা থিয়েটারের ইতিহাস- দর্শন চৌধুরী
৫. বুদ্ধদেব বসুর জীবন- সমীর সেনগুপ্ত
৬. শম্ভু মিত্রের বিচিত্র জীবন পরিক্রমা- শাঁওলি মিত্র
৭. নাট্য ব্যক্তিত্ব বাদল সরকার- দর্শন চৌধুরী

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BBNGMAJ17T**
Course Title: **বিবিধ গদ্য**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **বাংলা শিশু-কিশোর সাহিত্য, ব্যক্তিগত প্রবন্ধ ও ভ্রমণ সাহিত্যে সম্পর্কে ধারণা লাভ**
Learning Outcome: **বাংলা শিশু-কিশোর সাহিত্য, ব্যক্তিগত প্রবন্ধ ও ভ্রমণ সাহিত্যে সম্পর্কে ধারণা লাভ**

SEM-VIII

MAJOR-17 , (FOR HONS. ONLY) **, CREDIT- 6

COURSE TITLE : বিবিধ গদ্য

Course objectives and learning outcome:

বাংলা শিশু-কিশোর সাহিত্য, ব্যক্তিগত প্রবন্ধ ও ভ্রমণ সাহিত্যে সম্পর্কে ধারণা লাভ

COURSE CONTENT:

১. পঞ্চভূত (নির্বাচিত অংশ) - রবীন্দ্রনাথ ঠাকুর (Class hours-15)
পরিচয়, নরনারী, মনুষ্য, গদ্য ও পদ্য, কৌতুকহাস্য
২. রাজকাহিনী (নির্বাচিত অংশ) – অবনীন্দ্রনাথ ঠাকুর : শিলাদিত্য, গোহ, বাপ্পাদিত্য, হাম্বির (Class hours-15)
৩. ঠাকুরমার ঝুলি – (নির্বাচিত অংশ) – দক্ষিণারঞ্জন মিত্র মজুমদার
১ম ভাগ- ঘুমন্তপুরী, কলাবতী রাজকন্যা, কাঞ্চনমালা, সাত ভাই চম্পা , শীত বসন্ত আর কিরণমালা। (Class hours-15)
৪. দেশে বিদেশে (নির্বাচিত অংশ) – সৈয়দ মুজতবা আলি - প্রথম ১১টি পরিচ্ছেদ। (Class hours-15)

Reference Books/ সহায়ক গ্রন্থ :

১. বাংলা শিশু সাহিত্য – নবেন্দু সেন
২. বাংলা শিশু সাহিত্যের ক্রমবিকাশ – আশা গঙ্গোপাধ্যায়
৩. রবীন্দ্র মনীষা - অরুণকুমার মুখোপাধ্যায়
৪. বাণীশিল্পী অবনীন্দ্রনাথ- অশোকবিজয় রাহা
৫. অবনীন্দ্রনাথ ও অন্যান্য – পার্থজিৎ গঙ্গোপাধ্যায়

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BBNGMAJ18T**
Course Title: **ভারতীয় সাহিত্য**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **ভারতের বিভিন্ন ভাষার সাহিত্য ও সাহিত্যিকদের সঙ্গে পরিচিত হওয়ার মধ্যদিয়ে ভারতীয় সাহিত্য- সংস্কৃতির সঙ্গে একাত্ম হওয়া। জাতীয় ঐক্য ও সম্প্রীতি বোধ গড়ে তোলা। তুলনামূলক সাহিত্যপাঠ ও আলোচনায় আগ্রহী করে তোলা।**
Learning Outcome: **ভারতের বিভিন্ন ভাষার সাহিত্য ও সাহিত্যিকদের সঙ্গে পরিচিত হওয়ার মধ্যদিয়ে ভারতীয় সাহিত্য- সংস্কৃতির সঙ্গে একাত্ম হওয়া। জাতীয় ঐক্য ও সম্প্রীতি বোধ গড়ে তোলা। তুলনামূলক সাহিত্যপাঠ ও আলোচনায় আগ্রহী করে তোলা।**

MAJOR-18 , (FOR HONS. ONLY)**, CREDIT- 6

COURSE TITLE : ভারতীয় সাহিত্য

Course objectives and learning outcome:

ভারতের বিভিন্ন ভাষার সাহিত্য ও সাহিত্যিকদের সঙ্গে পরিচিত হওয়ার মধ্যদিয়ে ভারতীয় সাহিত্য- সংস্কৃতির সঙ্গে একাত্ম হওয়া। জাতীয় ঐক্য ও সম্প্রীতি বোধ গড়ে তোলা। তুলনামূলক সাহিত্যপাঠ ও আলোচনায় আগ্রহী করে তোলা।

COURSE CONTENT:

১. নির্বাচিত গল্প (৭টি) (Class hours-15)
ক. প্রেমচন্দ – কফন (হিন্দি)
খ. ইন্দিরা গোস্বামী – উদোম বাক্স (অসমিয়া)
গ. উডুপি রাজগোপালাচার অনন্তমূর্তি – একটি অপ্রত্যাশিত সাক্ষাৎকার (কন্নড়)
ঘ. অমৃতা প্রীতম – দুই নারী (পঞ্জাবি)
ঙ. অনিতা দেশাই - বিক্রি (ভারতীয় ইংরেজি)
চ. কালিন্দীচরণ পাণিগ্রাহী – বিজয় উৎসব (ওড়িয়া)
ছ. সআদত হোসেন মন্টো – টোবাটেক সিং
পাঠ্যগ্রন্থ - ভারতজোড়া গল্প কথা, সংকলন ও সম্পাদনা- রামকুমার মুখোপাধ্যায়
২. নির্বাচিত কবিতা (৭টি) : (Class hours-15)
ক. নবকান্ত বরুয়া - হে অরণ্য, হে মহামানব (অসমিয়া)
খ. বলরাজ কোমল – হলদে শিশু (উর্দু)
গ. রমাকান্ত রথ – ধানক্ষেত (ওড়িয়া)
ঘ. মনপ্রসাদ সুব্বা – ধরিত্রী (নেপালি)
ঙ. পরিমল হেমব্রম – এই ছেলেটা (সাঁওতালি)
চ. নামদেও ধসাল – কালো জাদু (মরাঠি)
ছ. কুঁওর নারায়ণ – যখন মানুষ মানুষ থাকে না (হিন্দি)
পাঠ্যগ্রন্থ - ভারতজোড়া কাব্য গাথা, সংকলন ও সম্পাদনা- রামকুমার মুখোপাধ্যায়
৩. নাটক : (Class hours-15)
চুপ আদালত চলছে – বিজয় তেন্ডুলকার
(অনুবাদ- শুক্লা সেন)
৪. উপন্যাস : (Class hours-15)
চিংড়ি – তাকাসি শিবশঙ্কর পিল্লাই
(অনুবাদ- বোমান্না বিশ্বনাথম্ ও নিলীনা আব্রাহাম)

Reference Books/ সহায়ক গ্রন্থ :

১. হিন্দী সাহিত্যের ইতিহাস- রামবহাল তেওয়ারী
২. ভারতীয় সাহিত্যের তুলনামূলক ইতিহাস – বিপ্লব চক্রবর্তী
৩. আধুনিক ভারতীয় নাটক- দিলীপকুমার মিত্র

Syllabus *(BENGALI)*

Course Type: **RPD-1**
Semester: **8**
Course Code:
Course Title: **Research/Project/Dissertation**
(L-P-Tu): **0-12-0**
Credit: **12**
Practical/Theory: **Practical**
Course Objective: **X**
Learning Outcome: **X**

***SEM-VIII

Research project/ Dissertation = 12 Credit for Honours with research.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Sidho-Kanho-Birsha University

Syllabus & Course Curriculam

Syllabus *(BOTANY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BBOTMAJ01C**
Course Title: **Plants and Microbial Diversity and its Evolution**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **To introduce the diversity of microbial, algal and cyanobacterial, fungal worlds, their identifying features, and applications; To know about the transition towards land habit, amphibians of the plant kingdom, pteridophytes and gymnosperms, their identify**
Learning Outcome: **After the completion of the course the students will be able to: 1. Develop understanding about the classification and diversity of Bacteria, viruses, Algae, Fungi & Lichens & their economic importance. 2. Develop conceptual skill about identifying micr**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Introduction to microbial diversity; Hierarchical organization and positions of microbes in the living world: Whittaker's five-kingdom system and Carl Richard Woese's three-domain system.	**3**
2	Viruses: characteristics; classification (Baltimore), idea about viroids and prions; detailed structure T4-phage and SARS-COV2, lytic and lysogenic cycle; Economic importance of viruses.	**7**
3	Bacteria general characteristics; Types-archaebacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Bergey's classification, Cell structure; Nutritional types; vegetative and Reproductive structure - asexual and recombination (conjugation, transformation and transduction). Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).	**8**
4	Algae General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food, flagella; methods of reproduction; Classification; criteria, system of Fritsch, and idea of different groups as per Lee; Morphology and reproduction and life cycles of *Nostoc*, *Oedogonium, Chara, Fucus* and *Polysiphonia*. Diatoms and their importance. Idea about cultivation of *Spirulina;* Economic importance of algae in- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae. Algal blooms and toxins.	**8**
5	Introduction to fungi, General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Heterothallism and parasexuality. Classification Ainsworth (up to Order). Life cycles of *Synchitrium, Saccharomyces, Ascobolus*, *Agaricus*. Symbiotic	**8**

	associations: Lichen – Occurrence; General characteristics; Growth forms; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance. Application of fungi.	
6	Introduction to Archegoniate, Unifying features of archegoniates, Alternation of generations. Bryophytes: General characteristics; Adaptations to land habit; Range of thallus organization. Idea about different orders. Morphology, anatomy and reproduction of *Marchantia, Porella, Anthoceros, and Funaria*; Ecological and economic importance of bryophytes with special reference to *Sphagnum*.	**7**
7	Pteridophytes: General characteristics; Idea about different orders. Morphology, anatomy and reproduction of *Psilotum, Selaginella, Equisetum* and *Adiantum. H*eterospory and seed habit. Ecological and economic importance.	**7**
8	Gymnosperms: General characteristics, idea about different orders, morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum*; Affinities and evolutionary significance of Gymnosperms Ecological and economic importance.	**7**
9	Palaeobotany: Plant life through ages with evolutionary significane, Geological time scale, Early land plant *(Cooksonia*). Types of plant fossils - impressions, compressions, incrustation, actual remains petrifaction. Factors for fossilization, Radiocarbon dating. Importance.	**5**

Practical (Credits -2, 60 Hrs)

1. Electron micrographs/Models of viruses – T-Phage and Sars-CoV2, Sketches of Lytic and Lysogenic Cycle.
2. Types of Bacteria to be observed in permanent slides/photographs. Micrographs of bacteria, binary fission, endospore, conjugation.
3. Study of curd organisms curd through Gram staining.
4. Study of vegetative and reproductive structures of *Nostoc*, *Oedogonium, Chara,* and *Polysiphonia*.
5. Study of *Ascobolus*, *Agaricus* and preparation of slides.
6. Study of *Saccharomyces* and *Penicillium* from permanent slides/photographs.
7. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through photographs. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs)
8. *Marchantia*- Morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).
9. *Anthoceros*- Morphology of thallus, dissection of sporophyte (to show spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).
10. *Funaria*- Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema.
11. *Psilotum*- Study of specimen, transverse section of synangium (permanent slide).
12. *Selaginella*- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).
13. *Equisetum*- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores, transverse section of rhizome (all permanent slide).
14. *Adiantum*- Morphology, transverse section of rachis, vertical section of sporophyll, wholemount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount

of prothallus with sex organs and young sporophyte (permanent slide).

15. *Cycas*- Morphology (leaf), vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).
16. *Pinus*- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle (temporary slide), transverse section of stem, longitudinal section of / transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section &radial longitudinal sections stem (permanent slide).
17. *Gnetum*- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (all permanent slide)
18. Study of fossil genera - *Rhynia, Cooksonia and Lepidodendron* through photographs.

Reading References:

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International,New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
6. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
7. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
8. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
9. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
10. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
11. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
12. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
13. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
14. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(BOTANY)*

Course Type: **MAJ-2**

Semester: **2**

Course Code: **BBOTMAJ02C**

Course Title: **Cell Biology and Biochemical Basis of Life**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, organelles, enzymes and bioenergetics. 2. To understand the chemical nature of biological macromolecules, their th**

Learning Outcome: **After the completion of the course the students will be able to: 1. Develop comprehensive understanding about the cellular architecture, communication systems and divisional types. 2. Understand details about bio-molecules, enzymes and bioenergetics. 3**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	**The Cell:** Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).	2
2	**Cell wall and plasma membrane:** Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis. Exracellular matrix.	5
3	**Cell organelles:** Nucleus, Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament. Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semi-autonomous nature of mitochondria and chloroplast.	15

	Endomembrane system: Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes.	
4	**Cellular communication:** General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.	**4**
5	**Cell division**: Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.	**4**
6	**Biomolecules:** Types and significance of chemical bonds; Structure and properties of water; pH and buffers. **Carbohydrates:** Monosaccharides - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives, oxidation of sugars. Formation of disaccharides, reducing and non- reducing disaccharides. Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides. **Lipids:** Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides. **Amino acids:** Definition, classification & structures. Physico-chemical properties of amino acids (amphoteric molecules, ionisation, zwitterions, pk values, isoelectric point, Lambert-Beer's law, optical density, absorption spectra). **Proteins:** Primary, secondary, tertiary and quaternary structure (definition and example), structure of globular protein (albumin, globulin, haemoglobin & myoglobin – Structure, function and occurrence in brief) and fibrous protein (keratin, collagen -role of Vitamin C in hydroxylation, Structure, function and occurrence in brief), Forces that stabilize structure of proteins, salting in and salting out, absorbance of proteins **Nucleic acids:** Nucleotides - structure and properties. Nucleic acid structure – Watson-Crick model of DNA. Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry - UV absorption, effect of acid and alkali on nucleic acids. Other functions of nucleotides – source of energy, component of coenzymes.	**20**
7	**Bioenergenetics:** Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.	**5**
8	**Enzymes:** Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; different classes of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theroy), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.	**5**

Practical (Credits -2, 60 Hrs)

1. Measurement of plant cell size by the technique of micrometry.
2. Study of plant cell structure with the help of epidermal peel mount of *Onion/Rhoeo.*
3. Study the phenomenon of plasmolysis and deplasmolysis.
4. Study of cell and its organelles with the help of electron micrographs.
5. Study different stages of mitosis (onion root tip).
6. Preparation of normal, molar solutions and percent solutions (using NaCl and Sucrose).
7. Concept of pH and preparation of phosphate buffer.
8. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins (quantitative, standard curve, through Lowry method).
9. Estimation of DNA by diphenylamine method.
10. Estimation of RNA by orcinol method.

Reading References:

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
8. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**

Semester: **2**

Course Code: **BAECLEN02T**

Course Title: **Communicative English**

(L-P-Tu): **4-0-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**

Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(BOTANY)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BBOTMAJ03C**
Course Title: **Morphology, Anatomy and Plant Taxonomy**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. This paper intends to offer the bird's eye view about the morphological, anatomical and systematic beauty of the angiosperms. 2. It offers the sound idea about the diversity of angiosperms along with its identification. 3. It offers the different t**
Learning Outcome: **1. Students will learn the morphological, anatomical & systyematic pleasure of the angiosperms world. 2. A detail concept & knowledge will develop to understand the angiosperm diversity. 3. Application of systematic knowledge will increase their appetit**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Vegetative morphology- A general account of root, stem & leaves with different types of modifications; Different types of stipules and modifications along with phyllotaxy and diversity of leaves.	**5**
2	Flower- different types of inflorescences**;** Floral morphology with special reference to adhesion and cohesion of the floral parts, Placentaion - types; Floral formula, Floral diagram.	**4**
3	Fruit s & seeds- types and their taxonomic relevance	**4**
4	Structure and Development of Plant Body internal organization of plant body: The three tissue systems, types of cells and tissues. Root stem transition. Apical meristems Evolution of concept of organization of shoot apex Types of vascular bundles; Structure of dicot and monocot stem.	**5**
5	Vascular Cambium and Wood Structure, function and seasonal activity of cambium; Secondary growth in root and stem with Types of Anomalous secondary growth with special emphasis on *Boerhavia and Dracaena*. Axially and radially oriented elements; reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology. Development and composition of periderm, rhytidome and lenticels.	**5**
6	Significance of Plant systematics as a synthetic science, Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access.	**8**

7	Taxonomic hierarchy, Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary). Botanical nomenclature, Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.	**8**
8	Systems of classification, Idea on classification systems of Bentham and Hooker, Engler and Prantl and Takhtajan; Classification system of Bentham and Hooker (up to series). Brief reference of Angiosperm Phylogeny Group (APG IV) classification.	**8**
9	Biometrics, numerical taxonomy and cladistics Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).	**5**
10	Phylogeny of Angiosperms Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram only).	**8**

Practical (Credits -2, 60 Hrs)

1. Study of phyllotaxy and stipules (including modifications).
2. Study of Inflorescence types- Racemose, Cymose, Special types and with respect to the specific families below
3. Study of floral morphology with special reference to adhesion and cohesion of the floral parts, placentation.
4. Study of different fruit types with respect to the specific families below

5. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):

Malvaceae – *Sida* sp. / *Abutilon* sp.
Acanthaceae – *Ruellia* sp./*Barleria* sp.
Fabaceae – *Tephrosia* sp./*Crotalaria* sp.
Verbenaceae – *Lantana* sp./*Duranta* sp.
Asteraceae - *Vernonia* sp./*Ageratum* sp., *Eclipta* sp./*Tridax* sp.
Solanaceae – *Solanum* sp./*Nicotiana* sp.
Lamiaceae – *Leucas* sp./*Ocimum* sp.
Euphorbiaceae – *Euphorbia* sp. / *Jatropha* sp.
Poaceae – *Triticum* sp./*Chrysopogon* sp. or any local common grass
Orchidaceae- *Vanda* sp.

6. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book – At least 25 nos.).
7. Root: monocot, dicot, secondary growth.
8. Stem: monocot, dicot - primary and secondary growth
9. Anatomy of Leaf: isobilateral, dorsiventral
10. Anomalous secondary growth (Through permanent slides).
11. Study of Stomata and its types
13. Field visit (two) at least one to study the local flora

Reading References:

1. College Botany: Volume 1 by Hirendra Chandra Gangulee (Author), Kumud Shankar Das (Author), Chittatosh Dutta (Author), Shyamapada Sen (Editor)
2. A Textbook of Botany: Vol II by Bhattacharya Ghosh Hait
3. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
4. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
5. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.

6. Evert, R.F. (2006) Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
7. Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi.3rd edition.
8. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
9. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
10. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
11. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York.

Syllabus *(BOTANY)*

Course Type: **MAJ-4**

Semester: **4**

Course Code: **BBOTMAJ04C**

Course Title: **Molecular Biology, Genetics and Plant Breeding**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. Understanding the mechanism and concepts of life process at molecular level. 2. Knowledge about nucleic acids, DNA organization, DNA replication, genetic code and transcription and translation. 3. To understand the processing and modification of RNA**

Learning Outcome: **After the completion of the course the students will be able to: 1. Understanding the mechanism and concepts of life process at molecular level through central dogma concept. 2. Understand nucleic acids, organization of DNA in prokaryotes and Eukaryot**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Nucleic acids: DNA as the carrier of genetic information (Griffith's, Hershey & Chase, McLeod & McCarty experiment).	**2**
2	The Structures of DNA and RNA/Genetic Material: DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. RNA Structure. Organelle DNA -- mitochondria and chloroplast DNA. The Nucleosome. Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.	**4**
3	The replication of DNA: Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semiconservative and semi discontinuous replication, RNA priming; rolling circle and θ (theta) mode of replication, replication of linear ds-DNA, replication of the 5'end of linear chromosome; Enzymes involved in DNA replication.	**5**
4	Transcription: Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: lac operon Eukaryotes: transcription factors, heat shock proteins, Gene silencing.	**4**

5	Processing and modification of RNA: Split genes-concept of introns and exons, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing, eukaryotic mRNA processing (5' cap, 3' poly A tail); Ribozymes; RNA editing.	**3**
6	Central dogma and genetic code: Genetic code (deciphering & salient features).	**2**
7	Translation: Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis.	**4**
8	Mendelian genetics and its extension: Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Polygenic inheritance.	**5**
9	Extrachromosomal Inheritance: Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail; Infective heredity- Kappa particles in Paramecium.	**3**
10	Linkage, crossing over and chromosome mapping: Linkage and crossing over-Cytological and molecular basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping.	**3**
11	Variation in chromosome number and structure: Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy.	**3**
12	Gene mutations: Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, and intercalating agents); Role of Transposons in mutation.DNA repair mechanisms.	**3**
13	Fine structure of gene: Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus.	**3**
14	Population and Evolutionary Genetics: Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift.	**4**
15	Plant Breeding: Introduction and objectives. Modes of reproduction in crop plants. Methods of crop improvement: Acclimatization; Selection methods: For self-pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations. Role of mutations; Polyploidy; Distant hybridization; Heterosis: Theories and Applications.	**12**

Practical (Credits -2, 60 Hrs)

1. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
2. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
3. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments).
4. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.
5. Isolation of genomic DNA from plant sample (demonstration through youtube video).
6. Meiosis through temporary squash preparation with special reference to *Allium sp*.
7. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
8. Chromosome mapping using point test cross data.
9. Idea about pre-treatment, fixation, staining and smear preparation.
10. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
11. Photograhs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.

Reading References:

1. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjaminn Cummings. U.S.A. 9th edition.
4. Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
6. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
7. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
8. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings, U.S.A. 9th edition.
9. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
10. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
11. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH.2nd edition.
12. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

Syllabus *(BOTANY)*

Course Type: **MAJ-5**

Semester: **4**

Course Code: **BBOTMAJ05C**

Course Title: **Economic Botany, Pharmacognosy and Natural Resource Management**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. To create an interest about the natural resources and its management practices among the students. 2. To create awareness about the economic important plants and their diverse uses in the society. 3. to induce interest among the different medicinal pla**

Learning Outcome: **1. The students should able to identify the major economically important plants and their role in civilization. 2. Able to use evidenced-based comparative knowledge and the propagation of plants with respect**

to environmental conditions. 3, Students will

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Natural resources Definition and types	**2**
2	Sustainable utilization Concept approaches (economic, ecological and socio-cultural).	**2**
3	Land Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.	**4**
4	Water Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.	**6**
5	Biological Resources Biodiversity-definition and types; Significance; Threats; Management strategies; Bioprospecting; IPR; CBD; National Biodiversity Action Plan).	**6**
6	Energy Renewable and non-renewable sources of energy.	**2**
7	Contemporary practices in resource management EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.	**4**
8	National and international efforts in resource management and conservation.	**2**
9	Origin of cultivated plants: Concepts of centres of origin and their importance with reference to Vavilov's work with special reference to Rice, Legumes and Beverages.	**4**
10	Study of the following economically important plants (Scientific names, families, parts used and importance Spices, Ginger, cumin, Beverages- Tea, coffee, Medicinal plants-, neem, Vasaka, Vegetables- Potato, radish, bottle, Fibre yielding plants- jute, Timber yielding plants- Sal, Lac Culture, Fruits- Mango, Sugar yielding plant- Sugarcane.	**8**
11	Sources of oils and fats General description, classification, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, comparison with fatty oils & their uses.	**5**
12	Medicinal botany: History, scope and importance of medicinal plant, a brief idea about indigenous medicinal sciences- ayurveda, siddha and unani. Polyherbal formulations.	**3**
13	Pharmacognosy- General account: Pharmacognosy and its importance in modern medicine, Crude drugs, Classification of drugs- chemical and pharmacological, Drug evaluation– organoleptic, microscopic, chemical, physical and biological, Major pharmacological groups of plant drugs and their uses.	**5**
14	Secondary metabolites: 3.1 Definition of secondary metabolites and difference with primary metabolites, 3.2 Interrelationship of	**4**

	basic metabolic pathways with secondary metabolite biosynthesis (outlines only), 3.3 Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against pathogenic microbes and herbivores.	
15	Pharmacologically active constituents: Source plants (one example) parts used and uses of: 1 Steroids (Solasodin, Diosgenin, Digitoxin), Tannin (Catechin), Resins (Gingerol, Curcuminoids), Alkaloids (Quinine, Atropine. Pilocarpine, Strychnine, Reserpine, Vinblastine), Phenols (Sennocide and Capsaicin).	**3**

Practical (Credits -2, 60 Hrs)

1. Estimation of solid waste generated by a domestic system (biodegradable and nonbiodegradable) and its impact on land degradation.
2. Estimation of foliar dust deposition.
3. Determination of total solid in water (TDS)
4. Determination of chemical properties of soil by rapid spot test (carbonate, iron, nitrate)
5. Estimation of organic carbon percentage present in soil sample.
6. Collection of data on forest cover of specific area
7. Study of economically important plants (rice/jute/ tea) through herbarium specimens and field study. 2. Study of cultivation practices in field and submission of report.
8. Study of local economically important plants and submission of report with photographs
9. Chemical tests for (a) Tannin (Camellia sinensis / Terminalia chebula), (b) Alkaloid (*Catharanthus roseus*)
10. Powder microscopy – *Zingiber* and *Holarrhena*.
11. Histochemical tests of (a) Curcumin (*Curcuma longa*), (b) Starch in non-lignified vessel (*Zingiber*), (c) Alkaloid (stem of *Catharanthus* and bark of *Holarrhena*).

Reading References:

Economic Botany:

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Pharmacognosy:

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
3. Pharmacognosy, Dr. C. K. Kokate et al. 1999. Nirali Prakashan.
4. Trease and Evans' Pharmacognosy (27 May, 2009) by FRPharmS Evans, William Charles, BPharm, BSc, PhD, DSc, FIBiol, FLS (Author)

Natural Resource Management:

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Course Type: **MAJ-6**
Semester: **5**

Course Code: **BBOTMAJ06C**

Course Title: **Ecology, Phytogeography and Sustainable Biology**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. The students will have the pleasure of the cognitive development and get the latest exposure in the domain of plant sciences. 2. To mould a responsible citizen who is aware of the most basic domain-independent knowledge including the critical thinking**

Learning Outcome: **1. A knowhow for the development of the proper description of the different environmental issues, 2. Internalization of the concept of conservation and evolution through the channel of the spirit of enquiry. 3. The graduates should be knowledgeable and**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Introduction: Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.	**4**
2	Edaphic factors: Soil Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development; Water ; States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil; Water table.: Light, temperature, wind and fire.	**8**
3	Ecosystems: Structure; Processes; Trophic organisation; Food chains and Food webs; Ecological pyramids.	**6**
4	Population ecology: Characteristics and Dynamics, Ecological Speciation	**4**
5	Plant communities: Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts.	**6**
6	Biotic interactions: Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.	**4**
7	Functional aspects of ecosystem: Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.	**6**
8	Phytogeography: Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation.	**6**
9	Sustainable Biology- Definitions, Scope and its different attributes; principles of Sustainability: Scope of sustainability; Need of Sustainability in agriculture, Environment & man made different ecosystems.	**6**
10	Carrying capacity, Sustainable development and Environmental impact assessment. Earth summits, SDGs 17; Different environmental movement like Chipco, Silent valley; Different	**6**

	conferences for sustainable development and the conservation of biotic resources; Laws & regulations	
11	Sustainability, global environmental challenges with special references to global warming & vulnerable ecosystems in Purulia.	**4**

Practical (Credits -2, 60 Hrs)

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH of various soil and water samples (pH meter, universal indicator/Lovibond comparator and pH paper)
3. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
4. Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.
5. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
6. (a). Study of morphological adaptations of hydrophytes and xerophytes (four each). (b). Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*) Epiphytes, Predation (Insectivorous plants).
8. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
9. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
10. Field visit to familiarise students with ecology & Sustainability of different sites.

Reading References:

1. Odum, E.P. (2005). Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology: An Earth Systems Approach.Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.

Syllabus *(BOTANY)*

Course Type: **MAJ-7**

Semester: **5**

Course Code: **BBOTMAJ07C**

Course Title: **Plant Physiology and Metabolism**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **Understand the role of physiological and metabolic processes for plant growth and development. Recognizing the wonderful mechanism of transport and the Interrelationships existing between metabolic pathways thereby gaining and idea about the importance of**

Learning Outcome: **After the completion of the course the students will be able to: 1. Understand basic functions and intermediary metabolism in a plant body. 2. Gain knowledge on the role of physiological and metabolic processes for plant growth and development. 2. Lear**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Plant-water relations: Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure,	**5**

	guttation. Ascent of sap– cohesion-tension theory. Transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement.	
2	Mineral nutrition: Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents. Transport of ions across cell membrane.	**5**
3	Translocation in the phloem: Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship.	**4**
4	Plant growth regulators: Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid and Ethylene,	**5**
6	Plant response to light and temperature: Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far-red light responses, Vernalization.	**4**
7	Concept of metabolism: Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, and Isozymes).	**3**
8	Photosynthesis: photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photosynthetic electron transport, PSI, PSII, Q cycle, CO_2 reduction, photorespiration, C4 pathways; CAM; Factors affecting CO_2 reduction.	**9**
9	Respiration: Glycolysis, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, cyanide-resistant respiration, factors affecting respiration.	**8**
10	ATP-Synthesis: Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, role of uncouplers.	**4`**
11	Lipid metabolism: Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination.	**4**
12	Nitrogen metabolism: Biological nitrogen fixation; Nitrate and ammonia assimilation.	**4**
13	Signal transduction**:** Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, Calcium calmodulin, MAP kinase cascade.	**5**

Practical (Credits -2, 60 Hrs)

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Determination of water potential of given tissue (potato tuber) by weight method.
3. Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf.
4. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and

xerophyte.
5. To study the phenomenon of seed germination (effect of light).
6. Experimental demonstration of Hill's reaction.
7. To study the effect of light intensity and bicarbonate concentration on O_2 evolution in photosynthesis.
8. To compare the rate of respiration in different parts of a plant.

Demonstration experiments
1. To demonstrate suction due to transpiration.
2. Fruit ripening/Rooting from cuttings (Demonstration).
3. Bolting experiment/Avena coleptile bioassay (demonstration).
4. Effect of auxins on rooting.
5. R.Q.

Reading References:

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
4. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.

Syllabus *(BOTANY)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BBOTMAJ08C**
Course Title: **Plant Biotechnology and Tissue Culture**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Learning of knowledge& skill in plant tissue culture, plant molecular biology and transgenic. Application of plant biotechnology in plant genomics, phylogenetic studies and metabolic engineering. Understanding of new molecular techniques in cell and metab**
Learning Outcome: **Students will have knowledge & skill in plant tissue culture, plant molecular biology and transgenic. They will understand the basic tools and techniques used in Plant tissue culture.**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Recombinant DNA Technology: Enzymes for DNA manipulation, Restriction Endonucleases (Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Basic idea about CRISPR gene editing, DNA and RNA Purification, Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC), Bacterial Transformation and selection of recombinant clones, Recombinant Screening	**10**
2	Introduction of DNA to host cells: Agrobacterium mediated gene transfer, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP)	**8**

3	Method of Clone identification, Expression and Modification: DNA Library, construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization, Expression Vector, DNA microarray technology, Site directed mutagenesis.	**9**
4	PCR and Reverse Transcriptase-PCR, Nucleic acid hybridization, Isotopic and non-Isotopic labelling of Nucleic acids, Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing.	**9**
5	Applications of Biotechnology: Pest resistant (Bt-cotton); herbicide resistant plants (Round Up Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Marigold); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Protease, Lipase); Genetically Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns.	**12**
6	Plant Tissue Culture: Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).	**12**

Practical (Credits -2, 60 Hrs)

1. (a) Preparation of MS medium. (b) Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, *Datura*, *Brassica* etc.
2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
3. Isolation of protoplasts
4. Construction of restriction map of circular and linear DNA from the data provided.
5. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.

Reading References:

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.

2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

3. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.

4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.

5. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Course Type: **MAJ-9**

Semester: **6**

Course Code: **BBOTMAJ09C**

Course Title: **Plant Health Science and Technology**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. The students will have the pleasure of the cognitive development and get the latest exposure in the domain of plant sciences. 2. To mould a responsible citizen who is aware of the most basic domain-independent knowledge including the critical thinking**

Learning Outcome: **1. Skill development of for the proper description of the plant health & disease consequences 2. Internalization of the concept of plant defence mechanisms of the spirit of enquiry. 3. The graduates should be knowledgeable and competent enough to approp**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Introduction to Plant Health Science–Definition and Importance of plant health science; Factors affecting plant health – edaphic factors and biotic factors; Basic principles of plant pathology, entomology and nematology; Plant health in response to plant stress physiology	**8**
2	Plant Pathogens and Diseases - Types of plant pathogens (viruses, bacteria, fungi, nematodes); Life cycle of pathogens; Mode of transmission; Plant-pathogen interactions- pathogenicity factors; Phytoalexins in defence mechanism; Systemic and Local acquired resistance; Common plant diseases and their symptoms- Late blight of potato, Black stem rust of wheat, Stem rot of jute, Brown spot of rice; Epidemiology of plant diseases; Disease development and progression; Symptomology; Symptoms variability; Disease diagnosis methods for biotic factors (visual, laboratory tests-PCR, ELISA, BIOLOG test) and abiotic factors; Impact of disease on plant growth and yield.	**15**
3	Plant Disease and Health Management - Principles of integrated pest management; Cultural practices of disease prevention, biological and chemical control methods; Resistance breeding; Soil fertility management; Weed management.	**8**
4	Plant Health in Agriculture–Disease management in agricultural system; Role of plant health in sustainable agriculture; Food safety and plant health.	**5**
5	Plant Health and the Environment–Impacts of plant health in ecosystems; Plant health and climate change; Bio-security and plant health; Plant quarantine	**4**
6	Technological advances in Plant health sciences–Genetic engineering and biotechnology for improvement of plant health; Precision agriculture; Remote Sensing and GIS uses in agriculture; Sensor-based plant protection techniques; Automation of irrigation systems; Drone usages in agriculture, Role of bioinformatics in plant disease management– Whole Genome Sequencing and Microarray Genomics in disease diagnosis; detection of various pathogenicity factors; Role of bioinformatics in raising disease resistance cultivars.	**15**

7	Intellectual Property Rights– Functions of IPR, Various forms of IPR, Importance of IPR in plant health, Plant Variety Protection (PVP) rights, Plant Breeder's rights.	**5**

Practical (Credits -2, 60 Hrs)

1. Visual diagnosis of common diseased plant symptoms and signs–Fungal leaf spots, Bacterial leaf spots, Vein banding, Mosaic and ring spot, Leaf distortion, Powdery mildew, Leaf tip death, Cankers, Fruit discoloration, Wilts, Blights, Damping off.
2. Laboratory testing of plant pathogen by microscopy and pathogen-selective media plates.
3. A field visit and assessment of plant disease incidence and severity.

Reading References:

1. Agrios, G. N. 1997. Introductory Plant Pathology. 4th ed. Academic Press, New York, NY.
2. Hansen, M. A. and R. L. Wick. 1993. Plant disease diagnosis: present and future prospects. Advances in Plant Pathology 10:65-126.
3. Hansen, M. A. and R. L. Wick. 1993. Plant disease diagnosis: present and future prospects. Advances in Plant Pathology 10:65-126.
4. "Law Relating to Intellectual Property Rights" by V K Ahuja (Lexis Nexis Publication)

Syllabus *(BOTANY)*

Course Type: **MAJ-10**

Semester: **6**

Course Code: **BBOTMAJ10C**

Course Title: **Reproductive Biology of Higher Plants**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. the students will have the pleasure of the cognitive development and get the latest exposure in the domain of the reproductive biology plant sciences. 2. to mould a responsible citizen who is aware of the most basic domain-independent knowledge includ**

Learning Outcome: **1. Skill development of for the proper description of the different plant reproduction issues, 2. Internalization of the concept of plants reproductive behavioural pattern through the channel of the spirit of enquiry. 3. The graduates should be knowledg**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Introduction: History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope.	**4**
2	Reproductive development: Induction of flowering; flower as a modified determinate shoot. Flower development: genetic and molecular aspects.	**6**
3	Anther and pollen biology: Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance. Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.	**10`**

4	Ovule: Structure; Types; Special structures–endothelium, obturator, aril, caruncle and hypostase; Female gametophyte–megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of Polygonum type); Organization and ultrastructure of mature embryo sac.	**8**
5	Pollination and fertilization: Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization.	**6**
6	Self incompatibility: Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self- incompatibility: mixed pollination, bud pollination, stub pollination; Intra-ovarian and in vitro pollination; Modification of stigma surface, parasexual hybridization; Cybrids, in vitro fertilization.	**10**
7	Embryo, Endosperm and Seed: Structure and types; General pattern of development of dicot and monocot embryo and endosperm; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in *Paeonia*. Seed structure, importance and dispersal mechanisms.	**10**
8	Polyembryony and apomixis: Introduction; Classification; Causes and applications.	**6**

Practical (Credits -2, 60 Hrs)

1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
2. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, psuedomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall(micrograph); Pollen viability: Tetrazolium test. Germination: Calculation of percentage germination in different media using hanging drop method.
3. Ovule: Types-anatropous, orthotropous, amphitropous/campylotropous, circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs).
4. Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus.
5. Intra-ovarian pollination; Test tube pollination through photographs.
6. Endosperm: Study of different types.
7. Embryogenesis: Study of development of dicot embryo through permanent slides.

Reading References:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
2. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
3. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
4. Johri, B.M. l (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands.

Semester: **7**

Course Code: **BBOTMAJ11C**

Course Title: **Analytical Techniques in Plant Sciences**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. To expose the students to different techniques those can be used to study different biological processes. 2. To provide information about the chemical composition of biomass, characterize its properties and also determine the concentration of both org**

Learning Outcome: **After the completion of the course the students will be able to: 1. Understand instruments, techniques, lab etiquettes and good lab practices necessary for working in a laboratory. 2. Develop skill in different microscopic techniques. 3. Gain knowledge**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	**Imaging and related techniques:** Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.	16
2.	**Cell fractionation**: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2gradient, analytical centrifugation, ultracentrifugation, marker enzymes.	6
3	**Radiolabelling techniques:** Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.	8
4	**Chromatography:** Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.	10
5	**Biophysical Method:** Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, Molecular structure determination using X-ray diffraction, NMR, different types of mass spectrometry.	8
6	**Characterization of proteins and nucleic acids:** Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods. Analysis of RNA, DNA and proteins by AGE, PAGE, SDS-PAGE, and two dimensional gel electrophoresis, Isoelectric focusing gels.	12

Practical (Credits -2, 60 Hrs)

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. To separate sugars by thin layer chromatography.
3. To separate amino acids by paper chromatography.
4. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).

5. Preparation of permanent slides (double staining).

Reading References:

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York.U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Upadhyay, Updhyay and Nath (2009) Biophysical Chemistry : Principles and Techniques, Himalaya Publishing House, Mumbai.
5. Glasel, J. and Deutscher, M. B., "Introduction to Biophysical Methods for Protein and Nucleic acid Research", Academic Press, 1995.
6. Analytical Techniques in Plant Sciences, by Dr. Sanjeeb Kumar Nath , Mahaveer publication , 2022.
7. Practical Manual on Plant Molecular Biology and Analytical Techniques, Dr. S. Girija, AkiNik Publications, 2020

Syllabus *(BOTANY)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BBOTMAJ12C**
Course Title: **Bioinformatics and Quantitative Biology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To determine the function of genes and proteins, to establish evolutionary relationships, and to calculate the three-dimensional shape of proteins by using computer programs. 2. Analysis of complex sequences, sequence assemble, sequence alignment, gen**
Learning Outcome: **After the completion of the course the students will be able to: 1. Gain working knowledge of the practical and theoretical concepts of bioinformatics. 2. Acquiring skill to utilize the computational apps, active data basis and tools in analysis in gene**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	**Introduction to Bioinformatics:** Introduction, aim, scope of bioinformatics, Examples of related tools (FASTA, BLAST), databases (GENBANK, PDB) Data generation; Generation of largescale molecular biology data. (Through Genome sequencing, Protein sequencing and microarray).	10
2	**Biological Sequence Databases:** Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System, National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database, EMBL Nucleotide Sequence Database (EMBL-Bank) Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools, Protein sequences Databases:- Swiss-Prot, UniProtKB, Protein-Protein interaction database:- STRING; Sequence motifs Databases:- Prosite, Pfam, InterPro , Chemical Structure database:- Pubchem, Molecular	18

	functions / Enzymatic catalysis databases:- KEGG ENZYME database.	
3	**Sequence Alignments:** Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM).	**6**
4	**Molecular Phylogeny:** Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.	**4**
5	**Structural Bioinformatics:** Sequence pattern, motifs and profiles, SCOP, CATH. Prediction of secondary structure of protein.	**4**
6	**Applications of Bioinformatics:** Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Crop improvement.	**4**
7	**Biostatistics:** Definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics. Types and methods of data collection procedures - merits and demerits. Classification - tabulation and presentation of data - sampling methods, Mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co- efficient of variations. Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression, student 't' test, Chi-square test for goodness of fit.	**14**

Practical (Credits -2, 60 Hrs)

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.
6. Calculation of mean, standard deviation and standard error.
7. Calculation of correlation coefficient values and finding out the probability.
8. Calculation of ‘F’ value and finding out the probability value for the F value.

Reading References:

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics II Edition. Benjamin Cummings.
4. Biostatistic, Danniel, W.W., 1987.New York, John Wiley Sons.
5. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore.
6. The Principles of scientific research, Freedman, P. New York, Pergamon Press.
7. Statistics for Biologists, Campbell, R.C., 1998.Cambridge University Press.
8. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BBOTMAJ13C**
Course Title: **Immunology and Applied Microbiology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **The main objectives of studying applied microbiology are to exploit microorganisms for a specific product or use. Applied microbiology can overlap with basic microbiology, where methods used and perfected for applied microbiology can become tools for basi**
Learning Outcome: **Students will learn about cells and molecules of Innate and adaptive immune system Students will learn about antibody molecules helps in detection of biomolecules Students will learn about bioreactors/fermenters and fermentation processes Students will le**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Innate and adaptive immune system, Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity.	**6**
2	B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies Antibody generation, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, Chemokine and cytokine , inflammation, hypersensitivity and autoimmunity, congenital and acquired immunodeficiencies, vaccines types.	**16**
3	Reas: Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.	**8**
4	Bioreactors/Fermenters and fermentation processes, Solid-state and liquid-state fermentations; Batch fed batch and continuous fermentations, Components of a typical bioreactor, Types of bioreactors-laboratory, Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter.	**8**
5	Microbial production of industrial products in nutrition, healthcare and agriculture, Antimicrobial drugs; Antibiotics: Classification molecular mechanism of mode of action and resistance; Antifungal and antiviral drugs, Amino acids, vitamins, enzymes, organic acids, antitumor, immune suppressants, Biofuel bioplastic, waste water treatment.	**8**
6	Downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying	**6**

7	Microbial interactions; Carbon, sulphur, phosphorus and nitrogen cycles in forest soil and agriculture soil, Soil microorganisms associated with vascular plants (endophytes, epiphytes), **Biological Nitrification Inhibition (BNI),** Bioremediation, Uncultivable microorganisms, Process of making microbial inoculants, Top down, Bottom up, Mixed, Challenge with the establishment of microbial inoculants.	**8**

Practical (Credits -2, 60 Hrs)

Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase urease, phosphatase, lipase activity

Reading References on Immunology:

1. Cellular and Molecular Immunology- Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai

2. Roitt's Essential Immunology- Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt

3. Kuby Immunology- Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis

4. Immunology –Saras Publication

Reading References of Applied Microbiology:

1. Prescott L.M; J.P Heavy and D.A. Klein 1993 Microbiology 7th edition Wm C- Brown Publishers

2. Michael T. Madigan, John M. Martinko, Kelly Bender, Daniel P Buckley, David A. Stahl. Brock Biology of Microorganisms, 13th edition, Prentice hall International, Inc

3. Atlas, R.M. 1997. Principles of Microbiology, Second edition. WCK. McGraw – Hill. Prescott LM, Harley JP and Klein DA (2007) Microbiology (7th Edition) McGraw Hill New York

4. Ananthanarayanan, R. and Jayaram Panicker C.K. (2013) Text book of Microbiology. 9th Edition University Press, Hyderabad.

5. Stanbury, P.F., A. Whitaker and Hall S.J. 1995. Principles of fermentation technology. 2nd edition., Pergamon press. Casida, J.E. 1968: Industrial Microbiology, Wiley Eastern. Pastel, A.H. 2012; Industrial Microbiology. 2nd edition. Macmillan India Limited. Cruger and Cruger, Textbook of Industrial Microbiology. 2004

6. Principles of Fermentation Technology by P.F. Stanbury, W. Whitaker &S.J. Hall, Aditya Books (P) Ltd., New Delhi, 1997.

7. Peppler, H. J. and Pearlman, D. 1979. Microbial Technology, Vol 1 ans 2, Academic press.

8. Industrial Microbiology: An Introduction by Waites, Morgan, Rockey & Highton, Blackwell Science, 2001.

9. Biochemical Engineering and Biotechnology by B. Atkinson & F. Mavituna, The Nature Press, 1982. Bioreactor Design and Product Yield (1992), BIOTOL series, Butterworths

10. Chand, Fermentation Biotechnology: Industrial Perspectives.

Syllabus *(BOTANY)*

Course Type: **MAJ-14**

Semester: **8**

Course Code: **BBOTMAJ14T**

Course Title: **Research Methodology**

(L-P-Tu): **4-0-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **1. To develop research legitimacy and provides scientifically sound findings. 2. To provide better familiarity with the research topic by properly explaining each concept associated with it. 3. Research methodology eases the process of whole research to**

Learning Outcome: **1. Decision making ability and logical thinking will be generated among the students. 2. Students will be able to determine the reliability and validity of the whole research work. It will tell accurate**

sources from where data should be taken for studyin

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Basic concepts of research: Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs emperical). Research methods vs methodology. Literature review and its consolidation; Library research; field research; laboratory research.	**10**
2	General laboratory practices: Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions, Dilutions, Percentage solutions, Molar, molal and normal solutions; Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.	**12**
3	Data collection and documentation of observations: Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography.	**6**
4	Overview of Biological Problems: History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics- Transcriptional regulatory network.	**6**
5	Methods to study plant cell/tissue structure: Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.	**6**
6	Plant microtechniques: Staining procedures, classification and chemistry of stains. Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.	**12**
7	The art of scientific writing and its presentation: Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.	**8**

Reading References:

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.

2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.

3. Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BBOTMAJ15T**
Course Title: **Horticulture Practices and Post Harvest Technology**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **1. To increase the area, production and productivity of fruits, vegetable, spices, Medicinal and floriculture crops. 2. Generating employment, providing raw material to various food processing industries, and higher farm profitability due to higher produ**
Learning Outcome: **1. Will be encouraged to conduct basic and applied research in the field of Horticulture. 2. Will be skilled in horticultural practices and get job opportunity in horticultural industries. 3. Will get idea about post-harvest lost and their management.**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	**Introduction:** Scope and importance, Branches of horticulture; Role in rural economy and employment generation; Importance in food and nutritional security; Urban horticulture and ecotourism.	4
2	**Ornamental plants:** Types, classification (annuals, perennials, climbers and trees); Identification and salient features of some ornamental plants [rose, marigold, gladiolus, carnations, orchids, poppies, gerberas, tuberose, sages, cacti and succulents (opuntia, agave and spurges)] Ornamental flowering trees (Indian laburnum, gulmohar, Jacaranda, Lagerstroemia, fishtail and areca palms, semul, coraltree).	4
3	**Fruit and vegetable crops:** Production, origin and distribution; Description of plants and their economic products; Management and marketing of vegetable and fruit crops; Identification of some fruits and vegetable varieties (citrus, banana, mango, chillies and cucurbits).	4
4	**Horticultural techniques:** Application of manure, fertilizers, nutrients and PGRs; Weed control; Biofertilizers, biopesticides; Irrigation methods (drip irrigation, surface irrigation, furrow and border irrigation); Hydroponics; Propagation Methods: asexual (grafting, cutting, layering, budding), sexual (seed propagation), Scope and limitations.	8
5	**Landscaping and garden design:** Planning and layout (parks and avenues); gardening traditions - Ancient Indian, European, Mughal and Japanese Gardens; Urban forestry; policies and practices.	6
6	**Floriculture:** Cut flowers, bonsai, commerce (market demand and supply); Importance of flower shows and exhibitions.	6
7	**Post-harvest technology:** Importance of post-harvest technology in horticultural crops; Evaluation of quality traits;	10

	Harvesting and handling of fruits, vegetables and cut flowers; Principles, methods of preservation and processing; Methods of minimizing loses during storage and transportation; Food irradiation - advantages and disadvantages; food safety.	
8	**Disease control and management:** Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices; Crop sanitation; IPM strategies (genetic, biological and chemical methods for pest control); Quarantine practices; Identification of common diseases and pests of ornamentals, fruits and vegetable crops.	**8**
9	**Horticultural crops - conservation and management:** Documentation and conservation of germplasm; Role of micropropagation and tissue culture techniques; Varieties and cultivars of various horticultural crops; IPR issues; National, international and professional societies and sources of information on horticulture.	**10**

Reading References:

1. Singh, D. & Manivannan, S. (2009). Genetic Resources of Horticultural Crops. Ridhi International, Delhi, India.

2. Swaminathan, M.S. and Kochhar, S.L. (2007). Groves of Beauty and Plenty: An Atlas of Major Flowering Trees in India. Macmillan Publishers, India.

3. NIIR Board (2005). Cultivation of Fruits, Vegetables and Floriculture. National Institute of Industrial Research Board, Delhi.

4. Kader, A.A. (2002). Post-Harvest Technology of Horticultural Crops. UCANR Publications, USA.

Syllabus *(BOTANY)*

Course Type: **MAJ-16**

Semester: **8**

Course Code: **BBOTMAJ16T**

Course Title: **Seed Biology and Seed Technology**

(L-P-Tu): **4-0-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **Seed science and technology is a multidisciplinary field that is rapidly advancing in tandem with the development of improved plant varieties and other climate-resilient technologies. Provide students with the fundamental knowledge of seed science and tec**

Learning Outcome: **1. Make skilled and technical human resources available to seed industries so that farmers can obtain high-quality seeds. 2. Students will learn about seed physiology, seed protection, seed pathology, seed entomology, and seed biotechnology. 3. Students**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Seed structure and related functions, Physiology of Seed, seed health and productivity	**10**
2	Seed Production: Principles and Practices, Principles and Techniques in Vegetable Seed production, Principles and Techniques in crop Seed production, Seed Production in	**20**

	Field Crops, Seed Production and Cultivation of Medicinal and Aromatic Plants (MAPs), Weed Management in Crop Seed Production, Hybrid Seed Production	
3	Seed Quality Testing, Seed Processing, Storage and Deterioration	**10**
4	Seed pathology and Entomology, purity, storage and preservation, Seed Health Technology and quarantine, Seed Biotechnology	**20**

Reading References:

1. Desai BB. 2004. Seeds Handbook. Marcel Dekker. Kelly AF. 1988. Seed Production of Agricultural Crops. Longman. McDonald MB Jr & Copeland LO. 1997. Seed Production: Principles and Practices. Chapman & Hall. Musil AF. 1967. Identification of Crop and Weed Seeds. Handbook No. 219, USDA, Washington, DC, USA

2. Seed Science and Technology" by Subir Sen & Nabinananda Ghosh

3. Principles of Seed Technology" by P K Agrawal

4. Objective Seed Technology" by Phundan Singh

5. Agarwal RL. 1997. Seed Technology. 2nd Ed. Oxford & IBH.

6. Chhabra AK. 2006. Practical Manual of Floral Biology of Crop Plants. Dept. of Plant Breeding CCS HAU, Hisar.

Syllabus *(BOTANY)*

Course Type: **MAJ-17**

Semester: **8**

Course Code: **BBOTMAJ17C**

Course Title: **Elements of Forestry**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. The students will have the pleasure of the cognitive development and get the latest exposure in the domain of Forest & Forestry. 2. to mould a responsible citizen who is aware of the most basic domain-independent knowledge including the critical think**

Learning Outcome: **1. Skill development of for the proper description of the forest tree species, 2. Internalization of the concept of conservation the channel of the spirit of enquiry. 3. The graduates should be knowledgeable and competent enough to appropriately deliver**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Forestry: Definition, Scope; Forest as natural Resources; Man and forestry; Sustainability & forestry; Importance of Forest in sustainable ecology and Green house controlling	**5**
2	Forest resources, Forest classification, Farm Forestry, Social Forestry & Agro-forestry; Different Forest related products-Major & Minor; Forest as a source of sustainable economy; Indian Forest & Forestry: Regional and Local Forest resources; Social forestry	**10**
3	Silviculture: Definition, scope & objective. Factors of locality: climatic (Light, temperature & Frost). Topographic (Affect of	**10**

	Altitude, Aspect & Exposure. Edaphic: General, Parental rock influence on vegetation, Pan formation. Biotic: Influence of plants, insects, wild animals, man and his animals; Concept of regeneration of forest.	
4	Mensuration: definition, object and scope; Measurement of diameter and girth; Breast height – Rules of diameter measurement, diameter and girth class. Measurement of height of tree: Principles of height measurement (similar triangle, trigonometric). Volume: Measurement of volume of standing and felled trees, volume table.	**10**
5	Silviculture & forest Management; Classification and objective, Clear felling system: clear strip and alternate strip system. Regeneration by Taungya and /or departmental plantation, Uniform system: Shelter wood system, kinds and pattern of felling, Periodic Block, Indian Irregular shelter wood system, Selection system, Coppice – System: Simple, Coppice with Standard	**10**
6	Principles and objective of Forest conservation and management; Reserve, Protected and un-classed forest. Management classification: Sustained yield and progressive yield, CAI, MAI, sustainable forest, Joint Forest Management: Concept, working and sustainability; Role of JFM in the environmental restoration and biodiversity conservation.	**10**
7	Forest of Purulia; Forest products, Livelihood of Forest dwellers; Role of Forest in eco-tourism in Purulia; Forest & future, NTFP	**5**

Practical (Credits -2, 60 Hrs)

1. Different types of instruments used in Forest mensuration
2. Estimation of stand diameter, height, bark thickness, bark volume, and volume estimation of felled trees;
3. Estimation of trees age, growth of the tree
4. Different practices of the Silvicultural operations
5. Development of nursery and seed bed; Micropropagation techniques of the forest species
6. Study of the different types of Forest vegetation in Purulia district; Social Forestry and its impact on the social life

Reading References:

1. Introduction to Forestry Paperback –C. Nagmani & S.R. Reddy
2. Introduction To forestry and Agroforestry by Parthiban (K T, Scientific Publishers)
3. Text Book Of Introduction To Forestry by Bhol, Mishra, Chauhan
4. Principles and Practices of Silviculture by S.S. Negi
5. Principles and Practice of Silviculture by L.S. Khanna
6. Silviculture of Tree Species A Forestry Field Manual for Shahapurmath, Girish B, Satish Serial Publishing House
7. Silviculture of Indian Trees by Kannur, Siddappa, S S Inamati & Girish B Shahapurmath, I B P S S
8. Practical Manual on Principles and Practices of Social Forestry by Joseph
9. Social forestry by Sushil Kumar, Reliance Publishing House
10. Compendium on Forestry Paperback – by Umakanta Dash & Sourav Ranjan Majumder
11. Introduction to Forestry by Sivakumar, B & B Muralidharan

Course Type: **MAJ-18**

Semester: **8**

Course Code: **BBOTMAJ18C**

Course Title: **Restoration Biology and Ecosystem Services**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. The main objective of studying restoration biology is to learn about the science of ecological restoration, which is the practice of renewing and restoring degraded, damaged, or destroyed ecosystems and habitats in the environment by active human inter**

Learning Outcome: **1. Ecosystem services are processes provided by nature that support human life. These services include water catchment and filtration, moderation of floods, pollination, and renewal of soil fertility. 2. Restoration ecology is the scientific study of r**

(Theory, Credit 4)

Unit	Topic	No. of Lectures/Hrs
1	Ecological Concepts, Ecological Succession	**2**
2	Restoration Process ,Steps in the Process ,Understanding Limitations ,Biological Limitations, Soil microbes, Bacteria, Mycorrhizal fungus , Physical Limitations , Rock content ,Soil texture , Soil aggregation , Moisture, Bulk Density, Compaction and Available Rooting Depth, Slope, Topography and Stability, Soil Color , Top soil and sub soil depth , Chemical Limitations, Soil pH, Soil fertility , Overcoming Limitations (a few examples), Revegetation, Mulching, Equipment, Phytoremediation , Collaborative Restoration, Restoration in Various Settings (examples) , mining , metal and mineral ,coal, Grasslands , Tropical Forests , Wetlands, Fire	**20**
3	Management of the Productive Mine Spoil, Rebuilding Soil Structure, Management of Soil pH, Increase soil fertility, Recharging Soil Microbes, Re-establishing Nutrient Cycles, Top Soil Management, Choice of seed or underground structure (Rhizome, bulb, corm etc) for plantation, Selection of C4 or C3 plants	**12**
4	Re-vegetation at abandoned land, Agricultural approach, Ameliorative approach, Adaptive approach, Site specific ecotypes, Types of plant, Monoculture (herbs shrubs or trees), mixed culture, native plants, introduced plants	**12**
5	Four Types of Ecosystem Services, Ecosystem functions: The 'supporting' services, From biodiversity to bioperversity: from good science to poor environmental policy, How to avoid bio-perversity (negative outcomes for biodiversity), Provisioning and regulating services, Ecological production functions- Biodiversity & C-sequestration, Cultural and relational services, Coral reefs and ecotourism, Ecotourism in local places like Ajodhya	**14**

Practical (Credits -2, 60 Hrs)

1. Soil pH
2. Soil texture

3. Soil aggregation, Moisture, Bulk Density

Reading References:
Restoration Biology:

1. Bell, S. S., Fonesca, M. S. *et al*. Linking restoration and landscape ecology. *Restoration Ecology* ***5*****,** 318–323 (1997).
2. Bradshaw, A. D. Restoration: the acid test for ecology. In *Restoration Ecology: A Synthetic Approach to Ecological Research.* eds. Jordan, W. R., Gilpin, M. E. *et al.* (Cambridge, UK: Cambridge University Press, 1987): 23–29.
3. Falk, D. A., Palmer, M. A. *et al. Foundations of Restoration Ecology*. Washington, DC: Island Press, 2006.
4. Hobbs, R. J. & Harris, J. A. Restoration ecology: Repairing the Earth's ecosystems in the new millennium. *Restoration Ecology* **9,** 239–246 (2001).
5. Hobbs, R. J. & Norton, D. A. Towards a conceptual framework for restoration ecology. *Restoration Ecology* **4,** 324–337 (1996).
6. Hobbs, R. J., Arico, S. *et al.* Novel ecosystems: theoretical and management aspects of the new ecological world order. *Global Ecology and Biogeography* **15,** 1–7 (2006).
7. Holl, K. D., Loik, M. E. *et al*. Tropical montane forest restoration in Costa Rica: overcoming barriers to dispersal and establishment. *Restoration Ecology* **8,** 339–349 (2000).
8. Lamb, D. Large-scale ecological restoration of degraded tropical forest lands: the potential role of timber plantations. *Restoration Ecology* **6,** 271–279 (1998).
9. McKay, J. K., Christian, C. E. *et al*. "How local is local?": a review of practical and conceptual issues in the genetics of restoration. *Restoration Ecology* **13,** 432–440 (2005).
10. Michener, W. K. Quantitatively evaluating restoration experiments: research design, statistical analysis, and data management considerations. *Restoration Ecology* **5,** 93–110 (1997).
11. Montalvo, A. M., Williams, S. L. *et al*. Restoration biology: a population biology perspective. *Restoration Ecology* **5,** 277–290 (1997).
12. Osborne, L. L. & Kovacic, D. A. Riparian vegetated buffer strips in water-quality restoration and stream management. *Freshwater Biology* **29,** 243–258 (1993).
13. Palmer, M. A., Bernhardt. E. S. *et al.* Standards for ecologically successful river restoration. *Journal of Applied Ecology* **42,** 208–217 (2005).
14. Temperton, V. M., Hobbs, R. J. *Assembly Rules and Restoration Ecology*. Washington, DC: Island Press, 2004.
15. Van Andel, J. and Aronson J. *Restoration Ecology*. Malden, MA: Blackwell Publishing, 2006.
16. Young, T. P. Restoration ecology and conservation biology. *Biological Conservation* **92,** 73–83 (2000).
17. Young, T. P., Petersen, D. A. *et al.* The ecology of restoration: historical links, emerging issues, and unexplored realms. *Ecology Letters* **8,** 662–673

Ecosystem services:

1. Cardinale, B.J., R. B. Primack, and J.D. Murdoch, Chapter 5 - The many values of biodiversity, in Conservation Biology, 1st ed. 2019, Oxford University Press: New York, NY. p. 117-139.

2. Cardinale, B.J., R. B. Primack, and J.D. Murdoch, Chapter 6 - Biodiversity and ecosystem services, in Conservation Biology, 1st ed. 2019, Oxford University Press: New York, NY. p. 141-180.

3. Lindenmayer, D.B., et al., Avoiding bio-perversity from carbon sequestration solutions. Conservation Letters, 2012. 5(1): p. 28-36.

4. Tilman, D., et al., Diversity and productivity in a long-term grassland experiment. Science, 2001. 294(5543): p. 843-845.

5. Hungate, B.A., et al., The economic value of grassland species for carbon storage. Science Advances, 2017. 3(4): p. 1-8.

6. Brander, L.M., P. Van Beukering, and H.S.J. Cesar, The recreational value of coral reefs: A meta-analysis. Ecological Economics, 2007. 63(1): p. 209-218.

7. Loomis, J., et al., Measuring the total economic value of restoring ecosystem services in an impaired river basin: results from a contingent valuation survey. Ecological Economics, 2000. 33(1): p. 103-117.

8. Fuller, R.A., et al., Psychological benefits of greenspace increase with biodiversity. Biology Letters, 2007. 3(4): p. 390-394.
9. Lester, S.E., et al., Evaluating tradeoffs among ecosystem services to inform marine spatial planning. Marine Policy, 2013. 38: p. 80-89.
10. Schwenk, W.S., et al., Carbon storage, timber production, and biodiversity: comparing ecosystem services with multi-criteria decision analysis. Ecological Applications, 2012. 22(5): p. 1612-1627.
11. Alix-Garcia, J.M., E.N. Shapiro, and K.R. Sims, Forest conservation and slippage: Evidence from Mexico's national payments for ecosystem services program. Land Economics, 2012. 88(4): p. 613-638.
12. Pyron, A.R., We don't need to save endangered species. Extinction is part of evolution, in Washington Post. 2015, The Washington Post: Washington, D. C.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Sidho-Kanho-Birsha University

Syllabus & Course Curriculam

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BCEMMAJ01C**
Course Title: **Inorganic Chemistry – I**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **COURSE OBJECTIVE OF MAJOR - 1: The syllabus of Major -1 has been designed to provide the students with the basic ideas of General Inorganic and Physical Chemistry. The four modules consisting of Atomic Structure, Periodic Properties, Acid-Base and Redox**
Learning Outcome: **COURSE OUTCOMES OF MAJOR – 1: CO-1.1 Gather an in-depth knowledge about atomic structure. CO-1.2 Understand the periodic properties of the elements. CO-1.3 Understand the concepts of a redox reaction. CO- 1.4 Explain various phenomenon of redox r**

THEORY:

i. **ATOMIC STRUCTURE: (15L)**

Bohr's theory, its limitations and atomic spectrum of hydrogen atom; Sommerfeld's Theory, de Broglie equation, Heisenberg's Uncertainty Principle, Photoelectric Effect, A brief introduction to wave mechanical model of atomic structure (Schrodinger Equation only) Auf-Bau Principle, Hund's Rule of Maximum Spin Multiplicity, Pauli's Exclusion Principle, Electronic configuration of elements (upto Z = 30). Determination of Ground State Term Symbols of elements and ions (upto Z=30).

ii. **PERIODIC PROPERTIES: (20L)**

Modern IUPAC Periodic table, Effective nuclear charge, screening effects andpenetration, Slater's rules, atomic radii, ionic radii. Ionization potential, electron affinity andelectronegativity (Pauling's, Mulliken's and Allred- Rochow's scales). Group trends and periodic trends in these properties in respect of s-, p-block elements.

iii. **CONCEPT OF ACID-BASE THEORIES: (15L)**

Acid-Base concept: Arrhenius concept, theory of solvent system (in H2O, NH3,SO2 and HF), Bronsted-Lowry's concept, relative strength of acids, Pauling's rules.Lux-Flood concept, Lewis concept, HSAB principle. Thermodynamic acidity parameters, Drago-Wayland equation.

iv. **REDOX CHEMISTRY: (10L)**

Ion-electron method of balancing equation of redox reaction. Elementary idea onstandard redox potentials with sign conventions, Nernst equation (without derivation).

Influence of complex formation, precipitation and change of pH onredox potentials;formal potential. Feasibility of a redox titration, redox potential at theequivalencepoint, redox indicators. Redox potential diagram (Latimer and Frost diagrams) ofcommon elements and their applications. Disproportionation and comproportionationreactions (typical examples).

Solubility product principle, common ion effect and their applications to theprecipitation and separation of common metallic ions as hydroxides, sulfides,phosphates, carbonates, sulfates and halides.

READING REFERENCES:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of InorganicChemistry Oxford, 1970.
3. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford UniversityPress (2010).
4. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.
5. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education), 2005.
6. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principlesof Structure andReactivity 4th Ed., Harper Collins 1993, Pearson,2006.
7. Das, Asim. K.; Fundamentals Concepts of Inorganic Chemistry, Vol 1-7, 3rd Ed., CBS Publishers.

PRACTICALS:

1. Estimation of carbonate and hydroxide present together in mixture.
2. Standardization of KMnO4 by Oxalic acid.
3. Estimation of Fe(II) using standardized KMnO4 solution.
4. Estimation of Fe(II) using standardized K2Cr2O7 solution.

REFERENCES FOR PRACTICALS:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Mukherjee, G. N., University Handbook of Undergraduate Chemistry Experiments, University of Calcutta, 2003.

3. Nad, Mahapatra and Ghoshal, An Advance Course in Practical Chemistry, New Central Book Agency, Kolkata.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects

- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.

- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-2**

Semester: **2**

Course Code: **BCEMMAJ02C**

Course Title: **Organic Chemistry – I**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 2: The syllabus of Major -2 has been designed to provide the students with the basic ideas of bonding and hybridization and fundamental understanding of stereochemistry. The five modules consisting of valence bond theory, elect**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 2: CO- 2.1 Understand the valence bond theory. CO- 2.2 Understand the basics of electronic displacements. CO- 2.3 Understand the concepts of a Molecular Orbital theory. CO- 2.4 Understand the physical properties of the organic**

THEORY:

BONDING AND HYBRIDIZATION IN THE LIGHT OF ORGANIC CHEMISTRY: (25L)

(i) VALENCE BOND THEORY:

Concept of hybridisation, shapes of molecules, resonance (including hyperconjugation); calculation of formal charges and double bond equivalent (DBE); orbital pictures of bonding (sp3, sp2, sp: C-C, C-N & C-O systems and s-cis and s-trans geometry for suitable cases).

(ii) ELECTRONIC DISPLACEMENTS: Inductive effect, field effect, mesomeric effect,resonance energy; bond polarization and bond polarizability; electromeric effect; steric effect, steric inhibition of resonance.

(iii) MO THEORY: qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ, σ*, π, π *, n – MOs; basic idea about Frontier MOs (FMO); concept of HOMO, LUMO and SOMO; interpretation ofchemical reactivity in terms of FMO interactions; sketch and energy levels of πMOs of acyclic p orbital system (C=C, conjugated diene, triene, allyl andpentadienyl systems) ii) cyclic p orbital system (neutral systems: [4], [6]-annulenes; charged systems: 3-,4-,5-membered ring systems); Hückel's rules for aromaticity up to [10]-annulene (including mononuclear heterocyclic compounds up to 6-memberedring); concept of antiaromaticity and homoaromaticity; non-aromatic molecules; Frostdiagram; elementary idea about α and β; measurement of delocalization energies interms of β for buta-1,3-diene, cyclobutadiene, hexa-1,3,5-triene and benzene.

(iv) PHYSICAL PROPERTIES: Influence of hybridization on bond properties: bond dissociation energy (BDE) and bond energy; bond distances, bond angles; concept of bond angle strain (Baeyer's strain theory); melting point/boiling point and solubilityof common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments; relative stabilities of isomeric hydrocarbons in terms of heat of hydrogenation, heat ofcombustion and heat of formation.

BASIC STEREOCHEMISTRY-I: (20L)

Bonding geometries of carbon compounds and representation of molecules: Tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flyingwedgeand Newman projection formulae and their inter translations.

2. Concept of chirality and symmetry: symmetryelements and point groups (Cv, Cnh, Cnv, Cn, Dh, Dnh, Dnd, Dn, Sn(Cs,Ci); molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of epimers; concept of stereogenicity, chirotopicity and pseudoasymmetry; chiral centres and number of stereoisomerism: systems involving 1/2/3-chiralcentre(s) (AA, AB, ABA and ABC types).

3. Relative and absolute configuration: D/L and R/S descriptors; erythro/threo and meso nomenclature of compounds; syn/anti nomenclatures for aldols; E/Z descriptors for C=C, conjugated diene, triene, C=N and N=N systems; combination of R/S- and E/ Z- isomerisms: Optical activity of chiral compounds: optical rotation, specific rotation and molar rotation; racemic compounds, racemisation (through cationic, anionic, radical intermediates and through reversible formation of stable achiral ntermediates); resolution of acids, bases and alcohols via diastereomeric salt formation; optical purity and enantiomeric excess; invertomerism of chiral trialkylamines.

GENERAL REACTION MECHANISM-I: (15L)

1. Mechanistic classification: ionic, radical and pericyclic (definition and example);reaction type: addition, elimination and substitution reactions (definition andexample); nature of bond cleavage and bond formation: homolytic and heterolytic bond fission, homogenic and heterogenic bond formation; curly arrow rules inrepresentation of mechanistic steps; reagent type: electrophiles and nucleophiles(elementary idea); electrophilicity and nucleophilicity in terms of FMO approach.

2. Reactive intermediates: carbocations (carbenium and carbonium ions), carbanions,carbon radicals, carbenes: generation and stability, structure using orbital picture andelectrophilic/nucleophilic behavior of reactive intermediates (elementary idea).

READING REFERENCES:

1. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012.
2. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.
3. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited.
4. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education).
6. Fleming, I. Molecular Orbitals and Organic Chemical Reactions, Reference/Student Edition, Wiley, 2009.
7. James, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003.
8. Robinson, M. J. T., Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005.

PRACTICALS:

1. Separation

Based upon solubility, by using common laboratory reagents like water (cold, hot),dil. HCl, dil. NaOH, dil. NaHCO3, etc., of components of a binary solid mixture; purification of any one of the separated components by crystallization and determination of its melting point. The composition of the mixture may be of the following types: Benzoic acid/p-Toluidine; p-Nitrobenzoic acid/p-Aminobenzoic acid; p-Nitrotolune/p-Anisidine; etc.

2. Determination of boiling point

Determination of boiling point of common organic liquid compounds e.g., ethanol, cyclohexane, chloroform, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide, etc. [Boiling point of the chosen organic compounds should preferably be less than 160°C]

3. Identification of a Pure Organic Compound

Solid compounds: oxalic acid, tartaric acid, citric acid, succinicacid, resorcinol, urea, glucose, cane sugar, benzoic acid and salicylic acidLiquid Compounds: formic acid, acetic acid, methyl

alcohol, ethyl alcohol,acetone, aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene.

REFERENCES FOR PRACTICALS:

1. Bhattacharyya, R. C, A Manual of Practical Chemistry.
2. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).

4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry,5th Ed., Pearson (2012).

Syllabus *(ENGLISH)*

Course Type: **AEC-1**

Semester: **2**

Course Code: **BAECLEN02T**

Course Title: **Communicative English**

(L-P-Tu): **4-0-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**

Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-3**

Semester: **3**

Course Code: **BCEMMAJ03C**

Course Title: **Physical Chemistry – I**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **Course Objective of Major-3: The syllabus of Major-3 has been designed to provide the students with in-depth ideas on two of the most important aspects of Physical Chemistry: Chemical Thermodynamics and Chemical Kinetics. The three major modules consistin**

Learning Outcome: **Course Outcomes of Major-3: CO- 3.1: Introduce the basic definitions of Thermodynamics and the concepts of heat, energy, work, and their interrelationship. CO- 3.2: To understand the details of two major Thermodynamic Laws along with their applicability**

THEORY:

THERMODYNAMICS –I (12L)

1. Zeroth and 1st law of Thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics; Concept of heat, work, internal energy and statement of first law; enthalpy, H; relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and vander Waals) under isothermal and adiabatic conditions; Joule's experiment and its consequence.

2. Thermochemistry: Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equations and effect of pressure on enthalpy of reactions; Adiabatic flame temperature; explosion temperature.

THERMODYNAMICS –II (30 L)

1. Second Law: Need for a Second law; statement of the second law of thermodynamics; Concept of heat reservoirs and heat engines; Carnot cycle; Physical concept of Entropy; Carnot engine and refrigerator; Kelvin – Planck and Clausius statements and equivalence of the two statements with entropic formulation; Carnot's theorem; Values of dQ/T and Clausius inequality; Entropy change of systems and surroundings for various processes and transformations; Entropy and unavailable work; Auxiliary state functions (G and A) and their variation with T, P and V. Criteria for spontaneity and equilibrium.

2. Thermodynamic relations: Maxwell's relations; Gibbs- Helmholtz equation, Joule-Thomson experiment and its consequences; inversion temperature; Joule-Thomson coefficient for a vander Waals gas; General heat capacity relations.

3. Partial properties and Chemical potential: Chemical potential and activity, partial molar quantities, relation between Chemical potential and Gibb's free energy and other thermodynamic state functions; variation of Chemical potential (μ) with temperature and pressure; Gibbs-Duhem equation; fugacity and fugacity coefficient; Variation of thermodynamic functions for systems with variable composition; Equations of states for these systems, Change in G,S H and V during mixing for binary solutions.

4. Chemical Equilibrium: Thermodynamic conditions for equilibrium, degree of advancement; van't Hoff's reaction isotherm (deduction from chemical potential); Variation of free energy with degree of advancement; Equilibrium constant and standard Gibbs free energy change; Definitions of KP, KC and KX; van't Hoff's reaction isobar and isochore from different standard states; Shifting of equilibrium due to change in external parameters e.g. temperature and pressure; variation of equilibrium constant with addition to inert gas; Le-Chatelier's principle and its derivation.

5. Dissociation of weak electrolyte. Solubility equilibrium.

6. Nernst's distribution law; Application- (finding out Keq using Nernst distribution lawfor KI+I2 = KI3 and dimerization of benzene.

CHEMICAL KINETICS: (18 L)

Rate law, order and molecularity: Introduction of rate law, Extent of reaction; rate constants, order; Forms of rates of First, second and nth order reactions; Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate); Determination of order of a reaction by half-life and differential method; Opposing reactions, consecutive reactions and parallel reactions (with explanation of kinetic and thermodynamic control of products; all steps of first order).

READING REFERENCES:

1. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press
2. Castellan, G. W. Physical Chemistry, Narosa
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill
5. Laidler, K. J. Chemical Kinetics, Pearson
6. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry
7. Rakshit, P.C., Physical Chemistry Sarat Book House
8. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas
9. Bera, N. K., Ghosh, S., Ghosh, P., Vol-II& III, Physical Chemistry Concepts & Models, Techno World, Kolkata
10. Ashish Kumar Nag, Physical Chemistry (Vol-I & II), McGraw Hill Education (India) Pvt. Ltd.

11. K. L. Kapoor, A Textbook of Physical Chemistry, Vol-I to Vol-V, Macmillan Publishers India Ltd. 2004.

12. Ghoshal, A. Numerical Problems on Physical Chemistry, Books & Allied Pvt. Ltd. Kolkata.

PRACTICALS:

1. Determination of heat of neutralization of a strong acid by a strong base.
2. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate.
3. Study of kinetics of decomposition of H2O2by $FeCl_3$ and Neutral KI method.
4. Determination of partition coefficient for the distribution of I2 between waterand $CHCl_3$.

REFERENCES FOR PRACTICALS:

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G N., University of Calcutta.
2. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
3. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.
4. Saharay, S. K. &Basu, A. S. A Guide to Practical Physical Chemistry, University of Burdwan.

5. Concise Practical Chemistry, Karmakar, P., Sarkar(Sain), R., Ray, S., Ghosh, A. K., The New Book Stall, Kolkata

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-4**

Semester: **4**

Course Code: **BCEMMAJ04C**

Course Title: **Inorganic Chemistry – II**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 4: The syllabus of Major -4 has been designed to provide the students with in-depth knowledge of Chemical bonding, including Ionic bonding, Covalent Bonding, Co-ordinate covalent bonding and other weak bonding interactions. Thi**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 4: CO- 4.1 Thorough understanding of Chemical Bonding with special Emphasis on Ionic, Covalent bonding and Concepts of weak bonds like Hydrogen Bond, van der Waals bond. CO- 4.2 Understanding the concepts of Molecular Orbit**

THEORY:

CHEMICAL BONDING-I: (20 L)

1. Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its application and limitations. Packing of ions in crystals. Born-Landé equation with derivationn for lattice energy, Madelung Constant, Born-Haber cycle and its application, Solvation energy. Defects in solids (elemementary idea). Solubility energetics of dissolution process.

2. Covalent bond: Polarizing power and polarizability, ionic potential, Fajan's rules. Lewis structures, formal charge. Valence Bond Theory. The hydrogen molecule (Heitler-London approach), directional character of covalent bonds, hybridizations, equivalent and non-equivalent hybrid orbitals, Bent's rule, Dipole moments, VSEPR theory, shapes of molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry) and multiple bonding (σ and π bond approach).

Chemical Bonding-II (25L)

1. Molecular orbital concept of bonding (The approximations of the theory, Linear combination of atomic orbitals (LCAO)) (elementary pictorial approach): sigma and pi- bonds and delta interaction, multiple bonding. Orbital designations: gerade, ungerade, HOMO, LUMO. Orbital mixing,. MO diagrams of H2, Li2, Be2, B2, C2, N2, O2, F2, and their ions wherever possible; Heteronuclear molecular orbitals: CO, NO, NO+, CN-, HF, BeH2, CO2 and H2O. Bond properties: bond orders, bond lengths.

2. Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

3. Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Intermolecular forces: Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), receptor-guest interactions, Halogen bonds. Effects of chemical force, melting and boiling points.

CO-ORDINATION CHEMISTRY-I: (15 L)

Coordinate bonding: double and complex salts. Werner's theory of coordination complexes, Classification of ligands, Ambidentate ligands, chelates, Coordination numbers, IUPAC nomenclature of coordination complexes (up to two metal centers), Isomerism in coordination compounds, constitutional and stereoisomerism, Geometrical and optical isomerism in square planar and octahedral complexes.

READING REFERENCES:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970.
3. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).
4. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.
5. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education), 2005.
6. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure andReactivity 4th Ed., Harper Collins 1993, Pearson,2006.
7. Das, Asim. K.; Fundamentals Concepts of Inorganic Chemistry, Vol 1-7, 3rd Ed., CBS Publishers.
8. Miessler, G. L., Fischer, P. J., Tarr, D. A., Inorganic Chemistry, Pearson, 5th Edition.

PRACTICALS:

1. Estimation of Cu(II) by Iodometric method.
2. Determination of available Chlorine in bleaching powder by Iodometric method.
3. Estimation of Oxalic acid and Sodium oxalate by KMnO4.
4. Estimation of Fe(III) & Cu(II) by K2Cr2O7.

REFERENCES FOR PRACTICALS:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Mukherjee, G. N., University Handbook of Undergraduate Chemistry Experiments, University of Calcutta, 2003.

3. Nad, Mahapatra and Ghoshal, An Advance Course in Practical Chemistry, New Central Book Agency, Kolkata.

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-5**

Semester: **4**

Course Code: **BCEMMAJ05C**

Course Title: **Organic Chemistry – II**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 5: The syllabus of Major -5 has been designed to provide the students with the basic ideas of organic reaction mechanism and few concepts of organic stereochemistry. The later part includes concepts chiral axis, prostereoisome**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 5: CO- 5.1 Understand the aliphatic substitution reactions. CO- 5.2 Understand the basics of elimination reaction. CO- 5.3 Understand the concepts of a Molecular Orbital theory. CO- 5.4 Understand few concepts of orga**

THEORY:

FUNDAMENTALS OF ORGANIC REACTION MECHANISM: (16 L)

1. Free-radical substitution reaction: halogentaion of alkanes, mechanism (with evidence) and stereochemical features; reactivity-selectivity principle in the light of Hammond's postulate.

2. Nucleophilic substitution reactions: substitution at sp3 centre: mechanisms (with evidence), relative rates & stereochemical features: SN1, SN2, SN2', SN1' (allylic rearrangement) and SNi; effects of solvent, substrate structure, leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite); substitutions involving NGP; role of crown ethers and phase transfer catalysts; [systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers, epoxides].

3. Elimination reactions: E1, E2, E1cB and Ei (pyrolytic syn eliminations); formation of alkenes and alkynes; mechanisms (with evidence), reactivity, regioselectivity (Saytzeff/Hofmann) and stereoselectivity; comparison between substitution and elimination; importance of Bredt's rule relating to the formation of C=C.

BASIC STEREOCHEMISTRY-II (22 L)

1. Chirality arising out of stereoaxis: stereoisomerism of substituted cumulenes with even and odd number of double bonds; chiral axis in allenes, spiro compounds, alkylidene cycloalkanes and biphenyls; related configurational descriptors (Ra/Sa and P/M); atropisomerism; racemisation of chiral biphenyls; buttressing effect.

2. Concept of prostereoisomerism: prostereogenic centre; concept of (pro)nchirality: topicity of ligands and faces (elementary idea); pro-R/pro-S, pro-E/pro-Z and Re/Si descriptors; pro-r and pro-s descriptors of ligands on propseudoasymmetric centre.

3. Conformation: conformational nomenclature: eclipsed, staggered, gauche, syn and anti; dihedral angle, torsion angle; Klyne-Prelog terminology; P/M descriptors; energy barrier of rotation, concept of torsional and steric strains; relative stability of conformers on the basis of steric effect, dipole-dipole interaction and H-bonding; butane gauche interaction; conformational analysis of ethane, propane, n-butane, 4. 2-methylbutane and 2,3-dimethylbutane; haloalkane, 1,2-dihaloalkanes and 1,2-diols (up to four carbons); 1,2-halohydrin; conformation of conjugated systems (s-cis and s-trans).

REACTION MECHANISM –II (22 L)

1. Reaction thermodynamics: free energy and equilibrium, enthalpy and entropy factor, calculation of enthalpy change via BDE, intermolecular & intramolecular reactions.

2. Concept of organic acids and bases: effect of structure, substituent and solvent on acidity and basicity; proton sponge; gas-phase acidity and basicity; comparison between nucleophlicity and basicity; HSAB principle; application of thermodynamic principles in acid-base equilibria.

3. Tautomerism: prototropy (keto-enol, nitro - aci-nitro, nitroso-oximino, diazoamino and enamine-imine systems); valence tautomerism and ring-chain tautomerism; composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3-dicarbonyl systems, phenols and related systems), factors affecting ketoenol tautomerism; application of thermodynamic principles in tautomeric equilibria.

4. Reaction kinetics: rate constant and free energy of activation; concept of order and molecularity; free energy profiles for one-step, two-step and three-step reactions; catalyzed reactions: electrophilic and nucleophilic catalysis; kinetic control and thermodynamic control of reactions; isotope effect: primary and secondary kinetic isotopic effect (kH /kD); principle of microscopic reversibility; Hammond's postulate.

READING REFERENCES:

1. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012.
2. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.
3. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited.
4. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education).
6. Fleming, I. Molecular Orbitals and Organic Chemical Reactions, Reference/Student Edition, Wiley, 2009.
7. James, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003.
8. Robinson, M. J. T., Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005.

PRACTICALS:

Organic Preparations

A. The following reactions are to be performed, noting the yield of the crude product:

1. Nitration of aromatic compounds
2. Condensation reactions
3. Hydrolysis of amides/imides/esters
4. Acetylation of phenols/aromatic amines
5. Benzoylation of phenols/aromatic amines
6. Side chain oxidation of aromatic compounds
7. Diazo coupling reactions of aromatic amines
8. Bromination of anilides using green approach (Bromate-Bromide method)
9. Redox reaction including solid-phase method
10. Green 'multi-component-coupling' reaction.

REFERENCES FOR PRACTICALS:

1. Vogel, A. I. Elementary Practical Organic Chemistry, Part 1: Small scale Preparations, CBS Publishers and Distributors.
2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).
4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012).
5. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry:Preparation and Quantitative Analysis, University Press (2000).
6. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.

Course Type: **MAJ-6**

Semester: **5**

Course Code: **BCEMMAJ06C**

Course Title: **Physical Chemistry – II**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **Course Objective of Major-6: The syllabus of Major-6 is divided into four modules: (1) Kinetic theory of gases; (2) Applications of Thermodynamics-II; (3) Applications of Thermodynamics-II; and (4) Transport Process-I. The first module deals with the theo**

Learning Outcome: **Course Outcomes of Major - 6: CO - 6.1: Kinetic Theory of Gases, Behaviour of Real Gases, and Related Theories CO - 6.2: Thermodynamic rationale of the behaviour of solutions and mixtures, the thermodynamics of different phases of matter, and phase trans**

THEORY:

KINETIC THEORY OF GASES: (20 L)

1. Kinetic Theory of gases: Concept of pressure and temperature; Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules); Wall collision and rate of effusion.

2. Maxwell's distribution of speed and energy (without derivation): Nature of distribution of velocities, Maxwell's distribution of speeds in one, two and three dimensions; Kinetic energy distribution in one, two and three dimensions, calculations of average, root mean square and most probable values in each case; Calculation of number of molecules having energy $\geq \varepsilon$.

3. Real gas and virial equation: Deviation of gases from ideal behavior; compressibility factor; Boyle temperature; Andrew's and Amagat's plots; vander Waals equation and its features; its derivation and application in explaining real gas behaviour, other equations of state (Berthelot, Dietrici); Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states; virial equation of state; van der Waals equation expressed in virial form and significance of second virial coefficient; Intermolecular forces (Debye, Keesom and London interactions; Lennard-Jones potential - elementary idea). Equipartition principles.

APPLICATION OF THERMODYNAMICS-II: (20 L)

1. Binary mixture: Chemical potential of individual components. Thermodynamic parameters of mixing ideal solution; Colligative properties: Vapour pressure of solution; Ideal solutions, ideally diluted solutions and colligative properties; Raoult's law; Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) Osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution; Abnormal colligative properties.

2. Phase rule: Definitions of phase, component and degrees of freedom; Phase rule and its derivations; Definition of phase diagram; Phase diagram for water, CO2, Sulphur.

3. First order phase transition and Clapeyron equation; Clausius-Clapeyron equation - derivation and use; Liquid vapour equilibrium for two component systems; Phenol-water system.

4. Binary solutions: Ideal solution; Positive and negative deviations from ideal behaviour; Principle of fractional distillation; Duhem-Margules equation; Henry's law; Konowaloff's rule; Azeotropic solution; Liquid-liquid phase diagram using phenol- water system; Solid-liquid phase diagram; Eutectic mixture.

APPLICATION OF THERMODYNAMICS-III: (12 L)

1. Electromotive Force: Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation /reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinine-hydroquinone, glass and SbO/Sb2O3 electrodes.

2. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers; Qualitative discussion of potentiometric titrations

(acid-base, redox, precipitation).

TRANSPORT PROCESS-I: (8 L)

1. Diffusion; Fick's law: Flux, force, phenomenological coefficients & their interrelationship(general form), different examples of transport properties.

2. Viscosity: General features of fluid flow (streamline flow and turbulentflow);Newton's equation, viscosity coefficient; Poiseuille's equation;principle ofdetermination of viscosity coefficient of liquids by falling sphere method, Viscosity of gasesand effect of temperature and pressure on coefficient of viscosity (qualitative treatment only),Temperature variation of viscosity of liquids and comparison with that of gases.

READING REFERENCES:

1. Castellan, G. W. Physical Chemistry, Narosa.
2. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill
5. Moore, W. J. Physical Chemistry, Orient Longman
6. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry
7. Rakshit, P.C., Physical Chemistry Sarat Book House
8. Bera, N. K., Ghosh, S., Ghosh, P., Vol-(I, II & III), Physical Chemistry Concepts & Models, Techno World, Kolkata.
9. Mortimer, R. G. Physical Chemistry, Elsevier
10. Denbigh, K. The Principles of Chemical Equilibrium Cambridge University Press
11. Engel, T. & Reid, P. Physical Chemistry, Pearson
12. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas
13. Ashish Kumar Nag, Physical Chemistry (Vol-I & II), McGraw Hill Education (India) Pvt. Ltd.
14. K. L. Kapoor, A Textbook of Physical Chemistry, Vol-I to Vol-V, Macmillan Publishers India Ltd. 2004.
15. Ghoshal, A. Numerical Problems on Physical Chemistry, Books & Allied Pvt. Ltd. Kolkata
16. Klotz, I.M., Rosenberg, R. M. Chemical Thermodynamics:Basic Concepts and Methods Wiley
17. Glasstone, S. An Introduction to Electrochemistry, East-West Press.
18. Reddy, A. K., Bockris, John O'M.; Modern Electrochemistry: An Introduction to an Interdisciplinary Area, Springer, 1995.

PRACTICALS:

1. Determination of Keq for KI + I2 = KI3, using partition coefficient betweenwater and CHCl3.

2. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water.

3. Potentiometric titration: (a) weak acid vs. base, (b) Redox, determination of E^0.

4. Determination of strength of unknown HCl by NaOH pH-metrically.

REFERENCES FOR PRACTICALS:

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G N., University of Calcutta.
2. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
3. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.
4. Saharay, S. K. &Basu, A. S. A Guide to Practical Physical Chemistry, University of Burdwan.
5. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009)
6. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson

7. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007).

Semester: **5**

Course Code: **BCEMMAJ07C**

Course Title: **Organic Chemistry – III**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 7: The syllabus of Major -7 has been designed to provide the students with in-depth knowledge of addition reactions of alkenes and alkynes, including aromatic electrophilic and nucleophilic substitution reactions, various react**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 7: CO- 7.1 Thorough understanding of addition reactions involving alkenes and alkynes. CO- 7.2 Detailed study of various aromatic electrophilic and nucleophilic reactions . CO- 7.3 Detailed study of reactions involving carbony**

THEORY:

CHEMISTRY OF ALEKENES & ALKYNES: (12 L)

1. Addition to C=C: mechanism (with evidence wherever applicable), reactivity, regioselectivity (Markownikoff and anti-Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenations, iodolactonisation, hydrohalogenation, hydration, oxymercuration-demercuration, hydroborationoxidation,epoxidation, syn and anti-hydroxylation, ozonolysis, addition of singlet and triplet carbenes; electrophilic addition to diene (conjugated dienes and allene); radical addition: HBr addition; mechanism of allylic and benzylic bromination incompetition with brominations across C=C; use of NBS; Birch reduction of benzenoid aromatics; interconversion of E - and Z - alkenes; contra-thermodynamic isomerization of internal alkenes.

2. Addition to C≡C (in comparison to C=C): mechanism, reactivity, regioselectivity (Markownikoff and anti-Markownikoff addition) and stereoselectivity; reactions: hydrogenation, halogenations, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation, dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes by exploring its acidity; interconversion of terminal and non- terminal alkynes.

AROMATIC REACTIONS: (10 L)

1. Electrophilic aromatic substitution: mechanisms and evidences in favour of it; orientation and reactivity; reactions: nitration, nitrosation, sulfonation, halogenation,Friedel-Crafts reaction; one-carbon electrophiles (reactions: chloromethylation, Gatterman-Koch, Gatterman, Houben-Hoesch, Vilsmeyer-Haack, Reimer-Tiemann, Kolbe-Schmidt); Ipso substitituion.

2. Nucleophilic aromatic substitution: addition-elimination mechanism and evidences in favour of it; SN1 mechanism; cine substitution (benzyne mechanism), structure of benzyne.

Carbonyl and Related Compounds (30L)

1. Addition to C=O: structure, reactivity and preparation of carbonyl compounds; mechanism (with evidence), reactivity, equilibrium and kinetic control; Burgi-Dunitz trajectory in nucleophilic additions; formation of hydrates, cyanohydrins and bisulphite add nucleophilic addition-elimination reactions with alcohols, thiols and nitrogen- based nucleophiles; reactions: benzoin condensation, Cannizzaro and Tischenko reactions, reactions with ylides: Wittig and Corey-Chaykovsky reaction; Rupe rearrangement, oxidations and reductions: Clemmensen, Wolff-Kishner,LiAlH4, NaBH4, MPV, Oppenauer, Bouveault-Blanc, acyloin condensation;oxidation of alcohols with PDC and PCC; periodic acid and lead tetraacetateoxidation of 1,2-diols.

2. Exploitation of acidity of α-H of C=O: formation of enols and enolates; kineticand thermodynamic enolates; reactions (mechanism with evidence): halogenation ofcarbonyl compounds under acidic and basic conditions, Hell-Volhard-Zelinsky (H. V.Z.) reaction, nitrosation, SeO2 (Riley) oxidation; condensations (mechanism withevidence): Aldol, Tollens', Knoevenagel, Claisen-Schmidt, Claisen ester includingDieckmann, Stobbe; Mannich reaction, Perkin reaction, Favorskii rearrangement;alkylation of active methylene compounds; preparation and synthetic applicationsof diethyl malonate and ethyl acetoacetate; specific enol equivalents (lithiumenolates, enamines, aza-enolates and silyl enol ethers) in connection with alkylation,acylation and aldol type reaction.

3. Elementary ideas of Green Chemistry: Twelve (12) principles of green chemistry;planning of green synthesis; common organic reactions and their counterparts:reactions: Aldol, Friedel-Crafts, Michael, Knoevenagel, Cannizzaro, benzoin condensation and Dieckmann condensation.

4. Nucleophilic addition to α,β-unsaturated carbonyl system: generalprinciple and mechanism (with evidence); direct and conjugate addition, addition of enolates (Michael reaction), Stetter reaction, Robinson annulation.

5. Substitution at sp2 carbon (C=O system): mechanism (with evidence): BAC2,AAC2, AAC1, AAL1 (in connection to acid and ester); acid derivatives: amides, anhydrides & acyl halides (formation and hydrolysis including comparison).

Organometallics: (8L)

Grignard reagent; Organolithiums; Gilman cuprates: preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directed ortho metalation of arenes using organolithiums, conjugate addition by Gilman cuprates; Corey-House synthesis; abnormal behavior of Grignard reagents; comparison of reactivity among Grignard, organolithiums and organocopper reagents; Reformatsky reaction; Blaise reaction; concept of umpolung and base-nucleophile dichotomy in case of organometallic reagents.

READING REFERENCES:

1. Clayden, J., Greeves, N., Warren, S. Organic Chemistry, Second edition, Oxford University Press 2012.
2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education, 2003.
3. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.
4. Carey, F. A., Guiliano, R. M. Organic Chemistry, Eighth edition, McGraw Hill Education, 2012.
5. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press, 2008.
6. Norman, R.O. C., Coxon, J. M. Principles of Organic Synthesis, Third Edition, Nelson Thornes, 2003.
7. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar, I. L. Organic Chemistry (Volume 1), Pearson Education.
9. Graham Solomons, T.W., Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.
10. March, J. Advanced Organic Chemistry, Fourth edition, Wiley.
11. Jenkins, P. R., Organometallic Reagents in Synthesis, Oxford Chemistry Primer, Oxford University Press.
12. Ward, R. S., Bifunctional Compounds, Oxford Chemistry Primer, Oxford University Press.

PRACTICALS:

Qualitative Analysis of Single Solid Organic Compounds

1. Detection of special elements (N, S, Cl, Br) by Lassaigne's test.
2. Solubility and classification (solvents: H2O, 5% HCl, 5% NaOH and 5%NaHCO3).
3. Detection of the following functional groups by systematic chemical tests:
4. Aromatic amino (-NH_2), aromaticnitro (-NO_2), amido (-$CONH_2$, including imide),phenolic – OH, carboxylic acid (-COOH), carbonyl (-CHO and >C=O); only one testfor each functional group is to be reported.
5. Melting point of the given compound
6. Preparation, purification and melting point determination of a crystalline derivative of the given compound.
7. Identification of the compound through literature survey.

Each student, during laboratory session, is required to carry out qualitative chemical tests for all the special elements and the functional groups with relevant derivatization in known and unknown (at least six) organic compounds.

REFERENCES FOR PRACTICALS:

1. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G.N. University of Calcutta, 2003.

3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).
4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry, 5th Ed.,Pearson (2012).

5. Clarke, H. T., A Handbook of Organic Analysis (Qualitative and Quantitative), Fourth Edition, CBS Publishers and Distributors (2007).

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-8**

Semester: **6**

Course Code: **BCEMMAJ08C**

Course Title: **Inorganic Chemistry – III**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 8: The syllabus of Major -8 has been designed to provide the students with thorough understanding of the Crystal Field Theory, its advantages over VBT, its challenges, and its achievements. After completing this course, a stud**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 8: CO- 8.1 Thorough understanding of Co-ordination chemistry in the light of VBT, CFT, LFT. CO- 8.2 Understanding of the colour and spectra of co-ordination Compounds and their magnetic properties. CO- 8.3**

THEORY:

Coordination Chemistry-II (24L)

VB description and its limitations. Elementary Crystal Field Theory: splitting of d^n configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy (CFSE) in weak and strong fields; pairing energy. Spectrochemical series. Jahn- Teller distortion. Octahedral site stabilization energy (OSSE). Metal-ligand bonding (MO concept, elementary idea), sigma- and pi bonding in octahedral complexes (qualitative pictorial approach) and their effects on the oxidation states of transitional metals (examples). Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of dn ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment: super exchange and antiferromagnetic interactions (elementary idea with examples only); d-d transitions; L-S coupling; qualitative Orgel diagrams for $3d^1$ to $3d^9$ ions. Selection rules for electronic spectral transitions; spectrochemical series of ligands; charge transfer spectra (elementary idea).

REACTION KINETICS & MECHANISM: (10 L)

Introduction to inorganic reaction mechanisms. Substitution reactions in square planarcomplexes, Trans- effect and its application in complex synthesis, theories of trans-effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligandfield effects and reaction rates, Mechanism of substitution in octahedral complexes.

RADIOACTIVITY: (10 L)

Nuclear Stability and binding Energy, Nuclear Models and Elementary Idea, Magic Number. Artificial Radioactivity, Transmutation, Fission, Fusion, Spallation, Uses of Radioactivity.

NOBLE GASES: (4L)

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF_2, XeF_4 and XeF_6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2 and XeF_4). Xenon oxygen compounds. Molecular shapes of noble gas compounds (VSEPR theory).

GROUP CHEMISTRY OF S- AND P-BLOCK ELEMENTS: (12 L)

Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Beryllium hydrides and halides. Boric acid and borates, boron nitrides, borohydrides (diborane) and graphitic

compounds, silanes, Oxides and oxoacids of nitrogen, phosphorus, sulphur and chlorine. Interhalogen compounds, polyhalide ions, pseudohalogens, fluorocarbons and basic properties of halogens.

READING REFERENCES:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970.
3. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).
4. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.

5. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education), 2005.
6. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson,2006.
7. Das, Asim. K.; Fundamentals Concepts of Inorganic Chemistry, Vol 1-7, 3rd Ed., CBS Publishers.
8. Miessler, G. L., Fischer, P. J., Tarr, D. A., Inorganic Chemistry, Pearson, 5th Edition.

PRACTICALS:

1. Standardization of Na_2EDTA by Zn(II).

2. Determination of Hardness of water due to Calcium and Magnesium.

3. Preparation of Tris-(ethylenediamine) nickel(II) chloride.

4. Preparation of $[Fe(acac)_3]$.

REFERENCES FOR PRACTICALS:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Mukherjee, G. N., Advanced Experiments in Inorganic Chemistry, U. N. Dhur & Sons Private Ltd, Kolkata – 700073.
3. Mukherjee, G. N., University Handbook of Undergraduate Chemistry Experiments, University of Calcutta, 2003.

4. Nad, Mahapatra and Ghoshal, An Advance Course in Practical Chemistry, New Central Book Agency, Kolkata.

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-9**

Semester: **6**

Course Code: **BCEMMAJ09C**

Course Title: **Physical Chemistry – III**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **Course Objective and Learning Outcome of Major 9: The syllabus of Major 9 has been designed to make the students learn the most modern aspects of Physical Chemistry, such as Quantum Mechanics, Molecular Spectroscopy, Photochemistry, Symmetry and Group The**

Learning Outcome: **Course Outcomes of Major-9: CO - 9.1: This module will be helpful in understanding the Fundamentals of Quantum Mechanics, which include the Postulates of Quantum Mechanics, the Concept of Wave Function, the Probabilistic Nature of Quantum Particles, and e**

THEORY:

FOUNDATION OF QUANTUM MECHANICS: (16 L)

Beginning of Quantum Mechanics: Wave-particle duality, light as particles: photoelectric and Compton effects; electrons as waves and the de Broglie hypothesis; Uncertainty relations (without proof).

1. Wave function: Schrodinger time-independent equation; nature of the equation, acceptability conditions imposed on the wave functions and probability interpretations of wave function.

2. Concept of Operators: Elementary concepts of operators, eigenfunctions and eigenvalues; Linear operators; Commutation of operators, commutator and uncertainty relation; Expectation value; Hermitian operator; Postulates of Quantum Mechanics.

3. Particle in a box: Setting up of Schrodinger equation for one-dimensional box and its solution; Comparison with free particle eigenfunctions and eigenvalues. Properties of PB wave functions (normalisation, orthogonality, probability distribution); Expectation values of x, x2, px and px2 and their significance in relation to the uncertainty principle; Extension of the problem to two and three dimensions and the concept of degenerate energy levels.

4. Simple Harmonic Oscillator: setting up of the Schrodinger stationary equation, energy expression (without derivation), expression of wave function for n = 0 and n = 1 (without derivation) and their characteristic features.

5. Hydrogen atom problem, Schrodinger Equation, Concept of Quantum Numbers, Radial Distribution Function, Shape of orbitals, Concept of Angular Momentum and Spin Angular Momentum, Ground State Term Symbols.

MOLECULAR SPECTROSCOPY: (15 L)

1. Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

2. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

3. Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies; Diatomic vibrating rotator, P, Q, R branches.

4. Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

PHOTOCHEMISTRY: (10 L)

1. Lambert-Beer's law: Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients; Laws of photochemistry, Stark-Einstein law of photochemical equivalence quantum yield, actinometry, examples of low and high quantum yields.

2. Photochemical Processes: Potential energy curves (diatomic molecules), Frank- Condon principle and vibrational structure of electronic spectra; Bond dissociation and principle of determination of dissociation energy (ground state); Decay of excited states by radiative and non-radiative paths; Predissociation; Fluorescence and phosphorescence, Jablonskii diagram.

3. Rate of Photochemical processes: Photochemical equilibrium and the differential rate of photochemical reactions, Photostationary state; HI decomposition, H2-Br2 reaction, dimerisation of anthracene; photosensitized reactions, quenching; Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

Symmetry and group theory- I: (10 L):

Point symmetry operations, groups and group multiplication tables, similarity transformation and conjugate classes, identification of point groups and stereographic projection, representation of symmetry operators and groups; characters of symmetry operators in a representation, invariance of character under similarity transformation, symmetry elements and symmetry operations of the Platonic solids.

Chemical Kinetics-II: (9 L)

Role of T and theories of reaction rate: Temperature dependence of rate constant; Arrhenius equation, energy of activation; Rate-determining step and steady-state approximation – explanation with suitable examples; Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment).

READING REFERENCES:

1. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press
2. Castellan, G. W. Physical Chemistry, Narosa
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill
5. Laidler, K. J. Chemical Kinetics, Pearson
6. Levine, I. N. Quantum Chemistry, PHI
7. Atkins, P. W. Molecular Quantum Mechanics, Oxford
8. Banwell, C. N. and McCash, E.M. Fundamentals of Molecular Spectroscopy, Edn. 4th, Tata McGraw-Hill, New Delhi.
9. Atomic and Molecular Spectroscopy: Basic Concepts and Applications, Rita Kakkar Cambridge University Press, 2015.
10. Moore, W. J. Physical Chemistry, Orient Longman.
11. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry
12. Bera, N. K., Ghosh, S., Ghosh, P., Vol-II, Physical Chemistry Concepts & Models, Techno World, Kolkata.
13. Rakshit, P.C., Physical Chemistry Sarat Book House.
14. Mortimer, R. G. Physical Chemistry, Elsevier.
15. Engel, T. & Reid, P. Physical Chemistry, Pearson.
16. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas.
17. Ashish Kumar Nag, Physical Chemistry (Vol-I & II), McGraw Hill Education (India) Pvt. Ltd.
18. K. L. Kapoor, A Textbook of Physical Chemistry, Vol-I to Vol-V, Macmillan Publishers India Ltd. 2004.
19. Ghoshal, A. Numerical Problems on Physical Chemistry, Books & Allied Pvt. Ltd. Kolkata.
20. Klotz, I.M., Rosenberg, R. M. Chemical Thermodynamics:Basic Concepts and Methods Wiley.
21. F. A. Cotton, Chemical Applications of Group Theory, 3rd Edn Reprint, John Wiley and Sons.
22. L. Pauling and E. B. Wilson, Introduction to Quantum Mechanics, McGraw-Hill, 1939.
23. H. Eyring, J. Walter and G. F. Kimball, Quantum Chemistry, Wiley, New York, 1944.

PRACTICALS:

1. Verification of Beer and Lambert's Law for $KMnO_4$.

2. Verification of Beer and Lambert's Law for $K_2Cr_2O_7$.

3. Study of kinetics of $K_2S_2O_8$ + KI reaction, spectrophotometrically.

REFERENCES FOR PRACTICALS:

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N., University of Calcutta.
2. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
3. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.
4. Saharay, S. K. &Basu, A. S. A Guide to Practical Physical Chemistry, University of Burdwan.
5. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009).
6. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson

7. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007).

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BCEMMAJ10C**
Course Title: **Organic Chemistry – IV**
(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 10: The syllabus of Major -10 has been designed to provide the students with in-depth knowledge of nitrogen compounds, rearrangement reactions, the logic of organic synthesis i.e, retrosynthetic analysis of organic compounds, o**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 10: CO- 10.1 Thorough understanding of reactions involving nitrogen compounds. CO- 10.2 Detailed study of rearrangement reactions , which includes several organic name reactions. CO- 10.3 Detailed study of**

THEORY:

Nitrogen compounds (12L)

1. Amines: Aliphatic & Aromatic: preparation, separation (Hinsberg's method)and identification of primary, secondary and tertiary amines; reaction (withmechanism): Eschweiler–Clarke methylation, diazo coupling reaction, Mannich reaction; formation and reactions of phenylenediamines, diazomethane anddiazoacetic ester.

2. Nitro compounds (aliphatic and aromatic): preparation and reaction (withmechanism): reduction under different conditions; Nef carbonyl synthesis,Henry reaction and conjugate addition of nitroalkane anion.

3. Alkylnitrile and isonitrile: preparation and reaction (with mechanism): Thorpe nitrile condensation, von Richter reaction.

4. Diazonium salts and their related compounds: reactions (with mechanism) involving replacement of diazo group; reactions: Gomberg, Meerwein, Japp-Klingermann.

Rearrangements (16L)

Mechanism with evidence and stereochemical features for the following:

1. Rearrangement to electron-deficient carbon: Wagner-Meerwein rearrangement, pinacol rearrangement, dienone-phenol; Wolff rearrangement in Arndt-Eistertsynthesis, benzil- benzilic acid rearrangement, Demjanov rearrangement, Tiffeneau–Demjanov rearrangement.

2. Rearrangement to electron-deficient nitrogen: rearrangements: Hofmann, Curtius, Lossen, Schmidt and Beckmann.

3. Rearrangement to electron-deficient oxygen: Baeyer-Villiger oxidation, Cumene hydroperoxide-phenol rearrangement and Dakin reaction.

4. Aromatic rearrangements: Migration from oxygen to ring carbon: Friesrearrangement and Claisen rearrangement.

5. Migration from nitrogen to ring carbon: Hofmann-Martius rearrangement, Fischer-Hepp rearrangement, N-azo to C-azo rearrangement, Bambergerrearrangement, Orton rearrangement and benzidine rearrangement.

6. Rearrangement reactions by green approach: Fries rearrangement, Claisen rearrangement, Beckmann rearrangement, Baeyer-Villiger oxidation.

The Logic of Organic Synthesis (12L)

1. Retrosynthetic analysis: disconnections; synthons, donor and acceptor synthons; natural reactivity and umpolung; latent polarity in bifunctional compounds:
consonant and dissonant polarity; illogical electrophiles and nucleophiles; synthetic equivalents; functional group interconversion and addition (FGI and FGA); C-C disconnections and synthesis: one-group and two-group (1,2- to 1,5-dioxygenated compounds), reconnection (1,6-dicarbonyl); protection-deprotection strategy (alcohol, amine, carbonyl, acid).

2. Strategy of ring synthesis: thermodynamic and kinetic factors; synthesis of large rings, application of high dilution technique.

3. Asymmetric synthesis: stereoselective and stereospecific reactions; diastereoselectivity and enantioselectivity (only definition); enantioselectivity, kinetically controlled MPV reduction; diastereoselectivity: addition of nucleophiles toC=O adjacent to a stereogenic centre: Felkin-Anh and Zimmermann-Traxler models.

Organic Spectroscopy (20L)

1. UV Spectroscopy: introduction; types of electronic transitions, end absorption; transition dipole moment and allowed/forbidden transitions; chromophores andauxochromes; Bathochromic and Hypsochromic shifts; intensity of absorptions (Hyper-/Hypochromic effects);

application of Woodward's Rules for calculation of λmax for the following systems: conjugated diene, α,β-unsaturated aldehydes and ketones (alicyclic, homoannular and heteroannular); extended conjugated systems (dienes, aldehydes and ketones); relative positions of λmax considering conjugative effect, steric effect, solvent effect, effect of pH; effective chromophore concentration: keto-enol systems; benzenoid transitions.

2. IR Spectroscopy: introduction; modes of molecular vibrations (fundamental and non-fundamental); IR active molecules; application of Hooke's law, force constant; fingerprint region and its significance; effect of deuteration; overtone bands;vibrational coupling in IR; characteristic and diagnostic stretching frequencies of CH,N-H, O-H, C-O, C-N, C-X, C=C (including skeletal vibrations of aromatic compounds), C=O, C=N, N=O, C≡C, C≡N; characteristic/diagnostic bending vibrations are included; factors affecting stretching frequencies: effect of conjugation, electronic effects, mass effect, bond multiplicity, ring- size, solvent effect, H-bondingon IR absorptions; application in functional group analysis.

3. NMR Spectroscopy: introduction; nuclear spin; NMR active molecules; basic principles of Proton Magnetic Resonance; equivalent and non-equivalent protons; chemical shift and factors influencing it; ring current effect; significance of the terms: up-/downfield, shielded and deshielded protons; spin coupling and coupling constant (1st order spectra); relative intensities of first-order multiplets: Pascal's

triangle; chemical and magnetic equivalence in NMR ; elementary idea about non first-order splitting; anisotropic effects in alkene, alkyne, aldehydes and aromatics;NMR peak area, integration; relative peak positions with coupling patterns ofcommon organic compounds (both aliphatic and benzenoid-aromatic); rapid proton exchange; interpretation of NMR spectra of simple compounds.

4. Applications of IR, UV and NMR spectroscopy for identification of simple organic molecules.

READING REFERENCES:

1. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
3. Norman, R.O. C., Coxon, J. M. Principles of Organic Synthesis, Third Edition, Nelson Thornes, 2003.
4. Clayden, J., Greeves, N., Warren, S., Organic Chemistry, Second edition, Oxford University Press 2012.
5. Silverstein, R. M., Bassler, G. C., Morrill, T. C. Spectrometric Identification of Organic Compounds, John Wiley and Sons, INC, Fifth edition.
6. Kemp, W. Organic Spectroscopy, Palgrave.
7. Pavia, D. L. et al. Introduction to Spectroscopy, 5th Ed. Cengage Learning India Ed. (2015).
8. Dyer, J. Application of Absorption Spectroscopy of Organic Compounds, PHI Private Limited
9. March, J. Advanced Organic Chemistry, Fourth edition, Wiley.
10. Harwood, L. M., Polar Rearrangements, Oxford Chemistry Primer, Oxford University Press.
11. Bailey, Morgan, Organonitrogen Chemistry, Oxford Chemistry Primer, Oxford University Press.
12. Warren, S. Organic Synthesis the Disconnection Approach, John Wiley and Sons.
13. Warren, S., Designing Organic Synthesis, Wiley India, 2009.
14. Carruthers, W. Modern methods of Organic Synthesis, Cambridge University Press.
15. Willis, C. A., Wills, M., Organic Synthesis, Oxford Chemistry Primer, Oxford University Press.

PRACTICALS:

1. Estimation of glycine by Sörensen's formol method.
2. Estimation of glucose by titration using Fehling's solution.
3. Estimation of sucrose by titration using Fehling's solution.
4. Estimation of vitamin-C (reduced).
5. Estimation of aromatic amine (aniline) by bromination (Bromate-Bromide)method.
6. Estimation of phenol by bromination (Bromate-Bromide) method.

7. Estimation of formaldehyde (Formalin).
8. Estimation of acetic acid in commercial vinegar.

REFERENCES FOR PRACTICALS:

1. Arthur, I. V. Quantitative Organic Analysis, Pearson

2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G.N., University of Calcutta

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BCEMMAJ11C**
Course Title: **Organic Chemistry – V**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **COURSE OBJECTIVE OF MAJOR - 11: The syllabus of Major -11 has been designed to provide the students with in-depth knowledge of carbocycles and heterocycles, cyclic stereochemistry, pericyclic reactions, carbohydrates and biomolecules.Discussion of biomole**
Learning Outcome: **COURSE OUTCOMES OF MAJOR – 11: CO- 11.1 Thorough understanding ofcarbocycle and heterocycle systems and corresponding reactions. CO- 11.2 Detailed study of stereochemistry of alicyclic compound s and corresponding reactions viz, elimination, substituti**

CARBOCYCLES AND HETEROCYCLES: (15 L)

1. Polynuclear hydrocarbons and their derivatives: synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook and other useful syntheses (withmechanistic details); fixation of double bonds and Fries rule; reactions (withmechanism) of naphthalene, anthracene, phenanthrene and their derivatives.

2. Heterocyclic compounds: 5- and 6-membered rings with one heteroatom; reactivity, orientation and important reactions (with mechanism) of furan, pyrrole, thiophene and pyridine; synthesis (including retrosynthetic approach and mechanistic details): pyrrole: Knorr synthesis, Paal-Knorr synthesis, Hantzsch; furan: Paal-Knorr synthesis, Feist- Benary synthesis and its variation; thiophenes: Paal-Knorr synthesis, Hinsberg synthesis; pyridine: Hantzsch synthesis; benzo-fused 5- and 6-membered rings with one heteroatom: reactivity, orientation and important reactions (with mechanistic details) of indole, quinoline and isoquinoline;synthesis (including retrosynthetic approach and mechanistic details): indole: Fischer, Madelung and Reissert; quinoline: Skraup, Doebner- Miller, Friedlander;isoquinoline: Bischler-Napieralski synthesis.

CYCLIC STEREOCHEMISTRY: (10 L)

Alicyclic compounds: concept of I-strain; conformational analysis: cyclohexane, mono and disubstituted cyclohexane; symmetry properties and optical activity; topomerisation; ring-size and ease of cyclisation; conformation & reactivity in cyclohexane system: consideration of steric and stereoelectronic requirements; elimination (E2, E1), nucleophilicsubstitution (SN1, SN2, SNi, NGP), merged substitution-elimination; rearrangements; oxidation of cyclohexanol, esterification, saponification, lactonisation,epoxidation, pyrolytic syn elimination and fragmentation reactions.

PERICYCLIC REACTIONS: (10 L)

Mechanism, stereochemistry, regioselectivity in case of

1. Electrocyclic reactions: FMO approach involving 4π- and 6π-electrons (thermal and photochemical) and corresponding cycloreversion reactions.

2. Cycloaddition reactions: FMO approach, Diels-Alder reaction,photochemical [2+2] cycloadditions.

3. Sigmatropic reactions: FMO approach, sigmatropic shifts and their order; [1,3]-and [1,5]- H shifts and [3,3]-shifts with reference to Claisen and Coperearrangements.

CARBOHYDRATES: (10 L)

1. Monosaccharides: Aldoses up to 6 carbons; structure of D-glucose & D-fructose(configuration & conformation); ring structure of monosaccharides (furanoseand pyranose forms): Haworth representations and non-planar conformations;anomeric effect (including stereoelectronic explanation); mutarotation; epimerization;reactions (mechanisms in relevant cases): Fischer glycosidation, osazone formation,bromine-water oxidation, HNO3 oxidation, selective oxidation of terminal $-CH_2OH$of aldoses, reduction to alditols, Lobryde Bruyn-van Ekenstein rearrangement;stepping–up (Kiliani-Fischer method) and stepping–down (Ruff's & Wohl'smethods) of aldoses; end-group-interchange of aldoses; acetonide (isopropylidene)and benzylidene protections; ring-size determination; Fischer's proof ofconfiguration of (+)-glucose.

2. Disaccharides: Glycosidic linkages, concept of glycosidic bond formation byglycosyl donor-acceptor; structure of sucrose, inversion of cane sugar.

3. Polysaccharides: starch (structureand its use as an indicator in titrimetricanalysis).

BIOMOLECULES: (15 L)

1. Amino acids: synthesis with mechanistic details: Strecker, Gabriel, acetamidomalonic ester, azlactone, Bücherer hydantoin synthesis, synthesis involvingdiketopiperazine; isoelectric point, zwitterions; electrophoresis, reaction (withmechanism): ninhydrin reaction, Dakin-West reaction; resolution of racemic aminoacids.

2. Peptides: peptide linkage and its geometry; syntheses (with mechanisticdetails) of peptides using N-protection & C-protection, solid-phase (Merrifield)synthesis; peptide sequence: C-terminal and N-terminal unit determination (Edman,Sanger & 'dansyl' methods); partial hydrolysis; specific cleavage of peptides: use ofCNBr.

3. Nucleic acids: pyrimidine and purine bases (only structure & nomenclature);nucleosides and nucleotides corresponding to DNA and RNA; mechanism for acidcatalysed hydrolysis of nucleosides (both pyrimidine and purine types); comparisonof alkaline hydrolysis of DNA and RNA; elementary idea of double helical structureof DNA (Watson-Crick model); complimentary base–pairing in DNA.

READING REFERENCES:

1. Clayden, J., Greeves, N., Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012.
2. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London.
3. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited.
4. Sen Gupta, Subrata. Basic Stereochemistry of Organic molecules.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, Eighth edition, New Age International, 2014.
6. Fleming, I. Molecular Orbitals and Organic Chemical reactions, Reference/Student Edition, Wiley, 2009.
7. Fleming, I. Pericyclic Reactions, Oxford Chemistry Primer, Oxford University Press.
8. Gilchrist, T. L. & Storr, R. C. Organic Reactions and Orbital symmetry, Cambridge University Press.
9. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
10. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
11. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
12. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press.
13. James, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003.
14. Robinson, M. J. T., Stereochemistry, Oxford Chemistry Primer, Oxford University Press, 2005.
15. Davis, B. G., Fairbanks, A. J., Carbohydrate Chemistry, Oxford Chemistry Primer, Oxford, University Press.
16. Joule, J. A. Mills, K. Heterocyclic Chemistry, Blackwell Science.
17. Acheson, R.M. Introduction to the Chemistry.

PRACTICALS:

Chromatographic Separations

1. TLC separation of a mixture containing 2/3 amino acids.
2. TLC separation of a mixture of dyes (fluorescein and methylene blue).
3. Column chromatographic separation of leaf pigments fromspinach leaves.
4. Paper chromatographic separation of a mixture containing 2/3 amino acids.

Spectroscopic Analysis of Organic Compounds

1. Assignment of labelled peaks in the 1H NMR spectra of the known organiccompounds explaining the relative δ-values and splitting pattern.
2. Assignment of labelled peaks in the IR spectrum of the same compoundexplaining the relative frequencies of the absorptions (C-H, O-H, N-H, C-O, C-N, CX,C=C, C=O, N=O, C≡C, C≡N stretching frequencies; characteristic bendingvibrations are included).
3. The students must analyze full spectra of at least 10 (ten) compoundsfrom the following list:

a. 4-Bromoacetanilide
b. 2-Bromo-4'-methylacetophenone c. Vanillin
d. 2-Methoxyacetophenone e. 4-Aminobenzoic acid
f. Salicylamide
g. 2-Hydroxyacetophenone h. 1,3-Dinitrobenzene
i. Benzylacetate
j. trans-4-Nitrocinnamaldehyde k. Diethyl fumarate
l. 4-Nitrobenzaldehyde
m. 4-Methylacetanilide
n. Mesityl oxide
o. 2-Hydroxybenzaldehyde
p. 4-Nitroaniline
q. 2-Hydroxy-3-nitrobenzaldehyde r. 2,3-Dimethylbenzonitrile

REFERENCES FOR PRACTICALS:

1. S. Perry, Practical Liquid Chromatography, 2012
2. C.F. Poole, S.A. Schuette, Contemporary Practice of Chromatography, · 2012
3. Ivor Smith, J. W. T. Seakins, Paper and Thin Layer Chromatography, · 2013
4. B. Ravindranath · Principles and Practice of Chromatography,1989.

5. Rosaleen J. Anderson, David J. Bendell, Paul W. Groundwater, Organic Spectroscopic Analysis,2004.

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BCEMMAJ12C**
Course Title: **Inorganic Chemistry – IV**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **COURSE OBJECTIVE OF MAJOR - 12: The syllabus of Major -12 has been designed to provide the students with thorough understanding of the Electron Transport System in Biological Systems, mechanism of Na+ / K+ pumps, photosysthesis process and most important**
Learning Outcome: **COURSE OUTCOMES OF MAJOR – 12: CO- 12.1 Developing the idea and concepts of Bio-inorganic chemistry. CO- 12.2 Understanding of Organometallic chemistry from Inorganic point of view. CO- 12.3 Study of catalysis by organometallic compounds. CO- 12.4**

THEORY:

Bioinorganic Chemistry: (15L)

Elements of life: essential and beneficial elements, major, trace and ultratrace elements. Basic chemical reactions in the biological systems and the role of metal ions (specially Na^+, K^+, Mg^{2+}, Ca^{2+}, $Fe^{3+}/^{2+}$, $Cu^{2+/+}$, and Zn^{2+}). Metal ion transport across biological membrane Na+/ K+-ion pump (Basic Idea). Dioxygen molecule in life. Dioxygen management proteins: Haemoglobin, Myoglobin, Hemocyanine and Hemerythrin.

Electron transfer proteins: Cytochromes and Ferredoxins. Hydrolytic enzymes: carbonate bicarbonate buffering system and carbonic anhydrase and carboxyanhydrase A. Biological nitrogen fixation (Basic Idea).

Photosynthesis: Photosystem-I andPhotosystem-II (Basic Idea). Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases (examples only).

ORGANOMETALLIC CHEMISTRY: (10L)

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. 18-electron and 16-electron rules (pictorial MO approach). Applications of 18-electron rule to metal carbonyls, nitrosyls, cyanides. General methods of preparation of mono and binuclear carbonyls of 3d-series. Structures of mononuclear and binuclear carbonyls. Pi-acceptor behaviour of CO, synergic effect and use of IR data to explain extent of back bonding. Zeise's salt: Preparation, structure, evidences of synergic effect. Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation); Applications based on MO diagram of Ferrocene, Structure of Ferrocene.

ORGANOMETALLIC CATALYSIS: (15 L)

1. Alkene hydrogenation (Wilkinson's Catalyst)
2. Hydroformylation
3. Wacker Process
4. Synthetic gasoline (Fischer Tropsch reaction)
5. Monsanto Acetic Acid Process.
6. Ziegler-Natta catalysis for olefin polymerization.

Reactions of organometallic complexes: substitution, oxidative addition, reductive elimination and insertion reactions.

d & f- BLOCK CHEMISTRY: (20 L)

Transition Elements:

General comparison of 3d, 4d and 5d elements in term of electronic configuration, oxidation states, redox properties, coordination chemistry.

Lanthanoids and Actinoids:

General Comparison on Electronic configuration, oxidation states, colour, spectral andmagnetic properties; lanthanide contraction, separation of lanthanides (ion-exchangemethod only).

READING REFERENCES:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970.
3. Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).
4. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.
5. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education), 2005.
6. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure andReactivity 4th Ed., Harper Collins 1993, Pearson,2006.
7. Das, Asim. K.; Fundamentals Concepts of Inorganic Chemistry, Vol 1-7, 3rd Ed., CBS Publishers.
8. Miessler, G. L., Fischer, P. J., Tarr, D. A., Inorganic Chemistry, Pearson, 5th Edition.
9. Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
10. Bertini, I., Gray, H. B., Lippard, S.J., Valentine, J. S., Viva, 2007.
11. Basolo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
12. Powell, P. Principles of Organometallic Chemistry, Chapman and Hall, 1988.

13. Collman, J. P. et al. Principles and Applications of Organotransition Metal Chemistry. Mill Valley, CA: University Science Books, 1987.
14. Crabtree, R. H. The Organometallic Chemistry of the Transition Metals. New York, NY: JohnWiley, 2000.

PRACTICALS:

Qualitative semi-micro analysis

Qualitative semimicro analysis of mixtures containing four radicals. Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition.

Cation Radicals: Na^{+}, K^{+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Al^{3+}, Cr^{3+}, Mn^{2+}/Mn^{4+}, Fe^{3+},Co^{2+}/Co^{3+}, Ni^{2+}, Cu^{2+}, Zn^{2+}, Pb^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}/Sn^{4+}, As^{3+}/As^{5+}, $Sb^{3+}/^{5+}$, NH^{4+}, Mg^{2+}.

Anion Radicals: F^{-}, Cl^{-}, Br^{-}, BrO_3^{-}, I^{-}, IO_3^{-}, SCN^{-}, S^{2-}, SO_4^{2-}, NO_3^{-}, NO_2^{-}, PO_4^{3-} , AsO_4^{3-}, BO_3^{3-}, CrO_4^{2-} / $Cr_2O_7^{2-}$, $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$.

Insoluble Materials: Al_2O_3(ig), Fe_2O_3(ig), Cr_2O_3(ig), SnO_2, $SrSO_4$, $BaSO_4$, CaF_2, $PbSO_4$.

REFERENCES FOR PRACTICALS:

1. Svehla, G., Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mukherjee, G. N., Semi-Micro Qualitative Inorganic Analysis, University of Calcutta, 2008.

3. Bhattacharya, R. C., A Manual of Practical Chemistry for degree classes (Vol. I & II) for Honours Students, Biswas Book Stall, Calcutta.

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-13**

Semester: **7**

Course Code: **BCEMMAJ13C**

Course Title: **Physical Chemistry – IV**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **Course Objectives of Major-13: The syllabus of Major-13 covers a vast area of details of Crystal Structure, Statistical Thermodynamics, 3rd Law of Thermodynamics and Surface Chemistry.**

Learning Outcome: **Course Outcome of Major-13 The objectives of the present major course are manyfold. There are six modules in this course, and the objectives of the modules can be stated as below: CO - 13.1 This module is designed to provide students with molecular- or at**

THEORY:

Crystal Structure: (8L)

1. Bravais Lattice and Laws of Crystallography: Concept of lattice, basis, primitive cell. Types of solid, Bragg's law ofdiffraction; Laws of crystallography (Haüy's law and Steno's law); Permissible symmetry axes in crystals; Lattice, space lattice, Cubical systems (SC, BCC, FCC).

2. Crystal planes: Distance between consecutive planes [cubic, tetragonal and orthorhombic lattices]; Indexing of planes, Miller indices; calculation of d_{hkl}; Relation between molar mass and unit cell dimension for cubic system;

3. Diffraction of X-ray by crystals, Braggequation, determination of crystal structure: Powder method; Structure of NaCland KCl crystals, elementary idea of structure factor.

STATISTICAL THERMODYNAMICS: (10 L)

1. Configuration: Macrostates, microstates and configuration; calculation with harmonic oscillator; variation of W with E; equilibrium configuration.

2. Boltzmann distribution: Thermodynamic probability, entropy and probability, Boltzmann distribution formula (with derivation); Applications to barometric distribution.

3. Partition function: molecular partition function and thermodynamic properties, Maxwell's speed distribution; Gibbs' paradox. Nature of particles and concept of other distribution formula (FD, BE).

3rd LAW OF THERMODYNAMICS: (12 L)

Specific heat of solid: Coefficient of thermal expansion, thermal compressibility of solids; Dulong –Petit's law; Equipartition theorem and heat capacities; Perfect Crystal model, Einstein's theory – derivation from partition function, limitations; Debye's T3 law – analysis at the two extremes. 1. 3rd law: Absolute entropy, Plank's law, Calculation of entropy, Nernst heat Theorem.

2. Adiabatic demagnetization: Approach to zero Kelvin.

APPLICATION OF THERMODYNAMICS-IV: (10 L)

Ionic equilibria: Chemical potential of an ion in solution; Activity and activity coefficients of ions in solution; Debye-Huckel limiting law-brief qualitative description of the postulates involved, qualitative idea of the model, the equation (without derivation) for ion-ion atmosphere interaction potential. Estimation of activity coefficient for electrolytes using Debye-Huckel limiting law; Mean ionic activity coefficient; Applications of the Debye-Huckel equation and its limitations.

TRANSPORT PROCESS-II: (8 L)

1. Conductance and transport number: Ion conductance; Conductance and measurement of conductance, cell constant, specific conductance and molar conductance; Variation of specific and equivalent conductance with dilution forstrong and weak electrolytes; Kohlrausch's law of independent migration of ions; Equivalent and molar conductance at infinite dilution and their determination for strong and weak electrolytes; Debye –Huckel theory of Ion atmosphere (qualitative)-asymmetric effect, relaxation effect and electrophoretic effect; Ionic mobility; Application of conductance measurement(determination of solubility product and ionic product of water);Conductometric titrations.

4. Transport number, Principles of Hittorf's and Moving-boundary method; Wieneffect, Debye-Falkenhagen effect, Walden's rule.

SURFACE CHEMISTRY & COLLOIDS: (12 L)

1. Surface tension and energy: Surface tension, surface energy, excess pressure, capillary rise and surface tension; Work of cohesion and adhesion, spreading ofliquid over other surface; Vapour pressure over curved surface; Temperature dependence of surface tension.

2. Adsorption: Physical and chemical adsorption; Freundlich and Langmuir

adsorption isotherms; multilayer adsorption and BET isotherm (no derivation required); Gibbs adsorption isotherm and surface excess; Heterogenous catalysis (single reactant); Zero order and fractional order reactions.

3. Colloids: Lyophobic and Lyophilic sols, Origin of charge and stability of Lyophobic colloids, Coagulation and Schultz-Hardy rule, Zeta potential and Stern double layer (qualitative idea), Tyndall effect; Electrokinetic phenomena(qualitative idea only); Determination of Avogadro number by Perrin's method; Stability of colloids and zeta potential; Micelle formation.

READING REFERENCES:

1. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press
2. Castellan, G. W. Physical Chemistry, Narosa
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill
5. Laidler, K. J. Chemical Kinetics, Pearson
6. Levine, I. N. Quantum Chemistry, PHI
7. Atkins, P. W. Molecular Quantum Mechanics, Oxford
8. McQuarrie, D. A. Statistical Mechanics, Viva Books Pvt. Ltd. 2003, New Delhi
9. Banwell, C. N. and McCash, E.M. Fundamentals of Molecular Spectroscopy, Edn. 4th, Tata McGraw-Hill, New Delhi.
10. Nash, L. K. Elements of Statistical Thermodynamics, Dover
11. Atomic and Molecular Spectroscopy: Basic Concepts and Applications, Rita Kakkar Cambridge University Press, 2015.
12. Moore, W. J. Physical Chemistry, Orient Longman
13. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry

14. Bera, N. K., Ghosh, S., Ghosh, P., Vol-(I, II and III), Physical Chemistry Concepts & Models, Techno World, Kolkata.
15. Rakshit, P.C., Physical Chemistry Sarat Book House
16. Mortimer, R. G. Physical Chemistry, Elsevier
17. Engel, T. & Reid, P. Physical Chemistry, Pearson
18. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas
19. Ashish Kumar Nag, Physical Chemistry (Vol-I & II), McGraw Hill Education (India) Pvt. Ltd.
20. K. L. Kapoor, A Textbook of Physical Chemistry, Vol-I to Vol-V, Macmillan Publishers India Ltd. 2004
21. Ghoshal, A. Numerical Problems on Physical Chemistry, Books & Allied Pvt. Ltd. Kolkata

Klotz, I.M., Rosenberg, R. M. Chemical Thermodynamics:Basic Concepts and Methods Wiley.

PRACTICALS:

1. Determination of surface tension of a liquid using Stalagmometer.

2. Determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator).

3. Conductometric titration of a strong / weak acid by strong base.

4. Conductometric titration of a dibasic acid by strong base.

REFERENCES FOR PRACTICALS:

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G N., University of Calcutta
2. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
3. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.
4. Saharay, S. K. &Basu, A. S. A Guide to Practical Physical Chemistry, University of Burdwan.
5. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009)
6. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson

7. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007)

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-14**

Semester: **8**

Course Code: **BCEMMAJ14C**

Course Title: **Inorganic Chemistry – V**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 14: The syllabus of Major -14 has been designed to provide the students with thorough understanding of Analytical Chemistry. After successfully completing this syllabus, the students should be able to analyze data for accuracy**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 14: CO- 14.1 Understanding and application of Sampling & Errors in Quantitative Analysis. CO- 14.2 Understanding and application of Lambert-Beer's Law. CO- 14.3 Understanding the basic principles of UV-Vis & IR spectros**

THEORY:

Qualitative and quantitative aspects of analysis (10L)

Sampling, evaluation of analytical data, errors, accuracy and precision, methods oftheir expression, normal law of distribution if indeterminate errors, statistical test ofdata; F, Q and t test, rejection of data, and confidence intervals, Detection Limit, Least Square Method.

Optical methods of analysis (15L)

1. Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

2. UV-Visible Spectrometry: Basic principles

3. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

4. Infrared Spectrometry: Basic principles

1. Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, and detector, choice of flame and Burner designs. Techniques of atomization and sample introduction;

Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Thermal methods of analysis (5L)

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture. DTA, DSC.

Electroanalytical methods: (10L)

Classification of electroanalytical methods, basic principle of pH metric, potentiometric, conductometric, amperometric and coulometric titrations. Techniques used for the determination of equivalence points, Dropping Mercury Electrode (DME), Ilkovich Equation, Polarography, Cyclic Voltametry (CV). Techniques used for the determination of pKa values.

Separation techniques (20L)

1. Solvent extraction: Classification, principle and efficiency of the technique.

Mechanism of extraction: extraction by solvation and chelation.

2. Technique of extraction: batch, continuous and counter current extractions.

3. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

4. Chromatography: Classification, principle and efficiency of the technique.

Mechanism of separation: adsorption, partition & ion exchange.

5. Development of chromatograms: frontal, elution and displacement methods.

6. Qualitative and quantitative aspects of chromatographic methods of analysis:

IC, GLC, GPC, TLC and HPLC.

7. Stereoisomeric separation and analysis: Measurement of optical rotation,calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios anddetermination of enantiomeric composition using NMR, Chiral solvents andchiral shift reagents. Chiral chromatographic techniques using chiral columns(GC and HPLC).

8. Role of computers in instrumental methods of analysis.

READING REFERENCES:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson,2009.
2. Willard, H.H. Et al.: Instrumental Methods of Analysis, 7th Ed. WardsworthPublishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York,2004.
4. Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman,2016.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age InternationalPublisher,2009.
6. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis,Cengage Learning India Ed.
7. Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, EllesHarwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
8. Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.

PRACTICALS:

1. Determination of Fe(III) content in cement.

2. Chromatographic separation of Amino acids.

3. Chromatographic separation of Ni & Co using Paper Chromatography.

4. Estimation of Ascorbic Acid in Vitamin-C by Iodometric method.

REFERENCES FOR PRACTICALS:

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
3. Harris, D.C. Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
4. Mukherjee, G. N., University Handbook of Undergraduate Chemistry Experiments, University of Calcutta, 2003.

5. Nad, Mahapatra and Ghoshal, An Advance Course in Practical Chemistry, New Central Book Agency, Kolkata.

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-15**

Semester: **8**

Course Code: **BCEMMAJ15C**

Course Title: **Physical Chemistry – V**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE MAJOR-15 This major has five modules that focus on (1) Angular Momentum, (2) Chemical Kinetics, (3) Catalysis, (4)Application of Computers in chemistry, and (5) Nanomaterials. These seemingly unrelated topics give the students in-depth ad**

Learning Outcome: **The Course Outcomes of Major-15 are as follows: CO - 15.1: This chapter includes the method of constructing the Hamiltonian and Schrodinger Equations for different quantum mechanical systems. Understanding the different mathematical techniques involved in**

THEORY:

1. **Angular momentum (25L):**

Commutation rules, quantization of square of total angular momentum and z-component; rigid rotator model of rotation of diatomic molecule; Schrödinger equation, transformation to spherical polar coordinates; Separation of variables. Spherical harmonic: Solutions for the stationary states of harmonic oscillator (wave function and operator methods), rigid rotator and the H-atom (with complex and real solutions).

2. **Chemical kinetics-III (15L):**

Theories of reaction rates: applications to uni-, bi-molecular reactions, thermodynamic formulation of reaction rate, and reactions in solution: cage effect, diffusion and activation controlled reactions (elementary idea), dielectric effect on ion-ion reaction; electrostriction; volume of activation; effect of pressure on reaction rate.

3. **Catalysis (10 L):**

Homogeneous catalysis: Homogeneous catalysis with reference to acid-base catalysis; Primary kinetic salt effect; Enzyme catalysis; Michaelis-Menten equation, Lineweaver-Burk plot, turn-over number; Autocatalysis; periodic reactions, Heterogeneous catalysis.

4. **Application of Computers in Chemistry (5L):**

Basic ideas of Computers, Basic idea of Roots of equations, matrix operations, numerical differentiation, integration, Graph plotting tools, Molecular visualization tools, Crystal structure database.

5. **Nanomaterials (5L):**

Importance of nano-systems; confinement and dimensionality with example (dot, wire etc.); Different approaches for preparation of nanomaterials.

READING REFERENCES:

1. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press
2. Castellan, G. W. Physical Chemistry, Narosa
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill

5. Laidler, K. J. Chemical Kinetics, Pearson
6. K. J. Laidler, Reaction Kkinetics, Vols. I & II, Pergamon Press, London, 1970.
7. L. P. Hammett, Physical Organic Chemistry, McGraw-Hill Book Company, New Delhi, 1970.
8. M. R. Wright, Fundamental Chemical Kinetics, Horwood Publishing, 1999.
9. Levine, I. N. Quantum Chemistry, PHI
10. Atkins, P. W. Molecular Quantum Mechanics, Oxford
11. Moore, W. J. Physical Chemistry, Orient Longman
12. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry
13. Bera, N. K., Ghosh, S., Ghosh, P., Vol-II, Physical Chemistry Concepts & Models, Techno World, Kolkata.
14. Rakshit, P.C., Physical Chemistry Sarat Book House
15. Mortimer, R. G. Physical Chemistry, Elsevier
16. Engel, T. & Reid, P. Physical Chemistry, Pearson
17. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas
18. Ashish Kumar Nag, Physical Chemistry (Vol-I & II), McGraw Hill Education (India) Pvt. Ltd.
19. K. L. Kapoor, A Textbook of Physical Chemistry, Vol-I to Vol-V, Macmillan Publishers India Ltd. 2004.
20. Ghoshal, A. Numerical Problems on Physical Chemistry, Books & Allied Pvt. Ltd. Kolkata
21. Klotz, I.M., Rosenberg, R. M. Chemical Thermodynamics:Basic Concepts and Methods Wiley
22. F. A. Cotton, Chemical Applications of Group Theory, 3rd Edn Reprint, John Wiley and Sons.
23. S. C. Rakshit, Molecular Symmetry Group and Chemistry, The New Book Stall, Kolkata, 1988.
24. L. Pauling and E. B. Wilson, Introduction to Quantum Mechanics, McGraw-Hill, 1939.
25. H. Eyring, J. Walter and G. F. Kimball, Quantum Chemistry, Wiley, New York, 1944.
26. F. L. Pilar, Elementary Quantum Chemistry, Tata McGraw-Hill, 1990.
27. A. K. Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill Publishing Co, New Delhi, 1989.
28. K.K. Choudhary, Nanoscience and Nanotechnology, Narosa Publishing House, New Delhi.
29. A. K. Das & M. Das, An Introduction to Nanomaterials and Nanoscience, CBS Publishers and Distributors Pvt. Ltd.

PRACTICALS:

1. Study of phenol-water phase diagram.
2. Study of The Effect of the PKSE on the kinetics of $K_2S_2O_8$ + KI reaction (bytitrimetric method).
2. Plotting of differential values of data obtained from Conductometric Titration using MS-Excel/Origin.
3. Plotting of differential values of data obtained from Potentiometric Titration using MS-Excel/Origin.
4. Plotting of differential values of data obtained from pH-metric Titration using MS-Excel/ Origin.

REFERENCES FOR PRACTICALS:

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G N., University of Calcutta.
2. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
3. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.
4. Saharay, S. K. &Basu, A. S. A Guide to Practical Physical Chemistry, University of Burdwan.
5. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009)
6. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson

7. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007)

Course Type: **MAJ-16**

Semester: **8**

Course Code: **BCEMMAJ16C**

Course Title: **Inorganic Chemistry – VI**

(L-P-Tu): **3-1-0**

Credit: **4**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 16: The syllabus of Major -16 has been designed to provide the students with the industrial application of chemistry. This course will empower the students with the knowledge of preparation of Glass, Ceramics, Cement, Fertilize**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 16: CO - 16.1 Understanding the basic principles of UV-Vis, IR, Mass, ESR & Raman spectroscopy. CO - 16.2 Understanding of preparation of glass, ceramics and silicates. CO - 16.3 Elementary idea of Fertiliz**

THEORY:

Spectroscopic Applications: (25 L)

Practical applications of UV-Vis, IR, Mass spectroscopy, EPR and Raman Spectroscopy in Inorganic Chemistry.

Industrial Chemistry: (20 L)

SILICATE INDUSTRIES:

1. Glass: Glassy state and its properties, classification (silicate and non-silicateglasses). Manufacture and processingof glass. Composition and properties of thefollowing types of glasses: Soda lime glass, lead glass, armoured glass, safety glass,borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

2. Ceramics: Important clays and feldspar, ceramic, their types and manufacture.High technology ceramics and their applications, superconducting andsemiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

3. Cements: Classification of cement, ingredients and their role, Manufacture ofcement and the setting process, quick setting cements.

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea,ammonium nitrate, calcium ammonium nitrate, ammonium phosphates;polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride,potassium sulphate.

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classificationof surface coatings. Paints and pigments-formulation, composition and relatedproperties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments,Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fireretardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oilpaints, additives, Metallic coatings (electrolytic and electroless), metal spraying andanodizing.

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties ofelements in alloys. Manufacture of Steel (removal of silicon decarbonization,demanganization, desulphurization dephosphorisation) and surface treatment (Ar andheat treatment, nitriding, carburizing).Composition and properties of different types of steels.

READING REFERENCES:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.

4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
5. P. C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
7. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

PRACTICALS:

1. Preparation of Zinc Oxide pigment.
2. Estimation of Calcium in Calcium Ammonium Nitrate fertilizer.
3. Analysis of Cement.

REFERENCES FOR PRACTICALS:

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
5. P. C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
7. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

8. Mukherjee, G. N., Advanced Experiments in Inorganic Chemistry, U. N. Dhur & Sons, Kolkata.

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-17**

Semester: **8**

Course Code: **BCEMMAJ17C**

Course Title: **Physical Chemistry – VI**

(L-P-Tu): **3-1-0**

Credit: **4**

Practical/Theory: **Combined**

Course Objective: **Course Objectives of Major – 17 This major has four modules to cover. The following are the individual objectives of the respective modules. This major is, to some extent, an advanced-level course required for the next level of higher studies.**

Learning Outcome: **The Course Outcomes of Major-17: CO - 17.1: This particular module focuses mainly on the understanding and analysis of NMR/ PMR spectroscopy. The chapter discusses mainly topics like chemical shift and shielding, spin interactions, and equivalent protons**

THEORY:

SPIN RESONANCE SPECTROSCOPY: (5 L)

Principles of NMR/ESR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.

Group theory II: (20 lectures)

The Great Orthogonality Theorem: statement and interpretation, proof of important corollaries; construction of character tables: construction of their character tables for abelian and cyclic groups. Direct product groups and construction of their character tables, direct product representations, reduction formula, vanishing of integrals and its applications, invariance of the Hamiltonian operator and eigen functions of H as bases of irreducible representations.

Projection operators (without derivation), application of group theoretical methods for (i) construction of SALC's and their use in calculation of π MO's under the Huckel approximations, (ii) symmetry aspects of molecular vibrations: infrared and Raman activity.

Quantum mechanics (10L):

de Broglie wavelength, Bohr's correspondence principle with examples; properties of wave functions, operators and related theorems.Schrödinger equation, energy-eigenvalue equation, expectation value, eigenvalue and spread of observation, definition of uncertainty; equation of motion, constants of motion; detailed treatment of the particle in a box, including degeneracy; step potential and tunneling.

Atomic spectra: (10 L):

Quantum numbers, orbital and spin angular momenta of electrons, Stern-Gerlach experiment, vector atom model, term symbols (one and two optical electron systems), normal and anomalous Zeeman effect, Paschen back effect.

Introduction to Molecular Term Symbols.

READING REFERENCES:

1. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press
2. Castellan, G. W. Physical Chemistry, Narosa
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press
4. Levine, I. N. Physical Chemistry, Tata McGraw-Hill
5. Laidler, K. J. Chemical Kinetics, Pearson
6. Levine, I. N. Quantum Chemistry, PHI
7. Atkins, P. W. Molecular Quantum Mechanics, Oxford
8. Moore, W. J. Physical Chemistry, Orient Longman
9. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry.
10. Rakshit, P.C., Physical Chemistry Sarat Book House
11. Mortimer, R. G. Physical Chemistry, Elsevier
12. Engel, T. & Reid, P. Physical Chemistry, Pearson
13. Banwell, C. N. and McCash, E.M. Fundamentals of Molecular Spectroscopy, Edn. 4th, Tata McGraw-Hill, New Delhi.
14. Atomic and Molecular Spectroscopy: Basic Concepts and Applications, Rita Kakkar Cambridge University Press, 2015.
15. K. L. Kapoor, A Textbook of Physical Chemistry, Vol-I to Vol-V, Macmillan Publishers India Ltd. 2004.
16. F. A. Cotton, Chemical Applications of Group Theory, 3rd Edn Reprint, John Wiley and Sons.
17. S. C. Rakshit, Molecular Symmetry Group and Chemistry, The New Book Stall, Kolkata, 1988.
18. A. Vincent, Molecular Symmetry and Group Theory, John Wiley and Sons, New York, 1998.
19. V. Heine, Group Theory in Quantum Mechanics: An Introduction to Its Present Usage, Dover Publication.
20. L. Pauling and E. B. Wilson, Introduction to Quantum Mechanics, McGraw-Hill, 1939.
21. H. Eyring, J. Walter and G. F. Kimball, Quantum Chemistry, Wiley, New York, 1944.
22. F. L. Pilar, Elementary Quantum Chemistry, Tata McGraw-Hill, 1990.
23. A. K. Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill Publishing Co, New Delhi,1989.

PRACTICALS:

1.Job's Method using Fe-Phenanthroline/ Fe-Salicylic acid complex by colourimetric / spectrophotometric method.

2. Mole Ratio method using Fe-Phenanthroline/ Fe-Salicylic acid complex by colourimetric / spectrophotometric method.

3. Determination of Rate Constant of Inversion of Cane sugar by polarimetric method.

REFERENCES FOR PRACTICALS:

1. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G N., University of Calcutta
2. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
3. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.
4. Saharay, S. K. &Basu, A. S. A Guide to Practical Physical Chemistry, University of Burdwan.
5. Viswanathan, B., Raghavan, P.S. Practical Physical Chemistry Viva Books (2009)
6. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson
7. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007).

Syllabus *(CHEMISTRY)*

Course Type: **MAJ-18**

Semester: **8**

Course Code: **BCEMMAJ18C**

Course Title: **Organic Chemistry – VI**

(L-P-Tu): **3-1-0**

Credit: **4**

Practical/Theory: **Combined**

Course Objective: **COURSE OBJECTIVE OF MAJOR - 18: The syllabus of Major -18 has been designed to provide the students with in-depth knowledge of Structure-reactivity relationship, application of spectroscopy including NMR and Mass spectroscopy, organic transformation and**

Learning Outcome: **COURSE OUTCOMES OF MAJOR – 18: CO - 18.1 : Thorough understanding ofStructure-reactivity relationship in the light of Hammett equation and Taft equation. CO - 18.2 : Detailed study of NMR and Mass spectroscopy. Determination of structure of organic mol**

THEORY:

1. Structure-reactivity relationship: (5 L)

The Hammett equation and linear free energy relationship, equilibria and rates in organic reactions, substituent and reaction constants, Taft equation.

2. Application of Spectroscopy: (15 L)

a) NMR Spectroscopy:

Principle, instrumentation and different techniques (CW & FT) of NMR spectroscopy, classification of A4, A3, ABX, AMX, ABC, A2B2 in proton NMR. Introduction to ^{13}C-NMR spectroscopy. Rules for carbon-13 calculations.

b) Mass Spectroscopy:

Instrumentation, methods of ionization: EI, CI, Electronimpact mass spectroscopy, low and high resolution, exact masses of nucleides, molecular ions, isotopeions, mass marking techniques, fragment ions of odd and even electron types, rearrangement of ions, base peak, nitrogen rule, metastable peaks, isotope peaks, isotope effects in chloro and bromo compounds, calculation of molecular formula, factors effecting cleavage patterns. Structure determination of organic compounds by IR, UV-Vis, 1H &^{13}C NMR and Mass spectroscopy.

3. Organic Transformation: (10 L)

Multi-component reactions-early examples, Ugi reaction, Passerini reactions, Biginelli condensation; Baylis-Hillman reaction, Olefin metathesis, Remote functionalisation.

4. Photochemistry: (15 L)

Basic principles, Jablonski diagram, photosensitization and quenching, photochemistry of olefinic compounds, cis-trans isomerisation, Peterno-Buchi reaction, Norrish Type – I and II reactions, photoreduction of ketones, di-π methane rearrangement, photo-induced reactions in organic compounds.

READING REFERENCES:

1. Organic Photochemistry -J. W. Coxon & B. Halton.
2. Elements of Organic Photochemistry -D. O. Cowan & K. L. Drisco.

3. Spectrometric Identification of Organic Compounds – R. M. Silverstein & F. O. Webster; 6th edition.
4. Applications of Nuclear magnetic Resonance Spectroscopy in Organic Chemistry L. M. Jackman.
5. NMR and Chemistry – J. W. Akitt.
6. Organic Spectroscopy – W. Kemp, 3rd Edn.
7. Strategic Applications of Named Reactions in Organic Synthesis By Laszlo Kurti, Barbara Czako · 2005.

PRACTICALS:

Synthesis of organic compounds involving:

1. Nitration, diazotization.
2. Photochemical reaction
3. Sandmayer reaction
4. Pinacol-pinacolone rearrangement, Claisen rearrangement etc.

REFERENCES FOR PRACTICALS:

1. Frederick George Mann, Bernard Charles Saunders - Practical Organic Chemistry.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(COMMERCE)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BBCOMMAJ01T**
Course Title: **Financial Accounting and Cost Accounting**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **This course aims to: 1. Provides conceptual knowledge of financial accounting and impart skills for recording various kinds of business transactions and preparing financial statement of sole proprietorship business entities; 2. Create awareness about the standards for reporting financial statements; 3. Enable the students to understand the various techniques in maintaining accounts for partnership business; 4. Develop understanding among learners about contemporary cost concept and rational approach towards cost systems for identification, classification and analysis of cost components; 5. Provide knowledge for cost ascertainment in different industries using various costing methods; 6. The course also aims to provide knowledge about various methods of cost determination under specific situations and to acquire the ability to use information determined through cost accounting for decision making purpose.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Apply the prescribed accounting standards while recording transactions and preparing financial statements; 2. Measure business income applying relevant Accounting Standards. 3. Know the accounting treatments for a partnership-firm and also for its insolvency 4. Determine various types of cost of production; 5. Compute unit cost and total cost of production and prepare cost statement; 6. Compute employee cost, employee productivity, and employee turnover and apply activity-based costing for cost determination**

Subject: Financial Accounting and Cost Accounting

Module-I: Financial Accounting

Unit 1: Theoretical Framework (Lectures:10)

Accounting as an information system, the users of financial accounting information and their needs; Qualitative characteristics of accounting, information. Functions, advantages and limitations of accounting; Branches of accounting; Bases of accounting- cash basis and accrual basis of accounting.

The nature of financial accounting principles; Basic concepts and conventions: entity, money measurement, going concern, cost, realization, accruals, periodicity, consistency, prudence (conservatism), materiality, matching and full disclosures.

Financial Accounting Standards: Concept, benefits, procedure for issuing accounting standards in India, International Financial Reporting Standards (IFRS)- Need and procedures.

Unit 2: Final Accounts (Lectures: 15)

Preparation of financial statements of sole proprietorship business entities from trial balance-Trading, Profit & Loss Account and Balance Sheet, Rectification of errors.

Unit 3: Partnership Accounts (Lectures: 15)

Profit & Loss Appropriation Account, Capital and Current account, Guarantee-by firm or by partner(s) or by both. Rectification of the wrong appropriation with retrospective effect; Change in profit sharing ratios, Treatment of goodwill. revaluation of assets and liabilities Admission and retirement of partner(s), and Death of a partner.

Dissolution of partnership- insolvency of one or more partners, piecemeal distribution-surplus capital method and maximum loss method

Module-II: Cost Accounting

Unit 4: Introduction (Lectures: 10)

Definition of Costing, Cost accounting and management accounting. Objectives of cost accounting. Importance of cost accounting in business, Relationship among cost accounting, management accounting and financial accounting, Relationship with financial management. Advantages of cost accounting system, Installation of cost accounting system, Essentials of good costing system.

Cost, Cost Object**,** Cost Units and Cost Centre; Types of costs and classification of costs. Cost sheet-total cost and unit cost; Costing methods and techniques. Preparation of Cost Sheet.

Unit 5: Material and Labour Cost (Lectures: 15)

Purchase, Storage- functions of storekeeper, requisition, receipt, issue and transfer of materials. Storage records and accounting for materials.

Materials control- Just-in-time purchase, stock levels, EOQ and ABC analysis, periodic and perpetual inventory. Physical verification, discrepancies in stock and their treatment. Turnover of stock.

Methods of pricing of materials, Advantages and disadvantages of different methods of pricing, comparative analysis and stock valuation for balance sheet; Treatment for normal and abnormal loss, wastes, scrap, spoilage and defectives.

Labour Cost: Introduction, Time booking, Payroll, payment of wages, Idle Time and Overtime- causes, effects and treatment in cost accounting.

Labour turnover- Causes and methods of calculation, Cost of labour turnover.

Incentive system-Main principles for a sound system of wage incentive schemes, Labour utilization, Distinction between direct and indirect labour cost, and System of wage payment and incentives. System of incentive schemes for indirect workers, Components of wages for costing purposes, Absorption of wages, Efficiency rating procedure.

Unit 6: Overhead (Lectures: 10)

Definition, Classification of overhead-element wise, functional and behavioural; Need for classification of overhead into fixed, variable and semi-variable, Various types of overhead.

Manufacturing Overhead- allocation and apportionment, Absorption of overhead-methods and their application; Treatment of over and/or under absorption of overhead, Basic Concepts of different capacities.

Reading References:
Basu and Das, Practice in Accountancy, Rabindra Library, Kolkata.
Belverd E. Needles & Marian Powers, Financial Accounting: (with IFRS), Cengage Learning.
Bhattacharya, Asish K., Accounting for Managers, PHI Learning.
Dhamija, Financial Accounting For Managers, Pearson Education.
Ghosh, T.P., Financial Accounting for Managers, Taxmann Publications.
Goldwin, Alderman and Sanyal, Financial Accounting, Cengage Learning.
Goyal & Goyal, Financial Accounting, PHI Learning.
Horngren, Charles T., Introduction to Financial Accounting, Pearson Education.
Lal, Jawahar & Srivastava, Seema, Financial Accounting, S. Chand and Co.
Maheshwari, S.N. & Maheshwari, S.K., Financial Accounting. Vikas Publishing House.
Mukherjee, Amitabha & Hanif; Mohammed, Modern Accountancy, Tata McGraw-Hill.
Paul, S.K., Accountancy, New Central Book Agency, Kolkata.
Sehgal, Deepak, Financial Accounting, Vikas Publishing House.
Tulsian, P.C. & Tulsian Bharat, Financial Accounting, S.Chand & Co.
Kishore, Ravi M., Cost Accounting, Taxamnn Publications.
Lal, Jawahar, Cost Accounting, Mc-Graw Hill Education.
Maheshwari, S.N. & Mittal, S.N., Cost Accounting: Theory and Problems, Shri Mahavir Book Depot, New Delhi.
Mitra, J.K., Advanced Cost Accounting, New Age International.
Nigam, B.M., Lall & Jain, I.C., Cost Accounting: Principles and Practice. PHI Learning.
Paul, S.K., Practical Cost and Management Accounting, New Central Book Agency, Kolkata.
Pillai, R.S.N. & Bagavathi, V., Cost Accounting, S. Chand.
Singh, Surender, Cost Accounting, Scholar Tech Press, New Delhi.
Tulsian, P.C., Tulsian, B. & Arora, M.N., Cost Accounting, S.Chand.
Thukaram Rao, M.E., Cost Accounting, New Age International.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.

- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency

2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(COMMERCE)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BBCOMMAJ02T**
Course Title: **Income Tax Laws and Practice**
(L-P-Tu): **5-01**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to: 1. Provide knowledge of the various provisions of income-tax law in India 2. Enable the learners to apply such provisions to compute total income and tax liability of individuals and HUFs. 3. It also aims to enable learners to understand the provisions relating to filing of return of income.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Comprehend the concepts of taxation, including assessment year, previous year, assesses, person, income, total income, agricultural income and determine the residential status of persons; 2. Compute income under different heads, applying the charging provisions, deeming provisions, exemptions and deductions; 3. Apply the clubbing provisions and provisions relating to set-off and carry forward of losses to determine the gross total income; 4. Calculate the tax liability of an individual and HUF as well as deductions from gross total income and determine the total income of an individual and HUF; 5. Comprehend the provisions relating to filing of return of income.**

Subject: Income Tax Laws and Practice

Unit 1: Introduction (Lectures: 15)

Basic concepts and Definitions: Income, Person, Assessee, Deemed Assessee, Previous Year, Assessment Year, Sources of Income, Heads of Income, Gross Total Income, Total Income, Difference between Exemption and Deduction, Rates of Income Tax- Normal Rate and Flat Rate, Surcharge, Education Cess, Concept of Tax Planning.

Residential Status**:** General Discussion regarding all types of persons and in detail including numerical problems relating to individuals.

Unit 2: Agricultural Income and Exempt Incomes U/S 10 (Lectures: 10)

Incomes Exempt under Section 10

Definition, Examples of Agricultural Income and Non-Agricultural Income, Income which is partly agricultural and partly from business (with simple numerical problems)

Unit 3: Computation of Income under Different Heads (Lectures: 20)

Income from Salaries Income from House Property and Income from Business only.

Unit 4: Computation of Total Income and Tax Liability (Lectures:10)

Income of other persons included in case of individual's total income; Deductions from gross total income (Sec.80C, 80D, 80DD, 80G, 80GG, 80TTA, 80U); Computation of total

income of an individual taking incomes under different heads, Computation of income tax payable by an individual.

Unit 5: Return of Income and Assessment (Lectures: 10)

Different Types of Returns, Due dates of Filing of returns for different types of assessees, Rectification of mistakes in the return, Different Return Forms, Verification and signing of return, Filing of Return in electronic form, advance payment of tax, time limit for completion of assessment/reassessment, PAN, TAN

Unit 6: Tax Deduction and Payment: **(Lectures: 10)**Type of deductors and Payment of TDS/TCS: Government, Non-corporate and Corporate, Download & Preparation-Form-16, Form-16A & Others from tdscpc.gov.in; AIS

Reading References:

Ahuja, Grish & Gupta, Ravi, Corporate Tax Planning and Management, Bharat Law House, Delhi.
Ahuja, Girish and Gupta, Ravi, Systematic Approach to Income Tax, Bharat Law House, Delhi.
Gaur and Narang, Direct Taxes, Kalyani Publishers.
Hariharan, Income Tax: Law & Practice, Mc-Graw Hill Education.
Lal, B.B., Direct Taxes, Konark Publisher, New Delhi.
Lal, Jawahar, Income Tax, Pearson Education.
Pagare, Dinakar, Law and Practice of Income Tax, Sultan Chand & Sons.
Pathak, A., Business Taxation, Mc-Graw Hill Education.
Pathak, Akhileshwar & Godiawala, Savan, Business Taxation, McGraw Hill Education.
Singhania, V.K. & Singhania, M., Corporate Tax Planning and Business Tax Procedures, Taxmann Publications.
Singhania, V.K. & Singhania, K., Direct Taxes: Law and Practice, Taxamnn Publications.
Singhania, V.K. & Singhania, M., Students' Guide to Income Tax, Taxmann Publications.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course,

which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(COMMERCE)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BBCOMMAJO3T**
Course Title: **Advanced Financial Accounting**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to: 1. Help the learners to impart knowledge about accounting for branches and various departments of firms; 2. The course also focuses on computation of loss on stock and loss of profit and also computes the claim amount under insurance; 3. Help the learners to understand the accounting procedures of convergence of partnership firm to a limited firm and impart knowledge about the new trends in accounting.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Assess the loss of stock and loss of profit and also compute the claim amount under insurance; 2. Solve various challenges in accounting in multi-branch firms and various departments; 3. Maintain accounting treatment of acquisition or convergence of partnership firms to limited firms; 4. Understand and compute the new trends in the field of accounting.**

Subject: Advanced Financial Accounting

Unit 1: Insurance for Loss of Stock and Loss of Profit (Lectures: 15)

Loss of stock: Physical & ownership concept. Under insurance and average clause, Computation of claim with price changes, unusual selling price and price reduction.

Loss of profit: Concept, insured and uninsured standing charges, G.P. rates, short sales and increased cost of working, average clause and computation of claim.

Unit 2: Branch Accounting (Lectures: 15)

Concept of Branch; Different types; Methods of Accounting:-Synthetic method-Branch A/C, Branch trading and P/LA/C (at cost & at IP); Analytical Method with normal & abnormal losses.

Independent Branch- Concept, wholesale profit and retail profit, incorporation of branch trial balance in the books of H.O.

Unit 3: Hire Purchase and Instalment Payment System (Lectures: 15)

Meaning, Difference between Hire Purchase and Instalment payment, Books of Account in Buyer's books, allocation of interest, Interest Suspense Account, Repossession-Partial and complete.

In the books of seller- Stock- Debtors system (with repossession). Hire Purchase Trading A/C (with repossession).

Unit 4: Departmental Accounts (Lectures: 10)

Concepts, and objectives of preparing Departmental Accounts. The difference with the branch. Apportionment of common costs, Preparation of Departmental Trading and P/L/A/C. Consolidated Trading and P/L/A/C; Inter-departmental transfer of goods and provisions for unrealised profit.

Unit 5: Business Acquisition and Conversion of Partnership into Limited Company (Lectures: 10)

Accounting for the acquisition of a business. Conversion of partnership into a limited company- with or without same set of books.

Unit 6: New Trends in Accounting: (Lectures: 10)

Human Resource Accounting, Inflation Accounting, Brand Valuation and Accounting, Environmental Accounting, Big Data Analytics in Accounting

Reading References:

Basu & Das, Practice in Accountancy, Rabindra Library, Kolkata.
Belverd E. Needles & Marian Powers, Financial Accounting: (with IFRS), Cengage Learning.
Bhattacharya, Asish K., Accounting for Managers, PHI Learning.
Dhamija, Financial Accounting For Managers, Pearson Education.
Ghosh, T.P., Financial Accounting for Managers, Taxmann.
Goldwin, Alderman and Sanyal, Financial Accounting, Cengage Learning.
Goyal & Goyal, Financial Accounting, PHI Learning.
Gupta, R.L., Advanced Accountancy, Sultan Chand & Sons.
Horngren, Charles T., Introduction to Financial Accounting, Pearson Education.
Jain, S.P. & Narang, K.L., Advanced Accountancy, Kalyani Publishers.
Lal, Jawahar, Financial Accounting, Himalaya Publishing House.
Lal, Jawahar & Srivastava, Seema, Financial Accounting, S. Chand and Co.
Maheshwari, S.N. & Maheshwari, S.K., Advanced Accountancy, Vikas Publishing House.
Monga, J.R., Financial Accounting: Concepts and Applications, Mayur Paper Backs, NewDelhi.
Mukherjee, Amitabha & Hanif; Mohammed, Modern Accountancy, Tata McGraw-Hill.
Paul, S.K., Accountancy, New Central Book Agency, Kolkata.
Pillai, R.S.N., Bagavathi & Uma, S., Fundamentals of Advanced Accounting, S. Chand & Co.
Sehgal, Deepak, Financial Accounting, Vikas Publishing House.
Shankaranarayana, H.V., Financial Accounting for Management, Cengage Learning.
Shukla, M.C., Grewal, T.S. & Gupta, S.C., Advanced Accounts, S.Chand & Co..
Thukaram Rao, M.E., Advanced Accountancy, New Age International.
Tulsian, P.C. & Tulsian Bharat, Financial Accounting, S.Chand & Co.
Compendium of Statements and Standards of Accounting, The Institute of Chartered Accountants of India, New Delhi.

Syllabus *(COMMERCE)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BBCOMMAJO4T**
Course Title: **Indirect Tax Laws**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**

Course Objective: **The course aims to: 1. Impart knowledge of principles and provisions of GST and Customs Law, the important legislation dealing with indirect tax system in India; 2. Impart knowledge about the process of registration under GST and its need; 3. Enable the students to apply the principles and provisions of GST in levy and collection of GST. 4. Impart skills for payment of taxes, maintenance of records & submission of return**

Learning Outcome: **After completion of the course, learners will be able to: 1. Analyse the rationale of Goods and Services Tax (GST), constitutional amendment carried out to install GST in India and comprehend the composition and working of GST council; 2. Interpret the meaning of supply under GST law, differentiate between intra-state and inter-state supply, provisions related to place of supply, time of supply and compute the value of supply; 3. Evaluate the utilization of input tax credit and the provisions of reverse charge mechanism; 4. Analyse various returns under GST and payment of taxes; and 5. Evaluate the concepts of Customs Act, various custom duties and computation of the assessable value for charging customs duty**

Subject: Indirect Tax Laws

Unit 1. **Introduction**: **(Lectures: 10)**

Basic concepts about Indirect Tax. Indirect taxes before GST: An overview; Concept of VAT; Major shortcomings in the structure of Indirect taxes prior to the GST. Need of GST in India; Genesis and Salient features of GST; Advantages and challenges of GST.

Unit 2. **Registration**: **(Lectures: 15)**

Process of Registration under GST; Compulsory Registration, Liability for Registration, Exemption from Registration, GST Unique Identity Number (GSTIN), Documents required for GST registration.

Unit 3: Levy and Collection of GST: **(Lectures: 10)**

Taxable event; 'Supply' of Goods and Services; Composite Supplies, Mixed Supplies; Place of Supply; Time of Supply; Schedules in GST; Small supplies and composition scheme.

Unit 4: **Input Tax Credit (ITC)**: **(Lectures: 10)**

Eligibility and Ineligibility for Input Tax Credit; Tax Credit in respect of Capital Goods; Recovery of Excess Tax Credit; Reverse Charge Mechanism, Job work.

Unit 5: **Payment of Taxes, Maintenance of Records & Submission of Return**: **(Lectures: 15)**

Maintenance of Records, Mode of payment, Process of payment, Maintenance of e-ledgers, ITC utilization rules, Types and periodicity of Returns, Matching Input Tax Credit.

Unit 6: Custom Law: **(Lectures: 15)**

Basic concepts of Custom Law, Territorial Waters, High seas, Types of Custom Duties- Basic custom duty, Countervailing & Anti-Dumping Duty; Safeguard Duty, Valuation, Customs Procedures, Import & Export Procedures, Baggage, Exemptions.

Reading References:

Agarwal, R.K., Taxmann's GST, Taxman Publisher

Datey, V.S., GST Input Tax Credit, Taxman Publisher

Datey, V.S., GST Ready Reckoner, Taxman Publisher

Garg and Garg, Handbook of GST in India- Concepts and Procedures, Taxman Publisher

Mehrotra, H.C. & Agarwal, V.P., Goods and Services Tax (G.S.T), Sahitya Bhawan Publications

Singhania, A., GST Practice Manual, Taxman Publisher

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BBCOMMAJ05T**
Course Title: **Advance Cost Accounting**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to: 1. Enable students to analyse the various factors involved in Contract Costing and preparation of contract account; 2. Enable students to analyse & prepare Process Costing and prepare statement of marginal costs and calculation of various aspects thereof; 3. Impart knowledge about Marginal Costing, Standard Costing and Strategic Cost Management.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Analyse various aspects of contract and prepare contract account; 2. Analyse & prepare process accounts; prepare statement of marginal costs and calculate various aspects of Marginal Costing; 3. Understand the marginal costing technique and apply them various managerial decisions; 4. Understand the standard costing technique and apply then in analysing of Material, Labour and Overhead Variances; 5. Understand Life Cycle Costing, Target Costing, Activity Based Cost Management.**

Subject: Advanced Cost Accounting

Unit 1: Job Costing, Contract Costing and Service Costing (Lectures: 15)

Job Costing**-** job cost cards and database, collecting direct costs for each job. Attributing overheads to jobs; Application of job costing.

Contract Costing-Progress Payments; Retention money, Escalation Clause; Contract A/C and Balance Sheet.

Service Costing- Introduction- Transport Costing, Hotel Costing (Staff Canteen, Boiler and Hospital Costing-brief idea only).

Unit 2: Process Costing (Lectures:10)

Process Costing-Meaning, Features, Process Vs Job Costing. Principles of cost ascertainment of materials, labour and overhead; Preparation of Process A/C with Normal and Abnormal Loss; Abnormal Gain.

Unit 3: C-V-P Analysis (Lectures:10)

Cost-Volume-Profit Analysis- Introduction, Assumptions and their Limitations; Uses; Break-Even Analysis; BE Point and Margin of Safety; Angle of Incidence; Graphical Presentation of CVP; Profit Graph.

Unit 4: Marginal Costing: (Lectures: 15)

Management decision-Marginal Costing Vs Absorption Costing. Marginal costing technique; Marginal Cost and product pricing; Product Mix and Make or Buy decision; Shut Down decision (with simple problems).

Unit 5: Standard Costing (Lectures: 15)

Standard costs and Standard Costing; Uses & importance; Difference with budgetary control; Preliminary steps, classification of standards; Analysis of Material, Labour and Overhead Variances.

Unit 6: Strategic Cost Management: (Lectures: 10)

Strategic cost analysis and management, Life Cycle Costing, Target Costing, Activity Based Cost Management,

Reading References:

Arora, M.N., Cost Accounting: Principles and Practice, Vikas Publishing House.
Atkinson, Management Accounting, Pearson Education.
Chakravarty, A.K., Cost and Management Accountancy, New Central Book Agency, Kolkata. Drury, Colin, Management and Cost Accounting, Cengage Learning.
Dutta, Cost Accounting: Principles & Practice, Pearson Education.
Goel, Rajiv, Cost Accounting, International Book House, New Delhi.
Hanif; M., Modern Cost and Management Accounting, Mc-Graw Hill Education.
Horngren, Datar & Rajan, Cost Accounting, Pearson Education.
Jain S.P. & Narang K.L., Cost and Management Accounting, Kalyani Publishers.
Jhamb, H.V., Fundamentals of Cost Accounting, Ane Books, New Delhi.
Khan, M.Y. & Jain, S.P., Cost Accounting, Mc-Graw Hill Education.
Kishore, Ravi M., Cost Accounting, Taxamnn Publications.
Lal, Jawahar, Cost Accounting, Mc-Graw Hill Education.
Iyengar, S.P., Cost Accounting, Sultan Chand & Sons.
Maheshwari, S.N. & Mittal, S.N., Cost Accounting: Theory and Problems, Shri Mahavir Book Depot, New Delhi.
Mitra, J.K., Advanced Cost Accounting, New Age International.
Nigam, B.M., Lall & Jain, I.C., Cost Accounting: Principles and Practice. PHI Learning.
Paul, S.K., Practical Cost and Management Accounting, New Central Book Agency, Kolkata.
Pillai, R.S.N. & Bagavathi, V., Cost Accounting, S. Chand & Co.
Singh, Surender, Cost Accounting, Scholar Tech Press, New Delhi.
Tulsian, P.C., Tulsian, B. & Arora, M.N., Cost Accounting, S.Chand & Co.
Thukaram Rao, M.E., Cost Accounting, New Age International.

Syllabus *(COMMERCE)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BBCOMMAJ06T**
Course Title: **Corporate Accounting**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to: 1. Help learners to acquire conceptual knowledge of corporate accounting systems; 2. Impart the techniques of preparing the financial statements of companies. 3. Impart knowledge and technique of accounting treatment in the case of Company Merger and Reconstruction and also in case of holding company; 4. Impart knowledge about accounting treatments for liquidation of Companies.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Understand the basic concepts of issue and valuation of share capital and debenture; 2. Prepare the financial statements (Profit & Loss A/C and Balance Sheet) for companies; 3. Ascertain the value of goodwill and shares using different methods; 4. Make necessary accounting treatments and adjustment in the case of Company Merger and Reconstruction and also in case of holding company 5. Prepare the Liquidator's Final Statement of Account.**

Subject: Corporate Accounting

Unit 1: Accounting for Share Capital and Debentures (Lectures: 8)

Concept & process of book building; Issue of rights and bonus shares; Buy back of shares; Redemption of preference shares; Issue and Redemption of Debentures.

Unit 2: Company Final Accounts (Lectures:12)

Introduction to Schedule-VI, Treatment of Tax, rules for and determination of managerial remuneration, Compulsory transfer to reserve, Dividend and applicable tax (out of current profit, out of past reserve), Preparation of Profit & Loss A/C and Balance Sheet.

Unit 3: Company Merger and Reconstruction (Lectures:15)

Amalgamation, absorption and reconstruction-meaning, relevant standards and terms, Accounting in the books of transferor and transferee company (both merger and purchase), Inter-company transaction including inter-company shareholdings.

Internal reconstruction- meaning, provisions and accounting, surrender of shares, preparation of Balance Sheet after reconstruction.

Unit 4: Valuation of Goodwill and Shares (Lectures: 13)

Goodwill-Valuation using different methods, i.e. average profit, super profit, capitalization and annuity method.

Shares-Valuation using different methods- Intrinsic and Earning, Dividend yield, Earning-price, Cum-dividend, Ex-dividend, Majority and minority view and fair value.

Unit 5: Holding Company (Lectures: 20)

Meaning of Holding and Subsidiary Company, Relevant standard; Consolidation of Balance Sheet of Parent and Subsidiary; Minority interest, Basic principles of preparation of CBS with loss from subsidiary, Treatment for revaluation of assets of subsidiary, Inter co. the transaction, Holding of different securities, Dividend declared by the subsidiary company (Proposed, interim and final), Treatment of bonus shares issued or proposed to be issued by subsidiary company (excluding shares acquired at different dates, cross and chain holding of shares).

Unit 6: Liquidation of Companies: (Lectures: 7)

Accounting for liquidation of Companies – Preparation of Liquidator's Final Statement of Account.

Reading References:

Arulanandam & Raman, Corporate Accounting, Himalaya Publishing House.

Goyal, Bhushan Kumar, Fundamentals of Corporate Accounting, International Book House, New Delhi.

Goyal**,**.Ruchi, Corporate Accounting, PHI Learning.

Jain, S.P. & Narang, K.L., Corporate Accounting, Kalyani Publishers, New Delhi.Maheshwari, Joseph, Corporate Accounting, Mc-Graw Hill Education.

Maheshwari, S.N. & Maheshwari, S.K., Corporate Accounting. Vikas Publishing House.

Monga, J.R., Fudamentals of Corporate Accounting, Mayur Paper Backs, New Delhi.

Mukherjee, Amitabha & Hanif, Mohammed, Corporate Accounting, Mc-Graw Hill Education.Sehgal, Ashok, Fundamentals of Corporate Accounting, Taxman Publications.

Rajsekaran,Corporate Accounting, Pearson Education.

Shukla, M.C., Grewal, T.S. & Gupta, S.C., Advanced Accounts, S. Chand & Co.Goyal, V.K. &

Tulsian, P.C. & Tulsian, Bharat, Corporate Accounting, S.Chand & Co.

Syllabus *(COMMERCE)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BBCOMMAJ07T**
Course Title: **Principles of Business Management and Strategic Business Management**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Practical**
Course Objective: **The course aims to: 1. Serves as an opportunity to develop skills by imparting knowledge about different principles of management: planning, organising, motivation, leadership, and control in managing different issues of an organisation. 2. The course also focuses on the concept of strategy formulation and implementation by exploring the functions and nature of general management. 3. Impart knowledge about business strategies under different level of Business (Functional–Level Strategy and Business-Level Strategy)**
Learning Outcome: **After completion of the course, learners will be able to: 1. Understand the basic principles and Evaluation of business management. 2. Impart knowledge about Planning, Organising, Motivation, Leadership and Control of different aspect of business management. 3. Apply understanding for the theories, concepts of management in organizations. 4. Critically analyse the internal and external environments in which businesses operate and assess their significance for strategic planning.**

Subject: Principles of Business Management and Strategic Business Management

Unit 1: Introduction (Lectures: 10)

Concept of management, Need for Study of management, Managerial Functions- An overview; Co-ordination, Essence of Managership. Evolution of the Management Thought, Classical Approach – Taylor, Fayol, Neo-Classical Approach - Human Relations Approach, Systems Approach, Contingency Approach – MBO

Unit 2: Planning and Organising (Lectures: 20)

Definition, nature and importance of planning, steps in planning, planning premises, benefits and limitations of planning, types of plan, decision making- concept, importance, steps.

Concept and process of organising – An overview, Span of management, Different types of authority, Decentralisation, Delegation of authority, departmentation, Formal and Informal Structure; Principles of Organising.

Unit 3: Motivation (Lectures: 10)

Concept, Importance, extrinsic and intrinsic motivation; Major Motivation theories - Maslow's Need-Hierarchy Theory; Hertzberg's Two-factor Theory, Vroom's Expectancy Theory.

Unit 4: Leadership (Lectures: 10)

Concept, Importance, Leadership style, Major theories of Leadership, Transactional leadership, Transformational Leadership, Transforming Leadership.

Unit 5: Control (Lectures:10)

Concept, Process, Limitations, Principles of Effective Control, Feed forward and feedback control.

Unit -6: Strategic Management: (Lectures: 15)

Concept of strategy; Strategic management process; levels of strategy, Importance of Strategic Management. Strategic Position – External and Internal Analysis: Concept of industry, Porter's Five Forces Model; analysing competitive advantages and profitability; value chain analysis.

Functional–Level Strategy and Business-Level Strategy, Implementation of Strategy, organizational design; control systems; organizational culture; strategic leadership for competitive advantage.

Reading References:

Bhat & Kumar, Management: Principles, Processes, and Practices, Oxford University Press.
Chandan, J.S., Management: Theory and Practice, Vikas Publishing House.
Chhabra, T.N, Principles and Practice of Management, Dhanpat Raj & Co., New Delhi.
Drucker, Peter F., Practice of Management, Mercury Books, London.
Griffin, Management Principles and Application, Cengage Learning.
Gupta, C.B., Management: Theory and Practice, Sultan Chand & Sons.
Gupta, R.N., Principles of Management, S. Chand & Co.
Kreitner, Robert, Management Theory and Application, Cengage Learning.
Murgan, M.S., Management Principles and Practices, New Age International, New Delhi.
Prasad, L.M., Principles and Practice of Management, Sultan Chand & Sons.
Rao, V. S. P., Principles of Management, Himalaya Publishing House.
Azhar Kazmi, STRATEGIC MANAGEMENT & BUSINESS POLICY, Tata McGraw-Hill Publishing Company Limited, New Delhi.
Vipin Gupta, Kamala Gollakota & Srinivasan, BUSINESS POLICY & STRATEGIC MANAGEMENT, Prentice Hall of India Private Limited, New Delhi.
Amita Mittal, CASES IN STRATEGIC MANAGEMENT, Tata McGraw-Hill Publishing Company Limited, New Delhi.
Fred R. David, STRATEGIC MANAGEMENT CONCEPT AND CASES, PHI Learning Private Limited, New Delhi.

Syllabus *(COMMERCE)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BCOMMAJ08T**
Course Title: **Business Mathematics and Statistics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to help the students: 1. To understand basic mathematical and statistical concepts and techniques and their applications in business operations. 2. To learn the tools and techniques necessary to analyse data and draw appropriate conclusions from the data. 3. To identify and use relevant techniques, such as forecasting and regression analysis, to make informed business decisions.**
Learning Outcome: **The outcomes of studying Business Mathematics and Statistics can include an increased knowledge of quantitative methods, the ability to think critically and solve problems using mathematical and statistical principles, and the skill to use and interpret models and data to inform important business decisions. Additional outcomes may include effectively communicating and discussing various analysis processes and understanding and analysing financial reports and other related analytics.**

Subject: Business Mathematics and Statistics

Unit 1: Mathematics of Finance (Lectures: 10)

Arithmetic and Geometric Progression with Business Applications, Theory of quadratic Equations- Function, Number and Nature of Roots, Simultaneous Quadratic Equations, Techniques of Compounding and Discounting.

Logarithms: Definitions, Laws, Basic Properties; Antilogarithm- characteristics and Mantissa; Uses of Logarithmic and Antilogarithmic Tables; Business Application of Logarithms.

Unit 2: Calculus (Lectures: 15)

Mathematical functions and their types- linear, quadratic, polynomial, exponential, logarithmic function, Concepts of limit and continuity of a function;

Concept and rules of differentiation, Maxima and Minima involving second or higher order derivatives.

Partial Differentiation: Partial derivatives up to second order; Homogeneity of functions and Euler's theorem.

Integration: Standard forms. Methods of integration – by substitution, by parts, and by use of partial fractions; Definite integration; Finding areas in simple cases.

Unit 3: Business Statistics-Introduction (Lectures: 10)

Definition, Importance, Scope and Limitations of Statistics; Nature, types and Sources of data, Classification of data: univariate, bivariate and multivariate data; Time-series and cross-sectional data Methods of collecting Primary Data; representation of Data- Tabular and Graphical Methods (Line chart, Bar chart, Pie chart, Histogram, Frequency polygon and Ogive), Frequency Distribution and its Diagrammatic Presentation.

Unit 4: Measures of Central Tendency and Dispersion (Lectures:10)

Measures of Central Tendency: A.M., G.M. H.M. – Measures, Properties, Merits and Demits; Composite Arithmetic Mean; Relationship among A.M., G.M. and H.M.; Median and Mode – Measures, Properties, Merits and Demits;

Measures of Dispersion: Absolute and Relative Measures of Dispersion- Merits and Demerits; Important Properties of Standard Deviation; Standard Deviation of Composite Group.

Unit 5: Correlation and Regression Analysis (Lectures: 10)

Correlation Analysis: Scatter Diagram, Pearson's Correlation Coefficient- Calculation and Properties (Proof not required); Spearman's Rank Correlation.

Regression Analysis: Simple Linear Regression- Estimation of regression equations, Properties of regression coefficients, Relationship between correlation and regression coefficients.

Unit 6: Index Number and Time Series Analysis (Lectures:20)

Meaning and uses of index numbers; Construction of Price and Quantity index numbers by Aggregative and Relative methods-simple and weighted, Construction and uses of cost of living index number.

Need for Time Series Analysis; Causes of Variation in Time Series Data; Component of Time Series, Additive and Multiplicative models, Determination of Trend- Semi Average Method, Moving Average Method and Least Square Method for Linear, Parabolic and Exponential Trends, Calculation of Seasonal Indices using Simple averages, Ratio-to-trend, and Ratio- to-moving averages methods.

Reading References:

Arora, S.R. & Khattar, D., Business Mathematics with Applications, S. Chand & Co.
Bhui, B.C. & Chatterjee, D., Mathematics for BBA, Vikas Publishing House.
Chakravarty, S.K., Financial Mathematics, New Age International.
Dikshit, Amarnath & Jain, Jinendra Kumar, Business Mathematics, Himalaya Publishing House.
Garg, S. & Julka, A., Business Mathematics and Statistics, Taxmann Publications.
Goel, Ajay and Goel, Alka, Mathematics and Statistics, Taxmann Publications.
Hazarika, Padmalochan, A Text Book of Business Mathematics, S. Chand & Co.
Kandoi, Balwant, Mathematics for Business and Economics with Application, Himalaya Publishing House.
Kapoor, V.K., Business Mathematics, Sultan Chand & Sons.
Mittal, P.K. & Sathyaprasad, B.G., Mathematics and Statistics for Management, Himalaya Publishing House.
Monga, G.S., Mathematics and Statistics for Economics, Vikas Publishing House.
Nag, N.K., Business Mathematics, Kalyani Publishers.
Ranganath, G.K. & Rajaram, Y., A Text Book of Business Mathematics, Himalaya Publishing House.
Ravindranath, V. & Vijayalaxmi, P., A Textbook on Mathematical Methods, Himalaya Publishing House.
Satyaprasad, B.G. & Nirmala, K., Business Mathematics and Statistics, Himalaya Publishing House.
Sehgal, K.L., Business Mathematics, Himalaya Publishing House.
Soni, R.S., Business Mathematics, Pitambar Publication.
Trivedi,Business Mathematics,Pearson Education.
Tulsian, Quantitative Techniques: Theory & Problems , Pearson Education.
Wilson, M., Business Mathematics, Himalaya Publishing House.

Syllabus *(COMMERCE)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BCOMMAJ09T**
Course Title: **Management Accounting**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to help the students: 1. To learn a framework and structure for better decision-making and resource allocation. 2. To identify ways to improve performance and the overall profitability of an organization. 3. To improve understanding of cost dynamics and how it affects a company's income statement. 4. To understand methods and techniques of budgetary control. 5. To understand the importance of responsibility accounting.**
Learning Outcome: **The outcomes of studying Management Accounting may include gaining a deeper understanding of financial statement analysis, an enhanced ability to develop and manage budgets, and becoming more comfortable interpreting and using financial models and analytics. Additionally, studying Management Accounting can enable students to make decisions based on the organization's financial goals, helping them anticipate and plan for future change.**

Subject: Management Accounting

Unit 1: Introduction (Lectures: 10)

Management Accounting: Definition, objectives, scope, functions, advantages, limitations, techniques and needs; Comparison with cost and financial accounting; Role of management accountant.

Unit 2: Working Capital Management (Lectures: 10)

Introduction, meaning and concepts of working capital; Management and issues of working capital; Estimating working capital needs, operating and working capital cycle; Various sources of working capital; Financing Current Assets and strategies of financing. Negative Working Capital

Unit 3: Cash Flow and Fund Flow Analysis (Lectures:10)

Cash Flow Statement- traditional and incorporating AS-14;

Fund flow statement with changes in working capital.

Unit 4: Ratio Analysis: (Lectures: 15)

Ratio analysis its meaning, advantages and disadvantages, Types of ratios, Interpretation of ratio, Common size statements, Trend analysis. Drafting of Balance Sheet with the help of accounting ratios, important ratios used in Capital Structure analysis.

Unit 5: Budgetary Control (Lectures:15)

Budget and Budgetary Control; Budget manual, Principal budget factors, Preparing and monitoring procedure; Preparation of functional budgets (Production, Sales, Materials), Cash budgets, Basic idea of Master Budget, Flexible Budget.

Unit-6: Responsibility Accounting: **(Lectures: 15)**

Introduction, Meaning and significance of responsibility accounting; Prerequisites for responsibility accounting, Meaning of responsibility centres; Types of responsibility centres; Relevance of Responsibility Reporting, Limitations of Responsibility Accounting.

Reading References:

Arora, M.N., Management Accounting, Vikas Publishing House.
Atkinson, Management Accounting, Pearson Education.
Banerjee, B., Financial Policy and Management Accounting, World Press, Kolkata.
Bhat, Sudhindra, Management Accounting, Excel Books.
Chakravarty, A.K., Cost and Management Accountancy, New Central Book Agency, Kolkata.
Chakraborty, H. & Chakraborty, S., Management Accountancy, Oxford University Press.
Drury, Colin, Management and Cost Accounting, Cengage Learning.
Goel, Rajiv, Management Accounting, International Book House, New Delhi.
Hanif; M., Modern Cost and Management Accounting, Mc-Graw Hill Education.
Jain S.P. & Narang K.L., Cost and Management Accounting, Kalyani Publishers.
Jhamb, H.V., Management Accounting, Ane Books, New Delhi.
Khan, M.Y. & Jain, S.P., Management Accounting, Mc-Graw Hill Education.
Kishore, Ravi M., Cost and Management Accounting, Taxamnn Publications.
Maheshwari, S.N. & Mittal, S.N., Management Accounting, Shree Mahavir Book Depot, New Delhi.
Narasimhan, M.S., Management Accounting, Cengage Learning.

Pandey, I.M., Management Accounting, Vikas Publishing House.
Paul, S.K., Management Accounting, New Central Book Agency, Kolkata.
Rustagi, R.P., Management Accounting, Taxamnn Publications.
Sahaf, M.A., Management Accounting: Principles and Practice, Vikas Publishing House.
Sekhar & Rajagopalan, Management Accounting, Oxford University Press.
Shah, Management Accounting, Oxford University Press.
Shankaranarayana, H.V., Management Accounting, Cengage Learning.
Sharma R.K. & Gupta Shashi, Management Accounting: Principles and Practice, Kalyani Publishers.
Singh, S.K. & Gupta Lovleen, Management Accounting: Theory and Practice, Pinnacle Publishing House.
Singh, Surender, Management Accounting, Scholar Tech Press, New Delhi.
Singh, S. K. & Gupta Lovleen, Management Accounting: Theory and Practice, Pinnacle Publishing House.
Thukaram Rao, M.E., Management Accounting, New Age International.

Syllabus *(COMMERCE)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BCOMMAJ10T**
Course Title: **Auditing**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to help the students: 1. To provide an independent opinion on whether a company's financial statements are free from material misstatement, accurately representing its financial position. 2. To help maintain the accuracy and reliability of financial information to protect the public interest. 3. To detect and prevent any form of fraud and any other illegal activity, acts of mismanagement, or other irregularities within the company. 4. To ensure the adherence of company management and shareholders to the established accounting principles and reporting standards. 5. To serve as a control mechanism to verify the accuracy of the financial information given to shareholders and other stakeholders.**
Learning Outcome: **The outcome of auditing studies can typically include the determination of the accuracy or validity of financial statements, identifying weak controls or deficiencies in internal processes, and discovering fraud or misappropriation of funds. Additionally, the outcomes of an audit can lead to improved processes or systems for managing and controlling an organisation's finances.**

Subject: Auditing

Unit 1: Introduction (Lectures: 10)

Auditing-Introduction, Meaning, Objectives, Basic Principles and Techniques; Classification of Audit, Audit Planning, Internal Control – Internal Check and Internal Audit; Audit Procedure- Vouching and Verification of Assets & Liabilities.

Unit 2: Company Audit-I (Lectures: 15)

Audit of Limited Companies: Company Auditor- Qualifications and Disqualifications, Appointment, Rotation, Removal, Remuneration, Rights and Duties, Auditor's Report-Contents and Types. Liabilities of Statutory Auditors under the Companies Act 2013.

Unit 3: Company Audit-II (Lectures: 15)

Depreciation**-**Causes**,** methods, necessity to charge depreciation, the difference from amortization, declaration of dividend without charging current and arrear depreciation (Ref. Companies Act, 2013)- the inadequacy of profit and depreciation, consequences of change in method of depreciation.

Reserves-types of reserves, funds and provision, sinking fund, secret reserve-creation, duties of auditor, capitalization of reserve.

Unit 4: Company Audit-III (Lectures: 15)

Dividend-Difference from divisible profit, types of dividend, sources, provisions of Companies Act regarding declaration of dividend-factors considerable for declaration of dividend-procedure for payment-auditors duty in cases of declaration of dividend out of abnormal profit or capital profit or revaluation profit or pre-acquisition profit or in absence of current profit; Is the declaration of dividend compulsory; payment of interest out of capital (Sec-208)

Unit 5: Special Areas of Audit (Lectures:10)

Special Areas of Audit: Special features of Cost audit, Tax audit, and Management audit; Propriety Audit.

Unit 6: Recent Trends in Auditing: (**Lectures: 10)**

Basic considerations of audit in EDP Environment; Computer-aided audit techniques and tools; Auditing Standards; Relevant Case Studies/Problems.

Reading References:

Basu, Auditing and Assurance, Pearson Education.
Ghatalia, S.V., Practical Auditing, Allied Publishers, New Delhi.
Gomez, Auditing and Assurance: Theory and Practice , PHI Learning.
Gupta, Kamal, Practical Auditing, McGraw Hill Education.
Jha, Aruna , Auditing, Taxmann Publication.
Kumar, Ravinder & Sharma, Virender, Auditing: Principles and Practice, PHI Learning.
Kumar & Sharma, Auditing: Principles and Practice, PHI Learning.
Pagare, Dinakar, Practice of Auditing, Sultan Chand & Sons.
Reddy, P.N. & Appannaiah, Auditing, Himalaya Publishing House.
Saxena, R.G., Principles and Practice of Auditing, Himalaya Publishing House.
Singh, A.K. & Gupta Lovleen, Auditing Theory and Practice. Galgotia Publishing Company.
Tandon, B.N., Practical Auditing, Sultan Chand and Sons.

Syllabus *(COMMERCE)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BCOMMAJ11T**
Course Title: **Marketing Management and Human Recourse Management**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The subject aims to help the students: 1. To gain a comprehensive understanding of the principles and techniques of marketing and human resource management. 2. To develop skills in analysing and interpreting consumer behaviour and employee motivation. 3. To become proficient in creating effective marketing strategies and human resource policies. 4. To understand the impact of marketing on organizational performance and its ability to influence key business decisions. 5. To identify core organizational objectives and the roles of different groups in the organization.**

Learning Outcome: **The outcomes of studying marketing and human resource management are numerous. Most importantly, students will learn how to apply marketing strategies and tactics to increase revenue and grow the business while understanding the importance of employee engagement, motivation, and engagement in ensuring success. This combination of knowledge and skills will enable students to lead better, manage, and develop teams while optimizing resources to reach organizational goals. Additionally, students will acquire valuable communication, organization, and project management skills that will benefit almost any field.**

Subject: Marketing Management and Human Recourse Management

Module I: Marketing Management

Unit1: Introduction (Lectures: 10)

Concept of Marketing: Concept, Customer's Need and Satisfaction, Marketing Environment,

Unit 2: Buyer Behaviour (Lectures:15)

Factors influencing Individual Buying Behaviour; Buying Decision Process for New Products; Market Segmentation.

Unit 3: Marketing Mix and Pricing Strategies (Lectures: 10)

Developing the Market Mix: Concept of Marketing Mix of Product and Service; Product Mix Decisions; New Product Development Process, Product Life Cycle; Price; Factors to consider when setting Price; Pricing Strategies.

Module II: Human Resource Management

Unit 4: Introduction: (Lectures:15)

Human Resource Management-challenges- responses –objectives - Models, job analysis and design; Job enrichment and Job enlargement - HR planning - recruitment - selection

Unit 5: **Development and Evaluation: (Lectures:10)**

Procurement and Development Functions: Job Analysis, Job description, job specification, recruitment, selection, placement and induction and socialization, Training & development. Types and method, job change – career planning, promotion, demotion, transfer, separations.

Unit 6: Compensation and Protection: (Lectures:10)

Job evaluation – Merit rating – Methods of wages payment, incentives and compensation – Types, advantages, perquisites. Wages system in India.

Reading References:

Bose, Biplab S., Marketing Management, Himalaya Publishing House.
Bose, Chandra, Modern Marketing: Principles and Practice, PHI Learning.
Chhabra, T.N. & Grover, S.K., Marketing Management, Dhanpat Rai & Company, New Delhi.
Datta, D. & Datta, M., Marketing Management, Vrindha Publications.
Gupta, C.B. & Nair, N.R., Marketing Management, Sultan Chand & Sons.
Jain, Subash C. & Haley, George T., Marketing: Planning and Strategy, Cengage Learning.
Kapil, Case Studies in Marketing, Pearson Education.
Kapoor, D.C., Marketing and Sales Management, S. Chand & Co.

Venkata Ratnam C. S. & Srivatsava B. K.,PERSONNEL MANAGEMENT AND HUMAN RESOURCES, Tata Mc-Graw Hill, NewDelhi,,
Aswathappa, HUMAN RESOURCE MANGEMENT, Tata McGraw Hill, NewDelhi,
Garry Dessler &Varkkey, HUMAN RESOURCE MANAGEMENT, Pearson, New Delhi,
Alan Price, HUMAN RESOURCE MANAGEMENT, Cengage Learning, NewDelhi,
Pravin Durai, HUMAN RESOURCE MANGEMENT, Pearson, New Delhi,
Snell, Bohlander & Vohra, HUMAN RESOURCES MANAGEMENT, Cengage, NewDelhi,

Syllabus *(COMMERCE)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BCOMMAJ12T**
Course Title: **Fundamentals of Business Research Methodology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The Paper aims to help the students: 1. To understand basic research methods and processes. 2. To learn how to design effective empirical research studies. 3. To gain different quantitative and qualitative methods of research. 4. To develop the ability to interpret and analyse data. 5. To gain a clear understanding of ethics in research.**
Learning Outcome: **The outcomes for studying Fundamentals of Research Methodology include gaining an understanding of the area of knowledge associated with research, developing the ability to select appropriate research methodologies and techniques for a particular purpose, and the capacity to develop research proposals. Other outcomes may include enhanced critical thinking and communication skills, understanding of how to manage and interpret data, and improved research report writing abilities.**

Subject: Fundamentals of Business Research Methodology

Unit-1: Introduction (Lectures: 10)

Meaning, Purpose, Characteristics and Types - Process of Research: Literature review and research gap, Formulation of research problem, objectives and Hypotheses: Types of Hypotheses - Methods of Research: Survey, Observation, Case study, experimental- Difficulties in Business research.

Unit-2: Techniques of Research: (Lectures: 15)

Meaning, Need and Importance - Classification: Statistical Techniques - Operations Research techniques - Role of Quantitative Techniques in Business and Industry - Quantitative Techniques in Decision making - Limitations.

Unit-3: Collection of Data: (Lectures:10)

Primary and Secondary Sources - Methods of collecting Primary Data - Designing Questionnaires- Sampling Design, Measurement Scale, Attitude Measurement.

Unit-4: Data Processing: (Lectures:15)

Editing, coding, classification, and tabulation - Graphical and diagrammatic presentation. Statistical analysis of Data: Types of analysis-Descriptive analysis and inferential analysis.

Unit-5: Interpretation (Lectures:15)

Essentials for Interpretation, Precautions in interpretation - Conclusions and Generalizations - Report Writing: Meaning and types of reports - Stages in preparation of Report - Characteristics of a good report - Structure of the report'- Footnotes and Bibliography.

Unit-6: Ethics in Business Research (Lectures: 10)

Research and publication Ethics; Plagiarism, Research Integrity

Reading References:

Panneerselvam, R., RESEARCH METHODOLOGY, Prentice Hall of India, New Delhi.
Kothari CR , RESEARCH METHODOLOGY-METHODS AND TECHNIQUES, New Wiley Eastern Ltd., Delhi.

Syllabus *(COMMERCE)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BCOMMAJ13T**
Course Title: **Financial Management**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The subject aims to help the students: 1. To understand the principles of finance, including sound financial decision-making, financial planning and leverages, and capital structure strategies. 2. To know the necessary technical knowledge and skills to evaluate companies' financial performance and position effectively. 3. Acquire the capabilities to identify and analyse financial issues, devise sound solutions, and make effective financial decisions.**
Learning Outcome: **learners will be able to: 1. Develop a better understanding of investments, financial analysis, and financial planning. 2. Increased ability to leverage financial tools to make business decisions. 3. Learn to create financial plans that optimize the use of resources and secure a company's financing. 4. Acquire the ability to identify financial risks and create strategies to manage those risks.**

Subject: Financial Management

Unit 1: Introduction (Lectures: 10)

Nature, scope, functions and objective of Financial Management, Time value of money, Risk and return, Valuation of securities – Bonds and Equities.

Unit 2: Investment Decisions (Lectures:10)

The Capital Budgeting Process, Cash Flow Estimation, Payback Period Method, Accounting Rate of Return, Net Present Value (NPV), Net Terminal Value, Internal Rate of Return (IRR), Profitability Index, Capital Rationing (Basic concepts only).

Unit 3: Financing Decisions (Lectures: 15)

Cost of Capital: Sources of long-term financing, Estimation of components of cost of capital. Methods for Calculating cost of equity capital, Cost of Retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average cost of capital (WACC) and Marginal cost of capital.

Unit 4: Capital structure: (Lectures: 15)

Theories of Capital Structure (Net Income, Net Operating Income, MM Hypothesis, Traditional Approach); Determinants of Capital Structure, Optimum capital structure.

Unit 5: Dividend Decisions (Lectures:10)

Meaning and nature, Theories for Relevance and irrelevance of dividend decision for corporate valuation; Walter's Model, Gordon's Model and M-M Theory, Cash and stock dividends; Dividend policies in practice.

Unit 6: Financial Leverage (Lectures:10)

Leverages; Financial, Operating and composite leverages. EBIT-EPS Analysis. Lease Financing, Venture Capital Financing

Reading References:

Agarwal, O.P., Financial Management, Himalaya Publishing House.
Avadhani, V.A., Investment Management, Himalaya Publishing House.
Banerjee, B., Fundamentals of Financial Management, PHI Learning.
Bhalla, V.K., Investment Management, S. Chand & Co.
Bhat, Sudhindra, Financial Management, Excel Books.
Brigham, Eugene F. & Houston, Joel F., Fundamentals of Financial Management, Cengage Learning.
Chandra, Prasanna, Financial Management, McGraw Hill Education.
Kapil, Financial Management, Pearson Education.
Khan, M.Y. & Jain, S.P., Financial Management, Tata McGraw Hill.
Kishore, Ravi. M., Financial Management, Taxmann.
Kulkarni, P.V. & Satyaprasad, B.G., Financial Management, Himalaya Publishing House.
Pandey, I.M., Financial Management, Vikas Publishing House.
Parasuraman, N.R., Financial Management: A Step by Step Approach, Cengage Learning.
Paul, S.K., Financial Management, New Central Book Agency, Kolkata.
Periasamy, F., Financial Management, Mc-Graw Hill Education.
Rustagi, R.P., Fundamentals of Financial Management, Taxmann.
Saxena, V.K. & Vashist, C.D., Basics of Financial Management, Sultan Chand.
Sharan, Fundamentals of Financial Management, Pearson Education.
Srivastava, R.M., Financial Management, Himalaya Publishing House.
Srivastava, R. & Misra, A., Financial Management, Oxford University Press.
Van Horne, Fundamentals of Financial Management ,Pearson Education.

Syllabus *(COMMERCE)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BCOMMAJ14T**
Course Title: **Fundamentals of Investment Management**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The course aims to help the students: 1. To understand the various investment products and markets available to investors. 2. To analyse and evaluate a portfolio of investments using different risk-return profiles. 3. To develop portfolio selection strategies tailored to the investment goals of a particular investor. 4. To understand the dynamics of different types of markets and investments.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Understand the financial products and investment strategies used in the financial markets. 2. Learn how to diversify portfolios to achieve asset allocation goals and minimize risk. 3. How to build integrated asset allocation models and determine the optimal mix of investments. 4. Develop and analyse strategies to manage portfolios. 5. Gain knowledge of capital markets, investment instruments, and securities regulations.**

Subject: Fundamentals of Investment Management

Unit 1: The Investment Environment and Investor Protection (Lectures: 20)

The investment decision process, Types of Investments - Commodities, Real Estate and Financial Assets; the Indian securities market; Market participants and trading of securities; Security market indices; Sources of financial information; Concept of return and risk; Impact of Taxes and Inflation on return.

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system; insider trading; Investors' awareness and activism.

Unit 2: Fixed Income Securities (Lectures: 10)

Bond – features and types; Estimating bond yields, Bond valuation, Types of bond risks, Default risk and credit rating.

Unit 3: Approaches to Equity Analysis (Lectures: 20)

Introductions to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis; Dividend capitalisation models and price-earnings multiple approach to equity valuation.

Unit 4: Portfolio Analysis and Financial Derivatives (Lectures: 10)

Portfolio and Diversification; Portfolio Risk and Return; Mutual Funds; Unit Introduction to Financial Derivatives; Financial Derivatives Markets in India

Reading References:

Avadhani, V.A., Capital Market Management, Himalaya Publishing House.
Avadhani, V.A., Investment Analysis and Portfolio Management, Himalaya Publishing House.
Bhalla, V.K., Investment Management, S. Chand & Co.
Bhat, Sudhindra, Security Analysis and Portfolio Management, Excel Books, New Delhi.
Bodie & Mohanty, Investments, Mc-Graw Hill Education.Chandra, Prasanna, Investment Analysis and Portfolio Management, McGraw Hill Education.
Don M. Chance & Robert Brooks, An Introduction to Derivatives and Risk Management, Cengage Learning.
Fischer and Jordan, Security Analysis and Portfolio Management, PHI Learning.
Herbert B. Mayo, Investments: An Introduction, Cengage Learning.
Hirt, Fundamentals of Investment Management, Mc-Graw Hill Education.

Syllabus *(COMMERCE)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BCOMMAJ15T**
Course Title: **Business and Corporate Governance**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The course aims to help the students: 1. To understand the legal responsibilities of businesses and the obligations of corporate officers and directors in a corporate governance structure. 2. To understand the ethical, social, and environmental considerations in strategic decision making. 3. To understand the different types of corporate governance systems and their impacts on business decision-making. 4. To understand the role of corporate governance in determining corporate culture and accountability.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Increased knowledge and understanding of the framework of rules, attitudes, and principles that govern and shape businesses. 2. Understand the legal and ethical considerations in a better way when making important business decisions. 3. A better understanding of the boardrooms and the responsibilities of each member. 4. An improved awareness of best practices in financial transparency.**

Subject: Business Ethics and Corporate Governance

Unit 1: Introduction: (Lectures: 10)

Meaning of ethics, difference between ethics and law. The nature of business ethics; the relationship between business ethics, corporate governance and ethical leadership; Kohlberg's six stages of moral development; various levels of ethical analysis.

Unit 2: Ethical Principles in Business: (Lectures: 15)

The teleological approach; the deontological approach; the virtue ethics approach; universalism versus ethical relativism. Characteristics of Business Ethics. Ethical Principles for Business Executives. Corporate philosophy; stakeholder theory versus stockholder theory.

Unit 3. Corporate Governance and Mis Governance: (Lectures:15)

Historical background of corporate governance in India, Agency theory versus stakeholder theory, Concept and core principles of corporate governance.

Mis- Governance-some recent examples – Factors responsible for such misgovernance – Lessons from corporate failures around the globe, Legal and Regulatory framework of corporate governance.

Unit 4: Companies Act, 2013: (Lectures: 20) with respect to improving the quality of corporate governance practice, Clause 49 of the Listing Agreement (SEBI). Corporate Governance Report as a part of the Annual Report of a Company – its major contents. Difference between corporate social responsibility and corporate governance.

Suggested Readings:

1. Dr. Neeru Vasishth and Dr. Namita Rajput - Corporate Governance values and ethics, Taxmann Publications Pvt Ltd, New Delhi.
2. S.Sanakaran – International Business & Environment, Margham Publication, Chennai.
3. Dr.S.S. Khanka – Business Ethics and Corporate Governance, S.Chand Publication.
4. Sundar.K, Business Ethics and Value, Vijay Nichole Prints, Chennai.
5. Taxmann - Corporate Governance, Indian Institute of Corporate Affairs,
6. A.C.Fernando, K.P.Muralidharan & E.K.Satheesh – Corporate Governance, Principles, Policies and Practices, Pearson Education.

Syllabus *(COMMERCE)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BCOMMAJ16T**
Course Title: **Corporate Reporting**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The course aims to: 1. Help the learners to understand, analyse and interpret the basic framework of financial reporting and information incorporated in the corporate annual reports. 2. Impart knowledge about the emerging corporate reporting standards and their needs; 3. Impart knowledge about Sustainability Reporting, ESG Reporting, Accounting and Reporting of Intellectual Capital and Integrated Reporting.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Analyse and interpret information provided in the financial statements of a company; 2. Interpret the contents of corporate annual reports; 4. Understand valuation of tangible and intangible assets; 5. Understand and summarise emerging areas in financial reporting and non-financial reporting.**

Subject: Corporate Reporting

Unit 1. Introduction (Lectures: 10)

Various concepts and relevant issues- Environment, society and governance (ESG); Triple-Bottom-Line (TBL).

Unit 2. Economic Value Added **(Lectures:15)**

Introduction, Limitations of traditional performance evaluation techniques of accounting, Genesis of EVA, Advantages and Limitations of EVA, Economic Value-Added Statements, Concepts of MVA and SVA

Unit 3. Modern Reporting Practices: Part-I (Lectures:10)

Extension of the boundary of corporate reporting– Social and Environmental reporting – Accounting and Reporting of Intellectual Capital.

Unit 4. Modern Reporting Practices: Part-II (Lectures:10)

Disclosure in Company Accounts and Corporate Social Responsibility, Sustainability Reporting, Business Responsibility Reporting, Global Reporting Initiative (GRI), and Integrated Reporting.

Syllabus *(COMMERCE)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BCOMMAJ17T**
Course Title: **International Business and Finance**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to: 1. Impart the core body of knowledge in international business to the students. 2. The course would introduce students to the international trading and investment environment 3. Create awareness about emerging issues such as outsourcing and sustainable development in the context of international business.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Analyse the process of globalization and its impact on growth of international business; 2. Evaluate the changing dynamics of the diverse international business environment; 3. Analyse the theoretical dimensions of international trade as well as intervention measures adopted; 4. Analyse the significance of different forms of regional economic integration and the role played by various international economic organisations; 5. Summarize the concept and components of the Balance of Payments statement; 6. Evaluate the forms of foreign direct investment and analyse benefits and costs of FDI;**

Subject: International Business and Finance

Unit 1. Introduction to International Business: (Lectures:10)

Concept, nature, scope and Importance of international business; Theories of international trade –absolute advantage, comparative advantage, H-O theory; Balance of Payments (BOP)-Principles of BOP Accounting, Components of BOP, Significance of Equilibrium and Disequilibrium in BOP, India's BOP and Economic Performance, Capital and Current Account Convertibility.

Unit 2. Vehicles of International Business: (Lectures: 15)

Concept of MNCs; Foreign Direct Investment and Cross Border Acquisitions; Major Vehicles of FDI – costs and benefits of FDI to host and home countries; Modes of entry to a foreign

market; Regionalism vs. Multilateralism; some important regional economic arrangements like EU and NAFTA, SAARC; Multilateralism and WTO.

Unit 3. Foreign Exchange Market and Exchange Rate Determination: (Lectures:15)

Demand and Supply of Foreign Exchange –Exchange Rate – Devaluation and Up valuation of Domestic Currency –Theories of Determination of Exchange Rate– Purchasing Power Parity, Interest Rate Parity.

Unit 4. Introduction to International Finance: (Lectures:10)

International money and capital markets; International Monetary System; International Financial Markets; The Euro Markets; International economic institutions - IMF, World Bank, UNCTAD, Asian Development Bank.

Unit 5. Foreign Investment Analysis: (Lectures: 15)

International Portfolio Investment; International Capital Budgeting; International Working Capital Management- Current Asset Management – Financing Current Assets.

Unit 6. International Transfer Pricing and International Taxation: (Lectures:10)

Concept and mechanisms of International Transfer Pricing, Concept and Issues of International Taxation- Double Taxation, Tax havens, Tax Treaties, Methods to avoid double taxation.

Suggested Readings:

1. Danoes, John D. Radebaugh, Lee H., and Daniel P. Sullivan International Business: Environment and Operations, 12th ed., Prentice Hall, 2009.
2. Hill, Charles, W.L., International Business, McGraw Hill Company, New York, 2009.
3. Ball, Donald, Wendall H. McCulloch, Michael Geringer, Michael S. Minor and Jeanne M. McNett, International Business: The Challenge of Global Competition, 12th edition, 2009, McGraw Hill Co.
4. Griffin, Ricky W. and Pustay, Michael W, International Business: A Managerial Perspective, Prentice Hall, 2009.
5. Levi, Maurice, International Finance, New York, McGraw Hill Inc., 1996.
6. Apte P.G., Multinational Financial Management, New Delhi, Tata McGraw Hill, 1998
7. Seth A.K., International Financial Management, New Delhi, Galgotia Publishing Company, 2000.

Syllabus *(COMMERCE)*

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BCOMMAJ18T**
Course Title: **Indian Financial System**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The course aims to help the students: 1. To understand the functioning of India's major financial institutions and markets. 2. To gain an insight into the different investment opportunities in the Indian financial system. 3. To understand the role of the government, regulators and participants in the Indian financial system. 4. To recognize and assess the risks and opportunities associated with investing in India.**
Learning Outcome: **After completion of the course, learners will be able to: 1. Aware about the role of financial institutions in the Indian economy. 2. Acquire knowledge of the major challenges currently facing the Indian**

financial system. 3. Understand the major economic and financial policies of the Indian government. 4. Understanding of the important role of the banking sector in driving economic growth.

Subject: Indian Financial System

Unit 1. Financial System - An overview: (Lectures:10)

Meaning and components of the Financial System; Role of Financial Institutions (FIs) in Financial System; Financial Systems and Development; Major issues in the Indian Financial System.

Unit 2. Financial Institutions: (Lectures: 10)

Banks- Apex Bank, Scheduled Commercial Banks, RRBs, Cooperative Banks, Private Banks and others, Credit Institutions; Development Financial Institutions; NBFCs: Types and Regulatory Authorities; RNBCs; Mutual Fund Institutions. Microfinance Institutions.

Unit 3. Insurance: (Lectures: 10)

Concept, Functions, Characteristics of Insurance, History of Insurance in India, Life Insurers and Non-life Insurers registered in India, Various life insurance products offered by LICI, Concept of Reinsurance, Scheme of Insurance Ombudsman.

Unit 4. Money Market and Capital Market: (Lectures:15)

Concept of Money Market, Difference between Money Market and Capital Market, Money Market Instruments –Treasury Bills, Commercial Papers and Certificates of Deposits –their features. Securities and Securities Market; Role of Securities Market in a Country's Economy; Structure of Indian Capital Market; Instruments Usually Traded In Capital Market; SEBI and its Functions and Role.

Unit 5. Primary Market – Intermediaries and Activities: (Lectures:15)

Primary Market Intermediaries – Merchant Bankers, Lead Managers, Underwriters; Bankers to an Issue; Registrars to an Issue and Share Transfer Agent. Primary Market Activities / Procedures – Pricing of Issues; IPO, FPO and OFS, Book Building Process – Concept, various terminologies used, various categories of investors, green shoe option; ASBA facility. Depositories & Depository Participants. Demat Accounts, Delivery Instruction Slips, Annual Maintenance Charge, Basic Services Demat Account (BSDA), Nomination of Shares and Transmission of Shares.

Unit 6. Secondary Market (Stock Exchanges): (Lectures: 15)

Role of Stock Exchanges in Security Trading; Role of Brokers and Sub-Brokers in Security Trading; Major Stock Exchanges in India - BSE, NSE; Concept of Stock Market Indices including sectoral indices; Listing of Securities on a Stock Exchange; Clearing and Settlement; Present Screen-Based Computerized Trading; Scrip-less Trading;

Suggested Readings

1. Indian Financial System, Vikas Publication House Pvt. Ltd.
2. Dr. S. B. Deodhar & Mrs. Aditi A. Abbyankar, Indian Financial System, Himalaya Publishing House
3. P.N. Varstney & D. K. Mittal, Indian Financial system, Sultan Chand & Sons
4. Vasant Desai, The Indian Financial System, Himalaya Publishing House
5. M.Y. Khan, Indian Financial System,TMH.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(COMPUTER SCIENCE)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BCOSMAJ01C**
Course Title: **Computer Fundamentals and Programming using C**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **• Understand the functionality and history of computer. • Design the logical structure of a C Programming Language. • Identify the input, output functions and format Specifiers in C Programming. • Understand built-in and user defined functions in**
Learning Outcome: **• Able to write the pseudo code for the programs. • Proficient enough to implement the derived and the user defined data types. • Describe the pointer and file data structures concepts with its operations. • Proficient enough to debug and test cod**

Fundamentals

Use of computer, history and generation of computer, Software/ Hardware, Computer peripherals, Basic component and storage, Fundamentals of Boolean Algebra, Logic Gates, Switching Functions, Simplification of Switching Functions, Data Representation and Basic Computer Arithmetic Number Systems and Codes, Base Conversion, Complements, Fixed and Floating-Point Representation, Character Representation, Addition, Subtraction, Magnitude Comparison. (10 Lectures)

Overview of C

Concept of Logic, Need of Programming, A Brief History of C, Form of a C Program, Basic syntax of C Program, Concept of Block, Compilation and Execution of a C Program, Use of Comments. (5 Lectures)

Data Types, Variables, Constants, Operators and Basic I/O

Basic Data Types, Declaration and Definition of Variables, Memory map of variable, Scope of Variables, Storage Class Specifiers, Variable Initialization, Constants, Type Qualifier (const), Operators, Formatted Console I/O, Unformatted Console I/O (getchar(), putchar()), Header Files. (5 Lectures)

Expressions and Statements

Operator Precedence, Type Conversion, Typecasting, Conditional Statements, Loops. (5 Lectures)

Arrays, Strings, Functions

Array, Types, Declaration and Initialization, Passing Arrays to Functions, Strings, General form of a Function, Function Declaration and Definition, Call by Value, Call by Reference, Arguments to *main()(argc and argv)*, Returning from a Function, Functions Returning Values, Function Returning Pointers, Functions of Type *void*, Declaring Variable-Length Parameter Lists, Recursion, Library Functions. (18 Lectures)

Derived Data Types (Structures and Unions)

Basics of Structures, Accessing Structure Members, Structure Assignments, Array of Structures, Pointers to Structures, Passing Structures to Functions, Nested Structures, Self-Referential Structures, Bit-Fields, Unions, typedef. (5 Lectures)

Pointers

Pointer Variables, Pointer Assignments, Pointer/Address Arithmetic, Pointer Comparison, Array of Pointers, Multiple Indirection, Pointers to Functions, Problems with Pointers.(5 Lectures)

Memory Allocation in C

Static and Dynamic Memory Allocation, C's Dynamic Allocation Functions (malloc(), calloc(), free()). (3 Lectures)

File I/O and Preprocessor Directives

Opening and Closing a File, Reading and Writing Text Files, Random Access in Files, Preprocessor Directives, Macros. (4 Lectures)

Programming Lab using C

- **Basics:** Print in Console, Arithmetic Operations, Swapping, Control Sequence.
- **Conditional Statement:** If, If else, If else ladder, Switch, Break.
- **Iteration:** For Loop, While Loop, Do While Loop, Continue Statement.
- **Function:** Simple Function, Recursion Structure, Union Pointer.

References:

1. R. Sethi, Programming Languages: concepts and constructs, Addison-Wesley.
2. B.W. Kernighan and D.M. Ritchie, The C Programming Language, PHI.
3. R.C. Hutchinson and S.B. Just, Programming using the C Language, McGraw-Hill.
4. B.S. Gottfried, Schaum's Outline of Theory and Problems of Programming with C, McGraw-Hill.
5. H. Schildt, C Made Easy, Osborne McGraw-Hill.
6. YashavantKanetkar, Let Us C, BPB Pubication.
7. E Balagurusamy, Computer Fundamentals and C Programming, McGraw-Hill.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies

- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)

4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(COMPUTER SCIENCE)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BCOSMAJ02C**
Course Title: **Data Structure**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **• Understand various Data Structures and Algorithms. • To analyze the performance of Algorithms • Application of Data Structures and Algorithms to solve complex problems. • Solve problems involving graph, trees, heaps, sorting, searching etc.**
Learning Outcome: **• Understand basic Data Structures, Dynamic Memory Management. • Ability to implement abstract data types. • Ability to understand algorithm analysis procedure. • Ability to understand time complexity and space complexity of various Algorithms.**

Theory

Arrays
Single and Multi-Dimensional Arrays, Sparse Matrices (Array and Linked Representation).(6 Lectures)

Linked Lists
Singly, Doubly and Circular Linked Lists, Basic Operations on these Lists, Polynomial Representation using Linked List. (8 Lectures)

Stacks
Implementing Stack (Array and Linked Representation), Prefix, Infix, and Postfix Expressions; Utility, and Conversion of these Expressions from one to another, Applications of Stack, Limitations of Array Representation of Stack. (8 Lectures)

Queues
Array and Linked Representation of Queues, Circular Queues, Priority Queues.(6 Lectures)

Recursion
Developing Recursive Definitions of Simple Problems and their Implementations, Tracing Recursion, Analyzing Recursion, Towers of Hanoi. (6 Lectures)

Trees and Graphs
Introduction to Trees, Binary Trees, Tree Traversals, Binary Search Trees, Various operations on Binary Search Trees, Height-Balanced Trees, Various Operations on Adelson-Velski and Landis (AVL) Trees, BFS, DFS, Spanning Tree. (10 Lectures)

Searching and Sorting
Linear Search, Binary Search, Comparison of Linear Search and Binary Search, Selection Sort, Bubble Sort, Insertion Sort, Shell Sort, Quick Sort, Merge Sort, Comparison of Sorting Techniques. (10 Lectures)

Hashing
Direct Address Table, Introduction to Hashing, Chaining, Open Addressing (Linear Probing, Quadratic Probing, Double Hashing). (6 Lectures)

Data Structures Lab using Python

- Implement single and multi-dimensional arrays, and perform operations.
- Implement linked lists (singly, doubly, and circular) and their basic operations.

- Implement stacks (array and linked representation), and perform conversions between prefix, infix, and postfix expressions.
- Implement queues (array and linked representation), circular queues, and priority queues.
- Develop recursive solutions for simple problems and analyze recursion.
- Implement tree structures (binary trees, binary search trees, AVL trees) and perform tree traversals.
- Implement searching algorithms (linear search, binary search) and sorting algorithms (selection sort, bubble sort, insertion sort, shell sort, quicksort, merge sort).
- Implement hashing techniques (direct address table, chaining, open addressing).

References:

1. *Michael T. Goodrich, Data Structures and Algorithms in Python.*
2. *Narasimha Karumanchi, Data Structures and Algorithmic Thinking with Python.*
3. *Kent D. Lee and Steve Hubbard, Data Structures and Algorithms with Python.*
4. *Bradley N Miller and David L. Ranum, Problem Solving with Algorithms and Data Structures Using Python.*
5. *Aaron M. Tenenbaum, Moshe J. Augenstein, Yedidyah Langsam, "Data Structures Using C and C++", PHI.*

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BCOSMAJ03C**
Course Title: **Computer Organization and Computer Architecture**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **• Understand the basic structure of Computer System, Instructions and Addressing Modes. • Understand the basic components, functions, and the design of CPU, ALU and Control Unit. • Study and analyze the model for pipelining. • Understand Memory Hi**
Learning Outcome: **• Understand the fundamental concepts and principles of computer organization and architecture. • Familiar with different instruction set architectures, such as CISC (Complex Instruction Set Computer) and RISC (Reduced Instruction Set Computer). • G**

Theory

Digital Logic Circuits

Simplification, Fundamentals of Boolean Algebra, Combinational Circuits, Introduction to Sequential Circuits, Flip-Flops, Registers, Counters, Memory Units. (15 Lectures)

Data Representation and Basic Computer Arithmetic

Number Systems and Codes, Complements, Fixed and Floating-Point Representation, Character Representation, Addition, Subtraction, Multiplication and Division Algorithms for Integers. (10 Lectures)

Memory Organization

Memory system hierarchy, Main Memory Organization, Cache Memory, Virtual Memory. (15 Lectures)

Central Processing Unit

Register Organization, Instruction Set, Instruction Formats, Addressing Modes, Timing and Control, Instruction Cycle, Arithmetic and Logical Micro-operations, Stack Organization, Microprogrammed Control, RISC and CISC Architectures, Pipelining. (12 Lectures)

Input/ Output Organization

Introduction to computer buses, Bus control, I/O transfer techniques: Program controlled, Interrupt controlled and DMA, Interrupts. (8 Lectures)

Digital Electronics Lab

- Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
- Implementation of Boolean functions using logic gates in both SOP and POS forms.
- Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
- Implementation and verification of Multiplexer, De-multiplexer, Decoder, Encoder using logic gates.
- Implementation of 4x1 multiplexer using logic gates.
- Implementation of 4-bit parallel adder using 7483 IC.
- Design and verify 4-bit synchronous and asynchronous counter.

References:

1. William Stallings, Computer Organization and Architecture-Designing for Performance, Pearson Education.
2. M. Mano, Computer System Architecture, Pearson Education.
3. D. A. Patterson and J. L. Hennessy, Computer Organization and Design, Morgan Kaufmann.
4. V. C. Hamacher, Z. G. Veranesic, and S. G. Zaky, Computer Organization, Tata McGraw Hill.

Course Type: **MAJ-4**

Semester: **4**

Course Code: **BCOSMAJ04C**

Course Title: **Database Management Systems**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **• Understand the basic concepts of Data, Database, DBMS, Relational Database and SQL. • To Organize and Maintain the Database. • Develop E-R Models and familiar with basic database storage structures. • Understand Database Transaction and it's p**

Learning Outcome: **• Ability to understand the principles of Database Management System. • Understand Database Design Principles. • Understand the role of Transaction Processing and Concurrency Control Mechanisms. • Easily recognize the importance of Database Analys**

Theory

Introduction

Traditional File Systems, Advantages of DBMS, Layered Architecture of DBMS, Data Independence, Data Models, Schemas and Instances, Database Users, DBA, Data Dictionary, Functional Components of DBMS. (6 Lectures)

Entity-Relationship Modeling

Entities, Attributes, Relationships, Integrity Constraints, Keys, Entity Sets, ER Diagrams, Specialization and Generalization, Aggregation. (8 Lectures)

Relational Model

Basic Concepts of a Relational Model, Relational Algebra, Introduction to Relational Calculus. (10 Lectures)

Relational Database Design

Database Anomalies, Functional Dependencies, Armstrong's Axioms, Closure of FD Sets, Minimal FD Set, Equivalence of FD Sets, Relational Decomposition, Lossless Decomposition, Dependency Preservation, Normalization, 1NF, 2NF, 3NF, BCNF. (10 Lectures)

SQL

Basic Structure, DDL, DML, DCL, Basic SQL Queries (SELECT, INSERT, DELETE, UPDATE), ORDER BY Clause, Complex Queries, Aggregate Functions, GROUP BY Clause, Nested Subqueries, Joins. (6 Lectures)

File Structure and Indexing

Fixed-length and Variable-length Records, Spanned and Unspanned Organization of Records, File Organization (Unordered, Sequential, Hashed), Indexing Structures for Files (Primary Index, Secondary Index, Clustering Index), Multilevel Indexing using B Trees and B+ Trees. (10 Lectures)

Transaction Processing

ACID Properties, Transaction States, Concurrent Execution, Serializability, Concurrency Control Protocols (Lock-Based Protocols). (10 Lectures)

DBMS Lab

- Creating and managing databases, querying data, and performing basic data analysis using SQL.

Reading References:

1. *R. Elmasri, S.B. Navathe,Fundamentals of Database Systems, Pearson Education.*
2. *R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw-Hill.*
3. *A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts, McGraw Hill.*
4. *R. Elmasri, S.B. Navathe, Database Systems Models, Languages, Design and Application Programming, Pearson Education.*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BCOSMAJ05C**
Course Title: **Operating Systems**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **● Understand Functions, Services, and structure of Operating Systems. ● Understand various scheduling policies, synchronization techniques, principles of deadlock and related problems. ● Understand different memory management techniques. ● Underst**
Learning Outcome: **● Analyze basic concepts and features of Operating systems. ● Implement algorithm of CPU scheduling, synchronization techniques to avoid deadlock. ● To learn different memory management and disk scheduling techniques. ● Synthesize the concepts of**

Theory

Introduction

Overview and Functions of Operating Systems, Operating Systems structures, services, system calls, Concept of Kernel, Basis Concept of Time Sharing, Distributed and Real-Time Operating System. (4 Lectures)

Process Management

Concept of a Process, Process Hierarchy, Threads, Multithreading Models, Scheduling Criteria, Process Scheduling Algorithms, Inter-Process Communication. (8 Lectures)

Process Synchronization:

Concept of Process Synchronization, The Critical Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors. (8 Lectures)

Principles of Deadlock:

Concept of Deadlock, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock. (5 Lectures)

Memory Management:

Physical and Virtual Address Space, Swapping, Memory Allocation Strategies (Fixed and Variable Partitions), Concept of Paging, Segmentation, Virtual Memory, Demand Paging, Page Replacement algorithm, Thrashing. (15 Lectures)

File System:

File Concept, Access Method, Directory Structure, File Sharing and Protection, Implementation of File system and Directory, Allocation Methods, Free-Space Management. (5 Lectures)

Storage Management and I/O Systems:

Overview of Mass Storage Structure, Disk Structure and Attachment, Disk Scheduling Algorithm, RAID Structure, I/O Hardware, Kernel I/O Subsystem, Polling, Interrupts, Direct Memory Access. (15 Lectures)

Operating Systems Lab

Basics of UNIX commands.

- Basics of SHELL commands.
- SHELL programming.

Reading References:

1. A. Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Principals, John Wiley Publications.
2. A.S. Tanenbaum, Modern Operating Systems, Pearson Education.
3. W. Stallings, Operating Systems, Internals & Design Principles, Prentice Hall of India.
4. Gary Nutt, Operating Systems, Pearson Education.
5. Sumitabha Das, Unix Concepts and Applications, Tata McGraw Hill Education.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(ECONOMICS)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BECOMAJ01T**
Course Title: **Foundation Course in Economics - I**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: To give basic ideas of general economics, the paper distributed among three parts. In micro-economics basic understanding with preliminary theories, in macro economics, ideas like functioning of an economy and a small introduction of int**

A. **Microeconomics: (30)**

1. Exploring the Subject Matter of Economics: Scope and Method of Economics: Scarcity and Efficiency, Competing Ends and Choice - Defining Economics, Thinking like an Economist: Basic Economics Questions, Microeconomics and Macroeconomics, Normative Economics and Positive Economics (8)

2. Supply and Demand: Determinants of demand and supply; Demand and Supply schedules; Individual and Market Demand and Supply; Law of demand and supply, shifts in the demand and supply curves; Interaction of demand and supply; Equilibrium price and quantity (7)

3. Elasticity and its Measurement: Types of Elasticity of Demand, Price, Income and Cross Elasticity, Measurement of Elasticity of Demand, Determinants of Elasticity of Demand (7)

4. Production: Production Function, Total Production, Marginal Production, Average Production, Revenue Functions (3)

5. Economic Costs and Revenue: Cost in the Short run, Fixed Costs and Variable Costs, Marginal Costs, Long run AC and MC, TR, MR, AR (3)

6. Market Structures: Definition, Types and Features (2)

B. **Macroeconomics: (30)**

1. **Introduction:** Nature and Scope of Macro Economics (5)
2. **National Income Accounting:** Concepts of GNP, NNP, GDP, NDP, NI, DI; Methods of measurement- Product Census Method, Income Census Method and Expenditure Method; Using GDP as a Measure of economic welfare and problems involved (10)
3. **Circular Flow of Income:** Household, Firm, Injection and Leakage (5)
4. **Open Economy :** Concepts; Output, Financial and Labour Markets; Distinguish between Closed and Open Economy (10)

C. **International Trade: (30)**

1. **Introduction:** One Factor Economy; Relative Prices and Production; Production under Self Sufficiency (Autarky); Specialization and Trade; Concept of International Economics (10)
2. **The Classical Theory:** Smith's Theory of Absolute Advantage; Ricardian Theory of Comparative Advantage (Assumption, Explanation, Algebraic Formulation); Comparative versus Absolute Advantage; Opportunity Cost Approach (Neo-Classical Theory) - Graphical Presentation (10)
3. **Balance of Payments:** BoP Account; Current Account; Capital Account, Terms of Trade (10)

Reading References:

(Microeconomics)

1. Hal R. Varian, 2010, *Intermediate Microeconomics: A Modern Approach*,W.W. Norton and Company/affiliated East West Press (India), 8th edition.
2. Anindya Sen, *Microeconomics: Theory and Applications*, Oxford University Press
3. Pindyck, Rubinfeld and Mehta, *Microeconomics,* Pearson
4. B. Douglas Bernheim and Michael D. Whilston, 2009, *Microeconomics,* Tata McGraw Hill (India)
5. C. Snyder and W. Nicholson, 2010, *Fundamentals of Microeconomics*, Cengage Learning (India).
6. Jogendranarayan Mitra, 2010, *Undergraduate Microeconomics*, New Central Book Agency, Kolkata.

(Macroeconomics)

1. Mankiw, N., 2016, *Macroeconomics*, 9th edition, Worth Publishers
2. Branson, W., 2013, *Macroeconomics*, Theory and policy, 3rd edition, East West Press
3. Jones, C., 2016, *Macroeconomics,* 4th edition, W. W. Norton
4. Blanchard, O., 2018, *Macroeconomics*, 7th edition, Pearson Education
5. Abel, A., Bernanke, B., 2016, *Macroeconomics*, 9th edition, Pearson Education
6. Errol D'Souza, 2009, *Macroeconomics,* Pearson Education , New Delhi
7. Richard T. Froyen, 2016, *Macroeconomics*, Pearson education Asia, 10th edition
8. Sikdar Soumen, *Principles of Macroeconomics*, Oxford University Press
9. Ackley, *Macroeconomic Theory and Policy*, 2nd edition

(International Trade)

1. Soderston, B.O., *International Economics,* Macmillan
2. Rajat Acharya, *International Economics*, Oxford University Press
3. J. Sarkhel and S. Salim, *International Economics*, Book Syndicate (P) Limited
4. KN Verma, 2021, *International Economics: Theory and Policy,* Vishal Publishing Co., 1st Edition.
5. Paul Krugman, Maurice Obsfeld and Marc Melitz, 2018, *International Trade: Theory and Policy,* Pearson, 11th Edition.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.

- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(ECONOMICS)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BECOMAJ02T**
Course Title: **Foundation Course in Economics - II**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: After getting general theoretical knowledge on basic foundation course, this course will helps the learners to make introductory ideas on development economics and Indian economics. The position & problems of our country in respect of fi**

1. **Indian Economics:** (25)

   Features of the Economy;
   Evolution of India's Development Goals;
   Agriculture and Industry;
   Public Sector vs. Private Sector;
   Population and Poverty;
   Inequality and Unemployment;
   Planning vs NITI Ayog;
   Economic Reforms in India**.**

2. **Development Economics:** (25)

   Meaning and Characteristics;
   Income and Capability Approach;
   HDI and MDG;
   Economic Growth;
   Growth vs Development;
   International Comparisons;
   Inequality and Development;
   HPI and Hunger Index;

Political Institutions and the State;
The Determinants of Democracy;
State Ownership and Regulation;
Government Failures and Corruption.

3. **Public Finance:** (15)

Definition and Scope;
Externalities,
Market Failure and Government Intervention;
Overview of Public Good;
Pure Public Good and Private Good;
Market Failures;
Classification of Taxes;
Canons of Taxation;
Benefit Principle;
Incidence and Burden of Taxes;
The Laffer curve;
Public Expenditure;
Government Budget and Expenditure;
Public Debt;
Sources of Public Borrowings.

4. **Basic Statistics:** (25)

Data Collection;
Presentation of Data;
Tabulation; Frequency Distribution;
Graphical Expression (Bar, Line, Pie, Histogram, Ogive);
Measures of Central Tendency;
Measures of Dispersion;
Moments, Skewness and Kurtosis.

Reading References:

(Indian Economics)

►R. Datt and K.P. M. Sundaram, 2023, *Indian Economy,* S. Chand and Co., (Paperback: Gourav Datt and Ashwani Mahajan).

► Raj Kumar Sen, 2011, *Modern Indian Economy*, Deep and Deep Publications, New Delhi.

►A.N. Agarwal and M.K. Agarwal, 2019, *Indian Economy: Problems of Development and Plannning,* New Age International Pvt. Ltd.

►K.L. Krishna and A. Vaidyanathan, *Institutions and Markets in India's Development.*

►Himanshu, 2010, "Towards New Poverty Lines for India", *Economic and Political Weekly*, January.

►Jean Dreze and Angus Deaton, 2009, "Food and Nutrition in India: Facts and Interpretations", *Economic and Political Weekly*, February.

(Development Economics)

►Jean Dreze and Amartya Sen, *Economic Development and Social Opportunity,* OUP.

►R.J. Chelliah, 2009, *Towards Sustainable Growth*, OUP.

►VC Sinha and S. Pandeya, 2021, *Planning and Economic Development*, SBPD Publications.
► Debraj Ray, 2009, *Development Economics*, Oxford University Press.
► Partha Dasgupta, 2007, *Economics: A Very Short Introduction*, Oxford University Press.
► Abhijit Banerjee, Roland Benabou and Dilip Mookerjee, 2006, *Understanding Poverty*, Oxford University Press.
► Kaushik Basu, 2007, *The Oxford Companion to Economics in India*, OUP.
► Amartya Sen, 2000, *Development as Freedom*, OUP.

(Public Finance)

►J. Hindriks and G. D. Myles, 2006, *Intermediate Public Economics*, The MIT Press; Annotated Edition.
►A Ghosh and C. Ghosh, 2014, *Public Finance*, Prentice Hall India Learning Private Limited; 2nd Revised edition.
►S. Mukherjee, A. Ghosh and R.N. Nag, 2008, *Analytical Public Finance: Ricardo to Musgrave*, New Central Book Agency, Kolkata.
►HL Bhatia, 1977, *Public Finance*, Vikash Publishing House, New Delhi.
►S. Mukherjee, A. Ghosh, and RN Nag, 2008, *Analytical Public Finance: Ricardo to Musgrave,* New Central Book Agency, Kolkata.

(Statistics)

►R.V. Hogg and A.T. Craig, *An Introduction to Mathematical Statistics*, Third Edition, Amerind, New York, London
►Mood, A.M., F.A. Greybill and D.C. Boe, 1974, *Introduction to the Theory of Statistics*, McGraw Hill.
►John E. Freund, 1992, *Mathematical Statistics*, Prentice Hall.
►Goon, Gupta & Dasgupta, 1985, *Basic Statistics*, World Press Private Limited.
►R.V. Hogg and A.T. Craig, *An Introduction to Mathematical Statistics*, Third Edition, Amerind, New York, London.
►Mood, A.M., F.A. Greybill and D.C. Boe, 1974, *Introduction to the Theory of Statistics*, McGraw Hill.
►John E. Freund, 1992, *Mathematical Statistics*, Prentice Hall.
►R. Ganesan and PV Sreenivasaiah, 2015, *Textbook of Statistics*, Write and Print Publication, 1st edition.
►SS Gupta and VK Kapoor, 2020, *Fundamentals of Mathematical Statistics*, 12th edition, Sultan Chand & Sons.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits
Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(ECONOMICS)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BECOMAJ03T**
Course Title: **Micro Economics with Mathematical Applications**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This course is formulated to give a solid base with further development of micro economic theories. Theoretical micro economics with applied examples will create a solid base for the students over this. Course Specific Outcome: The micr**

1. **Utility Theory:** Utility Functions and their properties **(5)**
2. **The Consumption Decision:** (15)

Budget constraint,
Consumption and income and price changes,
Demand for all other goods and price changes;
Description of preferences- most preferred bundle and its properties;
Consumer optimum choice;
Income and substitution effects;
Marshallian and compensated demand curves;
Price consumption curve,
Income consumption curve, and Engel curve;
Labour supply and savings decision - choice between leisure and consumption;
Compensating and equivalent variation,
Slutsky equation;
Consumption-leisure choice and labour supply;
Revealed preference approach.

3. **Production and Costs: (15)**
   Basic concepts of Isoquants; Cobb–Douglas Production Function, CES Production Function, General concept of homogenous and homothetic production function and their properties; iso cost line and firms equilibrium and expansion paths; relation between short run and long run costs.

4. **Market Structure: (30)**
   (a) Perfectly competitive market; (b) Monopoly; Pricing with market power; Degree of monopoly;

Price discrimination-different degrees; Multiplant monopoly; Peak-load pricing; Two-part tariff; Monopolistic competition.
(c) Oligopoly: Cournot Equilibrium, Bertrand Equilibrium, Stackelberg Equilibrium; Concept of collusion and cartels; (d) Monopsony, Bilateral monopoly in labour market.

5. Input Market: (10)
Distribution Theory, Input demand for competitive firm and competitive industry, returns to scale and product exhaustion.

6.General Equilibrium, Efficiency, and Welfare: (15)
(a) Exchange Economy, Consumption Allocation and Pareto Optimality; Edgeworth box and contract curve; Equilibrium and efficiency under pure exchange;
(b) Pareto efficiency with production: concepts of PPF, SIC, and resource allocation;
(c) Perfect competition, Pareto efficiency and market failure (externalities and public good); Property Right and Coase Theorem.

Reading References:

- Hal R. Varian, 2010, *Intermediate Microeconomics: A Modern Approach*, W.W. Norton and Company/Affiliated East-West Press (India), 8th edition.
- Hugh Gravelle and Ray Rees, 2004, *Microeconomics,* Prentice Hall (UK); 3rd edition.
- Anindya Sen , *Microeconomics: Theory and Applications*, Oxford University Press.
- Pindyck, Rubinfeld and Mehta, 2007, *Microeconomics,* Pearson, 7th Edition.
- Mas-Collel, Whinston and Green, 2012, *Microeconomic Theory,* OUP(Indian edition).
- GC Archibald and Richard Lipsey, 1984, *An Introduction to Mathematical Treatment of Economics*, 3rd Edition, AITBS, Delhi.
- B. Douglas Bernheim and Michael D. Whilston, 2009, *Microeconomics,* Tata McGraw Hill (India)
- C. Snyder and W. Nicholson, 2010, *Fundamentals of Microeconomics*, Cengage Learning (India).
- Jogendranarayan Mitra, 2010, *Undergraduate Microeconomics*, New Central Book Agency, Kolkata.
- Satya R. Chakravarty, *Microeconomics,* Allied Publishers Ltd.
- TC Bergstrom and HR Varian, 2014, *Workouts in Intermediate Microeconomics*, 9th Edition, W.W. Norton and Company.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BECOMAJ04T**
Course Title: **Macroeconomics with Mathematical Applications**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This course is formulated to give a solid base with further development of macroeconomic models. Theoretical macroeconomics with applied examples will create a solid base for the students over this. Course Specific Outcome: The macroeco**

1. **Simple Keynesian Model:** (10)

Income Determination in Simple Keynesian System in closed economy, Stability of equilibrium, Investment Multiplier, Paradox of Thrift; Mathematical Application

2. **Classical Model: (10)**

Classical System; Say's Law, Quantity Theory of Money; Classical Dichotomy and Neutrality of Money

3. **Money Market: (15)**

Motives for holding money---Transaction, Precautionary and Speculative; Liquidity Preference Theory of Keynes, Liquidity Trap; Determination of Equilibrium Interest Rate; Inventory Theoretic Approach to Transaction demand for money (of Baumol and Tobin); Friedman's Restatement of the demand for money.

4. **IS-LM Model:** (15)

Derivation of IS and LM curves; Determination of equilibrium income and interest rate; Stability of equilibrium; Comparative Static results; effects of fiscal and monetary policies; Real balance effects; Mundell- Fleming model; Mathematical Application

5. **Consumption function:** (10)

Kuznets Empirical finding; Relative Income Hypothesis; Life cycle hypothesis; Permanent Income Hypothesis; Mathematical Application

6. **Investment function:** (10)

MEC and MEI; Gorgenson's neoclassical theory; Acceleration Principle---fixed and variable; Net present value criterion; Mathematical Application

7. **Complete Keynesian System:** (10)

Derivation of aggregate demand and aggregate supply; Determination of equilibrium output, employment, wage, price and interest rate; Mathematical Application

8. **Inflation: (10)**

Demand Pull and Cost Push Inflation; Trade-off between Inflation and Unemployment; Short run and Long run Phillips Curves under Adaptive Expectations

Reading References:

1. Mankiw, N., 2016, *Macroeconomics*, 9th edition, Worth Publishers.
2. Branson, W., 2013, *Macroeconomics*, Theory and policy, 3rd edition, East West Press.
3. Jones, C., 2016, *Macroeconomics,* 4th edition, W. W. Norton.
4. Blanchard, O., 2018, *Macroeconomics*, 7th edition, Pearson Education.
5. Abel, A., Bernanke, B., 2016, *Macroeconomics*, 9th edition, Pearson Education.
6. Errol D'Souza, 2009, *Macroeconomics,* Pearson Education , New Delhi.
7. Richard T. Froyen, 2016, *Macroeconomics*, Pearson education Asia, 10th edition.
8. Sikdar Soumen, *Principles of Macroeconomics*, Oxford University Press.
9. Ackley, *Macroeconomic Theory and Policy*, 2nd edition.
10. Monoronjan Dey, 1999, *Macroeconomics,* Dhakeswari Library, Dhaka.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BECOMAJ05T**
Course Title: **Statistics -I**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:

Learning Outcome: **Course Objective After completion of this course, the learner will be able to apply elementary mathematical techniques required in statistics, and to decide and apply appropriate methods and techniques related to simple bivariate analysis, price index num**

GROUP A: ELEMENTARY MATHEMATICS FOR STATISTICS (40)

Unit 1: Set Theory (5)

a. Concept, Roster Method and Rule Method, Finite and Infinite Sets, Universal Set, Null Set, Subset & Superset, Complementary Set, Power Set;
b. Union, Intersection, and Subtraction of sets

(c)Venn Diagram, Laws of Set Operations (to be explained using only Venn Diagrams)

(d)Cardinality of Union of two and three sets (no algebraic proof is required, only concept using Venn Diagram) and simple applications

Unit 2: Elementary Algebra (12)

2.1 Permutations and Combinations (5)

(a) Concepts and elementary applications only

(b) Use of calculator

2.2: Binomial Theorem (2)

Expansion of $(a+b)^n$ where n is a positive integer, finding a particular term or its coefficient in the expansion, Relations of combinations obtained using Binomial Theorem (no proof is required throughout)

2.3: Exponential Function (1)

a. Introduction to e, functions in the form e^x, e^{-x}, $e^{1/x}$ and their graphs (first quadrant only);

(b)Use of Calculator

2.4: Logarithm (4)

a. Concept, Rules/Formulas (no proof is required), elementary numeric problems (with emphasis on, but not limited to, base 10 and e), elementary algebraic problems for application of rules/formulas;
b. Concept of anti-logarithm (no application);

(c)Log-table and its use in finding values;

(d)Use of Calculator in finding log and anti-log values.

Unit 3: Elementary concepts from calculus (23)

3.1 Functions (5)

Concept; Domain and Range of a function; Function of a Function; Graph of linear functions (detail); Graph of quadratic and cubic functions (in general, no particular functional form is to be used); introduction to logarithmic and exponential functions (no applications)

3.2 Limit & Continuity (1)

Concept; Existence of Limit; neither formulas nor applications

3.3 Differentiation (10)

(a) Concept; Existence; First Principle (no proofs/sums), formula of differentiation of only algebraic, exponential, and logarithmic functions (with elementary sums); differentiation of the sum, product, and ratio of functions (with elementary sums); introduction to chain rule and applications (up to multiplication of two derivatives)

(b) Introduction to and elementary sums on Double Differentiation

(c)Differentiation of functions of more than one independent variable – Introduction to and elementary sums on Partial Differentiation and Total Differentiation

(d)Concept of Maxima and Minima of functions of only one independent variable, and their conditions (no applications)

3.4 Integration (7)

Concept; basic formulas (only algebraic and exponential) and their elementary applications; method of substitution; integration by parts, concept of definite integral as area under a curve; simple applications (no formula involving logarithmic or trigonometric expressions are required throughout)

GROUP B: STATISTICS (50)

Unit 1: Elementary Statistics (10)

Axioms of Central Tendency; Theory of Dispersion; Skewness and Kurtosis; Mathematical Problems on Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Coefficient of Variation.

Unit 2: Bivariate Analysis (20)

a. Why study this unit, real life problems which can be answered after studying this unit; Bivariate data – concept, Scatter Diagram – Definition, Uses (2)
b. Pearson's Correlation Coefficient (5)

(c)Simple Linear Regression – Concept, Derivation of Regression Equations using the Method of Least Squares (normal equations are to be derived using calculus, estimated parameters must be denoted using hats), Applications, Relation between Total Variation, Explained Variation, and Unexplained Variation (with proof), introduction to coefficient of determination (r^2) – Determination of angle between two regression lines is not required (10)

(d) Spearman's Rank Correlation (both non-tied and tied cases) (3)

Unit 3: Index Number (20)

a. Why study this unit, real life problems which can be answered after studying this unit; Price Index Number – Concept, Definition, Uses. (6)
b. Aggregative and Relatives methods of calculating Price Index Numbers (Simple and Weighted Average of Price Relatives, Simple Aggregative Method, Weighted Aggregative Methods – Laspeyres, Paasche, Fisher, Marshall-Edgeworth), Tests for an ideal price index number (10)

(c) Chain Base Index Numbers vs. Fixed Base Index Numbers, Introduction to Quantity Index Number (only concept, no applications) (2)

(d) Cost of Living Index number – Concept, Uses, and Applications – Dearness Allowance, Real Wage, Real GDP (2)

Reading References:

Group A: Elementary Mathematics for Statistics

1. Relevant parts from the NCERT Class XI & XII Mathematics Books (OER).
2. Sanjay Mishra, 2021, *Fundamentals of Mathematics*, 2nd edition, GK Publication.
3. Garima Singh, 2020, *Mathematics (Volume I and II)*, AICTE Prescribed Textbook, Khanna Book Publishing Co. Ltd.
4. BC Das and BN Mukherjee, 1994, *Integral Calculus Including Differential Equations,* UN Dhar & Sons Private Ltd.
5. Arup Mukherjee, 2004, *Linear Programming and Numerical Analysis*, Shreetara Prakashani, Kolkata.

Group B: Statistics

1. Goon, A. M., Gupta, M. K., & Dasgupta, B., 2013, *Fundamentals of Statistics* (Volume I and II), The World Press Private Ltd.
2. NG Das, 2017, *Statistical Methods* (Combined Volume), McGraw Hill Education, Kolkata.
3. R.V. Hogg and A.T. Craig, *An Introduction to Mathematical Statistics*, Third Edition, Amerind, New York, London.
4. Mood, A.M., F.A. Greybill and D.C. Boes, 1974, *Introduction to the Theory of Statistics*, McGraw Hill.
5. John E. Freund, 1992, *Mathematical Statistics*, Prentice Hall.
6. R. Ganesan and PV Sreenivasaiah, 2015, *Textbook of Statistics*, Write and Print Publication, 1st edition.
7. SS Gupta and VK Kapoor, 2020, *Fundamentals of Mathematical Statistics*, 12th edition, Sultan Chand & Sons.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BECOMAJ06T**
Course Title: **Indian Economics and Development Economics - I**

(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This course is prepared to give a concrete foundation on Development economics & Indian Economics. Phase wise economic reforms will create ideas for the students about the path of development of the countries. Course Specific Outcome: T**

Group A: Indian Economics (45)

1. **Economic Development since Independence: (15)**
   Major features of the economy at independence; Planning and Evolution of India's development goals and strategies; An assessment of performance Sustainability and regional contrasts; Structural changes of the Indian Economy
   Savings - investment paradox.
2. **Population and Human Development: (10)**

Demographic trends and issues; Issues in Education and Health

3. **Growth and Distribution: (10)**

Trends and policies in poverty including Sen's Entitlement Analysis; Inequality and Unemployment.

4. **Economic Reforms in India: (10)**

Monetary, Fiscal, and Trade Policy Reforms; 1^{st}, 2^{nd} and 3^{rd} Generation of Economic Reforms.

Group B: Development Economics (45)

1. **Meaning of Economic Development: (25)**
   International variations in development measures; Comparing development trajectories across nations and within them; Dependency school of development.
2. **Economic Growth: (20)**
   An overview and policy implications of one sector growth models: Harrod-Domar, and Solow; Sources of economic growth; International comparisons.

Reading References:
(Indian Economics)

1. K.L. Krishna and A. Vaidyanathan, *Institutions and Markets in India's Development.*
2. R. Datt & K.P.M. Sundaram, 2023, *Indian Economy*, S. Chand Publisher (Paperback: Gaurav Datt & Ashwani Mahajan).
3. A.N. Agarwal and M.K. Agarwal, 2019, *Indian Economy: Problems of Development and Plannning,* New Age International Pvt. Ltd.
4. Uma Kapila, *Indian Economy since Independence*, Academic Foundation.
5. Ahluwalia and Little, *India's Economic Reforms and Development*, OUP.
6. Joshi and Little, *India's Economic Reforms,* OUP.
7. D. Mukhopadhyay, 2011, *Globalization and Inequality*, Deep and Deep Publications Pvt. Ltd., New Delhi.
8. S. Pan, S. Ghosh and A. Karmakar, 2014, *Two Decades of Economic Reforms in India,* Regal Publications, New Delhi.
9. Sanjiv Verma, 2022, *The Indian Economy,* Unique Publishers Pvt. Ltd, New Delhi.
10. Sukhomoy Chakraborty, *Development Planning: The Indian Experience*, OUP.

(Development Economics)

1. Jean Dreze and Amartya Sen, 2013, *An Uncertain Glory: India and its Contradictions*, Princeton University Press.
2. Jean Dreze and Amartya Sen, *Economic Development and Social Opportunity*, OUP.
3. R.J. Chelliah, 2009, *Towards Sustainable Growth*, OUP.
4. VC Sinha and S. Pandeya, 2021, *Planning and Economic Development*, SBPD Publications.
5. Debraj Ray, 2009, *Development Economics*, Oxford University Press.

6. Partha Dasgupta, 2007, *Economics: A Very Short Introduction*, Oxford University Press.
7. Abhijit Banerjee, Roland Benabou and Dilip Mookerjee, 2006, *Understanding Poverty*, Oxford University Press.
8. Kaushik Basu, 2007, *The Oxford Companion to Economics in India*, OUP.
9. Amartya Sen, 2000, *Development as Freedom*, OUP.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BECOMAJ07T**
Course Title: **Trade Theory and Public Economics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This course is prepared to give a concrete foundation on Trade theories & Public Finance. Approaches of modern trade theories and identification of features of public goods will create ideas regarding governance of the state among the st**

Group A: Trade Theory (45)

1. **Basics of Trade Theory: (10)**
   Arbitrage as basis and direction of trade; Fundamental sources of cross-country price differences and arbitrage; Concept of comparative advantage; Externalities, regulation and perverse comparative advantage; International equilibrium; offer curves; ToT and stability; Gains from Trade (GFT) Theorem; Concepts of Production possibility Frontier and Community Indifference curves; Illustration of GFT; Decomposition of GFT; Substitution possibilities and magnitude of GFT.
2. **Technology and Trade (Ricardian Model): (15)**
   Comparative versus Absolute Advantage; One-factor economy, production possibility frontier; Relative demand and relative supply; Terms of trade; Trade in Ricardian world; Determination of intermediate ToT; Complete specialization & GFT.
3. **Factor Endowment & Trade (Heckscher-Ohlin-Samuelson Model): (20)**
   H-O theorem and physical vs. price definitions of factor abundance; Properties of the HO model
   Factor intensity ranking; One-to-one correspondence between commodity price ratio & factor price ratio (Stolper-Samuelson theorem); One to one correspondence between endowment ratio and production proportion (Rybczysky's theorem); Proof of HO theorem; Taste bias and invalidation of HO theorem; Empirical studies - Leontief Paradox; Effects of trade on factor price and income distribution; factor price equalization; factor intensity reversal & factor price equalization.

Group: B Public Economics (45)

1. **Nature and Scope of Public Economics: (15)**
   Market Failure and Government Intervention; Coase Theorem; Public Expenditure to finance Development.
2. **Theory of Public Good: (15)**
   Optimal provision of Public Goods; Private Provision and Public Provision of Public Goods;
   Lindahl Equilibrium; Voting Equilibrium.
3. **Taxation: (15)**
   Benefit Principle; Equal Sacrifice Principle; Ability to Pay Principle; Incidence and Burden of Taxes;
   Effects of taxation on income distribution; Work efforts, and on savings; The Laffer curve; Optimal Taxation.

Reading References:
(Trade Theory)

- P. Krugman and M. Obstfeld, *International Economics, 8*th Edition, Pearson Education.
- R. Caves, J. Frankel and R.W. Jones, *World Trades & Payments*, 9th Education, Pearson Education.

- Rajat Acharyya, *International Economics;* Oxford University Press.
- Giancarlo Gandolfo, 2014, *International Trade Theory and Policy*, Springer.
- Anne O. Krueger, 2020, *International Trade: What Everyone Needs to Know*, OUP.

(Public Economics)

- A.B. Atkinson and J.E. Stiglitz, 1980, *Lectures on Public Economics*, McGraw-Hill Inc.,US.
- C.V. Brown and P.M. Jackson, 1991, *Public Sector Economics*, Wiley-Blackwell; 4th Edition.
- J.F. Due and A.F. Friedlander, 1994, *Government Finance-Economics of Public Sector,* AITBS Publishers and Distributors.
- J. Hindriks and G.D. Myles, 2006, *Intermediate Public Economics*, The MIT Press; Annotated Edition.
- R.A. Musgrave and P.B. Musgrave, 1989, *Public Finance in Theory & Practice*, McGraw Hill Publications, 5th edition.
- Amaresh Bagchi, *Readings in Public Finance*, OUP.
- J.E. Stiglitz, 2000, *Economics of Public Sector,* W. W Norton and Company, 3rd Edition.
- R.J. Chelliah, 2009, *Towards Sustainable Growth*, OUP.
- H.L. Bhatia, 1977, *Public Finance,* Vikas Publishing House, new Delhi.
- A. Ghosh and C. Ghosh, 2014, *Public Finance*, Prentice Hall India Learning Private Limited; 2nd Revised edition.
- S. Mukherjee, A. Ghose and R.N. Nag, 2008, *Analytical Public Finance*, New Central Book Agency, Kolkata

Syllabus *(ECONOMICS)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BECOMAJ08T**
Course Title: **Indian Economics & Development Economics - II**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This course is equipped to give a tangible base on Development economics & Indian Economics. Theories like poverty & inequality, growth productivity will helps the students to measure the gap between rich & poor. The functioning under gl**

Group A: Indian Economics (45)

1. **WTO and India: (20)**
   Different rounds of trade negotiations Macroeconomic Policies and Their Impact; Fiscal Policy; Trade and investment policy; Financial and monetary policies; Inflation and measures to control inflation; Labour laws and regulation; SEZ Policies and Performance in Agriculture.
2. **Growth, Productivity and India: (15)**

Agrarian structure and technology; Capital formation; Food Security and Food Policy; Pricing and Procurement; Globalization and Indian Agriculture; Policies and Performance in Industry Growth; Productivity; Diversification; Small scale industries; Public sector; Competition policy.

3. **Foreign Investment and Insurance: (10)**

Foreign Aid vs Foreign Investment; FDI & FII; Formal and Informal Sectors; Banking and Insurance; Trade in Services; Foreign Investment, Globalization and Indian Industry; Trends and Performance in Services.

Group B: Development Economics (45)

1. **Poverty and Inequality: (20)**
   Inequality axioms; A comparison of commonly used inequality measures; Gender Inequality; Connections

between inequality and development; Poverty measurement; HPI; Poverty traps and path dependence of growth processes.

2. **Political Institutions and the State: (25)**

Definition of Institutions; Evolution of Political and Economic Institutions; The determinants of democracy; Alternative institutional trajectories and their relationship with economic performance; Within-country differences in the functioning of state institutions; State ownership and regulation; Government failures and corruption.

Reading References:

(Indian Economics)

1. RK Sen and JF Raj, 2009, *WTO & Asian Union*, Deep and Deep Publications Pvt. Ltd, New Delhi.
2. Kaushik Basu and A. Maertens, 2013, *The New Oxford Companion to Economics in India*, Oxford University Press.
3. Uma Kapila, *Indian Economy since Independence,* Academic Foundation.
4. Ahluwalia and Little, *India's Economic Reforms and Development*, OUP.
5. Jean Dreze and Angus Deaton, 2009, "Food and Nutrition in India: Facts and Interpretations", in *Economic and Political Weekly*, February.
6. Himanshu, 2011, "Employment Trends in India: A Re-examination", *Economic and Political Weekly*, September.
7. Geeta G. Kingdon, 2007, "The Progress of School Education in India", *Oxford Review of Economic Policy*.
8. J.B.G. Tilak, 2007, "Post Elementary Education, Poverty and Development in India", *International Journal of Educational Development.*
9. R. Datt & K.P.M. Sundaram, 2023, *Indian Economy*, S. Chand Publisher (Paperback: Gaurav Datt & Ashwani Mahajan).
10. S. Pan, 2013, *Foreign Direct Investment and Indian Economy,* Regal Publications, New Delhi.

(Development Economics)

1. Jean Dreze and Amartya Sen, 2013, *An Uncertain Glory: India and its Contradictions*, Princeton University Press.
2. Jean Dreze and Amartya Sen, *Economic Development and Social Opportunity*, OUP.
3. Sukhomoy Chakraborty, *Development Planning: The Indian Experience,* OUP.
4. Kaushik Basu and A. Maertens, 2013, *The New Oxford Companion to Economics*, Oxford University Press.
5. R.J. Chelliah, 2009, *Towards Sustainable Growth*, OUP.
6. VC Sinha and S. Pandeya, 2021, *Planning and Economic Development*, SBPD Publications.
7. Debraj Ray, 2009, *Development Economics*, Oxford University Press.
8. Partha Dasgupta, 2007, *Economics: A Very Short Introduction*, Oxford University Press.
9. Abhijit Banerjee, Roland Benabou and Dilip Mookerjee, 2006, *Understanding Poverty*, Oxford University Press.
10. Kaushik Basu, 2007, *The Oxford Companion to Economics in India*, OUP.
11. Amartya Sen, 2000, *Development as Freedom*, OUP.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BECOMAJ09T**
Course Title: **Trade Policy and Public Finance**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This course is prepared to give a concrete foundation on Trade policies & Public Finance. Approaches of modern trade policies and identification of features of public expenditure will**

create ideas regarding governance of the state among

Group A: Trade Policy (45)

1. **Trade Policy: (20)**
   Partial Equilibrium Analysis; Tariff-cost–benefit; Quota; Quota-Tariff equivalence & non-equivalence; Effects of tariff, quota, subsidy and voluntary export restraint; General Equilibrium Analysis; Distinction between large and small economy; Welfare effects of a tariff on small country and large country; Offer curve and ToT; Tariff ridden offer curve; Tariff war; Optimum tariff for large economy; Metzler's Paradox.

2. **Balance of Payments & Exchange Rate: (25)**
Balance of Payment accounts in an open economy; Determination of National Income; Transfer problem; Introduction of foreign Country & repercussion effect; Open economy multiplier with & without repercussion effect; Fixed &Flexible Exchange Rate: Adjustment of demand and supply of Foreign Exchange; FDI and Trade; Effect of devaluation; Effects of exchange rate on domestic prices and ToT; Marshall-Lerner Condition; J-Curve effect.

Group B: Public Finance (45)

1. **Public Expenditure: (30)**
   Meaning and Classification of Public Expenditure; Government budget and its types; Government Expenditure and tax multipliers; Balanced budget multiplier; Fiscal Federalism in India, Indian Budgetary System.
2. **Public Debt: (15)** Meaning of Public Debt; Sources of Public Borrowings: Internal and external borrowing; Effects of Public Debt. Public Debt & Indian Experience

Reading References:

(Trade Policy)

- P. Krugman and M. Obstfeld, 2017, *International Economics, 8*th Edition, Pearson Education.
- R. Caves, J. Frankel and R.W. Jones, 2006, *World Trades & Payments: An Introduction*, 10th Education, Pearson Education.
- Rajat Acharyya, 2013, *International Economics;* Oxford University Press.
- Giancarlo Gandolfo, 2014, *International Trade Theory and Policy*, Springer.
- Anne O. Krueger, 2020, *International Trade: What Everyone Needs to Know*, OUP.
- S. Pan and R.K Sen, 2007, *Foreign Direct Investment and Trade in India*, Deep and Deep Publications Pvt. Ltd, New Delhi.
- H. Bangia, 2023, *Foreign Trade Policy,* Agarwal Law House.
- P.K. Rai and J. Kumar, 2021, *Foreign Trade of India*, Orange Books Publication, 1st Edition.

(Public Finance)

- A. B. Atkinson and J. E. Stiglitz, 1980, *Lectures on Public Economics*, McGraw-Hill Inc.,US.
- C. V. Brown and P. M. Jackson, 1991, *Public Sector Economics*, Wiley-Blackwell; 4th Edition.
- J. F. Due and A. F. Friedlander, 1994, *Government Finance-Economics of Public Sector,* AITBS Publishers and Distributors.
- J. Hindriks and G. D. Myles, 2006, *Intermediate Public Economics*, The MIT Press; Annotated Edition.
- R.A. Musgrave and P.B. Musgrave, 1989, *Public Finance in Theory & Practice*, McGraw Hill Publications, 5th edition.
- Amaresh Bagchi, *Readings in Public Finance*, OUP.
- J. E. Stiglitz, 2000, *Economics of Public Sector,* W. W Norton and Company, 3rd Edition.
- R.J. Chelliah, 2009, *Towards Sustainable Growth*, OUP.
- H.L. Bhatia, 1977, *Public Finance,* Vikas Publishing House, New Delhi.
- A. Ghosh and C. Ghosh, 2014, *Public Finance*, Prentice Hall India Learning Private Limited; 2nd Revised edition.
- S. Mukherjee, A. Ghose and R.N. Nag, 2008, *Analytical Public Finance*, New Central Book Agency, Kolkata.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BECOMAJ10T**
Course Title: **Statistics - II**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective After completion of this course involving probability and statistical inference, the learner will be able to formulate relevant numeric problems from real life situations and use appropriate techniques to solve them. The learner will also**

Unit 1: Probability: (15)

a. Why study this unit, real life problems which can be answered after studying this unit; Random Experiment, Trial, Outcome, Event, Mutually Exclusive Events, Exhaustive Events, Equally Likely Events, Complementary Events (1)
b. Classical Definition of Probability and its limitations, Applications (2)

(c) Axiomatic Approach to Probability – Rationale, Sample space and events, Additive Theorem of Probability for two and three events, Applications (2)

(d) Conditional Probability, Independence of Events – Definition, Concept, Applications (2)

(e) Bayes' Theorem – Statement, Proof, Applications (2)

(f) Probability Distribution – Random/Stochastic Variable, Expectation, Variance, Applications (3)

(g) Joint Probability Distribution (only for discrete variable) – Concept, Applications (3)

Note: Calculations of permutation and combinations are not to be shown in answers, they can be found using calculators

Unit 2: Theoretical Distributions: (18)

a. Why study this unit, real life problems which can be answered after studying this unit; Probability Function – pmf and pdf, their properties, Applications (2)
b. Distribution Function – Definition, Derivation of distribution function from probability function and vice versa (for both discrete and continuous variables) (2)

(c) Binomial Distribution – Uses, Properties (derivation of mean, variance and mode only), Applications (2)

(d) Poisson Distribution – Uses, Properties (derivation of mean, variance and mode only), Applications, Poisson Distribution as a limiting case of Binomial Distribution (2)

(e) Normal Distribution – Uses, Properties (proofs not required), Standard Normal Variable & its properties (proofs not required), Applications (3)

(f) Fitting of Binomial, Poisson, and Normal Distributions to observed distributions (goodness of fit is not to be checked here) (3)

(g) Hypergeometric, Uniform and Rectangular Distributions – Concept only (no properties, no applications) (1)

(h) Factorial Moments and Moment Generating Functions – Purpose, Definition, derivation and application of Moment Generating Functions for Binomial and Poisson Distributions (3)

Note: While answering, values of e^a are to be found using calculators; calculations of permutation and combinations are not to be shown in answers, they can be found using calculators

Unit 3: Sampling Theory: (6)

a. Why study this unit, real life problems which can be answered after studying this unit; Difference between Population and Sample, Advantages and Disadvantages of sample survey over population survey, Principal steps in a sample survey (1)

b. Random and non-random sampling techniques, SRSWR and SRSWOR – Properties, Method of drawing samples using Random Numbers, introduction to Random Number Tables (2)

(c) Difference between Parameter and Statistic, Sampling Distribution, Numeric problems on calculation of Expectation and Standard Error from Sampling Distribution, Derivation of Expectation and Standard Error of Sample Mean and Sample Proportion under SRSWR and SRSWOR (3)

Unit 4: Statistical Inference: (32)

a. Why study this unit, real life problems which can be answered after studying this unit; Purpose of Inferential Statistics, concept and difference between estimation and testing of hypothesis, difference between test of hypothesis and test of significance (1)
b. Difference between point estimation and interval estimation, difference between OLS estimation, MLM, and Method of Moments (1)

(c) Properties of a good estimator, MVUE, BLUE, Applications (only numeric problems, no theoretical proofs) (3)

(d) Maximum-Likelihood-Estimation – Definition, Properties (no application), Method of Moments – only concept (1)

(e) Null and Alternative Hypothesis, One-tailed and Two-tailed Tests, Type I and Type II Errors, power of a test, confidence interval, level of significance, critical region, region of acceptance, p-value, steps in testing of hypothesis (4)

(f) Concept of Degrees of Freedom (1)

(g) z, t, χ^2, and F Distributions – Definition and Properties (no proof), how to find values from distribution tables (2)

(h) Scope of application of z, t, χ^2, and F statistic in hypothesis testing – which one is to be used in what situation (2)

(i) Numeric problems only on application of z and t statistic in hypothesis testing, derivation of confidence interval for population mean and proportion and their application, use of t in checking goodness of fit of normal distribution to observed distribution (8)

(j) Application of χ^2 statistic and Fisher's Exact Test for testing independence of two attributes, and in checking goodness of fit of Binomial and Poisson Distributions to observed distribution (2)

(k) ANOVA (only one-way) – Purpose, Steps, Applications (6)

(l) ANOVA (two-way) – only introductory concept (no detailed discussion, nor applications) (1)

Unit 5: Vital Statistics: (4)

a. Why study this unit, real life problems which can be answered after studying this unit; Different measures of Birth, Death, and Fertility rates (2)
b. Life Table – Uses, construction, and simple applications (2)

Reading References:

1. Goon, A. M., Gupta, M. K., & Dasgupta, B.,2013, *Fundamentals of Statistics (Volume I and II)*, The World Press Private Ltd.
2. Mood, A.M, Graybill, F. A, & Boes, D.C., 1974, *Introduction to The Theory of Statistics*, McGraw Hill.
3. John E. Freund, 1992, *Mathematical Statistics*, Prentice Hall.
4. R. Ganesan and PV Sreenivasaiah, 2015, *Textbook of Statistics*, Write and Print Publication, 1st edition.
5. SS Gupta and VK Kapoor, 2020, *Fundamentals of Mathematical Statistics*, 12th edition, Sultan Chand & Sons.
6. NG Das, 2017, *Statistical Methods* (Combined Volume), McGraw Hill Education, Kolkata.
7. R.V. Hogg and A.T. Craig, *An Introduction to Mathematical Statistics*, Third Edition, Amerind, New York, London.
8. Shantilal R. Patel, 2021, *Statistical Inference*, IK International Pvt. Ltd.
9. Robert V. Hogg, Elliot Tanis and Dale Zimmerman, 2020, *Probability and Statistical Inference*, Pearson India.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-11**
Semester: **7**

Course Code: **BECOMAJ11T**
Course Title: **Advanced and Applied Microeconomics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: The paper prepares to create special skills of the students over micro economic theories. The further developed issue on consumer theory and market functioning are discussed with most up to date manner. Course Specific Outcome: The learn**

1. **Consumer Choices & Uncertainty: (20)**

v. Consumer's Surplus; Willingness to pay;
v. Compensating and Equivalent Variation;
v. Intertemporal Choice.
v. The Envelope Theorem and Duality: Comparative Static Analysis

v. Concepts of Lotteries, Applications;
v. Axioms of choice under uncertainty, Expected Utility Function and its properties, Expected Utility Theorem and its proof, Violations of Expected Utility Theorem – paradoxes.
v. Preferences towards risk, Reducing risk – diversification, Insurance, value of information
v. Dynamic Optimization Theory
v. Lagrangian vs Hamiltonian.
v. Control theoretic problem.
v. Use of Hamiltonian-finite and infinite time horizon cases with discrete and continuous time points.

2. **Market Behaviour, Social Choice & Game Theory: (25)**

v. Static Games of Complete Information

- Strictly dominated strategy,
- Pure and mixed strategy Nash equilibrium,

v. Dynamic Games of Complete Information

- Backwards induction outcome,
- Sub-game perfect Nash equilibrium,

v. Oligopoly Models (Game theoretic approach)

- Cournot,
- Bertrand,
- Stackelberg, and
- Collusive Oligopoly.

v. The Two Basic Theorems of Welfare Economics
v. Kaldor-Hicks Criteria for Welfare Improvement
v. Introduction to the Theory of Social Choice.

Reading References:

- Kreps, D.M., l990, A *Course in Microeconomic Theory,* Princeton University Press.
- Layard, P.R.G. and Walters, A.W., 1988, *Microeconomic Theory,* McGrawHill, New York.
- Mass-Colell, A., Whinston, M. and Green, J., 1995, *Microeconomic Theory,* Oxford University Press, New Delhi.
- Chakravarty S.R., 2010*, Microeconomics,* Allied Publishers Pvt Ltd.
- Hansen, B., 1970, *A Survey of General Equilibrium Systems,* McGraw-Hill Book Co.

- Sen, A., 1999, *Microeconomics; Theory and Applications, Oxford University Press, New Delhi.*
- Varian, H., 2000, *Microeconomic Analysis, W.W. Norton, New York*
- Quirk, J. and Saposnik, R., 1968, *Introduction to General Equilibrium Theory and Welfare Economics,* McGraw Hill, New York.
- Henderson, J.M. and Quandt, R.E., 1980*, Microeconomic Theory: A Mathematical Approach,* 3rd Edition, McGraw-Hill Book Company.
- Silberberg E and Suen, W., *The Structure of Economics - A Mathematical Analysis*, 3rd edition, McGraw Hill Publishing Company, International Edition.
- Johnson, S.R., Hassan, Z.A. and Green, R.D., *Demand Systems Estimations,* The Iowa State University Press, Ames.
- Malinvaud, E., 1976, *Lectures on Microeconomic Theory,* North Holland Publishing Company.
- Graff, J.D.E.V. ,1975, *Theoretical Welfare Economics,* Vikas Publishing House.
- Bator, M. F., 1957, "The Simple Analysis of Welfare Maximisation", *American Economic Review*, Vol 47, Reprinted in Townsend (ed): *Readings in Price Theory*, Penguin.
- Simon, C.P. and Blume, L., 1994, *Mathematics for Economists*, W. W. Norton & Company.
- Chiang, A.C., 1986, *Fundamental Methods of Mathematical Economics,* McGraw Hill, New York.
- Chiang, A. C., 1992, *Elements of Dynamic Optimization,* McGraw-Hill, Inc.
- Conrad, J.M. and Clark, C.W., 1987, *Natural Resource Economics: Notes and Problems*, Cambridge University Press.
- Allen, R.G.D., 1974, *Mathematical Analysis for Economists*, Macmillan Press and ELBS, London.
- D. Fudenberg and J. Tirole, *Game Theory,* MIT Press.
- J.J. Laffont and D. Martimort, *Theory of Incentives: The Principal Agent Model*, Princeton University Press.
- M. Osborne and A. Rubinstein, *A Course in Game Theory*, MIT Press
- Mas-Colell, M. Whinston and J. Green, *Microeconomic Theory*, Oxford University Press,1995.
- Robert Gibbons, 1992, *A Primer in Game Theory,* Princeton University Press.
- Erik Rasmusen, 1999, *Games and Information: An Introduction to Game Theory*, Basil Blackwell.
- K. Binmore, 1991, *Fun and Games: A Text on Game Theory*, OUP.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BECOMAJ12T**
Course Title: **Advanced and Applied Macroeconomics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: The paper prepares to create special skills of the students over macroeconomic theories. The further developed issue on disequilibrium macroeconomics and modern growth models are discussed with most up to date manner. Course Specific Out**

1. **Disequilibrium Models, Rational Expectations Theory & New Keynesian Macroeconomics:(30)**

v. Disequilibrium Models

- Patinkin,
- Clower and
- Barro-Grossman.

v. The Rational Expectations Theory

- Meaning

- Differences with Adaptive Expectations.

v. The Lucas Imperfect Information Model,

- Implications and Limitations
- The Phillips Curve and Lucas critique

v. Mundell-Fleming versions under fixed and flexible exchange rates
v. World capital Market equilibrium.

2. **The Solow-Swan Model & International Financial Markets and Crises: (30)**

- Steady-state equilibrium

- Golden Rule of capital accumulation
- Impact of technological progress
- Absolute versus conditional convergence
- Neutrality of Technical Progress and
- Returns to scale-different types of technological progress

v. Integration and efficiency of international financial markets,
v. Modigliani- Miller Theorem –leverage and cost of bankruptcy

3. **Modern Theory of Growth & Exchange Rate and Capital Flow: (30)**

v. Dissatisfaction with neoclassical theory

v. One sector models of endogenous growth: the AK model
v. Endogenous growth and human capital formation: the Lucas model
v. Endogenous growth and R&D- Romer model.

v. Alternative exchange rate regimes-an overview;
v. Capital flow to developing countries and its macroeconomic implications;
v. Some useful models of exchange rate dynamics

Reading References:

1. Dasgupta D.,1998, *The Macro Economy : A Text Book View*, Oxford University Press, New Delhi.
2. Dornbusch, R. 1980, *Open Economy Macroeconomics,* Cambridge University Press.
3. Barro, R.I. and Grossman, H.I., 1971, "A General Disequilibrium Model of Income and Employment", *American Economic Review*, March,Vol. 61(1):82-93.
4. Mueller, M.G., 1978, *Readings in Macroeconomics*, Surjeet Publications, New Delhi.
5. Blaug, M., 1978, *Economic Theory in Retrospect,* Cambridge University Press.
6. Ackley, G.,1978, *Macroeconomics: Theory and Policy*, Macmillan, New York.
7. Rakshit, M., 1987, *Money, Credit and Monetary Policy,* SBI Lectures.
8. Levacic, R. and Rebman, A., 1986, *Macroeconomics;* 2nd Edition, Macmillan.
9. Froyen, R.T., 2007, *Macroeconomics: Theories and Policies*, 8th Edition, Pearson Education.
10. Sen, A. 1960, *Growth Economics*, Harmonds worth, Penguin Books.
11. Romer, D., 2001, *Advanced Macroeconomics*, McGraw-Hill International Edition.
12. Mankiw, N.G. and D. Romer, 1991, *New Keynesian Economics*, 2 volumes, MIT Press, Cambridge.
13. Romer, D., 2001, *Advanced Macroeconomics,* McGraw-Hill International Edition.
14. Lucas, R.E Jr., 1988, "On the Mechanics of Economic Development", *Journal of Monetary Economics,* 22 (July): 3-42.

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BECOMAJ13T**
Course Title: **Econometrics - I**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: To Provide Basic Knowledge in Data Handling with econometric methods. To empower the students in analyzing the data behaviour with econometric methods. To understand the data handling problems and econometric interpretation. To handle th**

1. **Two Variable CLRM:** (15)

v. Estimation
v. Gauss-Markov Theorem
v. alternative measures of goodness of fit
v. Inference
v. Prediction

2. **Violation of CLRM:** (15)

- Heteroscedasticity,

- Nature of the problem,
- Consequences,
- Detection,
- Possible solutions

v. Autocorrelation

- Nature of the problem,
- Consequences,
- Detection
- Possible solutions

3. **Problem due to Nature of Regressors:** (15)

v. Multicollinearity

- Nature of the problem,
- Consequences,
- Detection of multicollinearity, and
- Possible solutions.

4. **Regression with Qualitative Regressors:** (15)

v. Dummy Independent Variables –Use; Classification system;
v. Dummy Variable Trap;
v. Interpretation of estimated coefficients;
v. Class-effect and Interaction-effect;
v. Testing structural stability of regression models comparing two regressions,
v. Estimating seasonal effects, ANOVA vs ANCOVA, piecewise linear regressions

5. **Computer Application: (Open Source Software) (30)**

v. Basic Regression Analysis

v. Factor Analysis

Reading References:

- Johnston, J., 1977 and 1984*, Econometric Methods,* 2nd and 3rd Editions, McGraw-Hill.
- Johnston, J. and Dinardo, J., 1997, *Econometric Methods,* 4th Edition, McGraw-Hill International Edition.
- Maddala, G.S., 1988, *Introduction to Econometrics*, Macmillan, London.
- Maddala, G.S., 1997, *Econometrics,* McGraw Hill, New York.
- Gujarati, D.N., 1995, *Basic Econometrics,* 4th Edition, McGraw Hill, New Delhi.
- Wooldrige, J.M., 2009, *Econometrics*, Cengage Learning, India Edition
- Nachane, D.M., 2006, *Econometrics: Theoretical Foundations and Empirical Perspectives*, Oxford University Press, New Delhi.
- Greene, W.H., 2000, *Econometric Analysis,* Prentice Hall International.
- Desai, M., 1976, *Applied Econometrics,* P. Allen.
- Klein, L.R., 1975, *A Text Book of Econometrics,* Prentice Hall, New Delhi.
- Intrilligator, M.D., 1978, *Econometric Methods, Techniques and Applications,* Prentice Hall, New Jersey.
- A. Koutsoyiannis, 1996, *Theory of Econometrics*, ELBS with Macmillan.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BECOMAJ14T**
Course Title: **Environmental and Resource Economics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This course is prepared to give a concrete foundation on environment economics. Environmental problems with the progress of economic activity will create ideas for the students about the path of sustainable development of the countries.**

Environmental Economics: Concepts; Review of Microeconomics and Welfare Economics; Theory of Externalities, Pareto Optimality and Market Failure; Property Rights and the Coase Theorem (10)

1. **Environmental Policy**: Design and Implementation; Pigouvian Taxes and Effluent Fees; Tradable Permits; Transaction Costs (10)
2. **Environmental Problems:** Trans-boundary Environmental Problems; Economics of Climate Change; Partial Equilibrium Model of Trade and Environment (10)
3. **Valuation and Evaluation:** Measurement with Cost-Benefit Analysis of Environmental Improvements; Non-Market values and measurement methods; risk assessment and perception. Concepts of Sustainable Development; MDG (10)
4. **Resource Economics:** Ecological Economics; Environmental Macroeconomics; Energy-Economy-Environment Model; Natural Resource Accounting; Renewable and Non-renewable Resources (10)
5. **Ecological Economics:** Interdisciplinary Issues; Ethical Aspects; Energy, Value, Ecology and Economics (5)
6. **Environmental Models:** Input-Output Analysis; General Equilibrium Model; Game Theory; Decomposition Methodology (5)

Reading References:

►Rabindra N. Bhattacharya, 2002, *Environmental Economics: An Indian Perspective*, Oxford India Paperbacks.

►Jeroean C.J.M. van den Bergh, 1999, *Handbook of Environmental and Resource Economics*, Edward Elgar Publication.

►Charles Kolstad, 2010, *Intermediate Environmental Economics*, Oxford University Press, 2nd edition.

► Robert N. Stavins, 2005, *Economics of the Environment: Selected Readings*, W.W. Norton, 5th edition.

► Roger Perman, Yue Ma, James McGilvray and Michael Common, 2003, *Natural Resource and Environmental Economics*, Pearson Education/Addison Wesley, 3rd edition.

► Maureen L. Cropper and Wallace E. Oates, 1992, *Environmental Economics: A Survey Journal of Economic Literature*, Volume 30:675-740.

►Ulaganathan Sankar, 2001, *Environmental Economics*, Oxford India Paperbacks.

►Katar Sing and Anil Shishodia, 2007, *Environmental Economics: Theory and Applications*, Sage Publications.

►Pranab Mukhopadhyay, Nandan Nawn, Kalyan Das, 2017, *Global Change, Ecosystems, Sustainability: Theory, Methods, Practice, SAGE Publication India*.

►Jon M. Conrad, 2010, *Resource Economics*, Cambridge University Press, 2nd Edition, ISBN: 9780521697675.

►Steven C. Hacket, 1997, *Environmental and Natural Resource Economics*, Taylor & Francis, ISBN: 9780765601094.

► N. Ghosh, P. Mukhopadhyay, A. Shah and M. Panda, 2016, *Nature, Economy and Society: Understanding and Linkages*, Springer Publications.

► J. Bandyopadhyay, K. Chopra and N. Ghosh, 2012, *Environmental Governance: Approaches, Imperatives and Methods*, Bloomsbury Publication.

►Conrad, J.M. and Clark, C.W., 1987, *Natural Resource Economics: Notes and Problems*, Cambridge University Press.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BECOMAJ15T**
Course Title: **Social Sector Studies**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: This paper tries to establish the relationship between the economic growth and social development. It aims at providing knowledge about the current scenario and challenges related education, environment, health and Gender. It further exp**

1. **Health Economics:** (15)

   Role of Health in Human Development; Importance in Poverty Alleviation; Health Outcomes; Microeconomic Foundations of Health Economics; Demand for Health; Uncertainty and Health Insurance Market; Evaluation of Health Programs; Burden of Disease; Health Sector in India: An Overview; Health Systems; Health Financing.

2. **Economics of Education:** (15)

Investment in Human Capital; Rate of Return to Education: Private and Social; Quality of Education; Signaling or Human Capital; Theories of Discrimination; Education Sector in India:An Overview; Literacy Rates, School Participation, School Quality Measures.

3. **Gender Studies:** (15)

Feminist Movement, Gender and Development; Women and Work; Growth of Women Studies in India; Gender Based Violence; Social Status of Women in India.

4. **Demographic Studies: (15)**

Introduction and Sources of Population Data; Methods of Demographic Analysis; Population Composition and Change; Nuptiality and Fertility; Mortality, Morbidity and Health; Urbanization and Migration.

Reading References:

►Mukta S. Adi, *An Introduction to Health Economics*, ISBN: 9789384803438

►William, Jack, 1999, *Principles of Health Economics for Developing Countries*, World Bank Institute Development Studies.

►The World Bank, 1993, *World Development Report: Investing in Health*.

►Ronald G., Ehrenberg and Robert S., Smith, 2005, *Modern Labour Economics: Theory and Public Policy*, Addison Wesley.

►Samuel Akinyemi, 2013, *The Economics of Education*, Strategic Book Publishing, ISBN: 978-1612042008.

►Fayaz Ahmed Bhat and Kulsuma Gill, *An Introductory Economics of Education*, Kalpaz Publication, ISBN: 9789386397690.

►Manjunatha K.M., 2022, *Gender Studies*, ISBN: 9789391542634.

►Jyoti Prasad Saikia, 2017, *Gender: Themes and Issues*, ISBN: 978-9351252832.

►Asha A. Bhende, and Tara Kanilkar, *Principles of Population Studies*, Himalaya Publishing House.

►Rathindra P. Sen, *Demographic Change and Levels of Living*, ISBN: 9788170350514.

►F. Raj, S. Mukherjee, M. Mukherjee, A. Ghosh and RN Nag, 2011, *Contemporary Development Economics: From Adam Smith to Amartya Sen*, New Central Book Agency, Kolkata.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BECOMAJ16T**
Course Title: **Econometrics - II**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: To Provide Basic Knowledge in Data Handling with econometric methods. To empower the students in analyzing the data behaviour with econometric methods. To understand the data handling problems and econometric interpretation. To handle th**

1. **Limited Dependent Variable Models: (12)**

v. Linear Probability Model
v. Logit Model
v. Probit Model
v. Specification Issues in Binary Response Models

2. **Simultaneous Equation System: (1**

v. Forms of Simultaneous Equation System

v. Identification Problem

- The concept of identification with economic examples. Observationally equivalent structure. Order and Rank Conditions

v. Estimation Problem

- Consequences of estimating simultaneous equation system by OLS method.
- Unbiasedness and consistency of estimator-use of the concept of plim. Recursive system.
- ILS estimator with properties,
- IV estimator with properties,

3. **Basics of Time Series Econometrics: (12)**

v. Properties of time series,
v. ACF and PACF - Some Useful Processes

- White Noise,
- Random Walks,
- MA Processes,
- AR Processes,
- ARMA Processes and
- ARIMA Processes

v. ARIMA models- identification, estimation, diagnostic testing,
v. Analysis of Time Series and Box-Jenkins Method, Barlett's test, Box-pierce Q-test, Ljung-Box test, Unit Root Tests,
v. Trend Stationary and Difference Stationary process,
v. Forecasting- MA(1), ARMA(1,1) and ARIMA(1,1,0) processes, Seasonality

4. **Modeling with Trends: (12)**

v. Deterministic and stochastic trends,

- Removing the trend,
- Spurious Regression,

v. Cointegration:

- General cointegrated system,
- Error correction model and tests for cointegration;
- Cointegration in single equations-
- Engle-Granger method,
- CRDW test,
- System estimation method – Johansen procedure

5. **Basics of Panel Data: (12)**

v. Sources and Types of Panel Data

v. Pooled Estimator
v. Random Effect Model
v. Fixed Effect Model
v. Fixed versus Random Effects Model & Hausmann Test

v. Dynamic Panel

Reading References:

- Johnston, J., 1977 and 1984, *Econometric Methods,* 2nd and 3rd Editions, McGraw-Hill.
- Johnston, J. and Dinardo, J., 1997, *Econometric Methods,* 4th Edition, McGraw-Hill International Edition.
- Hamilton, J. D. ,1994, *Time Series Analysis,* Princeton University Press.
- Granger, C.W.J. and Newbold, P., 1977, *Forecasting Economic Time Series,* 2nd Edition, Academic Press.
- Greene, W.H., 1997, *Econometric Analysis,* 3rd Edition, Prentice Hall.
- Gujarati, D.N., 1995, *Basic Econometrics,* 4th Edition, McGraw-Hill, New Delhi.
- Enders, W., 2004, *Applied Econometric Time Series,* Wiley.
- Maddala, G.S., 1997, *Econometrics,* McGraw Hill, New York.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BECOMAJ17T**
Course Title: **Rural-Urban Economics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Objectives: i) To create awareness among the students regarding the Rural & Urban Economy. ii) To study the Indian Agriculture, Industry & service sectors. iii) To study the concepts of Rural & urban poverty and unemployment and different policies rela**

Group A: Rural Economics (45)

1. **Introduction to Rural Economics: (5)**

Meaning and Objectives of Rural economy; Characteristics of Rural Economy; Indicators of Rural Development; Concepts of inclusive and sustainable development.

2. **Approaches to Rural Development: (5)**

Gandhian Model; Community Development Approach; Minimum Needs Approach; Integrated Rural Development and Inclusive Growth Approach.

3. **Poverty and Unemployment in Rural India: (5)**

Meaning and Measurement of Poverty; Causes of Poverty; Farm and Non-farm employment Measurement and Types of rural unemployment; Review of rural Poverty Alleviation and Employment Generation Programmes in India.

4. **Rural Enterprises: (5)**

Meaning and Importance; Classification of MSME; Progress and Problems of MSME; Khadi and Village Industries

5. **Rural Banking and Finance: (5)**

Credit Co-operative Societies Regional Rural Banks; Role of NABARD; Microfinance Institutions

6. **Rural Infrastructure: (5)**

Educational and Health Infrastructure Housing and Sanitation; Drinking Water Supply; Rural Transport and Communication Rural Electrification

7. Rural Development Programmes: (5)

Wage Employment Programmes; Self-employment and Entrepreneurship Development Programmes Rural Housing Programmes; Rural Sanitation Programmes

8. Rural Markets: (5)

Meaning and Types of Rural Markets; Defects and Government Measures for Removal of Defects in rural markets Co-operative Marketing Societies; Meaning and Importance of Regulated Markets; Digital Marketing (e-NAM)

9. Rural Governance (5)

Legislations powers; Functions, and sources of revenue of Panchayat Raj Institutions Role of NGOs in rural development ; People's participation in rural development

Group B: Urban Economics (45)

1. Introduction to Urban Economics: (5)

Definition and Scope of Urban Economics; Nature of Urban Economics Definition of Urban Area; Causes of urbanization- Sub-urbanisation; Characteristics of urban area; Concept of urban

2 . Models of Urban Development and Planning (10)

The Urban Economy and Development Strategy; The Economics of Urban Growth; Models of Urban Growth; **Concentric Zone Theory, Wedge or Radial Sector Theory, Components of Hoyt Model, Multiple-Nuclei Theory, Central Place Theory, Weber's Theory of Location, *Public Choice Theory,* Planning Theories** The Frontiers of Urban Growth; The Economics of Intra-urban Location Decisions- Residential and industrial locations Semi urban areas special townships-Features of Urbanization in Developing Countries; Land Acquisition and Resettlement Act.

3. Urban Local Government (5)

Types of local bodies and Governance; Special Areas Improvement Trust: Functions, Problems and limitations; Slums Areas: Locations and Problems; Slum development policy

4 Urban Poverty: (5)

Problems, Measures, and Policies; The Nature of Urban Poverty; The Causes of Poverty; Urban Crime and management

5. Labour Market in Urban Area (5)

Urban labour markets; Developed and developing economies; Informal sector; Segmentation and hierarchy; Dualism; Impact of globalization; Urbanization without labour absorption in India.

6.**Urban Development in India (5)**

Urbanization in India; Growth of Urban Population; Urban Development Policy in India Policies and Programmes under the Plans; Jawaharlal Nehru National Urban Renewal Mission (JNNURM).

7. **Issues in Urban Infrastructural Development and environmental problems (5)**

Issues in Urban infrastructure; Housing, health, education and sanitation; Transport bottlenecks. Smart city mission; Urban environmental problems; slums, pollution, Solid Waste Management; Urbanisation and sustainable development.

8. **Inter-relation between Rural and Urban Study (5)**

Common features of Rural and urban economy; Distinctive features of Rural and urban economy; Todaro Model of Rural-Urban Migration and Unemployment

Reading References:

(Rural Economics)

1. Chambers, R., 1983, *Rural Development: Putting the Last First*, Longman, Harlow.
2. Dandekar, V.M. and N. Rath, 1971, *Poverty in India*, GIPE, Pune.
3. Gupta. K .R., 2003, *Rural Development in India*, Atlantic Publishers and Distributors, New Delhi.
4. Karalay, G. N., 2005, *Integrated Approach to Rural Development: Polices, Programmes and Strategies*, Concept Publishing Company, New Delhi.
5. Tyagi, B. P., 1998, *Agricultural Economics and Rural Development*, Jai Prakash Math and Co., Meerut.
6. S. Bhushan, R. Pushap and S. Lal, 2023, *Economics of Rural Development*, VK Publishing House.
7. S.S. Nain and V. Mehata, 2017, *Introduction to Agricultural Economics*, CBS Publishers and Distributors.

(Urban Economics)

1. O'Sullivan, A., 2002, *Urban Economics,* McGraw-Hill Irwin.

2. Fred Durr, 1971, *The Urban Economy,* Index Educational Publishers, London.

3. Todaro Michael P, *Internal Migration in Developing Countries: A Review of Theory, Evidence, Methodology & Research Priorities*, ILO Geneva.

4. Hartwick, John M., 2015, *Urban Economics*, Routledge; 1st edition.

5. Shukla, V., 1996, *Urbanization and Economic Growth*, Himalaya Publishers

6. Government of India, 2019, *Handbook of Urban Statistics*, Ministry of Housing and Urban Affairs, New Delhi.

7. J.K. Brueckner, 2013, *Lectures on Urban Economics,* Phi Publishers.

Syllabus *(ECONOMICS)*

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BECOMAJ18T**
Course Title: **Money and Financial Economics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Objective: After getting general theoretical knowledge on basic foundation course, this course will helps the learners to make introductory ideas on monetary economics and financial economics. The position & problems of our country in respect of fi**

1. **Money: (10)**

Barter System; Introduction of Money; Paper Currency and Bank Money; Concept, functions, measurement; Theories of money supply determination.

2. **Financial Institutions: (25)**

Markets, Instruments and Financial Innovations; Role of financial markets and institutions; Problem of asymmetric information – adverse selection and moral hazard; Financial crises.

3. **Money and Capital Markets:** (15)

Organization, structure and reforms in India; Role of financial derivatives and other innovations; Financial Markets and Interest Rates Behaviour; Determination; Sources of interest rate differentials; theories of term structure of interest rates; interest rates in India.

4. **Banking System:** (25)
   Balance sheet and Portfolio management; Multiple Deposit Creation, Determinants of the Money Supply; Indian Banking System: Changing role and structure; Banking sector reforms.

5. **Central Banking and Monetary Policy:** (15)
   Functions, balance sheet; Goals, targets, indicators and instruments of monetary control; Monetary management in an open economy; Current monetary policy of India; Central Bank Digital Currency; Crypto currency.

Reading References:

1. F.S. Mishkin and S. G. Eakins, 2009, *Financial Markets and Institutions*, Pearson Education, 6th edition.
2. F.J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, 2009, *Foundations of Financial Markets and Institutions*, Pearson Education, 3rd edition.
3. M.R. Baye and D. W. Jansen, 1996, *Money, Banking and Financial Markets*, AITBS.

4. Rakesh Mohan, 2011, G*rowth with Financial Stability: Central Banking in an Emerging Market*, Oxford University Press.
5. L.M. Bhole and J. Mahukud, 2011, *Financial Institutions and Markets*, Tata McGraw Hill, 5th edition.
6. M.Y. Khan, 2011, *Indian Financial System,* Tata McGraw Hill, 7th edition.
7. N. Jadhav, 2006, *Monetary Policy, Financial Stability and Central Banking in India*, Macmillan.
8. CAE Goodhart, 1985, *Money Information and Uncertainty*, Springer Publication.
9. D. Bhowmik, 2022, *An Approach Towards Central Bank Digital Currency*, Kunal Books, New Delhi.
10. R.B.I., 1998, *Report of the Working Group: Money Supply Analytics and Methodology of Compilation.*
11. R.B.I. Bulletin, *Annual Report and Report on Currency and Finance*.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(EDUCATION)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BEDCMAJ01T**
Course Title: **Philosophical and Sociological Foundations of Education**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: On completion of the course the students will be able to: i) State and analyze the Meaning, Nature and Scope of Education ii) Establish the relationship between Education and Philosophy iii) Understand Indian schoo**
Learning Outcome: **Learning Objective and Learning Outcome: On completion of the course the students will be able to: i) State and analyze the Meaning, Nature and Scope of Education ii) Establish the relationship between Education and Philosophy iii) Understand Indian schoo**
M-1
Philosophical and Sociological Foundations of Education
[Credit: 5+1]
Learning Objective and Learning Outcome:
On completion of the course the students will be able to:
i) State and analyze the Meaning, Nature and Scope of Education
ii) Establish the relationship between Education and Philosophy
iii) Understand Indian schools of philosophy
iv) Understand Western schools of philosophy
v) Know the Meaning, Nature and Scope of Educational Sociology
vi) Understand the relationship between Education and Sociology
3
vii) Know and understand various Social issues in Indian Scenario.
viii) Understand the role of different Social agencies in Education.
Course Contents:
Unit-I: Meaning, Nature and Scope of Education
a) Education – Meaning, Nature and scope
b) Individualistic and socialistic aim.
c) Agencies of Education – Formal, Non formal, Informal
Unit-II: Schools of Philosophy and their Educational Contribution
a) Indian Schools of Philosophy – Vedanta, Jainism, and Buddhism
b) Western Schools of Philosophy – Idealism, Realism, and Pragmatism
c) Great Educators and their educational philosophy – (i) Swami Vivekananda, (ii) Rabindranath Tagore, (iii) Rousseau, and (iv) John Dewey
Unit-III: Sociology in Education
a) Sociology of Education and Educational Sociology, Socialization and Process of Socialization
b) Social group, Social stratification, social mobility and Social change
c) Contemporary Issues – Globalization, Privatization, Empowerment (Women and other Disadvantaged), Capacity building ,Capability enhancing
Suggested Books:
Aggarwal, J. C. (2010). Psychological Philosophical and Sociological Foundations of Education (1st Edition). New Delhi: Shipra Publication.

Aggarwal, J. C. (2010). Psychological Philosophical and Sociological Foundations of Education (1 st Edition).Shipra Publication, New Delhi.
Aggrawal, J.C.(2013). Theory and principle of education. New Delh: Vikash Publishing House Pvt Ltd.
Bhat, ManzoorAhmad (2014). Philosophical and Sociological Foundations of Education.APH.
Brubacher, John.S.(1969). Modern philosophies of education. New York: McGraw Hill Co.
Chand, Jagdish (2010). Sociological Foundations of Education.Shipra Publication, New Delhi.
Chatterjee. S. &Datta, D. (1948). An Introduction to Indian Philosophy.3rd Edition. Calcutta: University Press.
Dash, B.N. (1994) Foundation of Educational Thought and Practice, New Delhi: Kalyani Publishers
Dash, B.N. (2011) Foundation of education, New Delhi; Kalyani Publishers.
Gupta, S. (2009) Education in Emerging India, Delhi: Shipra Publications.
Hiriyanna, M. Outlines of Indian Philosophy, Delhi: MotilalBanarsidass Publishers Private Limited.
Mathur, S. S. (2000). A sociological Approach to Indian Education.Agra :VinodPustakMandir.
Mohanty, J. (1982) Indian Education in Emergency Society, New Delhi: Sterling Publishers.
4
Nayak, B. K. (2006) Foundation of Education, Cuttack, KitabMahal.
Pathak, R. P. (2009). Philosophical and Sociological Foundations of Education.Kanishka Publishers, New Delhi.
Pathak, R. P. (2012). Philosophical and sociological principles of education. Delhi: Pearson.
Radhakrishnan, S. Indian Philosophy Vol.I and Vol. II.
Safaya, R.N. &Shaida, B.D. (2010), Modern theory and principles of education. New Delhi: DhanpatiPublising Company Pvt. Ltd.
Safaya, R.N. &Shaida, B.D. (2010), Modern theory and principles of education. New Delhi: Dhanpati Publishing Company Pvt. Ltd.
Sharma, Anita (2011). Philosophical and Sociological Foundation of Education.New Delhi: Global Publication.
Sharma, S. N. (1995). Philosophical and Sociological Foundations of Education, New Delhi: Kanishka Publishers Distributors.
Sharma, Sita Ram (2003). Sociological Foundations of Education.New Delhi: ShriSaiPrintographers Pub. & Print.
Sharma, S. N. (1995). Philosophical and Sociological Foundations of Education. New Delhi: Kanishka Publishers Distributors.
Taneja, V.R. (2000). Educational thought and practice, New Delhi: Sterling Publishers Pvt. Limited.
Y. K. Sharma – Sociological Philosophy of Education

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**

Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**

Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(EDUCATION)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BEDCMAJ02T**
Course Title: **Educational Psychology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know and understand Learning, its characteristics and influencing factors of learning. Know and understand the different Stages and aspects of human d**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know and understand Learning, its characteristics and influencing factors of learning. Know and understand the different Stages and aspects of human d**

M - II

Educational Psychology

Credit: 5+1

Learning Objective and Learning Outcome:
After completion of the course the students shall be able to:

i. Know and understand Learning, its characteristics and influencing factors of learning.
ii. Know and understand the different Stages and aspects of human development.
iii. Understand of how learning is related with the development of a learner.
iv. Know, understand and explain personality.

Course Contents:

Unit-I: Learning and its Application in Education

a. Definition, characteristics and factors influencing learning
b. Theories of learning – Classical Conditioning, Operant Conditioning, Connectionism, Cognitivism and Constructivism
c. Application Learning Theories – Behaviour Modification, AOM and CAM

Unit-II: Growth and Development

a. Growth, Development and Maturity

a. Stages of Development
b. Developmental Disorder

Unit-III: Personality and Psychopathology

a. Personality – Definition and Charters tics
b. Mental health and Hygiene – Definition, Scope, Educational implication
c. Mental Disease and therapeutic intervention – Anxiety Disorders, OCD ,Chemo therapy, Cognitive Behavioural Therapy

Suggested Readings:

Adhikari, S (2015). SikshayayMonovidya. Classique Books, Kolkata

Chauhan, S. S. (2007). Advanced Educational Psychology (7th Edition). Vikas Publishing House Pvt. Ltd. Noida.

Hergenhahn (1996).Introduction to Theories of Learning, Pearson Higher Education.

Hergenhahn, B. R., and Olson, Matthew H. (2013).An Introduction to Theories of Learning (9th Edition).Prentice Hall.

Hilgard, E. O. (1976). Theories of Learning (4th Edition). New York: Appleton Century.

Hilgard, E.R. & Bower, S.H. (1975).Theories of Learning. Cliffs: Prentice Hall.

Mangal, S. K. (2009).Essentials of Educational Psychology (1st Edition).Phi Learning Private Limited.

Mangal, S. K. (2010). Advanced Educational Psychology (2nd Edition). Phi Learning Private Limited.

Misra, G., Jha A., and Woolfolk, A. (2012).Fundamentals of Educational Psychology (11th Edition).Pearson India.

Santrock, John W. (2011). Educational Psychology (4th Edition).Mcgraw Hill Education.

Sharma S. K.- Principles of Growth and Development. Gyan.

Sindhu, I. S. (2012).Educational Psychology.Pearson India.

Weiner, B. (1980). Human Motivation. New York: Halt, Rinehart & Winston.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(EDUCATION)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BEDCMAJ03T**
Course Title: **Development of Education in India**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know, understand and explain the different educational initiatives taken in 19th Century in India and their impacts on Indian education system. Know,**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know, understand and explain the different educational initiatives taken in 19th Century in India and their impacts on Indian education system. Know,**

M-III

Development of Education in India

Credit: 5+1

Learning Objective and Learning Outcome:

After completion of the course the students shall be able to:

i. Know, understand and explain the different educational initiatives taken in 19th Century in India and their impacts on Indian education system.
ii. Know, understand and explain the different educational initiatives taken in 20th Century in India and their impacts on Indian education system.
iii. Know, understand and explain developmental history of education in Post Independence India.
iv. Explain the contributions of University Education Commission (1948-49) in the field of Indian Higher education.
v. Explain the contributions of Secondary Education Commission (1952-53) in the field of Indian secondary education.
vi. Explain the contributions of Indian Education Commission (1964-66) in the field of Indian overall education system.

Course Contents:

Unit-I: **Indian Education in Ancient and Medieval India**

a. Brahmanic System of Education – aims, curriculum, teacher and methods of teaching, institutions, women education and evaluation system;
b. Buddhistic System of Education – aims, curriculum, teacher and methods of teaching, institutions (Nalanda, Bikramsila), women education and evaluation system
c. Education in Medieval India – aims, curriculum, teacher and methods of teaching, Institutions and Women education, Contribution of Firoz Shah Tughlak and Akbar

Unit-II: Education in 19thCentury in India

a. Charter Act of 1813 and its educational significance
b. Bengal Renaissance – concept, causes and its impact on education, the contribution of Raja Rammohan Roy, Derozio and Vidyasagar in Education
c. Wood's Despatch (1854); Lord Curzon as educational reformer; National education movement; Basic Education

Unit-III: Indian Education in Post-Independence Period

a. Education and Constitution – Preamble and various Articles on Education in Indian Constitution
b. Education Commission in post-Independent India, Radhakrishnan Commission, University Education Commission (1948-49), Indian Education Commission (1964-66), AsokeMitra Commission (1991-92)
c. National Policy on Education (1986) and Programme of Action (POA)-1992

Unit III: Contemporary Issues in Indian Education

a. Effect of globalization and privatization in education
b. Education for all and Lifelong learning
c. New Education policy-2020

Suggested Readings:

i. Agarwal, J. C. – Recent Developments and Trends in Education (with special reference to India), Shipra.
ii. Aggarwal, J. C. - Landmarks in the History of Modern Indian Education.
iii. Banerjee, J. P. – Education in India, Past, Present and Future.
iv. B. K. Nayak- Modern Trends and Issues in Education of India

v. B. K. Nayak - History Heritage and Development of Indian Education
vi. B. N. Dash –History of Education in India
vii. B. R. Purkait- Milestones of Modern Indian Education
viii. J. C. Aggarwal- Theory and Principles of Education
ix. Mukherjee, S. N. - Education in India, Today and Tomorrow, BorodaAcharya Book Depot.
x. Nurullah, S., and Naik, J. P. – History of Education in India; Macmillan Co.
xi. R. P. Pathak – Development and Problems of Indian Education

S. S. Ravi – A Comprehensive Study of Education

Syllabus *(EDUCATION)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BEDCMAJ04T**
Course Title: **Pedagogy**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know and understand the meaning and concept of Pedagogy. Understand and explain the relationship between teaching and learning. Explain the teaching p**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know and understand the meaning and concept of Pedagogy. Understand and explain the relationship between teaching and learning. Explain the teaching p**

M-IV

Pedagogy

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course the students shall be able to:

i. Know and understand the meaning and concept of Pedagogy.
ii. Understand and explain the relationship between teaching and learning.
iii. Explain the teaching process and its input and output variables.
iv. Know and understand the Maxims of Teaching.
v. Understand and explain the nature of classroom teaching and Functions of a teacher.
vi. Distinguish between traditional and constructivist teaching.
vii. Know and understand the various influencing factors of teaching methods.
viii. Know about various teaching methods and their utilities in classroom teaching-learning process.

Course Contents:

Unit-I: Teaching

a. Science of Teaching – relation between teaching and learning; Pedagogy, Andragogy, and Heutagogy
b. Factors affecting teaching process – input and output variables
c. General principles of teaching – maxims of teaching, fundamentals of teaching

Unit-II: Teacher and Classroom Teaching

a. Nature of classroom teaching
b. Differences between traditional and constructivist teaching
c. Functions of a teacher as a planner, as a facilitator, as a counselor, as a researcher

Unit-III: Teaching Methods

a. Factors influencing teaching – Perception, Attention and Attitude
b. Capability Pedagogy by Professor Amartya Sen
c. "Pedagogy of the Oppressed" – by Paulo Freire

Suggested Readings:

Borich, Gary D. (2011). Effective Teaching Methods: Research-Based Practice. Pearson India.
Johonnot, James (2010). Principles and Practices of Teaching. Mitchell Press.
Nayak, A. K. (2004). Classroom Teaching: Methods and Practices (01 Edition). A.p.h. Publishing Corporation.
RAM, S. (1998). Modern Teaching Methods. Sarup Book Publishers (P) Ltd.
Shukla, Chhaya (2003). Principles of Teaching in Elementary Schools. Mohit Publications.

Syllabus *(EDUCATION)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BEDCMAJ05T**
Course Title: **Education for Quality Living**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the Concept of Value and Value Education. Know the Nature and Scope of Value Education. Understand the Role of Parents, Teachers and Society for**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the Concept of Value and Value Education. Know the Nature and Scope of Value Education. Understand the Role of Parents, Teachers and Society for**

M-V

Education for Quality Living

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course the students shall be able to:

i. Know the Concept of Value and Value Education.
ii. Know the Nature and Scope of Value Education.
iii. Understand the Role of Parents, Teachers and Society for fostering Values.
iv. Know the various Approaches of Value Inculcation.
v. Know the Concept and Nature of Peace Education.
vi. Know the Curriculum of Peace Education.
vii. Know the role of Education in dissemination of peace and resolution of conflict.
viii. Know the Concept and Aims of Sustainable Development.
ix. Understand the Role of Education in Sustainable Development.
x. Know the difficulties in maintaining Sustainable Development.

Course Contents:

Unit-I: Value Education

a. Value and Value Education – meaning, definitions, nature and scope
b. Fostering Values – role of parents, teachers and society
c. Approaches to inculcating values among children

Unit-II: Peace Education

a. Peace Education – meaning and nature
b. Peace Education and Curriculum – method of integration peace concept in education
c. Role of Education – disseminations of peace and resolution of conflict

Unit-III: Education for Sustainable Development

a. Meaning, aims and objectives of sustainable development
b. Role of Education in Sustainable Development
c. Difficulties in maintaining sustainable development

Suggested Readings:

Aggarwal, J.C. (2010). *Education for Values, Environment and Human Rights.* New Delhi: Shipra Publications.

Chadha, S. C. (2008). Education value & value education. Meerut: R.Lall Books Depot.

Chakrabarti, Mohit (2003); *Value Education: Changing Perspectives*. New Delhi: Kanishka Publishers.

Chand, J. (2007). Value Education. Delhi: Anshah publishing House.

Diwahar, R. R., &Agarwal, M. (Ed).(1984). Peace education. New Delhi: Gandhi Marg.

Fountain, S. (1999) Peace Education in UNICEF, Working Paper, Education Section, Programme Division, UNICEF, New York.

Gupta, N.L. (2000). *Human Values in Education*. New Delhi: Concept Publishing Company.

Mahakud, L. &Behera, S.K. (2013) (Edit.) Value Education: Dimensions and Approaches, S.B. Enterprise, Kolkata.

Mishra, L. (2009) Peace Education Framework For Teachers, New Delhi: APH Publishing Corporation.

Morrison, M. L. (2003). Peace education. Australia: McFarland.

Passi, B. K., & Singh, P. (1999).Value education. Agra: Agra Psychological corporation.

Ruhela, S.P. (ed.) (1986). *Human Values and Education*. New Delhi: Sterling Publishers Pvt. Ltd.

Salomon, G., &Nevo, B. (2002). Peace Education: The concept, principles, and practices around the world. London: Lawrence Erlbaum Associates.

Sharma, R. A. (2008). Human value of education. Meerut: R.Lall Books Depot.

Sharma, Y.K. and Katoch, K.S. (2007) Education for Values, Environment and Human Rights, New Delhi: Deep & Deep Publications Pvt. Ltd.

Shukla, R. P. (2004). Value education and human rights. New Delhi: Sarup and sons.

Singh,Y. K. (2009). Value education. New Delhi: APH Publishing Corporation.

Subramanian, K. (1990). Value Education. Madurai: Ravana Publication.

Venkataiah, (2009).Value education. New Delhi: APH Publishing Corporation.

Syllabus *(EDUCATION)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BEDCMAJ06T**
Course Title: **Curriculum Studies**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the Nature and Functions of Curriculum. Describe the various Principles of Curriculum Construction. Understand the Bases of Curriculum. Know the**

Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the Nature and Functions of Curriculum. Describe the various Principles of Curriculum Construction. Understand the Bases of Curriculum. Know the**

M-VI

Curriculum Studies

[Credit: 5+1]

Learning Objective and Learning Outcome:

After completion of the course the students shall be able to:

i. Know the Nature and Functions of Curriculum.
ii. Describe the various Principles of Curriculum Construction.
iii. Understand the Bases of Curriculum.
iv. Know the Concept, Characteristics and Utility of Curriculum Evaluation.
v. Differentiate Formative and Summative Evaluation.

Course Contents:

Unit-I: Concept of Curriculum

a. Definition of Curriculum, Characteristics and Functions of Curriculum.
b. General Principles of Curriculum Construction.
c. Types of Curriculum – Explicit and Hidden Curriculum, Core and Activity based Curriculum.

Unit-II: Bases of Curriculum

a. Philosophical
b. Psychological
c. Sociological

Unit-III: Curriculum Evaluation and Recommendation

a. Meaning, Characteristics and Utility of Curriculum Evaluation
b. Formative and Summative Evaluation
c. Curriculum and Credit Framework for Undergraduate Programmes in NEP-2020

Suggested Books:

Brady, L. (1995). Curriculum development, New Delhi: Prentice Hall.

Brent, Allen. (1978); Philosophical Foundations for the Curriculum, Baston: Allen and Unwin.

Flinders, D.J (Ed) (1977); The Curriculum Studies; New Delhi: Atlantic Publishers

Oliva, P.F. (2001). *Developing the curriculum* (Fifth Ed.). New York, NY: Longman.

Ornstein, A.C. &Hunkins, E (1998).*Curriculum. Foundations, Principles and Issues*. Boston: Allyn& Bacon, Boston.

Saylor, J.G. & Alexander W.M.(1956); Curriculum Planning for Better Teaching and Learning: Rinehart& Company, Inc. New York.

Sharma, R.A. (2012) Curriculum Development and Instruction, Meerut: R. Lall Book Depot.

Taba, H. (1962). Curriculum development-theory and practice. New York: Harcourt Brace, Jovanoich.

Talla, Mrunalini (2012) Curriculum Development- Perspectives, Principles and Issues, Delhi, Chennai & Chandigarh: Pearson

Tanner, D. and Tanner, L.(1975) Curriculum development- theory and practice. New York: Macmillan Publishing Co. Inc.

Tyler, R.W.(1941). Basic principles of curriculum and instruction. Chicago: University of Chicogo Press.

Vashist, R.P., Curriculum Development

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BEDCMAJ07T**
Course Title: **Instructional Technology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course, the students will be able to: Know the Concept, Nature, Need and Scope of Educational Technology. Know the Approaches of Educational Technology. Understand the Concept, Nature, Typ**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course, the students will be able to: Know the Concept, Nature, Need and Scope of Educational Technology. Know the Approaches of Educational Technology. Understand the Concept, Nature, Typ**

M-VII

Instructional Technology

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course, the students will be able to:

i. Know the Concept, Nature, Need and Scope of Educational Technology.
ii. Know the Approaches of Educational Technology.
iii. Understand the Concept, Nature, Types, and Components of Communication.
iv. Know the Barriers of Classroom communication and strategies of overcoming barriers in communication
v. Understand the various Phases of Teaching such as Pre-active, Inter-active & Post-active.
vi. Understand the various Levels of Teaching.
vii. Identify the families of Models of Teaching.

Course Contents:

Unit-I: Educational Technology

a. Meaning, Nature, Need and Scope of Educational Technology
b. Problems of Technology of Education
c. Approaches of Educational Technology – Hardware, Software, and System

Unit-II: Classroom Communication and Media Used

a. Meaning, Nature, Types, and Components of Communication
b. Barriers of classroom communication and strategies of overcoming barriers in communication
c. Media used in education – Audio (Radio), Visual (Projector), Audio-visual (TV)

Unit-III: Phases, Levels, and Models of Teaching

a. Phases of Teaching – Pre-active, Inter-active and Post-active
b. Levels of Teaching – Memory, Understanding, Reflective
c. Models of Teaching – Concept, Components, Families, Bruner's Concept Attainment Model and Asubel's Advance Organizer Model

Suggested Books:

Aggarwal J C (2001), Essentials of Educational Technology, Vikash Publishing House, New Delhi.

Kumar, K.L. Educational Technology,
Mangal S K and Mangal U, (2009) Essentials of Educational Technology, PHI Learning Pvt. Ltd.
Mohanty, J. (2001) Educational Technology, New Delhi: Deep & Deep publication.
Sampath, Pannerselvan, Santhanam, Introduction to Educational Technology.
Sharma R. N., & S.S. Chandra, (2003) Advanced Educational Technology 2 Vols. Set, Atlantic Publishers & Dist.
Sharma Y. K., (2005) Fundamental Aspects of Educational Technology, Kanishka Publishers.
Sharma, V. P. & K. Prasad, (2010), Advanced Educational Technology, Pacific Books International.
Vashist, S.R. (1997) Research in Educational Technology, Guwahati: Eastern Book House.

Syllabus *(EDUCATION)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BEDCMAJ08T**
Course Title: **Educational Administration**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Practical**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able: To develop an understanding of the concepts of educational administration To develop an understanding of the types of educational planning To be acquaint**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able: To develop an understanding of the concepts of educational administration To develop an understanding of the types of educational planning To be acquaint**

M-VIII

Educational Administration

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course the students shall be able:

i. To develop an understanding of the concepts of educational administration
ii. To develop an understanding of the types of educational planning
iii. To be acquainted with various administrative bodies and their functions

Course Contents:

Unit-I: Educational Administration and Supervision

a. Educational Administration – Meaning and Function
b. Supervision – Meaning, Purpose; Distinguish between Supervision and Inspection
c. Factors affecting Managerial behaviour of teachers – Personal, Social, Cultural, Political and Institutional.

Unit-II: Educational Planning

a. Educational Planning – Meaning, Needs and Significance and SWOT analysis
b. Types of Educational Planning – Strategies and Steps in Educational Planning
c. Brief outline of the last Five Year Plan in Primary and Secondary Education in India

Unit-III: Various Administrative Bodiesand their Functions

a. Central Level – Government Departments, UGC, NAAC, NCERT, RCI, AICTE and NCTE

b. State Level – Government Departments, Higher Education Council, DPI, DSE, School Boards, SCERT, DIET
c. Local Level – Panchayat, Municipality, Non-Governmental Organizations

Suggested Readings:

Bala, M. (1990): Leadership Behaviour and Educational Administration. New Delhi: Deep & Deep Publications.
Sharma, R.A.(2012) Educational Administration and Management, Meerut :R. Lall Book Deport.

Syllabus *(EDUCATION)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BEDCMAJ09T**
Course Title: **Guidance and Counselling**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Practical**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able: To develop an understanding of the concepts of guidance and counselling. To develop an understanding of the types of guidance To be acquainted with diffe**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able: To develop an understanding of the concepts of guidance and counselling. To develop an understanding of the types of guidance To be acquainted with diffe**

M-IX

Guidance and Counselling

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course the students shall be able:

i. To develop an understanding of the concepts of guidance and counselling.
ii. To develop an understanding of the types of guidance
iii. To be acquainted with differenttestingdevicesand techniques of guidance
iv. To develop and understanding of the role of teacher as counsellor

Course Contents:

Unit-I: Concept and Functions of Guidance

a. Meaning, Nature, Function and Need of Guidance
b. Different Types of Guidance – (i) Educational: meaning, need and importance; (ii) Vocational: meaning, need and importance; (iii) Personal: meaning, need and importance; and Guidance Services – (i) Job Analysis: concept, need; (ii) Job Satisfaction: concept, factors affecting job satisfaction; (iii) Occupational Information: concept, need
c. Guidance of the Differently-Able Students: Gifted, Slow Learners, Learning Disabilities (Dyslexia, Dysgraphia, Dyscalculia) – only identification; Mainstreaming and providing support services to Differently-AbleStudents

Unit-II: Concept and Functions of Counselling

a. Meaning, purpose and scope of Counselling
b. Types of Counselling – Directive, Non-directive, Eclectic

c. Process of Counselling (introduction, in-depth, communication, suggestion); Skills in Counselling (listening, questioning, responding); Role of the Counsellor; Professional Ethics of a Counsellor

Unit-III: Tools and Techniques of Guidance and Counselling

a. Psychological tests – meaning, need, limitations
b. Testing – Intelligence, Aptitude, Attitude, Achievement, Interest, Personality
c. Techniques of Guidance and Counselling – (i) Interview: types and procedure; (ii) Case Study; (iii) Cumulative Record, (iv) Anecdotal Record; (v) Diary; and (vi) Questionnaire

Suggested Books:

Aggarwal J. C., (2004) Educational and Vocational Guidance and Counselling, 7th Edition, Doaba House; Delhi.

Aggarwal J.C. (2005) Career Information in Career Guidane - Theory and Practice, Doaba House, Delhi.

Chauhan S.S. Principles and Techniques of Guidance.

Dash, M (1997) Education of Exceptional Children, Atlantic publishers, New Delhi

DevKapil (2006) Educational Counselling, Pragun Publications, New Delhi

Gibson Robert & Mitchell Marianne (2005) Introduction to Guidance and Counselling, 6 Edition, Prentice Hall of India, New Delhi.

Gladding Samuel (2011) Counselling - A Comprehensive Profession, 6th Edition, Dorling Kindersley India Pvt. Ltd., New Delhi

Kenkateish, S (2001) Special Education, Anmol Publication Pvt. Ltd., New Delhi.

Kochhar S.K. (1981) Guidance in Indian Education, New Delhi

Kochhar S.K. (1987) Educational and Vocational Guidance in Secondary Schools, Sterling Publishers, New Delhi

Kochhar S.K. (1987) Guidance and Counseling in Colleges and Universities, Sterling Publishers, New Delhi

Milne Aileen (2003) Teach Yourself Counseling, McGraw Hill companies, Chicago.

Panda, K.C. (1997) Education of Exceptional Children, Vikas Publishing House, Delhi.

Sharma R.A. Fundamentals of Guidance and Counseling

Sharma Ramnath and Sharma Rachana (2004) Guidance and Counseling in India, Atlantic Publishers and Distributors, New Delhi.

Syllabus *(EDUCATION)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BEDCMAJ010T**
Course Title: **Comparative Education**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Practical**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able: To develop an understanding of the concepts ofComparative Education To develop an understanding of factors and forces of comparative education To**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able: To develop an understanding of the concepts ofComparative Education To develop an understanding of factors and forces of comparative education To**

M-X

Comparative Education

[Credit: 5+1]

Learning Objective and Learning Outcome:

After completion of the course the students shall be able:

i. To develop an understanding of the concepts ofComparative Education
ii. To develop an understanding of factors and forces of comparative education
iii. To acquaint with the structure, aims and objectives of education of different countries

Course Contents:

Unit-I: The Origins and Usefulness of Comparative Education

a. Meaning and Nature of Comparative Education
b. Approaches of Comparative Education – (i) Human Capital, (ii) Social Capital, (iii) School Quality, (iv) Alternative Student Outcomes
c. Methods of Comparative Education – (i) Philosophical Method, (ii) Sociological Method, (iii)Psychological Method

Unit-II: Factors and Forces of Comparative Education

a. Natural Factors – (i) World Systems, Dependency, and Neo-colonial Theories; (ii) Neo-institutionalist Approaches: Historical, Racial, Linguistic and Social Factors; (iii) Decentralization
b. School Choice and Privatization
c. Research for Policy and Future of Comparative Education

Unit-III: Elementary, Secondary and Higher Education in India, UK andUSA

a. Structure, Aims and Objectives
b. Curriculum, Methodology and Evaluation system
c. Administration including Finance

Suggested Readings:

Altbach, Phillip (1977). "Servitude of the Mind? Education, Dependency, and Neo- Colonialism," Teachers College Record 79(2), pp. 187-203.

Baker, David, Ruth Hayhoe, Stephen Heyneman, Keith Lewin, M. NajeebShafiq, Amy Stambach, Nelly Stromquist and Fran Vavrus (2008). "Response to Steven Klees' presidential address," invited contributors, Newsletter of the Comparative and International Education Society, May. Go to: http://cies.us/newsletter/may08/index_may08.htm.

Bereday, George (1977). "Comparative Analysis in Education," Prospects: Quarterly Review of Education 7(4), pp. 472-487.

Boli, John, Francisco Ramirez, and John Meyer (1985). "Explaining the Origins and Expansion of Mass Education," Comparative Education Review 29(2)

Bray, Mark and R. Murray Thomas (1995). "Levels of Comparison in Education: Different Insights from Different Literatures and the Value of Multilevel Analysis," Harvard Educational Review 65(3), pp. 472-490.

Carnoy, Martin and Jeffrey Marshall (2005). "Comparing Cuban Academic Performance with the Rest of Latin America," Comparative Education Review 49(2), pp. 230-261.

Chapman, David, Elizabeth Barcikowski, Michael Sowan, Emma Gyamera, and George Woode (2002). "Do Communities Know Best? Testing a Premise of Educational Decentralization: Community Members' Perceptions of their Local Schools in Ghana," International Journal of Educational Development 22(2), pp. 181-189.

Coleman, James (1988). "Social Capital in the Creation of Human Capital," American Journal of Sociology 94, pp. S95-S120.

Collins, Randall (1994). "Prologue: The Rise of the Social Sciences," in Four Sociological Traditions. New York: Oxford University Press.

Emler, Nicholas and Elizabeth Frazer (1999). "Politics: The Education Effect," Oxford Review of Education 25(1/2), pp. 251-273.

Farrell, Joseph (1979). “The Necessity of Comparisons in the Study of Education: The Salience of Science and the Problem of Comparability,” Comparative Education Review 23(1), pp. 255-261.

Ginsburg, Mark and Jorge Gorostiaga (2001). “Relationships between Theorists/Researchers and Policy Makers/Practitioners: Rethinking the Two-Cultures Thesis and the Possibility of Dialogue,” Comparative Education Review 45(2), pp. 173- 196.

Ginsburg, Mark, Susan Cooper, Rajeshwari Raghu, and Hugo Zegarra (1990). “National and World System Explanations of Educational Reform,” Comparative Education Review 34(4), pp. 474-499.

Hayhoe, Ruth and Karen Mundy (2010). Introduction to Comparative and International Education: Why Study Comparative Education? http://www.oise.utoronto.ca/cidec/UserFiles/Media/Research/Issues_for_Teachers/ATA_ ChapterOne.mov

Heyneman, Stephen and William Loxley (1983). “The Effect of Primary-School Quality on Academic Achievement Across Twenty-Nine High- and Low-Income Countries,” American Journal of Sociology 88(6), pp. 1162-1194.

Horvat, Erin, Elliot Weininger, and Annette Lareau (2003). “From Social Ties to Social Capital: Class Differences in the Relations between Schools and Parent Networks,” American Journal of Educational Research 40(2), pp. 319-351.

Klees, Steven (2008). “Reflections on Theory, Method, and Practice in Comparative and International Education,” Comparative Education Review 52(3), pp. 301-328

Levin, Henry (1984). “Assessing the Equalization Potential of Education,” Comparative Education Review 28(1), pp. 11-27.

Levin, Henry (1992).“Effective Schools in Comparative Focus.”In Phillip Altbach, Robert Arnove, and Gail Kelly (Eds.), Emergent Issues in Education: Comparative Perspectives, pp. 229-248. Albany, NY: SUNY Press.

Levin, Henry (2002). “A Comprehensive Framework for Evaluating Educational Vouchers,” Educational Evaluation and Policy Analysis, 24, pp. 159-174.

Mattei, Paola (2012). “Market Accountability in Schools: Policy Reforms in England, Germany, France, and Italy,” Oxford Review of Education 38(3), pp. 247-266.

McGinn, Noel and Luzete Pereira (1992).“Why States Change the Governance of Education: A Historical Comparison of Brazil and the United States,” Comparative Education 28(2), pp. 167-180.

Meyer, John W. and David Baker (1996).“Forming American Education Policy with International Data: Lessons from the Sociology of Education,” Sociology of Education (extra issue), pp. 123-130.

Meyer, John, Joane Nagel, and Conrad Snyder (1993). “The Expansion of Mass Education in Botswana: Local and World Society Perspectives,” Comparative Education Review 37(4), pp. 454-475.

Noah, Harold (1984). “Uses and Abuses of Comparative Education,” Comparative Education Review 28, pp. 153-163.

Noah, Harold and Max Eckstein (1969).Toward a Science of Comparative Education. New York: Macmillan.

Phillips, David and Michele Schweisfurth (2008). “Chapter 1: Making Comparisons,” in Comparative and International Education: An Introduction to Theory, Method, and Practice, pp. 8-27. New York: Continuum.

Phillips, David and Michele Schweisfurth (2008). “Chapter 2: How Comparative Education has Developed,” in Comparative and International Education: An Introduction to Theory, Method, and Practice, pp. 28-42. New York: Continuum.

Psacharapoulos, George and Harry Patrinos (2004). “Returns to Investment in Education: A Further Update,” Education Economics 12, pp. 111-134. (Focus on the tables only)

Rust, Val (2004).“Method and Methodology in Comparative Education,” Comparative Education Review 47(3), iii-vii.

Samoff, Joel (1999). “Education Sector Analysis in Africa: Limited National Control and Even Less National Ownership,” International Journal of Educational Development 19, pp. 249-272.

Schultz, Theodore (1961). “Investment in Human Capital,” American Economic Review

Shafiq, M. Najeeb& Karen Ross (2010). “Educational Attainment and Attitudes towards War in Muslim Countries Contemplating War: The Cases of Jordan, Lebanon, Pakistan, and Turkey,” Journal of Development

Studies 46(8), pp. 1424-1441.
Sorensen, Clark (1994). "Success and Education in South Korea," Comparative Education Review 38(1), pp. 10-35.
Weiler, Hans (1990). "Comparative Perspectives on Educational Decentralization: An Exercise in Contradiction," Educational Evaluation and Policy Analysis 12(4), pp. 433- 438.

Syllabus *(EDUCATION)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BEDCMAJ11T**
Course Title: **Research Methodology in Education**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course, the students will be able to: Know the Concept, Nature, Scope and Importance of Educational Research. Know the Sources of Knowledge. Know the Need of Research in Education. Underst**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course, the students will be able to: Know the Concept, Nature, Scope and Importance of Educational Research. Know the Sources of Knowledge. Know the Need of Research in Education. Underst**

M-XI

Research Methodology in Education

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course, the students will be able to:

i. Know the Concept, Nature, Scope and Importance of Educational Research.
ii. Know the Sources of Knowledge.
iii. Know the Need of Research in Education.
iv. Understand the various Methods and Types of Educational Research.
v. Identify the criteria of good Research Problem.
vi. Know the Concept, Characteristics and Types of hypothesis.
vii. Know the concept of Population , Sample and Sampling Techniques
viii. Know the Concept, Nature and Sources of Qualitative and Quantitative Data.
ix. Know the Research Tools.
x. Write and Evaluate the Research Proposal.

Course Contents:

Unit-I: Educational Research

a. Meaning, Nature and Scope of Educational Research
b. Sources of Knowledge (Authority, Tradition, Personal Experience, Deduction, Induction). Need of Research in Education
c. Types of Research – Basic, Applied & Action Research; Longitudinal and Cross Sectional Research; Historical, Descriptive and Experimental research (meaning only); Importance of Educational Research

Unit-II: Basic Ideas of Research

a. Criteria of selecting a good Research Problem
b. Research Hypothesis – Meaning, Nature and Types

c. Population, Sample and Sampling Techniques (Probability & Non Probability).

Unit-III: Research Data and Tools

a. Qualitative and Quantitative data – Concept, Nature and Sources
b. Tools of data collection and their characteristics, merits and demerits
c. Characteristics of good research tools

Suggested Books:

Aggarwal, J.C.(2002) Educational Research, Agra: Aryan Book Depot.

Best, J.W. & Kahn, J.V.(1989). Research in Education, (6th edition). New Delhi: Prentice Hall.

Gay, L.R. &Airasian, P. (2000) Educational Research : Competencies for Analysis and Application, New Jersey Mersil.

Good, C.V, Barr & Douglas, E. Scates. (1962). Methodology of Educational Research New York: Appleton Crofts.

Kerlinger F.N. (1978). Foundation of Behavior Research. Delhi: Surjeet Publications

Kothari, C.R.(2009) Research methodology methods and techniques, New Delhi: New age international (P) Ltd publishers.

Koul, L. (1998). Methodology of Educational Research. New Delhi: Vikash Publications.

Sukla S.P,& Others.(1974). Elements of Educational Research. (3rd edition), Bombay: Allied Publishers

Van Dalen, D.B & Meyer, W.J. (1979).Understanding Educational Research. New York: Mcgraw Hill C.

Syllabus *(EDUCATION)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BEDCMAJ12T**
Course Title: **Statistics in Educational Research**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course, the students will be able to: Know the Concept Scope and Need of Educational statistics. Make organization, tabulation and graphical representation of Data. Measure the Central Ten**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course, the students will be able to: Know the Concept Scope and Need of Educational statistics. Make organization, tabulation and graphical representation of Data. Measure the Central Ten**

M-XII

Statistics in Educational Research

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course, the students will be able to:

i. Know the Concept Scope and Need of Educational statistics.
ii. Make organization, tabulation and graphical representation of Data.
iii. Measure the Central Tendency and Measure the Variability.
iv. Compute Coefficient of Correlation by using various methods.
v. Know the Concept of Normal Distribution, its Properties and Uses.

Course Contents:

Unit-I: Basics of Statistics

a. Concept, Scope and Need of Educational Statistics
b. Organization and Tabulation of Data – frequency distribution
c. Graphical Representation of Data

Unit-II: Descriptive Statistics

a. Measures of Central Tendency – Mean, Median and Mode
b. Measures of Dispersion – Range, AD, SD, QD and Percentile and Percentile Rank
c. Concept of Correlation –Rank difference method and Product moment method, Interpretation of Co-efficient of Correlation

Unit-III: Inferential Statistics

a. Concept of Normal Distribution – Properties and Uses
b. Divergence from Normality – Skewness and Kurtosis
b. Derived Scores – Z-Score, Standard Score

Suggested Books:

Aggrwal, Y.P. (1988): Statistical Methods-Concepts, Application and Computation, New Delhi: Streling.
Ferguson, G.A. (1976). Statistical Analysis in Psychology and Education,NewYork:McGraw Hill.
Garret.H.E (1988). Statistics in Psychology and Education Bombay: Vakils, Ferrer& Simons Ltd
Guilford, J.P. &Fruchter, B. (1974).Fundamental Statistics in Psychology & Education. New York: McGraw Hill
Mangal, S.K. (2008). Statistics in Education and Psychology, New Delhi: Prentice Hall.
Rath, R. K.(1999) Fundamentals of Educational Statistics & Measurement, Orissa: TaratariniPustakalaya.
Saha, Kaberi (2012)Statistics In Education And Psychology, New Delhi: Asian Books Private Ltd
Sahu, B.K. (2004) Statistics in Psychology & Education, Kalyani Publishers.

Syllabus *(EDUCATION)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BEDCMAJ13T**
Course Title: **Life Skill Education**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Acquire knowledge about the concept of life skill education. Know and understand the concept, processes, barriers and various skills of communication.**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Acquire knowledge about the concept of life skill education. Know and understand the concept, processes, barriers and various skills of communication.**

M-XIII

Life Skill Education

[Credit: 5+1]

Learning Objective and Learning Outcome:

After completion of the course the students shall be able to:

i. Acquire knowledge about the concept of life skill education.
ii. Know and understand the concept, processes, barriers and various skills of communication.
iii. Know and understand the process of critical thinking and problem solving.

iv. Understand the process of Team formation, Team work and Group Dynamics.
v. Distinguish between Team and Group.
vi. Know and understand of how to manage Team performance and Team conflicts.
vii. Know and understand the concept and different types of Leadership.
viii. Know and understand of how to develop Leadership skills.

Course Contents:

UNIT-I: Communication Skill

a. Concept of Communication
b. The Process and Barriers of Communication
c. Skills of Communication: Listening, Speaking and Writing

UNIT-II: Critical Thinking and Problem Solving

a. Creativity: Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving
b. Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group
c. Group Dynamics, Managing Team Performance & Team Conflicts

UNIT-III: Leadership Skills

a. Leadership, Levels of Leadership and Types of leadership
b. Transactions Vs Transformational Leadership
c. Development Leadership Skills

Suggested Reading:

Aggarwal J C (2001), Essentials of Educational Technology, Vikash Publishing House, New Delhi.

Bala, M. (1990): Leadership Behaviour and Educational Administration. New Delhi: Deep & Deep Publications.

Mangal S K and Mangal U, (2009), Essentials of Educational Technology, PHI Learning Pvt. Ltd.

Pandey, S. P.- Life Skill Education for Adolescents. Serials.

Sharma R. N., & S.S. Chandra, (2003), Advanced Educational Technology 2 Vols. Set, Atlantic Publishers & Dist.

Sharma Y. K., (2005), Fundamental Aspects of Educational Technology, Kanishka Publishers.

Sharma, R.A.(2012) Educational Administration and Management, Meerut :R. Lall Book Deport.

Sharma, V. P. & K. Prasad, (2010).Advanced Educational Technology, Pacific Books International.

Sharma, Y.K. and Sharma, M. (2006): Educational Technology and Management. New Delhi: Kanishka Publishers, Distributors.

Syllabus *(EDUCATION)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BEDCMAJ14T**
Course Title: **Measurement and Evaluation in Education**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **[Credit: 5+1 Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Acquire knowledge about the concept of Measurement and Evaluation. Understand the relationship between Measurement and Evaluation. Know,**

Learning Outcome: **[Credit: 5+1 Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Acquire knowledge about the concept of Measurement and Evaluation. Understand the relationship between Measurement and Evaluation. Know,**

M-XIV

Measurement and Evaluation in Education

[Credit: 5+1

Learning Objective and Learning Outcome:

After completion of the course the students shall be able to:

i. Acquire knowledge about the concept of Measurement and Evaluation.
ii. Understand the relationship between Measurement and Evaluation.
iii. Know, understand and differentiate various scales of measurement from each other.
iv. Know and understand the different tools and techniques of evaluation used in education.
v. Know and understand the various important characteristics of a good test.

Course Contents:

Unit-I: Measurement and Evaluation in Education

a. Concept, Scope and Need of Evaluation
b. Relation between Evaluation and Measurement
c. Scales of Measurement: Nominal, Ordinal, Interval and Ratio.

Unit-II: Tools and Techniques of Evaluation

a. Tools: Tests- Essay type and Objective type; Short answer type and Oral type
b. Personality and Interest Test: Projective and Non-projective Tests
c. Techniques: Observation, Self-reporting (Interview, Questionnaire)

Unit-III: Characteristics of a Good Test

a. Objectivity: Meaning and nature
b. Evaluation Process: Concept, Types (Formative and Summative)
c. Concept of Gradation and Credit system.

Suggested Readings:

Asthana, Bipin(2016). Measurement and Evaluation in Psychology and Education.Amazon Publication.

Asthana, Bipin(2016).Measurement Evaluation and Assessment in Education.Amazon Publication.

Best, J. W. & Kahn, J. V. (1989).Research in Education, (6th edition). New Delhi: Prentice Hall.

Koul, L. (1998). Methodology of Educational Research. New Delhi: Vikash Publications.

Pathak, R. P. (2012). Measurement and Evaluation in Education.Pearson India.

Priyadarsaini, J. R., and Swarupa Rani, T. (2004).Educational Measurement and Evaluation (01st Edition).Discovery Publishing House Pvt. Ltd.

Puvvada George Raja Kumar (2012). Measurement and Evaluation in Education And Psychology. APH Publishing Corporation.

Radha Mohan (2016). Measurement, Evaluation and Assessment in Education.Amazon Publication.

Singh, A. K. (2009). *Tests, Measurements and Research Methods in Behavioural Sciences.*BharatiBhawan, New Delhi.

Sukla, S. P., & Others (1974).Elements of Educational Research. (3rd edition), Bombay: Allied Publishers.

VidyaSagar, J. (2016). Measurement and Evaluation in Education.Amazon Publication.

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BEDCMAJ15T**
Course Title: **Teacher Education**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Understand the Meaning, Nature and Scope of Teacher Education. Understand the Need and Importance of Teacher Education. Explain the role of various ag**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Understand the Meaning, Nature and Scope of Teacher Education. Understand the Need and Importance of Teacher Education. Explain the role of various ag**

M-XV

Teacher Education

[Credit: 5+1]

Learning Objective and Learning Outcome:

After completion of the course the students shall be able to:

i. Understand the Meaning, Nature and Scope of Teacher Education.
ii. Understand the Need and Importance of Teacher Education.
iii. Explain the role of various agencies of Teacher Education.
iv. Know and understand the concept of profession and professionalism.
v. Know the characteristics of professional teaching.

Course Contents:

UNIT-I: Concept of Teacher Education

a. Meaning and Nature of Teacher Education
b. Need and Scope of Teacher Education
c. Changing Context of Teacher Education in the Indian Scenario

UNIT-II: Development of Teacher Education in India

a. Teacher Education in Pre-Independence India
b. Teacher Education in Post-Independence India
c. Problems of Teacher Education and suggestions for improving conditions of Teacher Education in India

UNIT-III: Agencies of Teacher Education

a. SCERT, UGC, NCTE and UNESCO
b. Concept of Profession and Professionalism – Teaching as the noblest profession
c. Characteristics of professional teaching

Suggested Books:

Arora, G. L. (2002). Teachers and Their Teaching.New Delhi, Ravi Books.
Chaurasia, Gulab (2000). Teacher Education and Professional Organizations. New Delhi, Authors press.
Elahi, Nizam (1997). Teacher's Education in India New Delhi, APH Publishing Corporation.
Kohli V.K. (1992). Teacher Education in India, Ambala (India), Vivek Publishers.
Kundu, C. L. (1998). Indian Year Book on Teacher Education. New Delhi, Sterling Publishers Privatization Ltd.
Mangla, Sheela (2000). Teacher Education: Trends & Strategies. New Delhi.
Misra, K. S. (1993). Teachers and Their Education AmbalaCantt., The Associated Publishers.

Mohan, Radha (2011). Teacher Education. New Delhi: PHI Learning Private limited.
Mohanty, J. (2003). Teacher Education.Deep and Deep Publications Pvt. Ltd. New Delhi.
National Council for Teacher Education (NCTE) (1998) NCTE Document New Delhi, Published by Member Secretary, NCTE.
Passi, B. K. (1976). Becoming a Better Teacher, microteaching Approach. Amedabad: Sahitya Mudranalaya.
Raina, V. T. (1998). Teacher Education: A Perspective, Guwahati: Eastern Book House.
Shankar, V. (1984). Education of Indian Teachers, New Delhi: Sterling Publishers.
Sharma, ShashiPrabha (2004). Teacher Education in India, Vikas Publications, New Delhi.
Singh, L. C. (1990). Teacher Education in India: A Resource Book. New Delhi, NCERT.

Syllabus *(EDUCATION)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BEDCMAJ16T**
Course Title: **Education to Include the Excluded**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the concept, meaning and need of Inclusive Education. Explain the causes of inequality in education and role of education to remove inequality in**
Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the concept, meaning and need of Inclusive Education. Explain the causes of inequality in education and role of education to remove inequality in**

M-XVI

Education to Include the Excluded

[Credit: 5+1]

Learning Objective and Learning Outcome:
After completion of the course the students shall be able to:

i. Know the concept, meaning and need of Inclusive Education.
ii. Explain the causes of inequality in education and role of education to remove inequality in education.
iii. Know and understand the importance of students' prior knowledge, life experiences, and interests in achieving learning goals.
iv. Know and understand of how to create and maintain effective environments in classroom as well as in school.
v. Know and understand of how to plan instruction and design learning experiences for learners.

Course Contents:
UNIT-I: Inclusive Education and Standard for Engaging all Students in Learning

a. Inclusive Education: Meaning, Need and Programme
b. Equality and Equity in Education: Meaning, importance, causes of inequality, Role of education to remove inequality in education
c. Connecting students' prior knowledge, life experiences, and interests with learning goals

UNIT-II: Standard for Creating and Maintaining Effective Environments

a. Creating a physical environment that engages all students;
b. Establishing a climate that promotes fairness and respect behaviours in a fair, equitable way

c. Promoting social development and group responsibility

UNIT-III: Standard for Planning Instruction and Designing Learning Experiences

a. Drawing on and valuing students' backgrounds, interests, and developmental learning needs
b. Establishing and articulating goals for student learning
c. Developing and sequencing instructional activities and materials for student learning

Suggested Books:

Agarwal, Rashmi (2010). Learning Disabilities.Shipra Publication.

Bhave, Asawari, et al. (2015). Inclusive Education.Success Publications.

Chowdhury, Piku (2015). Inclusive Education; Policy, Practice and Prospects. Authorspress.

Das, A. - Inclusive Education: A Contextual Working Model. Concepts Publication.

Dash, Neena (2006).Inclusive Education for Children with Special Needs. Atlantic.

Farrell, Peter (2008). Psychology for Inclusive Education: New Directions in Theory and Practice. Taylor & Francis Ltd.

Goel, Sushil Kumar (2015). Inclusive Education For Special Children. Pointer Publishers, Jaipur.

Goel, Sushil Kumar (2015). Teaching Children with Learning Disabilities.Aavishkar Publishers, Distributors, Jaipur.

Hallahan, D., Kauffman, J., &Lyod, J. (1985).Introduction to Learning Disabilities (2nd Edition). Englewood Cliffs, NJ: Prentice Hall.

Mangal, S. K. (2009). Educating Exceptional Children: An Introduction to Special Education (1st Edition). Phi Learning.

Menon (2010).Learning Disabilities.Aph Publishing Corp.

Prakash, Prem (2006). Educational of Exceptional Children.Kaniska Publication.

Ranganathan, Namita (2012). Education for Mental Health.ShipraPrakashan.

Samuel A. Kirk, Nicholas J. Anastasiow, James J. Gallagher, Mary Ruth Coleman (2012). Educating Exceptional Children (13th Edition). Wadsworth.

Shankar, U. (1976). Exceptional Children. New Delhi: Sterling Publishers.

Sharma, ShashiPrabha (2006). Fundamental of Mental Health Education.Kaniska Publication.

Singh, Udai Veer (2010). Exceptional Children, RvS Books.

Tannenbaum, I. M. (1983).Gifted Children: Psychological and Educational Perspectives. New York: Macmillan.

Tewari, Rajshree, and Tewari, Aradhana (2015).Learning Disabilities.Pointer Publishers, Jaipur.

Tripathy, S. N.- Education for the Excluded Children. Abhijeet Pub.

Syllabus *(EDUCATION)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BEDCMAJ17T**
Course Title: **Computer Application in Education**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the definitions, characteristics and applications of computer. Know and understand the various important components of computer and its Input and**

Learning Outcome: **Learning Objective and Learning Outcome: After completion of the course the students shall be able to: Know the definitions, characteristics and applications of computer. Know and understand the various important components of computer and its Input and**

M-XVII

Computer Application in Education

[Credit: 5+1]

Learning Objective and Learning Outcome:

After completion of the course the students shall be able to:

i. Know the definitions, characteristics and applications of computer.
ii. Know and understand the various important components of computer and its Input and Output Devices.
iii. Know and understand the Basic Components of Windows.
iv. Manage files and folders, Control panel – display properties, add/remove software and hardware, set date and time, screensaver and appearance.
v. Know and understand about various functions of Microsoft office word.
vi. Know and understand about Internet and its various applications.
vii. Know and understand of how to Create Email Id, View an E-Mail, Send an E-Mail to a single and multiple users, Send a file as an attachment.

Course Contents:

UNIT-I: Computer

a. Definition, Characteristics, Applications
b. Components of Computer System, Input/Output Devices
c. Concept of Memory, Magnetic and Optical Storage Devices

UNIT-II: Operating System and Word Processing

a. Definition & Functions of Operating System
b. Basic Components of Windows, Managing files and folders, Control panel – display properties, add/remove software and hardware, setting date and time, screensaver and appearance.
c. Introduction to Word Processing, Menus, Creating, Editing & Formatting Document, Spell Checking, Printing, Views, Tables, Word Art, Mail Merge, Excel and PPT.

UNIT-III Computer Communication

a. Internet and its applications
b. Surfing the Internet using web browsers
c. Creating Email Id, Viewing an E-Mail, Sending an E-Mail to a single and multiple users, Sending a file as an attachment.

Suggested Books

Dromey, R.G., How to Solve it By Computer, PHI
Microsoft Office – Complete Reference – BPB Publication
Sinha, P. K. &Sinha, Priti, Computer Fundamentals, BPB

Syllabus *(EDUCATION)*

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BEDCMAJ18T**
Course Title: **Competency-Based Education**

(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Learning Objective and Learning Outcome: Over the course students will: Be able to operate confidently in a knowledge-based economy and a rapidly changing environment. Be confident and productive individuals able to work with others and contribute to so**
Learning Outcome: **Learning Objective and Learning Outcome: Over the course students will: Be able to operate confidently in a knowledge-based economy and a rapidly changing environment. Be confident and productive individuals able to work with others and contribute to so**

M-XVIII

Competency-Based Education

[Credit: 5+1]

Learning Objective and Learning Outcome:

Over the course students will:

i. Be able to operate confidently in a knowledge-based economy and a rapidly changing environment.
ii. Be confident and productive individuals able to work with others and contribute to society.
iii. Proud and responsible: proud of their rich heritage and able to take their place effectively in the wider world.

Course Contents:

UNIT-I: Competency

a. Conceptual Framework
b. Types of Competency – Economic, Social, Political and Psychological
c. Competency Development Strategies – Self Regulated Learning, Phenomenological Pedagogy, Life-Long Learning, Analysis of History, Heritage and Culture

UNIT-II: Capability and Functioning

a. Relationship between Capability and Functioning
b. Knowledge-based economy and a rapidly changing environment – Developing creative and critical thinking, problem solvingskills, pro-activeattitudes and learningtolearnskillsfromalife-long learningperspective
c. Addressing both the learner needs and the requirements ofnationaldevelopment – plans,includingthepresentand future needs of the labourmarket

UNIT-III: High Quality Education for All

a. Human Right Education – Development of the learner's skills and attitudes towards respecting humanrights
b. Addressing changes/new developments at the local and international levels – through dissemination of up-to-date knowledge
c. Building enlightened citizenship based on the principles and practices of democracy, freedom and social justice

Suggested Readings:

Biggs, J., & Tang, C. (2007).Teaching for quality learning at university. UK: Open University Press. Bloom, B. S. (1956).Taxonomy of educational objectives. Handbook I: Cognitive domain. New York: David

Bloom, B. S. (1968).Learning for mastery. Evaluation Comment, 1, 1–11.

Bolander, K., Josephson, A., Mann, S., et al. (2006). Teachers promoting expertise in medical education: Understanding the role of the core curriculum. Quality in Higher Education, 12, 41–55.

Carraccio, C., Wolfsthal, S. D., Englander, R., et al. (2002). Shifting paradigms: From Flexner to competencies. Academic Medicine, 77, 361–367.

Gagne´, R. M., Briggs, L. J. (1974). Principles of instructional design. London: Holt, Rinehart and Winston.

Hodge, S. (2007).The origins of competency-based training. Australian Journal of Adult Learning, 47, 179–209.

Mager, R. F. (1997).Preparing instructional objectives. Georgia: CEP Press.

Spady, W. G. (1988).Organising for results: The basis of authentic restructuring and reform. Educational Leadership, October, pp 4–8.

Spady, W. G. (1994). Outcome-based education: Critical issues and answers. American Association of School Administrators, USA.

Stenhouse, L. (1975). An introduction to curriculum research and development. London: Guilford.

Tooke, J. (2008). Aspiring to excellence.Findings and final recommendations of the independent inquiry into modernising medical careers. London: MMC Inquiry.

Tyler, R. W. (1949). Basic principles of curriculum and instruction. Chicago: The University of Chicago Press.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(ENGLISH)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BENGMAJ101**
Course Title: **History of English Literature: Old English to Shakespeare (with Social History) & Literary Types and Literary Terms related to that period**
(L-P-Tu): **501**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To introduce History of English Literature as a major basic of understanding literature**
Learning Outcome: **On successful completion of the Programme, the students will have a comprehensive knowledge of a portion of History of English Literature and related literary Types**
History of English Literature: Old English to Shakespeare (with Social History) &
Literary Types and Literary Terms related to that period
Literary Types & Terms: Epic poetry, Ballad, Tragic Drama, Revenge Play, Tragic Flaw, Comedy, Romantic Comedy, Pastoral Comedy, Comedy of Humours, Comedy of Manners, Sonnet, Elegy, Masque, Essay, Romance
Image (Auditory/Visual/Tactile/Gustatory/Olfactory), Symbol, Simile, Metaphor, Irony, Allegory, Soliloquy

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.

- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency

2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(ENGLISH)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BENGMAJ2**
Course Title: **British Poetry and Drama: 14th to 17th Centuries**
(L-P-Tu): **502**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To encourage students to make a detailed study of a few sample masterpieces of English Drama and Poetry from 14th to 17th century in order to develop an interest among the students to appreciate and analyze drama and poetry independently**
Learning Outcome: **Students will develop an understanding of poetry and drama of this specific period**
1. Geoffrey Chaucer: The Wife of Bath's Prologue from The Canterbury Tales (Nevill Coghill)
Philip Sydney: from Astrophel and Stella: Sonnet no 1
Edmund Spenser: from Amoretti: Sonnet LXXV 'One day I wrote her name...'
Shakespeare: Sonnet no. 64 & 130
2. William Shakespeare: Macbeth
3. William Shakespeare: As You Like It
4. Francis Bacon: "Of Studies", "Of Friendship"

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(ENGLISH)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **ENGMAJ301**
Course Title: **History of English Literature: Jacobean to Pre-Romantic age**
(L-P-Tu): **3-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Will provide students valuable background information that will enable them to understand and appreciate individual works from Jacobean to Pre-Romantic Age better. The syllabus will also help them develop a sense of history and the ability to organise, evaluate and present ideas from one coherent body of knowledge. It will also help them to comprehend poetry better through an in depth understanding of Rhetoric and Prosody.**
Learning Outcome: **The students will learn • How people lived during the Jacobean to Pre-Romantic Age in Britain. • What sort of social and political organisations evolved there. • What kind of literature emerged out of these conditions. • Rhetoric and Prosody**
History of English Literature: Jacobean to Pre-Romantic age (with Social History)
Rhetoric & Prosody

Syllabus *(ENGLISH)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BENGMAJ401**
Course Title: **British Poetry and Drama: 17th and 18th Centuries**
(L-P-Tu): **4-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• To enable the students to read, analyse and appreciate poetry and drama of 17th and 18th century • To sensitize them to the verbal and visual language of drama • To enhance students awareness in the aesthetics of poetry and to empower them to read, appreciate and critically evaluate poetry independently • To encourage students to make a detailed study of a few sample masterpieces of English poetry and drama of this period**
Learning Outcome: **On completion of the Course, the students should be able to • identify the various forms and schools of poetry and drama • analyse and appreciate poetry and drama • write critically about and engage actively in producing / performing drama**
British Poetry and Drama: 17th and 18th Centuries
1. John Milton: Paradise Lost: Book 1
2. John Donne: “The Sun Rising”, “Batter My Heart”
3.Andrew Marvell: “To His Coy Mistress”

4. Alexander Pope: The Rape of the Lock (Canto 1)
5. Oliver Goldsmith: She Stoops to Conquer

Syllabus *(ENGLISH)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BENGMAJ402**
Course Title: **History of English Literature: Romantic and Victorian period**
(L-P-Tu): **4-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Will provide students valuable background information that will enable them to understand and appreciate individual works from Romantic to Victorian Age better. The syllabus will also help them develop a sense of history and the ability to organise, evaluate and present ideas from one coherent body of knowledge. It will also help them to comprehend literary productions of the period through an in depth understanding of literary types**
Learning Outcome: **The students will learn • How people lived during the Romantic and Victorian Age in Britain. • What sort of social and political organisations evolved there. • What kind of literature emerged out of these conditions. • Different literary forms that evolved during this period**
History of English Literature: Romantic and Victorian period and
Literary Terms related to this period.
Literary types & Terms:
Mock Epic, Ode, Dramatic Monologue, Synesthesia, Negative Capability, Egotistical Sublime, Pantheism, Novel, Novel of Sensibility, Sentimental Comedy, Narrative Technique, Point of View (First/Second/Third Person Narrator),

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BGEOMAJ01C**
Course Title: **Introduction to Physical Geography & Elementary Practicals in Geography**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **The course offers a basic understanding about the principal characteristics of the physical environment of the Earth. To understand the evolution of landscape and landforms over time. To understand the idea of different types of Map Scale. To assess landf**
Learning Outcome: **The students will be able to identify different landscape evolved from different geomorphic processes. Student will be able to explain and interpret different land forms of the earth. Students will learn about the application of scale in geographic studie**

Course Title: Introduction to Physical Geography

Paper Type: Theoretical Course Credit: 4

Unit I: Our Earth and the Physical Environment [26 Hours]

1.1 Interior of the Earth; Earth's tectonic and structural evolution through Geological Time Scale (6 lectures)

1.2 Earth's atmosphere: Insolation; Pressure Belts; Planetary wind System; Greenhouse Effect and Global Warming. (8)

1.3 Earth's hydrosphere: Global hydrological cycle; Ocean circulation – major ocean currents. (4 lectures)

1.4 Earth's Biosphere: Biogeographical realms of the world; Soils – Zonal, Azonal and Intrazonal; Classification of forest (Champion). (8 lectures)

Unit II: Landforms and Landscape [26 Hours]

2.1 Landforms: Types & Order. Concept & Theory of Isostasy (Airy & Pratt). Geomorphic Processes (6 lectures)

2.2 Landforms due to Endogenic forces: Plate Tectonics and associated Landforms; Seismicity & Vulcanicity; Landform evolution in Uniclinal, Folded and Faulted structure (8 lecture)

2.3 Landforms due to Exogenic Processes: Weathering & Mass Movement (4 lectures)

2.4 Fluvial, Glacial, Aeolian, Coastal and Karst landscapes; Landscape evolution models: Davis, Penck and Hack (8 lectures)

Selected References:

1. Singh, Savindra 2020 Physical Geography. Pravalika Publications
2. Frisch, W., Meschede, M., Blakey, R.C. 2011. Plate Tectonics: Continental Drift and Mountain Building. Springer.
3. Goudie, A.S. (Ed) 2004. Encyclopedia of Geomorphology, vol. 1 and 2, Routledge.
4. Kale, V.S., Gupta, A. 2001. Introduction to Geomorphology, Orient Longman.
5. Selby, M.J. 1986. Earth's Changing Surface, Oxford University Press.
6. Strahler, A. 2016. Introducing Physical Geography, 6th ed, Wiley.
7. Summerfield, M.J. 2003. Global Geomorphology: An Introduction to the Study of landforms, Longman.
8. Thornbury, W.D. 1969. Principles of Geomorphology, 2nd ed, Wiley-India / CBS.
9. Barry, R.G., Chorley R.J. 2009. Atmosphere Weather and Climate. 9th Ed, Routledge.
10. Critchfield, H. J. 1983. General Climatology. Prentice Hall India Ltd (2010 Reprint).
11. Lal, D.S. 2012. Climatology. Sharda Pustak Bhawan.
12. Oliver, J.E., Hidore, J.J. 2002. Climatology: An Atmospheric Science, Pearson Education India.
13. Parihar, S & Bunett RB 2019 Physical Geography through Diagrams Pearson Education; Fourth edition

Course Title:Elementary Practicals in Geography

Paper Type: Practical Course Credit: 2

Unit I: Scale, Minerals and Rocks [22 Hours]

1.1 Concept and classification of Map Scales

1.2 Construction and use of scales: Simple linear, Comparative linear, Diagonal and Vernier

1.3 Megascopic identification of Mineral samples: Bauxite, Calcite, Chalcopyrite, Feldspar, Galena, Gypsum, Hematite, Magnetite, Mica, Quartz, Talc, Tourmaline

1.4 Megascopic identification of Rock samples: Granite, Basalt, Dolerite, Laterite, Limestone, Shale, Sandstone, Conglomerate, Slate, Phyllite, Schist, Gneiss, Quartzite, Marble.

Unit II: Interpretation of Geological Map [30 Hours]

2.1 Basic ideas and conventional symbols. Choice of section line; series and unconformity; strike and dip; topography; rules of three-point problems for measuring dip.

2.2 Drawing of geological section - Horizontal, Uniclinal with unconformity, and Simple folded structure.

2.3 Interpretation of geological section based on a) topography; b) sequence of beds; c) attitude of beds d) structure of beds e) correlation between structure and topography; f) geological history

Project File

a) Construction of Scales: Simple linear, Comparative scale, Diagonal & Vernier.
b) Identification of Minerals and Rocks.
c) Drawing and interpretation of geological section - Horizontal, Uniclinal with unconformity, & Simple folded structure.

Selected References:

1. Basak, N.N. 2017. Surveying and Levelling, 2nd ed, McGraw Hill Education.
2. Kanetkar, T.P., Kulkatni, S.V. 1988. Surveying and Levelling, Part I, Pune Vidyarthi Griha Prakashan.
3. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Pvt. Ltd.
4. Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publishers
5. Subramanian, R. 2012. Surveying and Levelling, 2nd ed, Oxford University Press.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**

Semester: **1**

Course Code: **BVACENV01T**

Course Title: **ENVIRONMENTAL STUDIES**

(L-P-Tu): **2-2-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**

Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification

- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)

4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-2**

Semester: **2**

Course Code: **BGEOMAJ02C**

Course Title: **Introduction to Human Geography & Map Projection and Topographical Sheet**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **To have a comprehensive understanding of human aspects of geographical phenomena and their interface. To introduce the different dimensions related to population, culture, and settlement. To understand the idea of different types of Map projections. To**

Learning Outcome: **Students will have a better understanding of the man-environment relation, from local to global scale. Students will be able to understand various contemporary developmental issues. Students will learn about the map projection. Students will analyze and i**

Course Title: Introduction to Human Geography

Paper Type: Theoretical Course Credit: 4

Unit I: Fundamentals of Human Geography [26 Hours]

1.1 Nature, scope and development of human geography.

1.2 Evolution of Man-Nature interaction: Hunting and Food gathering, Pastoral nomadism, Agrarian society and industrial society. Man-environment relationship in Equatorial, Monsoon, Tundra and Hot desert regions.

1.3 Race and ethnic groups: Concept, origin and distribution.

1.4 Language, religion and culture: Origin, diffusion and distribution

Unit II: Population, Settlement and Development [26 Hours]

2.1 Population geography and demography. Population growth and composition.

2.2 Types and patterns of rural and urban settlement. Morphology of Urban settlement.

2.3 Poverty and Food Security. Natural hazards and Environmental refugee.

2.4 Indicators of social well-being; Human Development, Sustainable Development Goals.

Selected References:

1. Blij, H.D. 1992. Human and Economic Geography, Macmillan Publishing Company.
2. Hussain, M. 2003. Human Geography, Rawat Publications, Jaipur.
3. Leong, G.C. 1997. Human and Economic Geography, Oxford University.
4. Singh, L.R. 2005. Fundamentals of Human Geography, Sharda Pustak Bhawan, Allahabad.
5. Maurya, S.D. 2012. Human Geography, Pravalika Publications, Allahabad.
6. Singh, R.B. (Ed) 1995. Studies in Environment and Development, Rakesh Prakashan, Varanasi.
7. UNDP. 2001-04. Human Development Report, Oxford University Press.
8. Knowles R 1990 ECONOMIC AND SOCIAL GEOGRAPHY MADE SIMPLE, Rupa Publication
9. Pacione, M. 2009. Urban Geography: A Global Perspective, Routledge.
10 Knox, P.L., Marston, S.A. 2014. Human Geography: Places and Regions in Global Context, 6th ed, Pearson Education Limited.
11. Knox, P.L., McCarthy, L.M. 2011. Urbanization: An Introduction to Urban Geography, 3rd ed, Pearson Educztuion Ltd.
12. Mandal, R.B. 2001. Introduction to Rural Settlement, 2nd ed, Concept Publishing Company.

Course Title: Map Projection and Topographical Sheet

Paper Type: Practical Course Credit: 2

Unit I: Map Projection [26 Hours]

1.1 Concept of Geoid and Spheroid; Datum with special reference to Everest and WGS-84 Coordinate systems: geographic, projected and local.

1.2 Concept of generating globe; Grids: Angular and linear systems of measurement. Bearing: Magnetic and true, whole-circle and reduced, Map projections: Classification,
properties and uses.

1.3 Concept and significance of UTM projection

1.4 Polar Zenithal Gnomonic and Stereographic, Simple conic with one standard parallel, Bonne's, Cylindrical Equal Area, and Mercator's

Unit II: Interpretation of Topographical Map [26 Hours]

2.1 Numbering systems in Topographical map (Metric and OSM).

2.2 Extraction and interpretation of geomorphic information: Construction of relief profiles (superimposed, projected and composite), and identification of micro landform features

2.3 Delineation of drainage basins: Relative relief map, slope map (Wentworth's method), drainage density map, stream ordering (Strahler) and bifurcation ratio on a drainage basin.

2.4 Transect chart.

Project File

a) Construction of projections: Polar Zenithal Gnomonic and Stereographic, Simple conic with One Standard parallel, Bonne's, Cylindrical Equal Area, and Mercator's.
b) Develop Broad Physiographic Divisions, Construction of Relief profiles (superimposed, projected and composite).
c) Preparation of relative relief map, slope map, drainage density map, and stream ordering on a drainage basin.
d) Correlate Physical aspects with Cultural landscape using Schematic Map, Transect chart.

Selected References:

1. Manual, International Cartographic Association, Elsevier Science Publishers..
2. Mishra, R.P., Ramesh, A. 1989. Fundamentals of Cartography, Concept, New Delhi..
3. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed, Orient Blackswan Private Ltd.
4. Singh, R.L., Singh, R.P.B. 1999. Elements of Practical Geography, Kalyani Publishers.
5. Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publisher
6. Subramanian, R. 2012. Surveying and Levelling, 2nd ed, Oxford University Press

Syllabus *(ENGLISH)*

Course Type: **AEC-1**

Semester: **2**

Course Code: **BAECLEN02T**

Course Title: **Communicative English**

(L-P-Tu): **4-0-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**

Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-3**

Semester: **3**

Course Code: **BGEOMAJ03C**

Course Title: **Course Title: Introduction to Climate, Soil and Biogeography & Geographical Survey through Instruments**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **To introduce about basic concepts of climate, soil and biogeography. To perceive the spatial distribution of biotic and abiotic components. able to record weather data, and analyze soil and water quality. To learn about surveying and leveling techniques t**

Learning Outcome: **Students will develop fundamental understandings of the atmosphere. Students can evaluate different aspects of floral and faunal distribution on the earth. Students will be able to analyze soil and water quality, and suggest measures for the sustainable u**

Course Title: Introduction to Climate, Soil and Biogeography

Paper Type: Theoretical Course Credit: 4

Unit I: Introduction to Climatology [26 Hours]

1.1 Concept of atmospheric sciences; Composition and Structure of the Atmosphere; Forms of Energy in the Atmosphere. (5 lectures)

1.2 Insolation and its influencing factors; Global Heat Budget; Horizontal and Vertical distribution of Temperature. (5 lectures)

1.3 Concept of Atmospheric Pressure; Pressure belts; factors influencing Air Motion; General Wind Circulation of the atmosphere with reference to Tri-cellular model and Jet stream.

1.4 Condensation, Precipitation, classification of climate (Koppen & Thornthwaite) (8 lectures)

Unit II: Introduction to Soil and Bio Geography [26 Hours]

2.1 Soil as a natural body; Physical and chemical properties of soils; Soil forming factors; Profile development (6 lectures)

2.2 Development of Soils: Laterite, Podzol, and Chernozem soil. Soil classification: genetic and USDA. Soil degradation and management. .(6 lectures)

2.3 Concepts and principles of ecology. Components of ecosystem; Ecosystem Hierarchy: individual, population, species, community. Concept and type of Trophic structure; food chain, food web; energy flow models in ecosystem. (7 lectures)

2.4 Biomes: Tropical Rain Forest, Grassland and Taiga. Bio-geochemical cycles: oxygen, carbon and nitrogen. Biodiversity: types, significance, threats and conservation (7 lectures)

Selected References:

1. Lal, D.S. (2006). Climatology. Chaitanya Publishing House.
2. Siddhartha, K. (2012). Atmosphere, Weather and Climate: A Text Book of Climatology. Kisalaya Publications Pvt. Ltd.
3. Oliver, J.E., and J. J. Hidore, J.J. (2011). Climatology: An Atmospheric Science,. Pearson.
4. Wild, A. (2006). Soils and the Environment.. Cambridge University Press.
5. Brady, N.C., and R. R. Weil, R.R. (1996). The Nature and Properties of Soils,. Prentice-Hall, Inc.
6. Kormondy, E.J. (1996). Concepts of Ecology. PHI Learning Pvt. Ltd.
7. Critchfield 2011 General Climatology , PHI

Course Title: Geographical Survey through Instruments

Paper Type: Practical Course Credit: 2

Unit I: Weather Instruments and Soil-Water Analysis [20 Hours]

1.1 Six's Maximum & Minimum Thermometer, Barometer and Hygrometer. (5 lectures)

1.2 Climograph (After G. Talyor), Identification of Continental-Maritime Climate from Climatic data/ Graph, Synoptic Chart. (5 lectures)
1.3 Collection of soil samples from field and develop Soil Nutrient Map. (5 lectures)
1.4 Collection of water samples from field and develop Water Quality Map. (5 lectures)

Unit II: Relief and Height Determination [32 Hours]

2.1 Definition scope and type of surveying, Survey instrument to measure angle direction, area and distance of object on ground. Measurement and mapping of a plot by Chain Survey (6 lectures)
2.2 Prismatic compass: The instrument; Method of taking reading; correction of data observed; Open traverse; plotting; closed traverse; plotting; correction of plotting error (Bowditch's
correction); interior angles and whole circle bearing; calculation of area of closed traverse; advantages and disadvantages. (8 lectures)
2.3 Leveling: definition; instrument used; dumpy level; the staff; taking reading through a dumpy level, determination of reduced level by rise and fall method and by collimation
method; checking of data; plotting of data; drawing of profile. Contouring: contouring by radial lines; contouring by cross sections. (10 lectures)
2.4 Theodolite: components; measurement of article angles; measurement of horizontal angle (only for traversing); Measurement of high transistence-1. Base accessible. 2. Base
inaccessible – (a) same vertical plan and (b) oblique plan methods (8 lectures)

Project File

a) Recording and tabulation of data on atmospheric temperature, pressure and humidity. Construction and interpretation of Climograph. Preparation of synoptic chart.
b) Preparation of soil nutrient map and water quality map based on primary data collection.
c) Mapping a Closed Traverse by Prismatic Compass, Profile and Contouring by Dumpy Level Survey.
d) Determination of Height of an Object by Theodolite survey.

Selected References:

1. Manual, International Cartographic Association, Elsevier Science Publishers.
2. Mishra, R.P., Ramesh, A. 1989. Fundamentals of Cartography, Concept, New Delhi.
3. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed. Orient Blackswan Private Ltd.
4. Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publisher
5. Subramanian, R. 2012. Surveying and Levelling, 2nd ed. Oxford University Press

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BGEOMAJ04C**
Course Title: **Resource and Population & Thematic and Cadastral Mapping**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **To make the students aware about the importance of resources and its utilization. To educate the students about the variations in economic activities . To educate students about changing spatial patterns, growth, determinants, theories, and policies of po**
Learning Outcome: **Students will achieve an understanding of different types resources and their judicious and sustainable utilization. Students will be able to analyze the variations in economic activities, and evaluate a couple of models describing the location of such a**

Course Title: Resource and Population
Paper Type: Theoretical Course Credit: 4

Unit I: Resource and Economic Activities [24 Hours]

1.1 Concept and classification of resources; Functional theory of resource; Conservation and management of resources; Classification of economic activities (6 lectures)
1.2 Primary activities: Agriculture (subsistence and commercial agriculture), Forestry, Fishing and Mining. Von Thunen's Model of Agriculture Location. (6 lectures)
1.3 Secondary activities: Manufacturing (Cotton textile, Iron and Steel, Petrochemical), SEZ, Theory of Industrial Location

(Weber). (6 lectures)
1.4 Tertiary activities: Transport and trade; Role of WTO, IMF and World Bank (6 lectures)

Unit II: Population Geography [28 Hours]

2.1 Concept and scope of population geography; Determinants and factors of population growth and distribution. (6 lectures)
2.2 Trend of population growth in the world and India; Concept of fertility, mortality and migration. (8 lectures)
2.3 Theories of population growth: Malthus, Marx and Demographic Transition Model. (8 lectures)
2.4 Population policies in developing counties with special references to India. (6 lectures)

Selected References:

1. Hassan, M.I. 2020. Population Geography: A Systematic Exposition, Routledge
2. Bhende, A.A. Kanitkar, T. 2011. Principles of Population Studies, Himalaya Publishing House, New Delhi.
3. Maurya, S.D. 2017. Population Geography, Pravalika Publication, Allahabad.
4. Chandna, R.C. 2015. Geography of Populations, Kalyani Publishers.
5. Alexander, J.W. 1963. Economic Geography, Prentice-Hall Inc., Englewood Cliffs, New Jersey.
6. Hartshorn, T. Alexander, J.W. 2000. Economic Geography, 3rd Edition, Prentice Hall of India, New Delhi.
7. Combes P., Mayer T.. Thisse, J.F. 2008. Economic Geography: The Integration of Regions and Nations, Princeton University Press.
8. Guha, J.L., Chattoraj, P.R. 2009. A New Approach to Economic Geography – A Study of Resources, World Press, Kol.
9. Siddhartha, K. 2018. Economic Geography, Kitab Mahal, Allahabad.
10. Saxena, H.M. 2018. Economic Geography, 2nd Edition, Rawat Publications, Jaipur.
11. Paul Knox, John Agnew, Linda Mccarthy 2014 The Geography of the World Economy Routledge London

Course Title: Thematic and Cadastral Mapping

Paper Type: Practical Course Credit: 2

Unit I: Thematic Mapping: Fundamental Concept [20 Hours]

1.1 Concepts of rounding, scientific notation, logarithm and anti-logarithm, natural and log scales. (5 lectures)
1.2 Cartography: meaning, rules and methods of geographical data representation. (5 lectures)
1.3 Types of diagrams, graph, distribution maps and cartogram. (5 letures)
1.4 Concept of Large-scale thematic maps (5 lectures)

Unit II: Thematic Mapping: Database Application [32 Hours]

2.1 Point and Line Symbol: Size of Dots, Flow Map (6 lectures)
2.2 Area Symbol: Pie Diagram (6 lectures)
2.3 Volume Symbol: Sphere Map (6 lectures)
2.4 Geomorphological maps from Toposheet and Cadastral map: Identification of plots and verification in the field (14 lectures)

Project File

a) Preparation of Dot map (Population Size) and Flow Diagram (Traffic/ Goods Flow)
b) Develop Comparative Pie Diagram (Area related issues) and Sphere Map (Urban Population).
c) Mapping Geomorphological maps from Toposheet
d) Cadastral map: Identification of plots and verification in the field.

Selected References:

1. Manual, International Cartographic Association, Elsevier Science Publishers.
2. Mishra, R.P., Ramesh, A. 1989. Fundamentals of Cartography, Concept, New Delhi.
3. Sarkar, A. 2015. Practical Geography: A Systematic Approach, 3rd ed. Orient Blackswan Private Ltd.
4. Singh, R.L., Singh, R.P.B. 2008. Elements of Practical Geography, Kalyani Publisher.

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BGEOMAJ05S**
Course Title: **Statistical Techniques in Geography**
(L-P-Tu): **0-6-0**
Credit: **6**
Practical/Theory: **Practical**

Course Objective: **Obtain knowledge on fundamental concepts of statistics. Understand the computation of univariate and bivariate statistical analysis of geographical data. Acquire knowledge about the process of interpretation of quantitative data.**

Learning Outcome: **Students will be able to apply statistical techniques in geographical inquiry. Student will be able to understand the methods and techniques of data collection, organization, and analysis. Student will be able to present scientific arguments based on quan**

Unit I: Univariate Analysis [70 Hours]

1.1 Data and Information, Data type, Scale of measurements, Sources of data, Data collection methods, Classification and Tabulation of data. (18 lectures)

1.2 Frequency distribution: Histogram, Frequency Curve, Frequency Polygon, Cumulative Frequency, Ogive. (18 lectures)

1.3 Central tendency: Mean (arithmetic, geometric, and harmonic), Median, Mode; Partition Values. (17 lectures)

1.4 Measures of Dispersion: Range, Mean Deviation, Standard Deviation, Coefficient of Variation and Moments. Shape and Spread: Skewness, Kurtosis. (17 lectures)

Unit II: Bivariate Analysis [86 Hours]

2.1 Association and correlation: Rank correlation, product moment correlation. (15 lectures)

2.2 Regression: Linear, Curvilinear, Parabolic and Geometric. (25 lectures)

2.3 Z-score, Residuals and Standard Error of Estimates. (20 lectures)

2.4 Time series analysis: Secular trend, Seasonal variation, Cyclical variation, Irregular variation, Semi-average, Moving average, Parabola. (26 lectures)

Project File

a) Frequency distribution table (ungrouped and grouped data): equal and unequal class; histogram; frequency polygon; ogive; graphical representation of mean, median, mode, quartile and percentile.

b) Measures of dispersion: mean deviation, standard deviation and coefficient of variation.

c) Correlation (Pearson and Spearman); Scatter diagram and plotting best-fit line using least-square method (linear); Z-score and Residual mapping.

d) Time series analysis using Semi average, Moving average and least square.

Selected References:

1. S. N. Pillai and Bagavathi (2007). Statistics: Theory and Practice. S. Chand Company Ltd.
2. N. G. Das (2017). Statistical Methods (Combined Edition). McGraw Hill Education Pvt. Ltd.
3. G. B. Wetherill (1972). Elementary Statistical Methods. Springer.
4. Harris Richard & Claire Jarvis 2011 Statistics for Geography and Environmental Science Paperback. Prentice Hall

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-6**

Semester: **5**

Course Code: **BGEOMAJ06T**

Course Title: **Hydrology and Oceanography**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **To focus on the fundamental hydrological components for environmental measurements. To brings out the elementary physical and chemical components of oceanography**

Learning Outcome: **Students will be able to apply concepts and instruments for the measurement of different hydrological parameters. Students will be able to understand and explain about the causes and consequences of different marine issues and hazards.**

Unit I: Fundamentals of Hydrology [26 Hours]

1.1 Definition, scope, content and evolution of hydrology. (4 lectures)

1.2 Surface and sub-surface hydrology: Interception, depression storage, infiltration and runoff -controlling factors; Runoff cycle. (8 lectures)

1.3 Drainage basin as a hydrological unit; Inter-basin water transfer. (6 lectures)

1.4 Groundwater: Occurrence, storage and movement; factors controlling recharge and discharge; aquifer properties (8 lectures)

Unit II: Applied Hydrology [26 Hours]

2.1 Concept and types of water harvesting. (6 lectures
2.2 Groundwater contamination and management. 6 lectures
2.3 Principles of micro-watershed management. 6 lectures
2.4 Water resource crisis, conflict and management. 8 lectures

Unit II: Fundamentals of Oceanography [26 Hours]

3.1 Major relief features of the ocean floor; Origin of oceans: seafloor spreading and plate tectonics. (6 lectures)
3.2 Physical and chemical properties of ocean water. Movements of ocean water: waves and tides (6 lectures)
3.3 Marine resources: Classification and sustainable utilization. Marine pollution: Causes, types & mitigation. (6 lectures)
3.4 Coral reefs: Theories of formation (Darwin and Daly), classification and threats. (8 lectures)

Selected References:

1. Dingman, S.L. 2015. Physical Hydrology, 3rd ed, Macmillan Publishing Co.
2. Garrison, T. 2016. Oceanography: An Invitation to Marine Science, 9th ed, Cengage Learning.
3. Karanth, K.R., 1988. Ground Water: Exploration, Assessment and Development, Tata- McGraw Hill.
4. Raghunath, H.M. 2006. Hydrology: Principles, Analysis, Design, 3rd ed, New Age International Publishers.
5. Reddy, P.J.R. 2014. A Textbook of Hydrology, University of Science Press.
6. Subramanya, K. 2013. Engineering Hydrology, McGraw Hill Education.
7. Todd, D.K., Larry, W.M. 2004. Groundwater Hydrology, John Wiley & Sons.
8. Ward, A.D., Trimble, S.W., Burckhard, S.R., Lyon, J.G. 2016. Environmental Hydrology, 3rd ed, CRC Press.
9. Sharma RC & M Vattal 2018 Oceanography for Geographers. SURJEET PUBLICATIONS.
10. Tom Garrison 2015 Oceanography: An Invitation to Marine Science. Brooks/Cole

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BGEOMAJ07S**
Course Title: **Field Report**
(L-P-Tu): **0-6-0**
Credit: **6**
Practical/Theory: **Practical**
Course Objective: **To introduce students to the principles of geography as a field science. To strengthen observation abilities of the students and educate them in field survey and data collection, data analysis utilizing various technologies, and advanced techniques. To**
Learning Outcome: **Students will be able to visualise spatial data utilising a variety of cartographic and mapping approaches . students will be trained to perform all levels of pre-field, field, and post-field activities.**

Course Title: Field Report

Marks Distribution Pattern:
Field Report 25
Viva-voce 15
Internal Assessment (Group Study) 10

Guidelines on execution:

a. The work is to be based mainly on processing of primary data collected from field with the help of appropriate schedules for physical and socio-economic survey, stressing on any local problem or any contemporary issue.
b. The following are to be taken as base maps, subject to availability: Cadastral map/ City Ward Boundary map.
c. Interrelations between physical, social, economic, cultural aspects of the study should be the focus of the Field Report.
d. Text of the Report should not exceed 3,000 words and should ideally be divided into the following sections: Introduction, Statement of problem(s) and Objectives, Materials and methods, Results & Discussions, Conclusion, References / Bibliography and Appendices (if any).
e. Maps, diagrams and sketches, excluding photographs, should not exceed 30 pages of A4 size paper.
f. Handwritten Report duly signed endorsed by the Faculty(s) and endorsed by the HOD is to be produced individually by the students. **Photocopying and computer typing are strictly restricted.**

Selected References:

1. Chandan, S.D., Debajyoti, M. 2023. Geospatial Techniques and Research in Geography, Enova

Publications.
2. Lemon, B. Paul, C. (). Fieldwork Techniques and Projects in Geography. Collins Pub.
3. Sengupta, P., Bandopadhya, M., Mitra, K., Sen, J. 2011. Project Work, Field Report and Geographical Study. Kalyani Publishers.
4. J.E. Archer and T.H. Dalton 2022 FIELDWORK IN GEOGRAPHY. Rawat Publication

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BGEOMAJ08T**
Course Title: **Philosophy of Geography**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To cater knowledge pertaining to the nature of the subject. to represent the systematic development of the subject from prehistoric to modern times. To promotes an understanding related to the vastness and dynamicity of the discipline as a science of synt**
Learning Outcome: **Students will have an in-depth knowledge of the development of the subject and its different philosophical outlooks. Students will get new knowledge in emerging areas for discourse and development in geographical studies. It will enable students to pursue**

Course Title: Philosophy of Geography

Unit I: Evolution of Prehistoric Geographical Ideas [26 Hours]
1.1 Contribution of pioneers in the development of geographical ideas: Greeks and Romans. (6 lectures)
1.2 Dark Age- A period of turmoil in Europe and its impact on Geography. (6 lectures)
1.3 Contribution of Indian, Chinese, and Arab geographers in shaping the geographical knowledge. (8 lectures)
1.4 Age of exploration and discoveries. (6 lectures)

Unit II: Evolution of Modern Geographical Ideas [28 Hours]
2.1 Bernhard Varenius and Immanuel Kant: Cosmography to scientific geography. Founders of modern geographical thoughts- Alexander von Humboldt and Carl Ritter. (6 lectures)
2.2 Schools of Geography- German, French, British, and American. (8 lectures
2.3 Dichotomies and dualism in geography, (8 lectures)
2.4 Quantitative revolution and paradigm shift in geography. (6 lectures)

Unit II: Contemporary Discourses [24 Hours]
3.1 Positivism and Empiricism (6 lectures)
3.2 Marxism, Radicalism (6 lectures)
3.3 Behaviourilism, Humanistic Geography (6 lectures)
3.4 Postmodernism, Gender Geography (6 lectures)

Selected References:
1. Hussain, M. 2017. Evolution of Geographical Thought, Rawat Publications.
2. Adhikari, S. 2015. Fundamentals of Geographical Thought, Orient Blackswan Pvt. Ltd.
3. Dikshit, R.D. 2018. Geographical Thought - A Contextual History of Ideas. PHI Learning.
4. Hartshorne, R. 2002. The Nature of Geography, Rawat Publication.
5. Peet, R. 2011. Modern Geographical Thought, Rawat Publication.
6. Harvey, D. 2007. Explanation in Geography, Rawat Publication
7. Cresswell, T. 2013. Geographic Thought: A Critical Introduction, Wiley-Blackwell.
8. Couper, P. 2015. A Student's Introduction to Geographical Thought: Theories, Philosophies, Methodologies. Sage

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-9**
Semester: **6**

Course Code: **BGEOMAJ10T**

Course Title: **Geography of India**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **This course aims to understand the regional geography of India and West Bengal. To introduce to the economic and cultural aspects, and their impact on the development of the different regions**

Learning Outcome: **Students will be aware of the spatial dimensions of the different regions of the country and evaluate the plans and policies for sustainable regional development. Students will be able to select and apply appropriate indicators for the measurement of regi**

Unit I: Geography of India [30 Hours]

1.1 Physical divisions of India: physiography, drainage, soil and vegetation. (8 lectures)

1.2 Indian Monsoon – theories on origin; characteristics and impact. (6 lectures)

1.3 Economy: Agriculture – major crops (Rice, Wheat) & role of Green Revolution; Industry - Cotton textile, Petrochemicals and Tourism. (8 lectures)

1.4 Population: growth, composition (age-sex, caste & tribe), migration and urbanization. (8 lectures)

Unit II: Regional Perspectives of India [24 Hours]

2.1 Concept and types of regions. Regionalization: Basis and techniques of delineation. (6 lectures)

2.2 Regional perspective: physical (Thar), ethnicity (North-East); planning (DVC) (6 lectures)

2.3 Regional problems and Regionalism. (6 lectures)

2.4 Regional disparity; Regional development: Five Year Plan; NITI Aayog (6 lectures)

Unit II: Regional Perspectives of West Bengal [24 Hours]

3.1 Physical regions with special reference to Rarh and Barendrabhumi (6 lectures)

3.2 Socio-economic regions: Hooghly Industrial Region; Tea plantation area (6 lectures)

3.3 Regional perspective & problems: Sundarban & Manbhum (6 lectures)

3.4 Regional Development Authority: Gorkhaland Territorial Administration and Paschimanchal Unnyayan Parshad (6 lectures)

Selected References:

1. Galina, S., Sengupta, P. 1967. Economic Regionalisation of India, Census of India.
2. Khullar, D.R. 2014. India: A Comprehensive Geography, Kalyani Publishers, New Delhi.
3. Raza, M. (Ed) 1988. Regional Development: Contributions to Indian Geography. New Delhi,
4. Sharma, T.C. 2003. India - Economic and Commercial Geography, Vikas Publ., New Delhi.
5. Singh, J. 2003. India - A Comprehensive & Systematic Geography, Gyanodaya Prakashan.
6. Singh, R. L. 1971. India: A Regional Geography, National Geographical Society of India.
7. Trewartha G.T., Horne, L.H. 1980. An Introduction to Climate, McGraw-Hill.
8.Tiwari, R.C. (2007) Geography of India. Prayag Pustak Bhawan, Allahabad
9. Majid Husain and Tasawwur Husain Zaidi 2022 **Geography of India . McGraw Hill**
10 Bhagat R.B. 2022 Population and the Political Imagination: Census, Register and Citizenship in India Routledge India; 1st edition
11. Quraishi S.Y (2021) POPULATION MYTH: ISLAM, FAMILY PLANNING AND POLITICS IN INDIA. HarperCollins;

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-10**

Semester: **6**

Course Code: **BGEOMAJ10S**

Course Title: **Geoinformatics**

(L-P-Tu): **0-6-0**

Credit: **6**

Practical/Theory: **Practical**

Course Objective: **To understand the basic concepts and principles of remote sensing and GIS. To study the basics of digital image processing to solve the real-world problems. To understand GIS data types and structures with**

geo-processing, visualization techniques in GIS

Learning Outcome: **Students will acquire employable skills in remote sensing and GIS. Students will be able to apply algorithms that will help to analyze and evaluate digital images. Students will also be able to create thematic maps relevant for resource analysis, managem**

Unit I: Aerial Photographs and Remote Sensing [78 Hours]

1.1 Concept of Aerial Photographs, Key elements, Photo scale, Height of flight, End lap and Side lap, Identification of Physico-cultural features from Aerial Photographs.(18 lectures)

1.2 Remote Sensing – definition, development, EMR & EMS, Spectral reflectance curves; Platforms, Orbits; Sensors, Types of Satellite Remote Sensing. IRS and Landsat missions.

Digital data format and metadata; Image referencing schemes and data acquisition. (18 lectures)

1.3 Principles of Image Rectification & Enhancement; Image Registration; Subset Image. Preparation of Colour Composites (TCC, FCC & SFCC) & Indices (NDVI, NDWI, NDBI) from

IRS LISS-3, Landsat TM and OLI data. (22 lectures)

1.4 Principles of visual & digital image interpretation. Preparation of inventories of land use land cover (LULC) features from satellite images. (20 lectures)

Unit II: GNSS & GIS [78 Hours]

2.1 Principles of GNSS positioning with special reference to GPS, Collection and retrieval of GNSS data. (18 lectures)

2.2 GIS – definitions, components, development and applications. (14 lectures)

2.3 Data Structures: Spatial & non-spatial; Spatial Data Models: Raster and Vector data models; Spatial data relationship – Topology. GIS Database Creation, DBMS and its use in GIS. (22 Lectures)

2.4 GIS-based Modelling and Spatial Overlay: Point, line & areal data; Application in Physical Geography and Human Geography, Web-GIS. (24 Lectures)

Project File

a) Mapping Physical and Cultural features from Aerial Photograph.

b) Georeferencing of maps and images. Creation of Subset image. Image enhancement; preparation of reflectance libraries of LULC features across different bands. Image classification, post-classification analysis and class editing. Application of Remotely Sensed data .

c) Topology Creation; Data attachment and Creation of DBMS, Thematic Mapping: Morphometric Analysis and Choropleth Mapping.

d) Preparation of map from GNSS data.

Selected References:

1. Campbell, J.B. 2007. Introduction to Remote Sensing, Guildford Press.
2. Jensen, J.R. 2004. Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall.
3. Lillesand, T.M., Kiefer, R.W., Chipman, J.W. 2004. Remote Sensing and Image Interpretation, Wiley.
4. Bhatta, B. 2011. Remote Sensing and GIS, 2nd ed, Oxford Univ. Press.
5.Bolstad, P. 2016. GIS Fundamentals: A First Text on Geographic Information Systems, 5th ed, XanEdu Publishing.
6. Brewer, C.A. 2015. Designing Better Maps: A Guide for GIS Users, 2nd ed, Esri Press.
7. Harvey, F. 2015. A Primer of GIS: Fundamental Geographic and Cartographic Concepts, 2nd ed, The Guilford Press.
8. Jensen, J.R., 2013. Remote Sensing of the Environment: An Earth Resource Perspective, Pearson Education India.
9. Joseph, G. and Jegannathan, C. 2018. Fundamentals of Remote Sensing, 3rd ed, Universities Press.
10. Lillesand, T.M., Kiefer, R.W. and Chipman, J.W., 2015. Remote Sensing and Image Interpretation, Wiley.

Syllabus *(GEOGRAPHY)*

Course Type: **MAJ-11**

Semester: **7**

Course Code: **BBGEOMAJ11P**

Course Title: **Geoinformatics**

(L-P-Tu): **0-6-0**

Credit: **6**

Practical/Theory: **Practical**

Course Objective: **To understand the basic concepts and principles of remote sensing and GIS. To study the basics of digital image processing to solve the real-world problems. To understand GIS data types and structures with**

geo-processing, visualization techniques in GIS.
Learning Outcome: **Students will acquire employable skills in remote sensing and GIS. Students will be able to apply algorithms that will help to analyze and evaluate digital images. Students will also be able to create thematic maps relevant for resource analysis, manage**

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(GEOLOGY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BGELMAJ01T**
Course Title: **Earth System Science**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Overall understanding of the subject as a branch of Earth science, Interpreting signature of geological incidents as may be preserved in rock records. Earth system science introduces the subject as a whole as it is not taught holistically in school level.**
Learning Outcome: **Overall students will learn the basics of geology, terminologies used in different branches of geology, origin and evolution of the earth itself as well as life and atmosphere on earth, cause of different geological phenomenon etc.**

Theory

Unit I: Earth as a planet

1. Introduction to various branches of earth sciences
2. General characteristics and origin and evolution of the Universe, the Solar system and its planets and satellites.
3. Meteorites and asteroids
4. Cosmic abundance of elements and distribution of elements in solar system and in Earth
5. Origin of atmosphere, ocean, and life

Unit-II: Solid Earth

1. Mechanical layering of the Earth-lithosphere, asthenophere, mantle and core
2. Seismic waves and internal structure of the Earth
3. Formation of core, mantle, crust
4. Concept of Isostasy
5. Geothermal gradient and internal heat of the Earth
6. Earth's magnetic field

Unit III: Plate Tectonics

1. Introduction to Plate tectonics, Concept of Continental drift and sea-floor spreading
2. Introduction to different types of plate and plate boundaries, orogeny and mountain building processes, types of mountains and their geological characters
3. Earthquake and earthquake belts
4. Volcanoes- types and distribution of volcanic belts

Unit IV: Understanding the past from stratigraphic records.

1. Concept of geological time scale
2. Concepts of Neptunism, Plutonism, Uniformitarianism, and Catastrophism
3. Nature of stratigraphic records
4. Concept of absolute and relative dating; radiometric dating methods

Unit V: Soil, Hydrosphere and Atmosphere

1. Weathering and Erosion
2. Soil types, process of formation of soil, weather and climate
3. Atmospheric circulations; Oceanic currents, tides and waves, Oceanic currents, surface currents and global ocean conveyor system,
4. Climate change, Climate change in geological past from rock records

Suggested Reference Books:

- Grotzinger, J., Jordan, T.H., Press, F., Siever, R. (2007): Understanding Earth. W.H. Freeman & Co., New York, 5 th Ed.
- Emiliani, C. (1992): Planet Earth: Cosmology, Geology, and the Evolution of Life and Environment. Cambridge University Press. Published in USA.
- Skinner, B.J., Porter, S.C., Botkin, D.B. (1999): The Blue Planet – An Introduction to Earth System Science. John Wiley & Sons, Inc. New York. P.552.
- Mathez, E.A. and Webster, J.D. (2004): The Earth machine – The Science of a Dynamic Planet. Columbia University Press, New York. P.335.
- Duff, P. M. D., & Duff, D. (Eds.). (1993). Holmes' principles of physical geology. Taylor & Francis.
- Gross, M. G. (1977). Oceanography: A view of the earth.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013

6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(GEOLOGY)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BGELMAJ02C**
Course Title: **Basics of Mineralogy and Petrology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Imparts basic knowledge of minerals & rocks which are natural specimens.**
Learning Outcome: **Students will learn the basics of mineral structures, formulas, rock composition and gain practical knowledge of the studied minerals and rocks from hand specimens.**

Theory

Unit I: Rock forming minerals

1. Minerals- definition and classification, physical and chemical properties
2. Chemical classification of minerals
3. Composition of common oxides, carbonated, sulphides and sulphates, phosphates and silicates
4. Physical properties of minerals

Unit II: Crystallography

1. Concept of crystal and crystalline matter.
2. Crystal structure, Elementary ideas about crystal morphology in relation to internal structures.
3. Crystal parameters and indices, form and zone.
4. Stereographic projection of crystal faces, crystal symmetry, classification of crystals into systems and point groups.

Unit III: Introduction to petrology

1. Definition of different type of rocks: igneous, sedimentary and metamorphic rock
2. Nomenclature of igneous, metamorphic and sedimentary rocks
3. Texture of igneous, metamorphic and sedimentary rocks
4. Mineralogical composition of common igneous, metamorphic and sedimentary rocks
5. Rock cycle

List of practicals:

1. Study of the symmetry of crystals. Stereographic projection of crystals.
2. Hand specimen identification of very common rock forming minerals & ore minerals.

Suggested Reference Books:

- Nesse, W.D., 2000, Introduction to Mineralogy, Oxford University Press, New York
- Deer, W. A., Howie, R. A., & Zussman, J., 2013, An introduction to the rock-forming mineral. 3rd Edn. The Mineralogical Society, London.
- Bose, M. K., 1997, Igneous Petrology. World Press, Kolkata.
- Winter, J. D., 2014, Principles of Igneous and Metamorphic Please etrology. Prentice Hall of India.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(GEOLOGY)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BGELMAJ03C**
Course Title: **Structural Geology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Structural geology is to apprise students of knowledge regarding impact of pressure, tension in the earth interior.**
Learning Outcome: **Students will learn the types of deformation pattern that rocks experience within earth's interior and surface.**

Theory

Unit I: Basics of Structural Geology

1. Scope of structural geology and tectonics.

2. Structural elements: Linear and planar structure. Representation of linear and planar structural elements: strike, dip, pitch and plunge.
3. Diastrophic and non- diastrophic structures. Concept and application of primary igneous and sedimentary structure in structural geology. Unconformity and its types, recognition of unconformity
4. Structural analysis and scale of observation.

Unit II: Stress and Strain in rocks

1. Concept of stress. Components of stress: normal stress, shear stress; stress tensor. Stress at a point: Concept of stress ellipse, principal stresses, principal axes of stress, differential stress, isotropic stress, deviatoric stress. Plane of maximum shear stress. Representation of stress in Mohr's circle
2. Concept of deformation and distortion: rigid body translation, rigid body rotation and strain. Longitudinal, shear and volumetric strain.principal axes of strain, strain ellipse; homogeneous and inhomogeneous strain; rotational and irrotational strain;Finite and infinitesimal strain.Types of Strain ellipsoids and their geological significance, Flinn and Ramsay's diagram, coaxial and non-coaxial deformation, progressive deformation.
3. Deformation behaviour of rock: Concept of rock deformation- brittle and ductile deformation. Rheological properties of rocks. Elastic, viscous and plastic behaviour of rock. Factors controlling the deformation behaviour of rock: temperature, pressure, time.

Unit III: Folds and Folding

1. Morphology and anatomy of fold and it's structural elements
2. Morphological, geometric and genetic classification of folds. Ramsay's classification of folds.
3. Outcrop patterns of folds. Minor folds and their relation with major folds
4. Mechanism of folding: Buckling, Bending, Flexural slip and flow

Unit IV: Foliation and Lineation

1. Concept of penetrative and non-penetrative structure. Concept of rock cleavage.
2. Morphological classification of foliation. Types of lineation. Relation of foliation and lineation with folds.

Unit V: Fractures and Shear zone

1. Type of fractures: tension and shear fracture. Fault and joints
2. Fault zone terminology, Geometric classification of faults. Criteria for recognition of faults, Fault zone rocks. Anderson dynamic analysis of faulting, Characteristics of Normal, Thrust and Strike slip fault systems
3. Basic concept of shear zone.Shear zone rocks and shear sense indicators

List of Practicals:

1. Stereographic projections of planes and lines
2. Graphical method of solution of True dip and apparent dip problems, 3-point problems, fold-fault problems and their solutions through stereographic projection methods, simple problems of tilt corrections
3. Use of topographic map. Outcrop patterns of different structures
4. Interpretation of geological maps containing unconformity, fault, fold and igneous bodies. Construction of structural cross section.

Suggested Reference Books:

- Davis, H.G, Reynolds, S.J, Kluth, C. F. (2011), Structural Geology of Rocks and Region, John Wiley
- Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th. Ed.) Cambridge University Press (For Practical)
- Twiss, R. J. and Moores, E. M (2007) Structural Geology, Second Edition. W. H. Freeman and Company.
- Fossen, H (2010), Structural Geology, Cambridge University Press.
- Marshak, S and Mitra G. (1988) Basic Methods in Structural Geology, Prentice Hall.
- Ben A. van der Pluijm and Stephen Marshak (2004) Earth Structure: An Introduction to Structural Geology and Tectonics (Second Edition) 2nd Edition

- Ghosh, S.K., 1993. Structural Geology: Fundamentals, and modern developments, Pergamon Press.
- Passhier, C. and Trouw, RAJ, 2005. Microtectonics. Springer, Berlin.
- Ramsay, J.G and Huber, M.I., 1983. Techniques of Modern Structural Geology: Vol.I & 11. Academic Press
- Ramsay, J. G, 1967. Folding and Fracturing of Rocks, McGraw-Hill Book Company, New York.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BGELMAJ04C**
Course Title: **Principles of Stratigraphy and Paleontology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Principles of stratigraphy imparts the basic knowledge about the concept of stratigraphy, the basic stratigraphic sub-divisions and geological time scale.**
Learning Outcome: **Principles of stratigraphy imparts the basic knowledge about the concept of stratigraphy, the basic stratigraphic sub-divisions and geological time scale.**

Paper - 401 Course Title: Principles of Stratigraphy and Paleontology:

4 credit (60 lectures) + 2 credit (practicals)

Unit I: Principles of stratigraphy & Nomenclature

1. Fundamentals of lithostratigraphy, biostratigraphy and chronostratigraphy.
2. Principles of stratigraphic correlation & Walther's Law of Facies. Methods of collecting strati graphic data, identification of stratigraphic contacts and unconformities.
3. Relevance of Type section. Concepts of Stratotypes. Global Stratotype Section and Point (GSSP) with Indian examples.
4. Introduction to concepts of chemostratigraphy, seismic stratigraphy, Magneto-stratigraphy, se- quence stratigraphy.

Unit II: Fossilization and fossil record

1. Fossilization: Definition of fossil, fossilization processes and modes of preservation, exceptional preservation
2. Taphonomy: Definition, different types of Taphonomic filters and processes
3. Palaeoecology

Unit III: Taxonomy and Systematics

1. Taxonomy: Concept of taxonomy and taxonomic hierarchy
2. Biological and morphological species concept

Unit IV: Definitions

Biozones, index fossils, examples

Practical: Geological Field Work (2 credits)

Unit I: Basic field measurement techniques: Use of Diagonal scale, Clinometer and Brunton compass, abney level. Study of Toposheet.

Recognition and measurement of attitudes of diastropic features, tracing lithologic contacts of igneous and metamorphic rocks and representing on toposheet.

Unit-II: Identification of rock types in field; structures and textures of rocks (Igneous, Metamorphic and Sedimentary), use of hand lens, step count, measuring tape and hammer.
Unit III: Recognition and measurement of attitudes of primary sedimentary structures, preparation of cross-sections, description and measurement of a sedimentary section and lithologic representations
Unit-IV: Preparation of detail field report and viva-voce

Syllabus *(GEOLOGY)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BGELMAJ05T**
Course Title: **Hydrogeology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The main objectivity of the course module is to have an accrued knowledge regarding exploration of ground water as a resource.**
Learning Outcome: **Students will learn about different types of aquifers, how ground water exploration happens and geological aspects of groundwater.**

Theory:

Unit I: Introduction and basic concepts

1. Scope of hydrogeology and its societal relevance. Global and Indian distribution of water resource.
2. Hydrologic cycle: Precipitation, evapo-transpiration, run-off, infiltration and groundwater flow. Basic concept of hydrographs Origin of groundwater, Vertical distribution of subsurface water, Genetic classification of groundwater.
3. Classification of rocks with respect to water bearing characteristics, geomorphic and geologic controls of groundwater, Types of aquifer– unconfined, confined and semi confined. Water table and piezometric surface.
4. Rock properties affecting groundwater: Porosity, void ratio, specific retention and Storage coefficient - specific yield, specific storage and storativity, Anisotropy and heterogeneity of aquifers

Unit II: Groundwater flow

1. Darcy's law and its validity; Reynold's Number. Groundwater velocity.
2. Intrinsic permeability and hydraulic conductivity, Transmissivity, Measurement of hydraulic conductivity in laboratory – Constant Head Permeameter and Falling (Variable) Head Permeameter. Water Table and Piezometric surface contour maps and Groundwater flow direction, Laminar and turbulent groundwater flow, Ghyben-Herzberg Principle and sea water intrusion in coastal aquifers.

Unit III: Groundwater chemistry

1. Physical, chemical and bacteriological properties of water and water quality
2. Elementary concept on groundwater pollution: Arsenic and Fluoride

Unit IV: Groundwater management

1. Surface and subsurface water interaction. Recharge and discharge areas. Groundwater level fluctuations. Effects of Climate Change on groundwater.
2. Basic concepts of water balance studies.

Reading References:

- Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.
- Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
- Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGraw- Hill Pub. Co. Ltd.
- Raghunath H, M. 2007, Groundwater, 3rd Ed. New Age International Publishers, New Delhi

Syllabus *(GEOLOGY)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BGELMAJ06C**
Course Title: **Mineralogy and Geochemistry**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Mineral science imparts a thorough knowledge of minerals which is fundamental unit of rock. Theory and practical mode of teaching aim to inculcate holistic knowledge on mineralogy.**
Learning Outcome: **Students will be equipped with the knowledge of identifying minerals in the field and in laboratories. Finally, they could assemble these knowledge in understanding and identifying areas with economic potentials.**

Theory

Unit I: Mineralogical structure & Crystal chemistry

1. Ionic radius and coordination, Pauling's rules. Solid Solution, Polymorphism, Pseudomorphism
2. Atomic structure of silicate minerals
3. Study of different rock forming group of minerals

Unit II: Optical Mineralogy

1. Nature of light and optical behaviour of minerals.
2. Introduction to petrological microscopy

Unit III: Basic concepts of Geochemistry

1. Introduction to properties of elements; Chemical bonding
2. Meteorite-classification and significance.
3. Cosmic abundance of elements.
4. Geochemical classification of elements.

Unit IV: Geochemistry of solid Earth

1. Composition of the bulk silicate Earth.
2. Composition of core, mantle, and crust; depleted mantle and enriched mantle.
3. Concept of partition coefficient, compatible and incompatible elements; REE-essential characters
4. Geochemical behaviour of elements during magmatic crystallization, partial melting.

Unit V: Isotope and Low temperature geochemistry

1. Introduction to isotope geochemistry; Radiogenic and stable isotopes.
2. Radiometric dating techniques.
3. Aqueous geochemistry- basic concepts and application in geological processes like weathering, diagenesis & hydrothermal system
4. Eh and pH relationships.

List of Practicals:

1. Hand specimen identification of felsic & mafic minerals.
2. Study of optical properties of common rock-forming non opaque minerals like quartz, orthoclase, microcline, plagioclase, perthite, nepheline, olivine, orthopyroxene, clinopyroxene, hornblende, staurolite, garnet, muscovite, biotite, calcite
3. Different Geochemical variation diagrams and its interpretations; Harker plot, Alkali lime index etc.

4. Distribution coefficient and associated problems

Suggested Reference Books:

- Klein, C., Dutrow, B., Dwight, J., & Klein, C. (2007). The 23rd Edition of the Manual of Mineral Science (after James D. Dana). J. Wiley & Sons.
- Deer, W. A., Howie, R. A., & Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.
- Nesse, W. D. (2011). Introduction to Optical Mineralogy (Fourth Edition). Oxford University Press.
- Verma, P. K. (2010). Optical Mineralogy (Four Colour). Ane Books Pvt Ltd.
- Nesse, W.D., 2000, Introduction to Mineralogy, Oxford University Press, New York, 442 p.
- Mason, B. (1986). Principles of Geochemistry. 3rd Edition, Wiley, New York.
- Rollinson, H. (2007). Using geochemical data – evaluation, presentation and interpretation 2nd Edition. Publisher Longman Scientific and Technical.
- Walther, J. V. (2009). Essentials of geochemistry. Jones and Bartlett Publishers.
- Albarède, F. (2003). Geochemistry: an introduction. Cambridge University Press.
- Faure, Gunter and Teresa M. Mensing (2004). Isotopes Principles and Applications. Wiley India Pvt. Ltd
- Killops S.D., Killops V.J. 2005. An introduction to organic geochemistry. 2nd ed.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BGELMAJ07C**
Course Title: **Igneous Petrology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Igneous petrology as a branch of petrology it gives a knowledge regarding magma devitrification and also throws light upon upper mantle composition of earth interior.**
Learning Outcome: **students learn to apply the knowledge to explore minerals in igneous rocks.**

Theory:

Unit I: Basics of Igneous Petrology

1. Modes of magma formation
2. Physical properties of magma - temperature, viscosity, density, and volatile content
3. Mode of occurrence and emplacement of different igneous rocks
4. Forms of igneous rock bodies

Unit II: Texture and microstructure of Igneous rocks

1. Crystallinity, granularity, shapes and mutual relations of grains; nucleation and growth of igneous minerals
2. Description of the following textures and microstructures with their occurrence in different rocks - panidiomorphic, hypidiomorphic, allotriomorphic, porphyritic, vitrophyric, poikilitic, ophitic, sub-ophitic, intergranular, intersertal, pilotaxitic, trachytic, graphic, granophyric, rapakivi, orbicular, corona, perthitic, myrmekitic, variolitic, speherulitic & spinifex

Unit III: Classification and Petrography of Igneous rocks

1. Introduction and bases of classification of igneous rocks; mineralogical, textural, chemical, chemico- mineralogical and associational
2. Norm and Mode. Standard classification schemes – Niggli, Hatch & Wells and IUGS. TAS diagram for volcanic rocks

3. Composition and texture of important igneous rocks: Granitoids, Pegmatite, Syenite, Monzonite, Diorite, Norite, Gabbro, Anthrothosite, Dolerite, Pyroxenites, Peridotite, Lamprophyres, Carbonatite, Rhyolite, Andesite, Dacite, Basalt, Komatiite.

Unit IV: Phase diagram for Igneous petrology

1. Introduction to phase rule and phase diagram
2. Phase Rule and its application to eutectic, peritectic and solid solution system
3. Phase equilibria in the following binary and ternary systems, and their petrogenetic significance: diopside – anorthite, forsterite – silica, albite – anorthite, albite – orthoclase, diopside – albite – anorthite, forsterite – diopside – silica and nepheline - kalsilite – silica.

Unit V: Diversification and chemical evolution of magma

1. Bowen's reaction Series and its application.
2. Magma generation in crust and mantle, their emplacement and evolution
3. Magma series, Magmatic evolution, Magmatic differentiation- fractional crystallization, partial melting, assimilation, and their role in magmatic differentiation.
4. Chemical variation diagrams

Unit VI: Petrogenesis of Igneous rocks

1. Petrogenesis of Felsic and Mafic igneous rocks: Granitoids, Basalt, Gabbros, Anorthosite.

Unit VII:Magmatism in different tectonic settings

1. Mid Oceanic Ridge setting
2. Subduction Zone setting
3. Continental and oceanic rift zone setting

List of Practicals

1. Study of important igneous rocks in thin sections: granite, granodiorite, diorite, syenite, nepheline syenite, gabbro, anorthosite, ultramafic rock, basalt, andesite, dolerite, rhyolite, dacite.
2. Norm calculation for silica undersaturated and silica oversaturated rocks
3. Plotting of modal data in IUGS classification diagram for plutonic rocks (Streckeisen diagram).

Suggested Reference Books:

- Philpotts, A. and Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.
- Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
- Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.
- Myron G. Best (2001). Igneous and Metamorphic Petrology.
- Cox, K. G. and Bell. J. D. (1979). The Interpretation of Igneous Rocks. Springer/Chapman and Hall.
- Bose M. K. (1997). Igneous Petrology.
- Frost B. R. and Frost C. D (2014). Essentials of Igneous and Metamorphic Petrology. Cambridge University Press.
- Pitcher, W.S. 1997.The Nature and Origin of Granitic Rock. Springer.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BGELMAJ08C**
Course Title: **Metamorphic petrology**

(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Metamorphic petrology deals with metamorphism of crustal material as a function of pressure and temperature.**
Learning Outcome: **Students learn to observe the change of crustal substrate due to ever changing pressure temperature.**

Theory:

Unit I: Metamorphism- Types and controls

1. Definition of metamorphism. Factors controlling metamorphism.
2. Types of metamorphism– contact, regional, burial, fault zone metamorphism, impact metamorphism.
3. Fundamentals of geochemical thermodynamics.

Unit II: Metamorphism and deformation

1. Structure and textures of metamorphic rocks
2. Relationship between metamorphism and deformation

Unit III: Metamorphic Facies, Facies series and grade of metamorphism

1. Index minerals, metamorphic zones and isograds.
2. Concept of metamorphic facies and grade
3. Mineralogical phase rule of closed and open system
4. Composition-paragenesis diagrams. ACF, AKF and AFM diagrams
5. Concept of metamorphic P-T-t path

Unit IV: Metamorphic reactions

1. Types of metamorphic reactions
2. Kinetics of metamorphic reactions
3. Progressive and retrogressive metamorphism
4. Progressive metamorphism of pelitic, basic and carbonate rocks

Unit V: Metamorphism and crustal evolution

1. Metasomatism and role of fluids in metamorphism.
2. Migmatites and its origin
3. Brief idea of anatexis and partial melting of crustal rocks
4. Geothermobarometry

Unit VI: Metamorphic rock associations and plate tectonic settings

1. Regional occurrence and tectonic significance of metamorphic rocks
2. Metamorphism along convergent plate margins, in continent-continent collisions, in rifting terrains and sea floor metamorphism.

List of Practicals

1. Textural and mineralogical study of following metamorphic rocks in thin sections under microscope: Phyllites, Schists, Gneissic rocks, Amphibolite, Charnockite, Khondalite, mafic granulite, eclogite, marble, high Mg-Al granulites.
2. Graphical plots of metamorphic mineral assemblages using chemographic diagrams; ACF, AKFM, AFM diagrams

Suggested Reference Books:

- Philpotts, A., & Ague, J. (2009). Principles of igneous and metamorphic petrology. Cambridge University Press.

- Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.
- Rollinson, H. R. (2014). Using geochemical data: evaluation, presentation, interpretation. Routledge.
- Yardley, B. W. D. (1989). An introduction to metamorphic petrology. Longman Scientific and Technical, London.
- Spear F. S. 1993. Metamorphic phase equilibria and Pressure-Temperature-Time paths. Mineralogical Society of America Monograph 799.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BGELMAJ09C**
Course Title: **Sedimentology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Sedimentology imparts a knowledge dome regarding weathering, erosion, deposition and lithification through diagenesis.**
Learning Outcome: **students learn to track elements dispersion which can be applied to explore minerals hosted in sedimentary rocks.**

Theory:

Unit I: Introduction to Sedimentology

1. Outline of sedimentation process: Definition of sediment; origin of sediments: mechanical and chemical sediments; source rock or provenance

Unit II: Granulometry

1. Grain size: concept and size scale, particle size distribution, environmental connotation; particle shape and fabric; Sedimentary textures

Unit III: Basic hydraulics and Sedimentary structures

1. Fluid flow: Types of fluids, Laminar and turbulent flow, subcritical, critical and supercritical flows; particle entrainment, transport and deposition
2. Mass flow: types, mechanisms and controlling factors, process-product relationship, Penecontemporaneous deformation: mechanisms and controlling factors
3. Sedimentary structure: Primary and penecontemporaneous deformation structures

Unit IV: Sedimentary rocks

1. Siliciclastic rocks: Components and classification(s) of conglomerates and sandstones
2. General introduction to Mudrocks, Carbonate rocks; controlling factors of carbonate deposition; components and classifications of limestone; dolomite and dolomitisation

Unit V: Diagenesis

1. Concepts of Diagenesis
2. Stages of diagenesis: Diagenetic changes in siliciclastic and carbonate deposits

Unit VI: Sedimentary environments

Introduction to sedimentary environment: aeolian, glacial, fluvial, near-shore and deep-marine environments.

List of Practicals:

1. Particle size distribution and statistical analysis (Graphical and moment measures)
2. Directional data analysis

3. Study of clastic and non-clastic rocks through hand specimen and petrographic thin sections

Suggested Reference Books:

- Prothero, D. R., & Schwab, F. (2004). Sedimentary geology. Macmillan.
- Tucker, M. E. (2006) Sedimenary Petrology, Blackwell Publishing.
- Collinson, J. D. & Thompson, D. B. (1988) Sedimentary structures, Unwin- Hyman, London.
- Nichols, G. (2009) Sedimentology and Stratigraphy Second Edition. Wiley Blackwell

Syllabus *(GEOLOGY)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BGELMAJ10C**
Course Title: **Economic Geology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **Objective is to introduce genesis of ores, natural fuels along with their mode of occurrence augmented with temporal and spatial relationship.**
Learning Outcome: **This will help students to apply their expertise to explore natural resource which enhances the applicability of the subject and makes the subject itself a viable career option.**

Theory:

Unit I: Introduction to economic geology

1. Ores, gangue minerals, tenor, grade, and lodes

1. Resources and reserves

Unit II: Classical concepts of Ore formation and mineral deposits

1. Mineral occurrence, Mineral deposit, and Ore deposit
2. Metallogenic provinces and epochs
3. Orthomagmatic and magmatic hydrothermal process
4. Sedimentary processes; placer deposits
5. Metamorphic and hydrothermal process; skarn deposits
6. Supergene enrichment processes
7. Modern seafloor deposits and their genetic implications

Unit III: Structure and texture of ore deposit

1. Concordant and discordant ore bodies
2. Mode of occurrences of ore bodies; morphology and nature of ore mineralization

Unit IV: Mineral Exploration

1. Exploration, brief idea on different stages & methods of exploration
2. Assessment of ore grade and reserve, reserve estimation

Unit V: Fuels and Non-metallic minerals

1. Fossil fuels; basic concepts, genesis, exploration of coal and petroleum.
2. Uranium as a fuel.
3. Non-metallic and industrial rocks and minerals, in India.

List of practicals

1. Hand sample identification of common ores
2. Study of resource maps

Reference Books:

- Guilbert, J.M. and Park Jr., C.F. (1986) The Geology of Ore deposits. Freeman & Co.
- Bateman, A.M. and Jensen, M.L. (1990) Economic Mineral Deposits. John Wiley.
- Evans, A.M. (1993) Ore Geology and Industrial minerals. Wiley.
- Laurence Robb. (2005) Introduction to ore forming processes. Wiley.
- Gokhale, K.V.G.K. and Rao, T.C. (1978) Ore deposits of India their distribution and processing, Tata-McGraw Hill, New Delhi.
- Deb, S. (1980) Industrial minerals and rocks of India. Allied Publishers.
- Sarkar, S.C. and Gupta, A. (2014) Crustal Evolution and Metallogeny in India. Cambridge Publications.
- Mishra, K.C.(2000) Understanding Mineral Deposits. Springer

Syllabus *(GEOLOGY)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BGELMAJ11T**
Course Title: **Precambrian and Phanerozoic Stratigraphy of India**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Study of historical geology that is unraveling the development of rock types as well as their inter relationships with respect to geologic time**
Learning Outcome: **sStratigraphy deals with stratified rocks. A stratum of rock gets formed during a specific time span over - lain and underlain by younger and older rock respectively. Students learn to unearth the information en- crypted in a stratum of rock to interpret and correlate remote past with special thrust on Indian context.**

Paper - 701 Course Title: Precambrian and Phanerozoic Stratigraphy of India:

Unit I: Stratigraphic boundaries in India

Precambrian-Cambrian boundary; Permian-Triassic boundary; Cretaceous-Tertiary boundary

Unit II: Precambrian Stratigraphy

1. Brief introduction to the physiographic and tectonic subdivisions of India.
2. Introduction to Indian Shield (craton and mobile belts of India).
3. Introduction to Proterozoic sedimentary basins of India.
4. Geology of Vindhyan and Cuddapah basins.
5. Geologic evolution with emphasis on sedimentation, lithology, magmatism, structure, metamor- phism and geochronology of Singhbhum and Dharwar.

Unit III: Palaeozoic Stratigraphy

1. Palaeozoic Succession of Kashmir and its correlatives from Spiti Stratigraphy.
2. Geology and hydrocarbon potential of Gondwana basins.

Unit IV: Mesozoic stratigraphy of India

Triassic successions of Spiti; Jurassic of Kutch; Cretaceous succession of Cauvery Basin.

Unit V: Cenozoic stratigraphy of India

Kutch basin; Siwalik succession; Bengal basin, Assam, Andaman and Arakan basins; Stratigraphy and structure of Krishna-Godavari basin, Cauvery basin, Bombay offshore basin and their potential for hydrocarbons.

Unit VI: Volcanic provinces of India:

1. Deccan
2. Rajmahal

Reading References:

- Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers, Delhi
- Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley
- Ramakrishnan, M. &Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.
- Valdiya, K. S. (2010). The making of India, Macmillan India Pvt. Ltd.
- Ravindra Kumar, 1985. Fundamentals of historical geology and stratigraphy of India. Wiley Eastern Ltd., Delhi.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BGELMAJ12T**
Course Title: **Paleontology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Paleontology is the study of fossil specimens of organism that lived through geologi- cal history. Hence, objective will be to impart knowledge about origin and evolution of life through geo - logical time.**
Learning Outcome: **In paleontology students learn about evolution by taking into consideration chrono species which is bio species along with a 3rd dimension called Lineage since bio events are synchronous throughout the world and the very much ambient environment sensitive, this domain of knowledge is used as a tool to interpret past along with relative age determination and corelation.**

Paper - 702 Course Title: Paleontology:

4 credit (60 lectures) + 2 credit (practicals)

Unit I: paleontology, definition, subdivisions and scope, its relationship with other sub-disciplines of ge- ology.

Unit II: Organic evolution

1. Origin of life and Principles of organic evolution - speciation, micro- and macroevolution, theories of evolution

Unit III: Invertebrate paleontology:

1. Brief introduction to important invertebrate groups (Bivalvia, Gastropoda, Brachiopoda, Trilobita, Echinoidea) and their biostratigraphic significance
2. Functional adaptation in trilobites and ammonoids
3. Micropaleontology and its application in earth sciences

Unit IV: Vertebrate paleontology:

1. Origin of vertebrates and major steps in vertebrate evolution
2. Mesozoic reptiles with special reference to origin, diversity and extinction of dinosaurs 3.
3. Evolution of horse and intercontinental migrations; Human evolution

Unit V: Introduction to Paleobotany, Gondwana Flora and Ichnology

1. Introduction to Paleobotany
2. Introduction to Gondwana Flora
3. Plants as indicator of past climate
4. Ichnology and its application in paleoecology

List of Practicals

1. Study of fossils with various modes of preservation
2. Study of systematic position, stratigraphic position and age of various invertebrate, Study of functional morphological characters of different groups (Pelecypods, Gastropods, Brachiopoda, Echinodermata, Cephalopods, Gondwana flora, vertebrates)
3. Hard part morphology and identification of common Brachiopoda, Anthozoa, Trilobita, Echi- noidea, Gastropoda. Identification of Gondwana flora
4. Cladistics and Cladogram

Reading References:

1. Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology
2. Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing.
3. Benton, M. (2009). Vertebrate paleontology. John Wiley & Sons.
4. Benton, M. J., Harper, D. A. T. (2010). Introduction to Paleobiology and the Fossil Record, Wiley-Blackwell.
5. Shukla, A. C., & Misra, S. P. (1975). Essentials of paleobotany. Vikas Publisher

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Syllabus *(GEOLOGY)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BGELMAJ13C**
Course Title: **Geodynamics**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **This branch of the subject deals with the sluggish changes that continuously take place within earth, ever changing plate configuration as function of internal forces and rheology.**
Learning Outcome: **The students would be in a stage to reconstruct the past and may frame models/experiments to predict the future geo-morphological scenario with respect to earths geo-dynamicity. The learners can exercise or advice proper action to reduce the natural or or human induced calamities at times when it cannot be prevented.**

Theory:

Unit I: Introduction:

1. Concept of asthenosphere and lithosphere: continental and oceanic. Rheology of lithosphere and asthenosphere; Lithosphere as a thermal boundary layer. Characteristics of Continental and oceanic crust; Lithosphere as a thermal boundary layer.

2. Concept of hot spot and mantle plume. Ophiolites and its significance.

Unit II: Plates and plate boundaries:

1. Concept of plates. Distribution of plates in the Earth, physical characters of plates. Macro and micro plates. Plate boundaries: types, character, identification of boundaries, motion along plate boundaries; Triple junction. Detailed anatomy of different plate boundaries.

1. Magmatism and earthquake associated with different plate boundaries.

Unit III: Movement of plates:

1. Plate tectonics model and its evidence. Reconstruction of plate motions. Supercontinents, their break up and assembly. Wilson cycle.
2. Driving Mechanisms of plates, Plate tectonics and mantle convection.
3. Plate motion on spherical earth; Kinematics of plate motion; Concept of absolute and relative plate motion.
4. Geomagnetism: Its concept, geomagnetic anomaly and geomagnetic reversals; Linear Magnetic Anomalies; Vine & Mathew's hypothesis
5. Palaeomagnetism: Concept of fossil magnetism, palaeo-lattitude and plaeaomagnetic evidences and its implication to the plate motion.

Unit IV: Implications of plate movements:

1. Origin of fold thrust belt associated with convergent boundaries. Special reference to Himalaya
2. Hydrothermal vents and mineralisation associated with divergent plate boundaries.

List of practicals:

1. Study of Tectonic maps of Earth
2. Graphical and numerical problems related to Plate tectonics and plate motions.

Reading References:

- Kearey, P., Klepeis, K.A. and Vine, F.J. (2009) Global Tectonics. Third edition. Wiley-Blackwell, Oxford.
- Condie K.C. (1997), Plate Tectonics and Crustal Evolution. Fourth Edition, Butterworth Heinemann.
- Moores E.M. and Twiss, R.. J. (1995) Tectonics. W.H. Freeman, New York.
- Van Kranendonk, Martin J., Vickie Bennett, and Elis Hoffmann, 2018. eds. Earth's oldest rocks. Elsevier.
- Schubert, G., Turcotte, D. L., and Olson, P., 2001. Mantle convection in the Earth and planets. Cambridge University Press.
- Stuwe, K., 2007. Geodynamics of the Lithosphere. Springer
- Cox and Hart, 1986. Plate tectonics: How it works by, Blackwell.
- Mussett, A.E. and Khan, M.A. (2000) Looking into the Earth: An Introduction to Geological Geophysics. Cambridge University press.
- Turcotte, D. L. and Schubert, G., 2002. Geodynamics. Cambridge university press.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BGELMAJ14S**
Course Title: **Advanced Geological Field Work**
(L-P-Tu): **0-4-0**
Credit: **4**
Practical/Theory: **Practical**

Course Objective: **The objective is to inculcate a transparent idea of spatial & temporal distribution of rocks along with their paragenesis. For sake of mineral exploration, mapping idea is a pre requisition. Field work inculcates an accretion of knowledge and get them equipped with industrial orientation.**

Learning Outcome: **One must have field exposure. Natural happenings and terrestrial and even cosmic events to some extent has some form of bearings or signatures encrypted on crustal units called rocks, and as a geologist, one has to unearth that to interpret what happened in remote past at a particular stage of crustal evolution. It benefits students of geology to become industry ready.**

Part 1: Field Work (3 credits)

Unit-I:

Geological mapping techniques, Mapping structural geology features: faults, folds, inclined bedding, cleavages, foliations and understanding the interaction between topographic and geologic structures.

Unit-II:

Trend, plunge, Rake/Pitch, Stereoplots of linear and planar structures, Orientation analyses

Unit-III:

Collection of sedimentological, stratigraphic and paleontological details and their representation

Unit-IV:

Facies concept and its spatio-temporal relation (Walther's Law) and concept of facies distribution at basinal-scale

Unit-V

Fossils sampling techniques and their descriptions

Unit-VI:

Basics of field data collection, analyses, interpretation, geological report writing and viva voce.

Part 2: Computer applications in geology (1 credits)

Computer application for geostatistics and geology: spread packages for calculations, drawing and plotting packages (Corel draw and grapher)

Data analysis: Statistical data analysis through computer: mean, median, varience, sorting, skewness, kurtosis etc.

Frequency Distribution: Histogram, Frequency Polygon and Ogives and plots.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-15**

Semester: **8**

Course Code: **BGELMAJ15T**

Course Title: **Engineering Geology**

(L-P-Tu): **3-0-1**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **In engineering geology students acquire a know-how regarding feasibility study and impact assessment prior to a heavy civil construction.**

Learning Outcome: **Students will be able to contribute by assessing the impact of developing a civil engineering projects initiated by the Govt. or in private sectors.**

Theory:

Unit I: Role of Engineering geologists in planning, design and construction of major man-made structural features

Unit II: Foundation treatment; Grouting, Rock Bolting and other support mechanisms

Unit III: Rock aggregates; Significance as Construction Material

Unit IV: Concept, Mechanism and Significance of:

a) Rock Structure Rating (RSR)

b) Rock Mass Rating (RMR)

c) Tunnelling Quality Index (Q)

Geological, Geotechnical and Environmental considerations for Dams and Reservoirs, slope stability analysis

Unit V: Tunnels and Tunnelling Methods; Geological considerations of Bridge site selection

Unit VI: Landslides: Causes, Factors and corrective/Preventive measures

Unit VIII: Earthquakes: Causes, Factors and corrective/Preventive measures. Mitigating the damage caused by Earthquake

Reading References:

- Krynin, D.P. and Judd W.R. 1957. Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
- Johnson, R.B. and De Graf, J.V. 1988. Principles of Engineering Geology, John Wiley.
- Goodman, R.E., 1993. Engineering Geology: Rock in engineering constructions. John Wiley & Sons, N.Y.
- Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.) Taylor & Francis.
- Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
- Bell, .F.G, 2007. Engineering Geology, Butterworth-Heineman

Syllabus *(GEOLOGY)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BGELMAJ16T**
Course Title: **Remote sensing, GIS & Geomorphology**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **It imparts some knowledge regarding morphology of surficial features. Remote sensing is an effective tool particularly for inaccessible terrain. Preliminary knowledge and basic level acquaintance of GIS has relevance to some extent in Geology.**
Learning Outcome: **Technological advancement in the field of Geology with the proper knowledge of GIS and Remote Sensing will aid them to monitor and predict calamities in advance for proper implementation. They will also have the scope to expand/progress in any sector from all the previous theoretical and practical knowledge.**

Theory:

Unit I: Introduction to Geomorphology

1. Introduction to Geomorphology
2. Relationship between the landforms and the properties of earth material and different kind of processes
3. Endogenic and Exogenic processes

Unit II: Surficial Processes and geomorphology, Weathering and associated landforms, Hill slopes Glacial, Periglacial processes and landforms, Fluvial processes and landforms, Aeolian Processes and landforms, Coastal Processes and landforms, Landforms associated with igneous activities
Unit III: Endogenic- Exogenic interactions. Rates of uplift and denudation. Tectonics and drainage development, Sea-level change, Long-term landscape development.

Unit IV: Remote Sensing, Concepts in Remote Sensing

1. Concepts in Remote Sensing and its types (thermal and microwave)
2. Optical remote sensing- Orbits, platforms, Sensors and scanners.
3. Satellites and their characteristics, types of satellite data, panchromatic, multispectral and hyperspectral, spectral curve analysis of different objects
4. Data formats- Raster and Vector.
5. Morphometric study/analysis

Unit V: GIS and GPS

1. Conceptsof GPS, and factors affecting GPS signals
2. Applications in earth system sciences.

Reading References:

- Robert S. Anderson and Suzzane P. Anderson (2010): Geomorphology - The Mechanics and Chemistry of Landscapes. Cambridge University Press.
- M.A. Summerfield (1991) Global Geomorphology. Wiley & Sons.

- Demers, M.N., 1997. Fundamentals of Geographic Information System, John Wiley & sons. Inc.
- Hoffmann-Wellenhof, B., Lichtenegger, H. andCollins, J., 2001. GPS: Theory & Practice, Springer Wien New York.
- Jensen, J.R., 1996 Introductory Digital Image Processing: A Remote Sensing Perspective, Springer- Verlag.
- Lillesand, T. M. & Kiefer, R.W., 2007. Remote Sensing and Image Interpretation, Wiley.
- Richards, J.A. and Jia, X., 1999. Remote SensingDigital Image Analysis, Springer- Verlag.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BGELMAJ17T**
Course Title: **Fuel Geology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Natural fuels like coal, petroleum are traditional energy resources. These are regulators of fiscal health of a country. Nuclear fuels are strategic minerals.**
Learning Outcome: **Students will learn the genesis, mode of occurrence and exploration of these materials.**

Fuel Geology

Unit I: Energy Resources

1. Different Sources of energy: Global and Indian scenario

Unit II: Coal

1. Definition and origin of Coal
2. Basic classification of coal.
3. Fundamentals of Coal Petrology - Introduction to macerals in coal
4. Proximate and Ultimate analysis

Unit III: Coal as a fuel

1. Concept of clean coal technology
2. Coal Bed Methane (CBM): Global and Indian scenario

Unit IV: Petroleum

1. Chemical composition and physical properties of crudes oil
2. Origin and migration of petroleum
3. Kerogen: Maturation of kerogen; Biogenic and Thermal effect

Unit V: Petroleum Reservoirs and Traps

1. Reservoir rocks: general attributes and petrophysical properties.
2. Cap Rocks: definition and general properties
3. Hydrocarbon traps: definition, Classification of hydrocarbon traps- structural, stratigraphic and combination
4. Time of trap formation and time of hydrocarbon accumulation.
5. Plate tectonics and global distribution of hydrocarbon reserves
6. Stratigraphy and structure of Krishna-Godavari basin, Cauvery basin and Bombay offshore basin and their potential for hydrocarbon exploration

Unit VI: Other fuels

1. Nuclear Fuel

2. Gas Hydrate

Reading References:

- Chandra D. (2007). Chandra's Textbook on applied coal petrology. Jijnasa Publishing House.
- Shelly R. C. (2014). Elements of Petroleum geology: Third Edition, Academic Press
- Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.
- Bastia, R., & Radhakrishna, M. (2012). Basin evolution and petroleum prospectively of the continental margins of India (Vol. 59). Newness.

Syllabus *(GEOLOGY)*

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BGELMAJ18C**
Course Title: **Geo-exploration**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **The acquired knowledge in this domain is basically application of entire knowledge dome of geology. Minerals and other natural resources are needed to be explored prior to mining. This will orient students for exploration and utilization of natural energy resources and their alternative sources.**
Learning Outcome: **This imparts an applicational edge of the subject itself and enhances its viability as a career option.**
This paper will be opted by students pursuing 4 years Honours course without research.
Theory

Unit I: Prospecting and Exploration

1. Principles of mineral exploration
2. Prospecting and exploration- conceptualization, methodology and stages with reference to UNFC
3. Sampling, subsurface sampling including pitting, trenching and drilling, geochemical exploration.

Unit II: Drilling and Logging

1. Core and non-core drilling
2. Planning of bore holes and litho-logging - Gamma log, Sonic and Density log for oil and mineral exploration.

Unit III: Reserve estimations

1. Principles of reserve estimation, and reserve estimation using various methods, factors affecting reliability of reserve estimation.

List of Practicals:
• Visit to any mineral deposit or Mines
• Mode occurrence of ore, Ore mineralogy
• Mining Methods, Ore formation process
• Writing of geological report and viva voce.
Reading References:

- Chandra D. (2007). Chandra's Textbook on applied coal petrology. Jijnasa Publishing House.
- Shelly R. C. (2014). Elements of Petroleum geology: Third Edition, Academic Press
- Bjorlykke, K. (1989). Sedimentology and petroleum geology. Springer-Verlag.
- Bastia, R., & Radhakrishna, M. (2012). Basin evolution and petroleum prospectively of the continental margins of India (Vol. 59). Newness.

- Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.
- Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.
- Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(HINDI)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BHINMAJ01T**
Course Title: **HINDI SAHITYA KA ITIHAS (हिन्दी साहित्य का इतिहास)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **साहित्येतिहास के अध्ययन का एक प्रयोजन साहित्य के विकास की गति और दिशा के साथ-साथ समाज के विकास को**
Learning Outcome: **• छात्र हिंदी साहित्य के इतिहास लेखन की परंपरा एवं विकास के बारे में जान सकेंगे एवं मूल्यांकन कर**

इकाई – एक

- **हिन्दी साहित्येतिहास – लेखन की परम्परा**
- **हिन्दी साहित्य के इतिहास का काल विभाजन और नामकरण**

इकाई – दो

- **आदिकाल – परिस्थितियाँ, नामकरण , प्रवृत्तियाँ , प्रमुख कवि एवं कृतियाँ**
- **सिद्ध साहित्य , नाथ साहित्य , जैन साहित्य , रासो काव्य , लौकिक साहित्य**

इकाई – तीन

- **भक्तिकाल : परिस्थितियाँ , प्रवृत्तियाँ**

इकाई – चार

- **प्रमुख कव्य धाराएँ - संत काव्य , सूफी काव्य , राम काव्य , कृष्ण काव्य , प्रमुख कवि एवं कृतियाँ**

इकाई – पाँच

- **रीतिकाल : परिस्थितियाँ, नामकरण, प्रवृत्तियाँ**

- **प्रमुख कव्य धाराएँ - रीतिबद्ध , रीतिसिद्ध , रीतिमुक्त , प्रमुख कवि एवं कृतियाँ**

इकाई – छः

- **आधुनिक काल : सामान्य परिचय (गद्य, पद्य एवं अन्य विधाएँ)**

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)
Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)
Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity

- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(HINDI)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BHINMAJ02T**
Course Title: **HINDI BHASHA KA ITIHAS (हिन्दी भाषा का इतिहास)**
(L-P-Tu): **5-0-1**

Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• उपर्युक्त पाठ्यक्रम के माध्यम से हिंदी भाषा के सैद्धांतिक पहलू साथ व्यावहारिक रूप का ज्ञान प्**
Learning Outcome: **• छात्र हिंदी भाषा के इतिहास एवं विकास के बारे में समझ सकेंगे । • छात्र हिंदी के क्षेत्र, उपभाषाएँ**

इकाई – एक

- **हिंदी : नामकरण एवं स्वरूप**

इकाई – दो

- **भारतीय आर्य भाषा के परिप्रेक्ष्य में हिंदी भाषा का विकास (प्राकृत, अपभ्रंश, ब्रजभाषा, अवधी, खड़ी बोली)**

इकाई – तीन

- **हिंदी : क्षेत्र, उपभाषाएँ एवं बोलियाँ**

इकाई – चार

- **हिंदी के शब्द भण्डार**

इकाई – पाँच

- **राष्ट्रभाषा, राजभाषा एवं संपर्क भाषा के रूप में हिंदी**

इकाई – छ:

- **देवनागरी लिपि का विकास**

Syllabus ***(ENGLISH)***

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(HINDI)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BHINMAJ03T**
Course Title: **MADHYKALIN HINDI KAVYA (मध्यकालीन हिन्दी काव्य)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • **इस पाठ्यक्रम में शामिल मध्यकालीन कवियों एवं उनके द्वारा रचित काव्यों के अध्ययन से छात्रों में**
Learning Outcome: • **छात्र मध्यकालीन प्रमुख कवियों कबीर , तुलसी , जायसी, सूरदास से परिचित होगे तथा उनकी कविताओं का सम्**

इकाई – एक

- **कबीर (कबीर : आचार्य हजारीप्रसाद द्विवेदी – राजकमल प्रकाशन) :**

पद - मोकों कहाँ ढूढ़े बन्दे (1), अवधू ,माया तजी न आई (5), अनगढ़िया देवा, कौन करे तेरी सेवा (13), मन, तू पार उतर कहँ जैहौ (20), गगनघटा घहरानी साधो , गगनघटा घहरानी(87), साधो,देखो जग, वौराना (168), खेल ले नैहरवा दिन चार (218)

इकाई – दो

- **जायसी – पद्मावत (नागमती वियोग खण्ड –सं.वासुदेवशरण अग्रवाल) :**

पद - नागमती चितउर पंथ हेरा (341) , पिउ वियोग अस बाउर जीऊ (342) चढ़ा असाढ़ गगन घर गाजा (344) , पूस जाड़ थरथर तन काँपा (350) ,

फागुन पवन झकोरे बहा (352) , भा बैसाख तपनि अति लागी (354) , कुहकि कुहकि जसि कोइलि रोई (359)

इकाई – तीन

- सूरदास – (भ्रमरगीतसार – सं. रामचंद्र शुक्ल) :

पद - आयो घोष बड़ो व्योपारी (23), बिलग जनि मानहु, उधो प्यारे (38), अँखिया हरि दरसन को भूखी (42) , अलि हो ! कैसे कहौं हरि के रूप रसहि (51), हमारे हरि हारिल की लकरी (52), निर्गुन कौन देस को बासी (64), ऊधो ! ब्रज की दशा बिचारौ (109)

इकाई – चार

- तुलसीदास – विनयपत्रिका (सं.एवं टीकाकार वियोगी हरी) :

पद - ऐसी मूढ़ता या मन की (90), जाउँ कहाँ तजि चरन तुम्हारे (101), हरि तुम बहुत अनुग्रह कीन्हों (102), अबलौं नसानी अब न नसैहों (105), केशव! कहि न जाइ का कहिये (111), केसव ! कारन कौन गुसाई (112), ऐसो को उदार जग माहीं (162)

इकाई - पाँच

- मीराबाई : मीराबाई की पदावली (सं. – आचार्य परशुराम चतुर्वेदी) :

पद - मण थें परस हरि रे चरण (1), तनक हरि चितवाँ म्हारी ओर (5), म्हाराँ री गिरधर गोपाल दूसराँ णाँ कूयाँ (18), मैं तो गिरधर के घर जाऊँ (20), मीरा मगन भई हरि के गुण गाय(41), हेरी म्हा तो दरद दिवाँणी म्हाराँ दरद न जाण्याँ कोय (70), म्हाँरो जणम जणम रो साथी (105)

इकाई – छः

- बिहारी (रीतिकाव्य संग्रह – जगदीश गुप्त) :

दोहा - मेरी भव-बाधा हरौ (1) , नीकी दई अनाकनी (2) , फिरि-फिरि चितु उत ही रहतु (3), जम-करि-मुँह-तरहरि परयौ (8), तो पर बारौं उरबसी (9), कहत,नटत ,रीझत, खिझत (11), कौन भाँति रहिहै बिरदु (12), नहिं परागु नहिं मधुर मधु (13), कब को टैरतु दीन रट (19), तंत्री- नाद कवित्त-रस (22)

- **घनानंद (रीतिकाव्य संग्रह – जगदीश गुप्त) :**

पद - रावरो रूप की रीति अनूप (3), पीरी पीरी देह छीनी (7), एरे बीर पौन ! तेरो सबै ओर गौन (16), कारी कूर कोकिला ! कहाँ क बरै काढ़ति (17) , अति सूधो सनेह को मारग है (23)

Syllabus *(HINDI)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BHINMAJ04T**
Course Title: **Adhunik hindi kavita (chhayawad tak) आधुनिक हिन्दी कविता (छायावाद तक)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• इस पाठ्यक्रम में निहित आधुनिक कवि और उनकी कविताओं की समझ छात्रों में विकसित होगी। इसके साथ ही क**
Learning Outcome: **• छात्र छायावादी प्रमुख कवियों प्रसाद, पंत , निराला एवं महादेवी से परिचित होगे तथा उनकी कविताओं क**

इकाई – एक

- **भारतेंदु - प्रताप समीरन, भारत दुर्दशा (गीत), बसंत, दशरथ–विलाप**
- **हरिऔध - पवनदूत प्रसंग ('प्रियप्रवास' के षष्ठ सर्ग से छंद संख्या-26 से 35 तक)**

इकाई – दो

- **मैथिलीशरण गुप्त - यशोधरा (चुने हुए अंश), महाभिनिष्क्रमण , सखि वे मुझसे कहकर जाते ...5, 6 ,7 ,8 ,9**
- **रामनरेश त्रिपठी - कामना , अतुलनीय जिनके प्रताप का , पुष्प विकास**

(कविता कोश से संग्रहित)

इकाई – तीन

- **जयशंकर प्रसाद - हिमाद्री तुंग श्रृंग से, मेरे नाविक, इतना न चमत्कृत हो बाले, अरी बरूणा की शान्त कछार**

इकाई – चार

- **सूर्यकांत त्रिपाठी निराला - सरोज स्मृति, बादल राग-6, स्नेह निर्झर बह गया, राम की शक्ति-पूजा**

इकाई – पाँच

- **सुमित्रानंदन पंत - नौका विहार , ताज , द्रुत झरो, चाँदनी**

इकाई – छः

- **महादेवी वर्मा - मैं नीर भरी दु:ख की बदली , धीरे धीरे उतर क्षितिज से , सब आँखों के आँसू उजले, हे चिर महान**

Syllabus ***(HINDI)***

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BHINMAJ05T**
Course Title: **Prayojanmulak hindi ewam hindi sahityik patrakarita (प्रयोजनमूलक हिन्दी एवं हिन्दी साहित्यिक पत्रकारिता)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• इस पाठ्यक्रम के अध्ययन से विद्यार्थियों को प्रयोजनमूलक हिंदी की उपयोगी जानकारी देना एवं रोजगा**
Learning Outcome: **• छात्र प्रयोजन मूलक हिंदी की अर्थ , उपयोगिता एवं महत्व को समझ सकेंगे । • छात्र हिंदी की साहित्यिक**

इकाई – एक

- **प्रयोजनमूलक हिन्दी – अभिप्राय , उपयोगिता और महत्व**
- **हिन्दी के विभिन्न रूप – बोलचाल की सामान्य हिन्दी, मातृभाषा, संपर्क भाषा, राजभाषा, मानक हिन्दी, साहित्यिक हिन्दी**

इकाई – दो

- **हिन्दी के प्रयोग क्षेत्र – भाषा प्रयुक्ति की संकल्पना , वार्ता प्रकार और शैली**

इकाई – तीन

- **प्रयोजनमूलक हिन्दी के प्रमुख प्रकार – कार्यालयी हिन्दी, वैज्ञानिक हिन्दी, व्यवसायिक हिन्दी, संचार माध्यम (आकाशवाणी , दूरदर्शन , चलचित्र , कंप्यूटर ,इन्टरनेट) की हिन्दी और उनके प्रमुख लक्षण**

इकाई – चार

- **भाषा व्यवहार – टिप्पणी, मसौदा लेखन, सार-लेखन, विज्ञापन व निविदा लेखन**
- **हिन्दी में पारिभाषिक शब्द निर्माण : प्रक्रिया एवं प्रस्तुति**

इकाई – पाँच

- **हिन्दी की साहित्यिक पत्रकारिता - अर्थ ,अवधारणा और महत्व**
- **स्वतंत्रता पूर्व हिन्दी पत्रकारिता – परम्परा , परिचय और प्रवृत्तियाँ**
- **समकालीन साहित्यिक पत्रकारिता - परिचय और प्रवृत्तियाँ**

इकाई – छ:

पत्रलेखन – सरकारी, व्यावसायिक

Syllabus ***(HINDI)***

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BHINMAJ06T**
Course Title: **Chhaywadottar hindi kavita (छायावादोत्तर हिन्दी कविता)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • **इस पाठ्यक्रम के माध्यम से छात्र छायावादोत्तर हिंदी कविता के कवियों की कविताओं को गहन रूप से समझ**
Learning Outcome: • **छात्र छायावादोत्तर प्रमुख कवियों अज्ञेय ,मुक्तिबोध ,नागार्जुन एवं धूमिल से परिचित होगे तथा उन**

इकाई – एक

- **रामधारी सिंह दिनकर – कुरूक्षेत्र (केवल षष्ठ सर्ग)**
- **अज्ञेय – साँप, नदी के द्वीप , कलगी बाजरे की**

इकाई – दो

- **नागार्जुन - बादल को घिरते देखा है, प्रेत का बयान, अकाल और उसके बाद**

इकाई – तीन

- **मुक्तिबोध – चाँद का मुँह टेढ़ा है, भूँल गलती, मैं तुम लोगों से दूर हूँ**

इकाई – चार

- रघुवीर सहाय - हँसो-हँसो जल्दी हँसो . स्वाधीन व्यक्ति , अधिनायक

इकाई – पाँच

- धूमिल – पटकथा, रोटी और संसद, मोचीराम

इकाई – छः

- भवानी प्रसाद मिश्र – सतपुड़े का जंगल , गीत-फरोश

सर्वेश्वर दयाल सक्सेना – काठ की घंटियाँ , पथराव

Syllabus *(HINDI)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BHINMAJ07T**
Course Title: **Hindi kahani (हिन्दी कहानी)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • इस पाठ्यक्रम के अंतर्गत छात्र प्रमुख कहानीकार और उनकी कहानी के माध्यम से कहानी की उपयोगिता और व
Learning Outcome: • छात्र कहानी की रचनागत वैशिष्ट्य बता सकेंगे । • छात्र कहानी के विभिन्न तत्वों की विशेषताएँ बता स

इकाई – एक

- उसने कहा था – चंद्रधर शर्मा गुलेरी
- पूस की रात – मुंशी प्रेमचंद

इकाई – दो

- आकाश दीप – जयशंकर प्रसाद
- पाजेब – जैनेन्द्र कुमार

इकाई – तीन

- तीसरी कसम – फनीश्वरनाथ रेणु
- परिन्दे – निर्मल वर्मा

इकाई – चार

- दोपहर का भोजन – अमरकांत

- सिक्का बदल गया – कृष्णा सोवती

इकाई – पाँच

- पिता – ज्ञानरंजन
- धुसपैठिऐ – ओमप्रकाश बाल्मीकि

इकाई – छः

- वारेन हेस्टिंग्स का साँड़ – उदय प्रकाश
- तुम किसकी हो बिन्नी – मैत्रेयी पुष्पा

Syllabus *(HINDI)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BHINMAJ08T**
Course Title: **Bharatiya kavyashastra (भारतीय काव्यशास्त्र)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • इस पाठ्यक्रम के द्वारा विद्यार्थी भारतीय काव्यशास्त्र की पंरपरा से परिचित होंगे। • काव्यशास्
Learning Outcome: • छात्र साहित्य का मूल्यांकन करने वाला साहित्यशास्त्र से अवगत होगे । • छात्र काव्य की परिभाषा बत

इकाई – एक

- काव्य लक्षण , काव्य हेतु एवं काव्य प्रयोजन
- रस सिद्धान्त - रस की अवधारण , रस की निष्पति और सधारणीकरण , रसांग

इकाई – दो

- ध्वनि सिद्धान्त – ध्वनि की अवधारणा , ध्वनि का वर्गीकरण
- अलंकार सिद्धान्त – अलंकार की अवधारणा , अलंकारो का वर्गीकरण

इकाई – तीन

- अलंकार सिद्धान्त एवं अन्य सम्प्रदाय
- रीति सिद्धान्त – रीति की अवधारणा , रीति एवं गुण , रीति का वर्गीकरण

इकाई – चार

- **वक्रोक्ति सिद्धान्त – वक्रोक्ति की अवधारणा , वक्रोक्ति का वर्गीकरण , वक्रोक्ति एवं अभिव्यंजनावाद**

इकाई – पाँच

- **औचित्य सिद्धान्त – औचित्य की अवधारणा**
- **काव्य रूप – दृश्यकाव्य (रूपक एवं उपरूपक)**

इकाई – छः

- **श्रव्यकाव्य - पद्य , गद्य , चम्पू, प्रबन्ध एवं मुक्तक**

Syllabus *(HINDI)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BHINMAJ09T**
Course Title: **Hindi Upanyas (हिन्दी उपन्यास)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• विद्यार्थियों को इस पाठ्यक्रम के अध्ययन से उपन्यास के विश्लेषण की पद्धति की जानकारी मिलेगी। •**
Learning Outcome: **• छात्र हिंदी उपन्यास के स्वरुप , उद्भव एवं विकास की प्रक्रिया को जान सकेंगे । • छात्र हिंदी के प्**

इकाई – एक

- **गबन – मुंशी प्रेमचंद**

इकाई – दो

- **सुनीता – जैनेन्द्र कुमार**

इकाई – तीन

- **महाभोज – मन्नू भंडारी**

इकाई – चार

- **मैला आंचल – फणीश्वरनाथ रेणु**

इकाई – पाँच

- **सावधान नीचे आग है – संजीव**

इकाई – छः
ग्लोबल गाँव के देवता – रणेन्द्र

Syllabus *(HINDI)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BHINMAJ10T**
Course Title: **Hindi Natak Ebong ekanki (हिन्दी नाटक एवं एकांकी)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• इस पाठ्यक्रम के माध्यम से विद्यार्थियों में संवाद-कला का विकास होगा। • पाठ्यक्रम में निहित नाट**
Learning Outcome: **• छात्र हिंदी नाटक के स्वरुप , उद्भव एवं विकास की प्रक्रिया को जान सकेंगे । • छात्र हिंदी के प्रति**

नाटक
इकाई – एक

- **अंधेर नगरी – भारतेंदु हरिश्चंद्र**

इकाई – दो

- **आधे-अधूरे – मोहन राकेश**

इकाई – तीन

- **स्कंदगुप्त – जयशंकर प्रसाद**

इकाई – चार

- **माधवी – भीष्म साहनी**

एकांकी
इकाई – पाँच

- **औरंगजेब की आखिरीरात – रामकुमार वर्मा**
- **और वह जा न सकी – विष्णु प्रभाकर**

इकाई – छः

- **भोर का तारा – जगदीशचंद्र माथुर**

- **औरत – सफदर हाशमी**

Syllabus *(HINDI)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BHINMAJ11T**
Course Title: **Pashchatya Kavyashastra (पाश्चात्य काव्यशास्त्र)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• विद्यार्थी पश्चिमी साहित्य चिंतन की परम्परा से परिचित हो सकेंगे तथा वे भारतीय और पाश्चात्य आल**
Learning Outcome: **• छात्र पाश्चात्य काव्य चिंतको से परिचित होगे तथा उनके काव्य दर्शन ,सिध्दांतो को जान सकेगे । • छा**

इकाई – एक

- **प्लेटो – काव्य संबंधी मान्यताएँ**
- **अरस्तु – अनुकृति सिद्धान्त, विरेचन सिद्धान्त**

इकाई – दो

- **मैथ्यू अर्नाल्ड – कला और नैतिकता का सिद्धांत**
- **होरेस – औचित्य सिद्धांत**

इकाई - तीन

- **लोंजाइनस - काव्य में उदात्त की अवधारणा**
- **क्रोचे – अभिव्यंजनावाद**

इकाई – चार

- **टी .एस . इलियट – परम्परा की अवधारणा , निवैयक्तिकता का सिद्धान्त**
- **आई.ए.रिचर्डस – मूल्य सिद्धान्त , सम्प्रेषण सिद्धान्त**

इकाई – पाँच

- **स्वच्छंदतावाद , यथार्थवाद ,आधुनिकता , उत्तर अधुकिता**

इकाई – छः

- **संरचनावाद, बिम्ब, प्रतीक, फेंटेसी, मिथक**

Syllabus *(HINDI)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BHINMAJ12T**
Course Title: **Hindi alochna (हिन्दी आलोचना)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • **इस पाठ्यक्रम के अध्ययन से विद्यार्थियों में आलोचना की सैद्धांतिक और व्यावहारिक समझ विकसित होग**
Learning Outcome: • **छात्र आलोचना के अर्थ , स्वरुप एवं विकास को समझ सकेंगे । • हिंदी के प्रमुख आलोचको की आलोचना दृष्टि**

इकाई – एक

- **हिन्दी आलोचना की पृष्टभूमि और परम्परा का विकास**

इकाई – दो

- **भारतेंदु युगीन आलोचना – परिस्थितियाँ, प्रमुख आलोचक एवं उनकी आलोचना दृष्टि**
- **द्विवेदी युगीन आलोचना – परिस्थितियाँ, प्रमुख आलोचक एवं आलोचना दृष्टि**

इकाई – तीन

- **शुक्ल युगीन आलोचना – परिस्थितियाँ, प्रमुख आलोचक एवं आलोचना दृष्टि**

इकाई – चार

- **शुक्लोत्तर युगीन आलोचना –परिस्थितियाँ, प्रमुख आलोचक एवं आलोचना दृष्टि**

इकाई – पाँच

- **हिन्दी के प्रमुख आलोचक और उनकी आलोचना दृष्टि – रामचंद्र शुक्ल , हजारीप्रसाद द्विवेदी , नन्ददुलारे वाजपेयी , रामविलास शर्मा , नामवर सिंह**

इकाइ – छ:

- **रसवादी आलोचना , मानोवैज्ञानिक आलोचना , प्रगतिशील आलोचना , नयी समीक्षा , समकालीन आलोचना**

Syllabus *(HINDI)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BHINMAJ13T**
Course Title: **Hindi Nibandh (हिन्दी निबंध)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • विद्यार्थियों में विश्लेषण और रचना-प्रक्रिया की समझ विकसित होगी। वे हिंदी निबंध के वृहद परिप्
Learning Outcome: • छात्र निबंध का रचनागत वैशिष्ट्य बता सकेंगे । • छात्र निबंध के तत्वों की विशेषताएँ , विभिन्न भेद

इकाई – एक

- **भारतवर्ष की उन्नति कैसे हो सकती है? – भारतेन्दु हरिश्चंद्र**
- **मूँछ – प्रतापनारायण मिश्र**

इकाई – दो

- **कवि कर्तव्य – महावीर प्रसाद द्विवेदी**
- **कछुआ धर्म – चंद्रधर शर्मा 'गुलेरी'**

इकाई – तीन

- **यथार्थवाद और छायावाद – जयशंकर प्रसाद**
- **स्त्री के अर्थ स्वातंत्र्य का प्रश्न – महादेवी वर्मा**

इकाई – चार

- **कविता क्या है? – आचार्य रामचंद्र शुक्ल**
- **ठाकुरजी की बटोर – हजारीप्रसाद द्विवेदी**

इकाई – पाँच

- **आस्था और सौंदर्य – रामविलास शर्मा**
- **वैष्णव की फिसलन – हरिशंकर परसाई**

इकाई – छः

- **मेरे राम का मुकुट भींग रहा है – विद्यानिवास मिश्र**
- **बेहाया का जंगल – कृष्णबिहारी मिश्र**

Syllabus *(HINDI)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BHINMAJ14T**
Course Title: **Hindi ki anye gady vidhayen (हिन्दी की अन्य गद्य विधाएँ)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• इस पाठ्यक्रम के अध्ययन से विद्यार्थी हिंदी गद्य के कथा साहित्य से भिन्न अन्य गद्य विधाओं का ज्ञ**
Learning Outcome: **• छात्र गद्य की अन्य विधाएँ जीवनी , आत्मकथा , रेखाचित्र , संस्मरण , डायरी साहित्य , यात्रा वृतांत को**

इकाई – एक
संस्मरण

- **विष्णु प्रभाकर - जाने अनजाने**
- **शिवपूजन सहाय - वे दिन वे लोग**

इकाई – दो
रेखाचित्र

- **रामवृक्ष बेनीपुरी – रजिया (माटी की मूरतें संग्रह से)**
- **महादेवी वर्मा – चीनी फेरीवाला**

इकाई – तीन
आत्मकथा

- **ओमप्रकाश बाल्मीकि – जूठन**

इकाई – चार
जीवनी

- **अमृत राय – कलम का सिपाही (आरंभ से दो अध्याय)**

इकाई – पाँच
यात्रा वृत्तांत

- **राहुल सांस्कृत्यायन – अथातो घुम्मकड़ जिज्ञासा**

इकाई – छ:
डायरी साहित्य

- **रामधारी सिंह दिनकर - दिनकर की डायरी**

Syllabus ***(HINDI)***

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BHINMAJ15T**
Course Title: **Asmitamulak vimarsh aur hindi sahitya (अस्मितामूलक विमर्श और हिन्दी साहित्य)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **• विद्यार्थियों में अस्मितामूलक विमर्श का ज्ञान विकसित होगा तथा इसके साथ ही विभिन्न अस्मिताओं**
Learning Outcome: **• छात्र अस्मिता मूलक विमर्श की अवधारणा को समझ सकेंगे । • छात्र दलित विमर्श , स्त्री विमर्श तथा आदि**

इकाई – एक

- **विमर्शों की सैद्धांतिकी :**

(क) दलित विमर्श : अवधारणा और आन्दोलन , फुले और अम्बेडकर
(ख) स्त्री विमर्श:अवधारणा और मुक्ति विमर्श (पाश्चात्य और भारतीय विमर्श)
इकाई - दो
(क) आदिवासी विमर्श : अवधारणा और आन्दोलन
(ख) किसान विमर्श : अवधारणा और आन्दोलन
इकाई – तीन

- **विमर्शमूलक कथा साहित्य :**

(क) ओमप्रकाश बाल्मीकि – सलाम
(ख) हरिराम मीणा – घूणी तपे तीर , पृष्ट संख्या : 158 – 167
इकाई – चार
(क) नासिरा शर्मा – खुदा की वापसी
(ख) पूस की रात – प्रेमचंद
इकाई – पाँच

- **विमर्शमूलक कविता :**

(क) दलित कविता : अछूतानंद - दलित कहा तक पड़े रहेंगे, माता प्रसाद - सोनवा का पिंजरा
(ख) स्त्री कविता : कीर्ति चौधरी : सीमा रेखा, सविता सिंह : मैं किसकी औरत हूँ
(ग) आदिवासी कविता : अनुज लुगुन - अघोषित उलगुलान, निर्मला पुतुल –आदिवासी स्त्रियाँ

इकाई – छ:

- **विमर्शमूलक अन्य गद्य विधाएँ :**

(क) प्रभा खेतान : अन्या से अनन्या (पृष्ट 28 से 42 तक)
(ख) तुलसीराम : मुर्दहिया (चौधरी चाचा से प्रारंभ, पृष्ट संख्या 125 से 135)
(ग) महदेवी वर्मा : 'स्त्री के अर्थ स्वातंत्र्य का प्रश्न

Syllabus ***(HINDI)***

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BHINMAJ16T**
Course Title: **BHASHA VIGYAN (भाषा विज्ञान)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • विद्यार्थी भाषा विज्ञान के स्वरूप और महत्व को समझ सकेंगे। क्योंकि भाषा ही साहित्य अध्ययन की नी
Learning Outcome: • छात्र भाषा एवं भाषा विज्ञान के अर्थ एवं स्वरुप को समझ सकेंगे । • छात्र भाषा एवं भाषा विज्ञान के

इकाई – एक

- **भाषा : परिभाषा , विशेषताएँ , भाषा परिवर्तन के कारण , भाषा और बोली, भाषा की सामाजिक भूमिका।**

इकाई – दो

- **भाषा विज्ञान की परिभाषा, अंग, भाषा विज्ञान की शाखाएँ।**

इकाई – तीन

- **भाषा का पारिवारिक वर्गीकरण : भारोपीय परिवार के विशेष संदर्भ में।**
- **स्वनिम विज्ञान : परिभाषा , स्वन, वागीन्द्रियाँ , स्वनों का वर्गीकरण : स्थान और प्रयत्न के आधार पर , स्वन परिवर्तन के कारण**

इकाई – चार

- **वाक्य विज्ञान : वाक्य की परिभाषा , वाक्य के प्रकार , वाक्य परिवर्तन के कारण**

इकाई – पाँच

- **रूपिम विज्ञान : रूपिम की परिभाषा, रूपिम के प्रकार, रूपिम परिवर्तन के कारण**

इकाई – छः

- **अर्थ विज्ञान : अर्थ परिवर्तन के कारण और दिशाएँ**

Syllabus ***(HINDI)***

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BHINMAJ17T**
Course Title: **Lok sahitya : (लोक साहित्य)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • इस पाठ्यक्रम के अध्ययन से छात्र लोक साहित्य की भाव गंभीरता, सांस्कृतिक रूप और सहज अभिव्यक्ति का
Learning Outcome: • छात्र लोक साहित्य की अवधारणा एवं स्वरूप को समझ सकेंगे । • छात्र लोक और साहित्य के अंत: संबंध ,लोक

इकाई – एक

- **लोक साहित्य की अवधारणा , लोक संस्कृति और साहित्य**

इकाई - दो

- **साहित्य और लोक का अंतः सम्बन्ध , लोक साहित्य के अध्ययन की समस्याएँ**

इकाई – तीन

- भारत में लोक साहित्य का अध्ययन का इतिहास , लोक साहित्य के प्रमुख रूपों का वर्गीकरण
- लोक गीत - संस्कारगीत , व्रतगीत , श्रमगीत , ऋतुगीत , जातिगीत

इकाई – चार

- हिन्दी नाटक एवं रंगमंच पर लोकनाट्य का प्रभाव

इकाई – पाँच

- लोकनाट्य - रामलीला , रासलीला , कीर्तनियाँ, विदेशिया , नौटंकी
- हिन्दी लोकनाट्य की परम्परा एवं प्रविधि

इकाई – छः

- लोकभाषा : लोक संभाषित मुहावरे , कहावते, लोकोक्तियाँ , पहेलियाँ
- लोकनृत्य और लोक संगीत

Syllabus ***(HINDI)***

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BHINMAJ18T**
Course Title: **Tulanatmak sahitya (तुलनात्मक साहित्य)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: • विद्यार्थियों को तुलनात्मक साहित्य के द्वारा विविध साहित्यिक-भाषाकि-सांस्कृतिक परम्पराओं के
Learning Outcome: • छात्र तुलनात्मक साहित्य के अर्थ एवं स्वरूप को जान सकेंगे । • छात्र तुलनात्मक साहित्य के महत्व

इकाई – एक

- तुलनात्मक साहित्य सिद्धांत : परिभाषा एवं स्वरूप

इकाई – दो

- तुलनात्मक साहित्य : विविध स्कूल (केंद्र)

इकाई – तीन

- तुलनात्मक साहित्य की विशेषताएँ व समस्याएँ

इकाई – चार

- **हिंदी और बांग्ला साहित्य का तुलनात्मक अध्ययन : क्षेत्र एवं समस्याएँ**

इकाई – पाँच

- **तुलनात्मक साहित्य में अनुवाद की भूमिका**

इकाई – छ:

- **निराला और नजरूल की कविताओं का तुलनात्मक अध्ययन**

निराला – विधवा
नजरूल – नारी

- **प्रेमचंद और शरतचंद्र की कहानियों का तुलनात्मक अध्ययन**

प्रेमचंद – कफन
शरतचंद्र – अभागी का स्वर्ग

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Sidho-Kanho-Birsha University

Syllabus & Course Curriculam

Syllabus *(HISTORY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BHISMAJ01T**
Course Title: **Idea of Bharat and Its History up to 600 BC**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Idea of Bharat and Its History up to 600 BC**
Learning Outcome: **Idea of Bharat and Its History up to 600 BC**

SIDHO-KANHO-BIRSHA UNIVERSITY
4 years B.A Honours with Major under CCFUGP
Paper-I
FIRST SEMESTER
BHISMT 101

Idea of Bharat and Its History up to 600 BC

UNIT-I: Idea of Bharatvarsha
I. Understanding of Bharatvarsha
II. The glory of Indian Literature: Vedas, Vedanga, Upanishads, Epics, Jain and Buddhist Literature, Smriti, Puranas etc. - 10 classes

UNIT-II: Indian Philosophy, Science and Environment
I. Evolution of language and Scripts
II. Indian educational system
III. The ethics of Indian valor
IV. Science and Technology
V. Environmental conservation: Indian View
VI. Health consciousness of (Science of Life): Ayurveda Yoga and Naturopathy -10 classes

UNIT – III: Sources and Historiography
I. Sources and Historiographical trends of ancient Indian History up to 600 C.E.
III. The Indus Civilization, Debate on the relationship of Indus and Vedic civilization.
IV. Significant features of Indus, its continuity, fall and survival.-15 classes

UNIT – IV: Hunter-gatherers and the advent of food products

i. Paleolithic cultures- sequence and distribution; stone industries and other technological developments.
ii. Mesolithic cultures – regional and chronological distribution; new developments in technology and economy; rock art.
iii. Neolithic and Chalcolithic cultures: distribution and subsistence pattern- 10 Classes

UNIT – IV: Harappa and Vedic Civilization
I. Its origins and Phases of Harappan Civilization- settlement patterns and town planning system; General Features of the Civilization

II. Agrarian base; Industries and craft productions- pottery and trade; social and political organizations; religious beliefs and practices; famous Harappan Sites -the problem of urban decline - 20 Classes

III. Original home land of Aryans, Myths of Aryan Invasion: Various theories

IV. Vedic Cultures- Early Vedic and Post Vedic Literature and Vedic Polity, society and Economy - 15 classes

UNIT- V: India from Sixth Century BCE to Mauryan Age

I. Sources

II. India in sixth century BCE Mahajanpada, Republic and Growth of Urban Centers, Rise of Magadhan Imperialism.

III. Religious systems in 6th century BCE, Buddhism and Jainism.

IV. The Maurya Empire, Chandragupta Maurya, Mauryan administration, Ashok and Ashoka's Dhamma. Mauryan Society, Fall of Mauryan Empire. Greek Invasion and its Impact-10 Classes

UNIT-VI: Buddhism and Jainism

I. Doctrines of Buddhism-Buddhism and Brahmanism- Popularity of Buddhism-decline of Buddhsim-Buddhist Councils-Important Buddhist writers –Eight Great Bodhisattava/path-Vardhama Mahavira

II. Jainism: early jain Literature- Life of Vardhama Mahavira-doctrines of Jainism-Buddhism and Jainism-spread-and influence of Jainism- Different scholars of Jainism – Jain Councils -10 classes

Reading References:

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Balbir Singh Sihag: Kautilya: The true founder of Economics, Vitasta Publishing Pvt. Ltd, Delhi, 2014

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Will Durant: The Story of civilization, five communications, US, Jan. 1993(11 Vol)

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ShereenRatnagar, Understanding Harappa: Civilization in the Greater Indus Valley, New Delhi

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D.D. Kosambi, An Introduction to the Study of Indian History, Bombay

R.S, Sharma, Aspects of Political Ideas and Institutions in Ancient India, Delhi

Upinder Singh, A History of Ancient and Early Medieval India, from Stone Age to the 12th Century, Delhi

Dilip Kr. Chakraborty, The Oxford Companion to Indian Archaeology, OUP, New Delhi

Sankalia, HD: Prehistory and Prohistory of India and Pakistan, Poona 1974

Sastri, K.A Nilakanta: A History of South India, from Prehistoric Times to the fall of Vijyanagar, Oxford University Press, 1955; Also, in Hindi Translation by Bihar Hindi Granth Academy.

Singh, Kripa Shankar: Rigveda, Harrappa Sabhyata and Sanskritic Nirantarta, Kitab Ghar publication, New Delhi, 2007

Raychaudhary, H.C: Political History of Ancient India, rev Edition, 1953

শর্মা, রামশরণ, ভারতের সমাজতন্ত্র, (Indian Feudalism), কে পি বাগচি এন্ড কোং, কলকাতা

শর্মা, রামশরণ, আর্যদের অনুসন্ধান, (Looking for the Aryans), প্রগ্রেসিভ পাবলিশার্স, কলকাতা

শর্মা, রামশরণ, আর্যদের ভারতে আগমন, (Advent of the Aryans), ওরিয়েন্ট লংম্যান, ২০০১

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**

Semester: **1**

Course Code: **BVACENV01T**

Course Title: **ENVIRONMENTAL STUDIES**

(L-P-Tu): **2-2-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**

Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980

- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(HISTORY)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BHISMAJ02T**
Course Title: **Cultural Transition in Ancient India: 600 BC-187 BC**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Cultural Transition in Ancient India: 600 BC-187 BC**
Learning Outcome: **Cultural Transition in Ancient India: 600 BC-187 BC**

Paper-II

SECOND SEMESTER

BHISMT 201

Cultural Transition in Ancient India: 600 BC-187 BC

UNIT-I: Mauryan Arts and Architectures

I. Architecture- Palaces, Caves and StūpasSculpture- Aśoka's Pillars, cultural relations in Maurya states as reflected in art and architecture – 15 Classes

II.Cultural developments in post-Maurya age: art, architecture, sculpture with special reference to Mathura and Gandhara School of Arts- 15 classes

UNIT-II: Amaravati School of Arts

I. Historical Background, Major features and significance - 5 classes

UNIT-III: Sangam Age

I. Development of Literature, II. Polity- Economy, Arts -5 Classes

UNIT-IV: Mathura School of Arts

I.Early stone sculpture in Mathura and Mathura sculpture styles

II.Jain and Buddhist relives and its major features and significance - 10 classes

UNIT-V: Literary Development

I. Development of classical literatures of Maurya with special reference to Buddhist Literature– 10 Classes

Reading References:

R.S. Sharma, Material Culture and Social Formations in Ancient India, Delhi; Sudras in Ancient India: A Social History of the Lower Order Down to circa AD 600, Delhi; Indian Feudalism, McMillan; Urban Decay in India (c.300 – c.600), New Delhi

Uma Chakraborti, The Social Dimensions of Early Buddhism, OUP

Dipankar Gupta (ed), Social Stratification, OUP

R.c. majumdar (ed), History and Culture of Indian People, BharatiyaVidyabhavan

Agarwal, D.P: The Archaeology of India, 1985

Jayaswal, Vidula: Bhartiya Itihas Ke Adi Charna ki Rooprekha, Delhi, 1987

Majumdar, R.C. and Pusalkar, A.D (edited): The History and Culture of Indian

People Vol. I, Vedic Age.

Majumdar, R.C. and Pusalkar, A.D (edited): The History and Culture of Indian

People Vol. II: The Age of Imperial Unity

Pandey, Rajbali: Prachin Bharat, Vishwavidyalya Prakashan, revised edition, Varanasi, 2010.

Raychaudhary, H.C.: The History and Culture of Ancient India, Vol III: The Classical age

ভট্টাচার্য, নরেন্দ্রনাথ, প্রাচীন ভারতে ধর্ম, কলকাতা, ১৯৮৮

ভট্টাচার্য, নরেন্দ্রনাথ, প্রাচীন ভারতীয় সমাজ, পশ্চিমবঙ্গ রাজ্য পুস্তক পর্ষদ, কলকাতা

ভট্টাচার্য, সুকুমারী, ইতিহাসের আলোকে বৈদিক সাহিত্য, পশ্চিমবঙ্গ রাজ্য পুস্তক পর্ষদ, কলকাতা

ভট্টাচার্য, সুকুমারী, প্রাচীন ভারত- সমাজ ও সাহিত্য, আনন্দ পাবলিশার্স, কলকাতা

চক্রবর্তী, দিলীপ কুমার - ভারতবর্ষের প্রাক্ ইতিহাস আনন্দ পাবলিশার্স, কলকাতা, ১৯৯৯

গঙ্গোপাধ্যায়, দিলীপ কুমার - ভারত ইতিহাসের সন্ধানে, (২ খন্ডে), ২০০৭

চক্রবর্তীরণবীর, প্রাচীন ভারতের অর্থনৈতিক ইতিহাসের সন্ধানে, আনন্দ পাবলিশার্স, কলকাতা ২০০২ (সংশোধিত সংস্করণ)

বাশাম ,এ. এল. অতীতের উজ্জ্বল ভারত, (The Wonder That Was India), প্রগ্রেসিভ পাবলিশার্স, কলকাতা, ২০০৫

চক্রবর্তী, রণবীর, ভারত ইতিহাসের আদি পর্ব, কলকাতা, ২০০৭

হাবিব, ইরফান, ভারতবর্ষের সাধারণ মানুষের ইতিহাস

প্রথম খন্ড – প্রাক-ইতিহাস, (Pre-history) এন বি এ, কলকাতা, ২০০২

দ্বিতীয় খন্ড: সিন্ধু সভ্যতা, (The Indus Civilization) এন বি এ, কলকাতা, ২০০২

তৃতীয় খন্ড – বৈদিক সভ্যতা, (The Vedic Age) এন বি এ, কলকাতা, ২০০২

ঝাডি এন, আদি ভারত – একটি সংক্ষিপ্ত ইতিহাস, (Ancient India: An Introduction), প্রগ্রেসিভ পাবলিশার্স, কলকাতা

কোশাম্বী ডি. ডি. ভারত ইতিহাস চর্চার ভূমিকা (An Introduction to the Study of Indian History) বাগচি কে পি এন্ড কোং, কলকাতা, ২০০২

রত্নাগর. শিরিণ, হরপ্পা সভ্যতার সন্ধানে (Understanding Harappa) এন বি এ, কলকাতা, ২০০৩

রায়চৌধুরী, হেমচন্দ্র, প্রাচীন ভারতের রাজনৈতিক ইতিহাস, (Political History of Ancient India), পশ্চিমবঙ্গ রাজ্য পুস্তক পর্ষদ, কলকাতা

থাপার, রোমিলা, ভারতবর্ষের ইতিহাস, ওরিয়েন্ট লংম্যান, কলকাতা

ভট্টাচার্য, নরেন্দ্রনাথ, প্রাচীন ভারতে ধর্ম, কলকাতা, ১৯৮৮

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(HISTORY)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BHISMAJ03T**
Course Title: **Consolidation of Gupta Empire: 187BC – 650 CE**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Consolidation of Gupta Empire: 187BC – 650 CE**
Learning Outcome: **Consolidation of Gupta Empire: 187BC – 650 CE**

Paper-III

THIRD SEMESTER

BHISMT 301

Consolidation of Gupta Empire: 187BC – 650 CE

UNIT-I: Sources

I: Literary Sources: Indian and Foreign Evidences, Archaeological sources

II: Biography and Inscriptions – 10 Classes

UNIT-II: Political Scenario of Guptas

I. Changing political formations: age of imperial unity; rise of Guptas – 10 Classes

II. The Gupta empire: nature and bases; polity and administrations-Decline of the Guptas- the causes of urban decline and its historical interpretations– 10 Classes

UNIT-III: Society and Economy

I. Age of Guptas: agrarian expansion; changing production relations;society and economy

II. Development of Science and Technology during Gupta periods – 10 Classes

UNIT-IV: Foreign Invasions

I. Post-Guptas developments: foreign invasions and their impacts; post-Guptas policies with special reference to Kushanas and Satavahanas - 10 Classes

UNIT-V: Other Dynasties

Different facets of other contemporary dynasties - Maitrakas- Maukharies- Chalukyas, Pallavas- Pandyas- 10 Classes

Reading References:

R. Thapar, Asoka and the Decline of the Mauryas, OUP; The Mauryas Revisited, Calcutta

Ashvini Agrawala, The Rise and Fall of the Imperial Guptas, Motilal Banarsidas

Ranabir Chakraborti, Bharat-ItihaaserAadiparva (Vol. I), Kolkata

R. Thapar, Interpreting Early India, OUP

R.C. Majumdar (ed), The History and Culture of the Indian People: Vol. 2, 3 & 4, Bharati Vidyabhavan

Niharranjan Ray, Bangalir Itihaas Adi Parva, Kolkata

R.S. Sharma, Perspectives in the Social and Economic History of Early India, Munshiram Manoharlal

Syllabus *(HISTORY)*

Course Type: **MAJ-4**

Semester: **4**

Course Code: **BHISMAJ04T**

Course Title: **The Early Medieval History of India: C. 650-1206**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **The Early Medieval History of India: C. 650-1206**

Learning Outcome: **The Early Medieval History of India: C. 650-1206**

Paper-IV

FOURTH SEMESTER

BHISMT 401

The Early Medieval History of India: C. 650-1206

UNIT- I: Studying Early Medieval India

Studying early Medieval India: sources and approaches; debate on Indian Feudalism; Rajput states: rise and nature – 10 Classes

UNIT- II: Political Structures:

I. Evolution of political structures: Rashtrakutas, Palas, Senas, Pratiharas, Rajputs and Cholasand Chalukyas Chauhans-Chandellas- Paramars - Karkota-Utpal-Hindu Shahi Dynasty - Conflicts; administration, Economy-Society; and Chola's contact with South-East Asia and China-10

II. Arab conquest of Sindh : nature and impact of the new set-up; Ismaili Dawah

Cause and consequences of early Turkish invasions : Mamud of Ghazna; Shahab-ud-Din of Ghur-10

UNIT- III: Agrarian structure and social change:

I. Agricultural expansion with hydraulic structures
II. Settlements History
III.Peasantry and land lords during the period – 10 Classes

UNIT –IV: Trade and Commerce

I. Inter-regional trade
II. Maritime trade
III. Forms of exchange
IV. Process of urbanization
V. Merchant guilds of South India-10

UNIT-V: Religious and Cultural developments:

I. Bhakti, Tantrism, Puranic traditions; Buddhism and Jainism; Popular religious cults

II. Islamic intellectual traditions: Al-Biruni; Al-Hujwiri-10 classes

Suggested Readings:

Basham, A.L., (ed.), A Cultural History of India
Basham, A.L., The Wonder that was India
Bose Mandakranta (ed.), Faces of Feminine in Ancient Medieval and Modern India, New York, 2000
Chakravarti Ranabir, Exploring Early India upto Circa AD 1300
Chakravarti, R(ed.), Trade in Early India, Delhi
Champalakshmi, R, Trade, Ideology and Urbanization: South India 300 BC – AD 1300, Delhi, 1966
Chandra, S, History of Medieval India (800 -1700)
Chattopadhyay, B.D, Aspects of Rural settlements and Rural Society in Early Medieval India
Chattopadhyay, B.D, Science and Society in Ancient India, Calcutta, 1977
Chattopadhyay, B.D, Studying Early India: Archaeology, Texts and Historical Issues , New Delhi, 2003
Chaudhuri, K.N, Trade and Civilizations in the Indian Ocean : An Economic History from the Rise of Islam to 1750
Gopal Lalanji, The Economic Life of Northern India, Varanasi, 1965
Habib, Irfan, Economic History of Medieval India: A Survey, New Delhi, 2001
Habib, Irfan, Medieval India: The Study of Civilizations, New Delhi, 2008
Habib, Md. And Nizami KA (eds), A Comprehensive History of India Vol. V
Habibullah, A.B.M, The Foundation of Muslim Rule in India
Jackson, Peter, The Delhi Sultanate: A Political & Military History, Cambridge, 1999
Jha D.N (ed), The Feudal Order, New Delhi, 2000
Kulke, H., The State in India (1000- 1700)
Majumdar R.C and Dasgupta K.K. (eds), A Comprehensive History of India Vol.Ill
Majumdar R.C. et al (eds), History and Culture of the Indian People Vol. IV and Vol. V
Meister M.M & Dhaky MA, Indian Temple Architecture, Delhi, 1983
Mukherjee B.N, Post-Gupta Coinages of Bengal, Calcutta, 1989
Mukhia, H., The Feudalism Debate
Rakaswami Vijaya, Walking Naked: Women, Society, Spirituality in South India (Simla, 1997)
Ray H.C, Dynastic History of Northern India (New Delhi, 1973)
Ray Nihar Ranjan et al ed., A Source Book of Indian Civilizations (Kolkata, 2000)
Rizvi, S.A.A, The Wonder that was India, Vol. II
Roy Kumkum (ed), Women in Early Indian Societies (New Delhi, 1999)
Sastri , K.A. Nilkanta, A History of South India from Prehistoric Times to the Fall of Vijaynagar,
Sastri K.A. Nilkantha, The Cholas (Madras, 1975 [reprint])
Sastri, K.A. Nilkanta (ed), A Comprehensive History of India Vol. II
Sharma R.S, Early Medieval Indian Society: A Study in Feudalisation, Delhi, 2001.
Sharma R.S, Indian Feudalism, University of Calcutta, 1965.

Sharma R.S, Perspectives in the Social and Economic History of Early India, New Delhi, 1983.
Sharma, R.S, Indian Feudalism
Singh Upinder ed., Rethinking Early Medieval India: A Reader, 2011
Singh Upinder, A History of Ancient and Early Medieval India. Delhi, 2008
Thapar Romila, Early India: From the Origins to AD 1300, London, 2002
Thapar, R; Early India
Veluthat, K; The Political Structure of Early Medieval South India
India and the Expansion of Islam 7-11 century, 1990
Yadava, B.N.S, Society & Culture in North India in the 12th century
Yazdani, G., (ed), The Early History of the Deccan
বাশাম, এ. এল, অতীতের উজ্জ্বল ভারত, (The Wonder That Was India), প্রগ্রেসিভ পাবলিশার্স, কলকাতা, ২০০৫
মুখোপাধ্যায় হীরেন্দ্রনাথ, ভারত বর্ষের ইতিহাস (১মখন্ড) (প্রাচীনওমধ্যযুগ), পশ্চিমবঙ্গ রাজ্য পুস্তক পর্ষদ, প্রথম মুদ্রণ নভেম্বর১৯৯৭
ভট্টাচার্য, নরেন্দ্রনাথ,ধর্ম ও সংস্কৃতিক: প্রাচীনভারতীয় প্রেক্ষাপট
চক্রবর্তী, রণবীর, প্রাচীন ভারতের অর্থনৈতিক ইতিহাসের সন্ধানে, আনন্দ পাবলিশার্স, কলকাতা২০০২
চক্রবর্তী, রণবীর, ভারত ইতিহাসের আদিপর্ব, ওরিয়েন্ট লংম্যান,কলকাতা, ২০০৭
সেন, সমরেন্দ্রনাথ, বিজ্ঞানের ইতিহাস, শৈব্যা প্রকাশন, ১৯৯৬
শর্মা, রামশরণ, ভারতের সামন্ততন্ত্র, (Indian Feudalism), কে. পি. বাগচিএন্ড কোং, কলকাতা
শর্মা, রামশরণ, আদি মধ্যযুগের ভারতীয় সমাজ: সামন্ত-প্রক্রিয়া বিষয়ে এক সমীক্ষা(Early Medieval Indian Society: A Study in Feudalization), ওরিয়েন্ট লংম্যান, ২০০৩

Syllabus *(HISTORY)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BHISMAJ05T**
Course Title: **Religion, Society and Culture in Medieval India**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Religion, Society and Culture in Medieval India**
Learning Outcome: **Religion, Society and Culture in Medieval India**

Paper-V
FOURTH SEMESTER
BHISMT 402

Religion, Society and Culture in Medieval India

UNIT: I: Development of Literature

I.Rise and growth of regional languages; culture in transition with special reference to art, architecture, painting and sculpture-10 classes

UNIT-II: Schools of Philosophy

I. Vaishnavite movements in Eastern India; Jagannath cult in Orissa; Warkari movement and Vithobamovement in Maharastra – 15 Classes

II. Sufism and Bhaktism: Its origin and development, doctrines, practices, relevance and its impact on society in North-East and South India – 15 Classes

I. Religious tolerance and Sulh-i-kul; cultural developments with special reference to language, literature, art and architecture – 10 Classes

UNIT –III: Economic Scenario

I. Agriculture, Economy and development of science and technology of the period – 10 classes

Reading References:

B.D. Chattopadhyay, The Making of Early Medieval India, OUP
Burton Stein, Peasant State and Society in Medieval South India, OUP
Satish Chandra, History of Medieval India, New Delhi
K.A. Nizami, State and Culture in Medieval India, New Delhi
K.A. Nilkantha Sastri, A History of South India, Oxford

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Sidho-Kanho-Birsha University

Syllabus & Course Curriculam

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BMTMMAJ01T**
Course Title: **Classical Algebra, Analytical Geometry (2D) & Calculus**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **TO BE DONE**
Learning Outcome: **The whole course will have the following outcomes: Upon successful completion of this course, students will be able to CO1: solve tangent and area problems using concepts of limit, derivatives and integrals. CO2: calculate higher order derivatives and fin**

Syllabus:

Unit -1: Classical Algebra [Credit: 2, 30L]

- Complex Numbers: De-Moivre's Theorem and its applications, Direct and inverse circular and hyperbolic functions, Exponential, Sine, Cosine and Logarithm of a complex number.
- Polynomial equation, Fundamental theorem of Algebra (Statement only), Multiple roots, Statement of Rolle's theorem only and its applications, Equation with real coefficients, Complex roots, Descarte's rule of sign, relation between roots and coefficients, transformation of equation, reciprocal equation, binomial equation– special roots of unity, solution of cubic equations–Cardan's method, solution of biquadratic equation– Ferrari's method.
- Inequalities involving arithmetic, geometric and harmonic means. Schwarz and Weierstrass's inequalities.

Unit -2: Analytical Geometry (2D) [Credit: 2, 30L]

- Transformation of Rectangular axes: Translation, Rotation and Rigid body motion, Invariants.
- Pair of straight lines: Condition that the general equation of second degree in two variables should represent a pair of straight lines, Angle between pair of straight lines, Bisectors of angle between the pair of straight lines, Equation of two lines joining the origin to the points in which a line meets a conic.
- General Equation of second degree in two variables: Reduction into canonical form.
- Polar Equations: Polar Co-ordinates, Polar equation of straight lines, Circles, conics referred to a focus as pole. Equations of tangents, normal.

Unit -3: Calculus [Credit: 2, 30L]

- ***Differential Calculus:*** Higher order derivatives, Leibnitz rule of successive differentiation and its applications; Indeterminate forms, L'Hospital's rule; Basic ideas of Partial derivatives, Chain Rules, Jacobian, Euler's theorem and its converse; Tangents and Normals, Sub-tangent and sub-normals, Derivatives of arc lengths, Pedal equation of a curve; Curvature and radius of curvature; Asymptotes; Envelopes; Concavity, convexity and point of inflexion.
- ***Integral Calculus:*** Reduction formulae; Rectification & quadrature of plane curves, length of a curve; Arc length as a parameter; Volume and surface area of revolution.

Reading References:

1. S.K. Mapa, Higher Algebra (Classical), Levant.

2. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006.
3. W.S. Burnstine and A.W. Panton, Theory of equations, Wentworth Press.
4. J.G. Chakraborty & P.R. Ghosh, Advanced Analytical Geometry, U.N. Dhur & Sons Pvt. Ltd.
5. S.L. Loney, The Elements of Coordinate Geometry (Part 1), Arihant.
6. R. M. Khan, Analytical Geometry of two and three dimensions and vector analysis, New Central Book Agency (P) Ltd.
7. Arup Mukherjee and Naba Kumar Bej, Analytical Geometry of Two and Three Dimensions (Advanced level), Books & Allied Pvt. Ltd.
8. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005
9. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
10. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
11. T.M. Apostol, Calculus, Volumes I and II, Wiley Edition.
12. Shanti Narayan, P. K. Mittal, Differential Calculus, S. Chand.
13. Maity & Ghosh, Integral Calculus, New central book agency (P) Ltd.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)
Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)
Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession

- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BMTMMAJ02T**
Course Title: **Algebra-I & Real Analysis-I**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **TO BE DONE**
Learning Outcome: **The whole course will have the following outcomes: CO1: Objective of this course is the revision of their previous lessons of relation, equivalence relation, mapping, inverse mapping and their properties. CO2: Group theory is one of the building blocks of**

Syllabus:

Unit -1: Algebra-I [Credit: 2, 30L]

- **Relation:** Equivalence relation, equivalence classes and partition, partial ordered relation. Hesse's diagram, Lattices as partially ordered set, definition of lattice in terms of meet and join, equivalence of two definitions, linear order relation.
- **Mappings:** Injective, surjective, one-to-one correspondence, composition of two mappings. Inversion of mappings. Extension and restriction of a mappings.

- Principles of Mathematical Induction, Well-ordering Principle, Division Algorithm, Greatest common divisor, Primes and composite numbers, Fundamental theorem of arithmetic, relatively prime numbers, Euclid's algorithm, least common multiple.
- **Congruences:** Properties and algebra of congruences, power of congruence, Fermat's congruence, Fermat's theorem, Wilson's theorem, Euler – Fermat's theorem, Chinese remainder theorem, Number of divisors of a number and their sum, least number with given number of divisors.
- Eulers φ function-φ(n). Mobius μ-function, relation between φ function and μ function. Diophantine equations of the form $ax+by=c$, a, b, c are integers.
- **Group:** Groupoid, semigroup, monoid and quasigroup (definitions and examples). Group, uniqueness of identity and inverse element, law of cancellation, order of a group and order of an element, abelian group, elementary properties of group.
- Definitions of rings and fields with examples.

Unit -2: Real Analysis-I [Credit: 4, 60L]

- Review of Algebraic and Order Properties of R , ε-neighbourhood of a point in R . Idea of countable sets and countability of R , uncountable sets and uncountability of R . Boundedness. Suprema and Infima. Completeness Property of R and its equivalent properties. The Archimedean Property, Density of Rational (and Irrational) numbers in R .

- **Point Set Theory in R:** Intervals. Interior points of a set, open sets. Limit points of a set, isolated points, closed set, derived set, Illustrations of Bolzano-Weierstrass theorem for sets.

- **Sequences:** Real sequence, Bounded sequence, Limit of a sequence, Convergent sequence, liminf, limsup. Limit Theorems. Monotone Sequences, Monotone Convergence Theorem. Sandwich Rule, Nested interval theorem, Cauchy's first and second limit theorem. Subsequences, Divergence Criteria. Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

- **Infinite series**: Convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio test, Cauchy's nth root test, Raabe's test (proof not required), Gauss's test (proof not required), Cauchy's condensation test (proof not required), Integral test

(proof not required). Alternating series, Leibnitz test (proof not required). Absolute and Conditional convergence. Re-arrangement of terms (concepts and elementary examples only).

- **Limits**: Concepts of limits of a function (ε-δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity.

- **Continuity**: Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.

- **Differentiability:** Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem. Mean value theorem. Intermediate value property. Darboux's theorem (statement only). Applications of mean value theorem to inequalities and approximation of polynomials. Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions. Application of Taylor's theorem to inequalities.

Reading References:

1. Sen, Ghosh, Mukhopadhaya, Maity; Topics in Abstract Algebra; Universities Press.
2. S. K. Mapa, Higher Algebra (Abstract and Linear), Levant.

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002
2. Joseph A. Gallian; Contemporary Abstract Algebra; 9th Ed..; Narosa Pub. H.; New Delhi, 1999.
3. D.S. Malik, John M. Mordeson and M.K. Sen; Fundamentals of abstract algebra; McGraw-Hill.
4. T.M. Apostol; Introduction to Analytic Number Theory; Springer.
5. I. Niven, H.S. Zuckerman, H.L. Montgomery; An Introduction to Theory of Numbers; 5th Ed.; John Wiley & Sons, Inc.
6. A.K. Chowdhury; Introduction to Number Theory; 2nd Ed.; NCBA.
7. R.G. Bartle and D. R. Sherbert; Introduction to Real Analysis; 3rd Ed.; John Wiley and Sons (Asia) Pvt. Ltd.; Singapore; 2002.
8. S.K. Berberian; A First Course in Real Analysis; Springer-Verlag; New York; 1994.
9. W. Rudin; Principles of Mathematical Analysis; Tata McGraw-Hill.
10. S.K. Mapa; Introduction to Real analysis; Levant.
11. S.C. Malik & Savita Arora; Mathematical Analysis; New Age International (P) Limited.
12. S.R. Ghorpade and B.V. Limaye; A Course in Calculus and Real Analysis: Springer: 2006.
13. Tom M. Apostol; Mathematical Analysis; Narosa Publishing House.
14. Charles G. Denlinger; Elements of Real Analysis; Jones & Bartlett (Student Edition); 2011.
15. Richard R. Goldberg; Methods of Real Analysis; 2nd Ed.; John Wiley and Sons, Inc.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement**

Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BMTMMAJ03T**
Course Title: **Ordinary Differential Equations & Linear Algebra-I**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **TO BE DONE**
Learning Outcome: **The whole course will have the following outcomes: Upon successful completion, student will be able to CO1: solve first order differential equations utilizing the standard techniques for exact, linear, homogeneous, or Bernoulli cases. CO2: solve first ord**

Syllabus:

Unit -1: Ordinary Differential Equations [Credit: 3, 45L]

- Prerequisite [Genesis of differential equation: Order, degree and solution of an ordinary differential equation, Formation of ODE, Meaning of the solution of ordinary differential equation, Concept of linear and non-linear differential equations].
- Picard's existence and uniqueness theorem (statement only) for dydx=f(x, y) with y = y0 at x = x0 and its applications.
- **Solution of Differential Equations of first order and first degree:** Homogeneous equations and equations reducible to homogenous form. Exact differential equations, condition of exactness, Integrating Factor, Rules of finding integrating factor (statement of relevant results only), equations reducible to exact forms, Linear Differential Equations, equations reducible to linear forms, Bernoulli's equations.
- **Solution of Differential Equations of first order but not of first degree:** Equations solvable for *p*, equations solvable for *x*, equation solvable for *y*, singular solutions, Clairaut's form, equations reducible to Clairaut's Forms - General and Singular solutions.

  Applications of first order differential equations: Geometric applications, Orthogonal Trajectories.

- **Solution of Differential Equations of higher order:** Linear differential equations of second and higher order, Linearly dependent and independent solutions, Wronskian, General solution of second order linear

differential equation, General and particular solution of linear differential equation of second order with constant coefficients. Particular integrals for polynomial, sine, cosine, exponential function and for function as combination of them or involving them, Method of variation of parameters for particular integral (P.I.) of linear differential equation of second order

- Linear Differential Equations with variable co-efficients, Euler- Cauchy equations, Exact differential equations, Reduction of order of linear differential equation, Reduction to normal form. Solutions of some special types of differential equations.
- Simultaneous linear ordinary differential equation in two dependent variables, Solution of simultaneous equations of the form $dx/P = dy/Q = dz/R$.
- Pfaffian Differential Equation $Pdx + Qdy + Rdz = 0$, Necessary and sufficient condition for existence of integrals of the above (proof not required), Total differential equation.

Unit -2: Linear Algebra-I [Credit: 3, 45L]

- Vector space, subspaces, Linear Sum, linear span, linearly dependent and independent vectors, basis, dimension, finite dimensional vector spaces, Replacement Theorem, Extension theorem, Deletion theorem, change of coordinates, Row rank and column rank of a matrix. Rank of a matrix. Row reduced echelon matrix, Normal form of the matrix.
- Systems of linear equations and the matrix equation $Ax=b$. Existence of solutions of homogeneous and non-homogeneous system of equations and determination of their solutions.
- Characteristic Equation of a matrix, Cayley-Hamilton theorem (statement only) and its applications. Eigen values, Eigen Vectors of a matrix, Similar matrices, Diagonalization of matrices of order 2 and 3.

Reading References:

1. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
2. Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
3. Boyce and Diprima, Elementary Differential Equations and Boundary Value Problems, Wiley.
4. G.F. Simmons, Differential Equations, Tata McGraw Hill
5. Ghosh and Chakraborty, Differential Equations, U N Dhur
6. Maity and Ghosh, An Introduction to Differential Equations, New Central Book Agency
7. G. C. Gorain, Introductory course on Differential Equations
8. S. K. Mapa, Higher Algebra, Vol. – II, Academic Publishers
9. Hoffman, K. and Kunze, R., Linear Algebra, Pearson
10. Finkbeincr, Matrices and Linear Algebra

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BMTMMAJ04T**
Course Title: **Abstract Algebra-I & Multivariate Calculus**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **TO BE DONE**
Learning Outcome: **The whole course will have the following outcomes: Upon successful completion of this course, the students will be able to CO1: acquire knowledge of group such as permutation group, symmetric group, quaternion group etc. CO2: understand Lagrange's, Ferm**

Syllabus:

Unit -1: Abstract Algebra-I [Credit: 3, 45L]

- Subgroup – Necessary and sufficient condition. Subgroup generated by a subset. Finite Group. Simple examples. Centralizer, Normalizer, Center of a group, Product of two subgroups.

- Symmetries of a square, Dihedral groups, Permutation groups, Symmetric groups and Quaternion groups (through matrices).
- Cyclic group, properties of cyclic groups, classification of subgroups of cyclic groups, Cycle notation for permutations, properties of permutations, even and odd permutations, Alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.
- Normal Subgroups, Quotient Group.
- Group homomorphism and isomorphism and their properties. Cayley's theorem. First, Second and Third Isomorphism Theorems. Correspondence theorem for groups.
- Subrings, Ideals, Divisor of zero, Unit, Idempotent element, Nilpotent element, Integral Domains, Quotient Ring, Quotient field, Characteristic of a Ring, Subfield. Ring Homomorphism, Isomorphism. First, Second and Third Isomorphism theorems.

Unit -2: Multivariate Calculus [Credit: 3, 45L]

- Functions of several variables, limit and continuity of functions of two or more variables.
- Partial differentiation, total differentiability, sufficient condition for differentiability, Schwartz and Young's theorems (statement only) and their verification. Directional derivatives, the gradient, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.
- Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates. Change of order in double integrals and triple integrals.

Reading References:

1. Sen, Ghosh, Mukhopadhaya, Maity; Topics in Abstract Algebra; Universities Press.
2. S. K. Mapa, Higher Algebra (Abstract and Linear), Levant.
3. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
4. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
5. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., 1999, Narosa Publishing House, New Delhi.
6. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
7. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra, McGraw-Hill Education-Europe.
8. Tom M. Apostol, Mathematical Analysis, Narosa Book Distributors Pvt. Ltd.-New Delhi.
9. Shanti Narayan, P.K. Mittal, Integral Calculus, S. Chand.
10. Maity & Ghosh, Integral Calculus, New Central Book Agency (P) Ltd.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BMTMMAJ05T**
Course Title: **Analytical Geometry (3D), Vector Calculus & Partial Differential Equations**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **TO BE DONE**
Learning Outcome: **The whole course will have the following outcomes: Upon successful completion of this course the students will be able to CO1: understand the three dimensional geometry of planes, straight lines, spheres, cones and cylinders. CO2: acquire knowledge of cyl**

Syllabus:

Unit -1: Analytical Geometry (3D) [Credit: 2, 30L]

- Plane; Straight lines.
- **Sphere:** General Equation, Circle, Sphere through circle, Tangent, Normal.

- **Cone:** General homogeneous second degree equation, Enveloping cone, Section of cone by a plane, Tangent and normal, Condition for three perpendicular generators, Reciprocal cone, Right circular cone, Cylinder, Enveloping cylinder, Right circular Cylinder.
- **Conicoids:** Ellipsoid, Hyperboloid, Paraboloid: Canonical equations only. Plane sections of it.
- Transformation of coordinates, Reduction of general second degree equations.

Unit -2: Vector Calculus [Credit: 2, 30L]

- Product of three or more vectors.
- **Vector Calculus:** Continuity and differentiability of vector-valued function of one variable, Space curve, Arc length, Tangent, Normal. Serret-Frenet's formulae. Integration of vector-valued function of one variable.
- Vector-valued functions of two and three variables, Gradient of scalar function, Gradient vector as normal to a surface, Divergence and Curl, their properties.
- Evaluation of line, surface and volume integrals.
- Green's theorem in the plane. Gauss and Stokes' theorems (Proof not required) and problems based on these.

Unit -3: Partial Differential Equation [Credit: 2, 30L]

- Partial Differential Equations – Basic concepts and Definitions. Mathematical Problems. First- Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations. Canonical Forms of First- order Linear Equations. Method of Separation of Variables for solving first order partial differential equations. Solution by Lagrange's and Charpit's method.

Reading References:

1. S.L. Loney; The Elements of Coordinate Geometry; Arihant.
2. Shantinarayan; Analytical Solid Geometry; S. Chand.
3. J.G. Chakraborty & P.R. Ghosh, Advanced Analytical Geometry, U.N. Dhur & Sons Pvt. Ltd.
4. R.M. Khan, Analytical Geometry of two and three dimensions and vector analysis, New central book agency (P) Ltd., Kolkata.
5. Arup Mukherjee and Naba Kumar Bej, Analytical Geometry of Two and Three dimensions (Advanced level), Books & Allied Pvt. Ltd.
6. Shantinarayan and P K Mittal, A Text Book of Vector Analysis, S. Chand.
7. J.G. Chakraborty & P.R. Ghosh, Vector Analysis, U.N. Dhur & Sons Pvt. Ltd.
8. Robert J.T. Bell, An Elementary Treatise on Coordinate Geometry of Three Dimensions, McMilan & Co. Ltd., London.
9. S. Lipschutz, D. Spellman, M.R. Speigel, Vector Analysis, Schaum's outline series.
10. J. Marsden and Tromba, Vector Calculus, McGraw Hill.
11. Ghosh & Maity, Vector Analysis, New Central Book Agency (P) Ltd.
12. Dipak Kumar Ghosh; Introduction to Partial Differential Equation and Laplace Transform; NCBA.
13. I.N. Sneddon, Elements of Partial Differential Equations, McGraw Hill, New York
14. F.H. Miller, Partial Differential Equations, John Wiley and Sons.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BMTMMAJ06T**
Course Title: **Dynamics of a Particle and System of Particles**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To be done.**

Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: After successful completion of the course, students will be able to CO1: get a basic knowledge of forces and moments that covers concepts of particle dynamics. CO2: understand the co**

Syllabus:

Unit -1: Dynamics of a Particle [Credit: 4, 60L]

Kinematics

1. Expressions for velocity & acceleration for

(i) Motion in a straight line;

(ii) Motion in a plane;

(a) Cartesian co-ordinates, (b) Polar co-ordinates, (c) Intrinsic co-ordinates

Kinetics

2. Newton's laws of motion, Equation of motion of a particle moving under the action of given external forces.

(a) Motion of a particle in a straight line under the action of forces μx^n, n = 0, ± 1, n = -2 ($\mu>0$ or < 0) with physical interpretation,

(b) Simple harmonic motion and elementary problems,

(c) The S.H.M. of a particle attached to one end of an elastic string, the other end being fixed,

(d) Harmonic oscillator, effect of a disturbing force, linearly damped harmonic motion and forced oscillation with or without damping,

(e) Vertical motion under gravity when resistance varies as some integral power of velocity, terminal velocity.

(f) Works, power and energy, Conservation laws: conservation of linear momentum, angular momentum and total energy for conservative system of forces.

3. Impulse of force, Impulsive forces, change of momentum under impulsive forces, Examples, Collision of two smooth elastic bodies, Newton's experimental law of impact, Direct and oblique impacts of (i) Sphere on a fixed horizontal plane, (ii) Two smooth spheres, Loss of Kinetic Energy and Impulse

4. Motion in plane/ two dimensions:

(a) Motion of a particle moving on a plane referred to a set of rectangular axes, Angular velocity and acceleration, Circular motion,

(b) Trajectories in a medium with the

(i) Motion of a projectile under gravity in free space;

(ii) Motion of a projectile under gravity with air resistance proportional to velocity, square of the velocity;

(c) Motion of a particle moving on a plane referred to polar co-ordinate system, radial and transverse Accelerations.

(d) Central forces and central Orbits: Motion under a central force, basic properties and differential equation of the path under given forces and velocity of projection, Apses, Time to describe a given arc of an orbit, Law of force when the center of force and the central orbit are known. Special study of the following problems; to find the central force for the following orbits:

(i) A central conic with the force directed towards the focus;

(ii) Equiangular spiral under a force to the pole;

(iii) Circular orbit under a force towards a point on the circumference.

To determine the nature of the orbit and of motion for different velocity of projection under a force per unit mass equal to –

(i) μ / $(\text{dist})^2$ towards a fixed point ;

(ii) under a repulsive force μ / $(\text{dist})^2$ away from a fixed point .

(e) Circular orbit under any law of force $\mu f(r)$ with the centre of the circle as the centre of force, stability analysis of a circular orbit under a force μ f (r) towards the center. Particular case $\mu f(r) = 1/r^n$.

(f) Kepler's laws of planetary motion from the equation of motion of a central orbit under inverse square law, Modification of Kepler's third law from consideration of motion of a system of two particles under mutual attractions according to Newton's law of gravitational attraction, Escape velocity.

(g) Constrained Motion: Motion of a particle along a smooth curve, Examples of motion under gravity along a smooth vertical circular curve, smooth vertical cycloidal arc (cycloidal pendulum), Motion of a particle along a rough curve (circle, cycloid) & in a resisting medium.

Unit -2: Dynamics of System of Particles [Credit: 1, 15L]

Fundamental concepts: Centre of mass, linear momentum, angular momentum, kinetic energy, work done by a field of force, conservative system of forces – potential and potential energy, internal potential energy, total energy.

The following results to be deduced in connection with the motion of system of particles:

(i) Centre of mass moves as if the total external force were acting on the entire mass of the system concentrated at the centre of mass (examples of exploding shell, jet and rocket propulsion).

(ii) The total angular momentum of the system about a point is the angular momentum of the system concentrated at the centre of mass, plus the angular momentum for motion about the center.

(iii) Similar theorem as in (ii) for kinetic energy.

An idea of constraints that may limit the motion of the system, definition of rigid bodies, D'Alembert's principle, principle of virtual work for equilibrium of a connected system.

Reading References:

1. Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press.
2. Terence Tao, Analysis II, Hindustan Book Agency, 2006.
3. Ganguly and Saha; Analytical Dynamics of Particles; New Central Book Agency.
4. Dutta and Jana; Dynamics of a Particle; Shreedhar Prakashani.
5. A. S. Ramsey; Dynamics (Part 1); CBS Publisher.
6. J. L. Synge & B. A. Griffith ; Principles of Mechanics; McGraw Hill Book Company Inc.
7. Chorlton; A Text Book of Dynamics; D. Van Nostrand Company Ltd.
8. Mollah, S. A., Advanced Dynamics of Particles, Books & Allied.
9. H. Goldstein; Classical Mechanics; Addison-Wesley.
10. Ghosh, Chakraborty; Advanced Analytical Dynamics; U.N. Dhur Publishing House.
11. R. G. Takwale, P. S. Puranik; Introduction to Classical Mechanics; McGraw Hill Education.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-7**

Semester: **5**

Course Code: **BMTMMAJ07T**

Course Title: **Real Analysis-II**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **To be done.**

Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: CO1: Upon successful completion, the students will be familiar with open cover and functions of bounded variation in R. CO2: Objective of this course is the introduction of some new**

Syllabus:

Real Analysis-II [Credit: 5, 75L]

- **Compactness in R :** Concepts of open cover of a set. Compact set in IR, Heine-Borel theorem (Proof not required).
- **Functions of bounded variation (BV)**: Definition and examples. Monotone function is of BV. If f is on BV on [a,b] then f is bounded on [a,b]. Examples of functions of BV which are not continuous and continuous functions not of BV. Bounded variation functions and their properties. Necessary and sufficient condition for a function f to be of BV on [a,b] is that f can be written as the difference of two monotonic increasing functions on[a,b].
- **Riemann integration:** Partition and refinement of partition of a closed and bounded interval. Upper and lower sums, Darbaux integration, Darbaux theorem, Riemann conditions of integrability, Riemann sum and definition of Riemann integral through Riemann sums, equivalence of two Definitions. Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals.

Antiderivative (primitive or indefinite integral). Fundamental theorem of Integral Calculus. First Mean Value theorem of integral calculus. Statement of second mean value theorems of integrals calculus (both Bonnet's and Weierstrass' form) and simple problems.

- **Riemann-Stieltjes integral:** Upper and lower Riemann-Stieltjes integral, Rectifiable Curves. Change of variable in a Riemann-Stieltjes integral, Reduction to Riemann integral, necessary as well as sufficient conditions for existence of Riemann-Stieltjes integrals.
- **Improper integrals**: Types of improper integrals with examples, convergence of improper integrals with examples. Convergence of Beta and Gamma functions.
- **Sequence of Functions:** Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions.
- **Series of functions:** Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.
- **Fourier series:** Definition of Fourier coefficients and series, Reimann-Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition. Examples of Fourier expansions and summation results for series.
- **Power series:** Radius of convergence. Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem (statement only).

Reading References:

1. S.K. Mapa; Introduction to Real analysis; Levant.
2. G.B. Thomas and R.L. Finney; Calculus, 9th Ed.; Pearson Education, Delhi; 2005.
3. Tom M. Apostol; Mathematical Analysis; Narosa Publishing House.
4. Courant and John; Introduction to Calculus and Analysis, Vol II; Springer.
5. W. Rudin; Principles of Mathematical Analysis; Tata McGraw-Hill.
6. S.N. Mukhopadhyay, S. Mitra; Mathematical Analysis, Vol-II; U.N Dhur & Sons Pvt. Ltd; 2014.
7. S.C. Malik & Savita Arora; Mathematical Analysis; New Age International (P) Limited.
8. Steen, L., Seebach, J.; Counter Examples in Topology; Holt, Reinhart and Winston, New York.
9. Hocking, J., Young, G.; Topology; Addison-Wesley Reading; 1961.
10. Kelley, J.L.; General Topology; Van Nostrand Reinhold Co., New York; 1995.
11. Simmons, G.F.; Introduction to Topology and Modern Analysis; McGraw Hill, 1963.
12. Dugundji, J.; Topology; Allyn and Bacon, 1966.
13. Munkres, J.R.; Topology: A First Course; Prentice Hall of India Pvt. Ltd., New Delhi; 2000.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BMTMMAJ08T**
Course Title: **Linear Programming Problems & Game Theory**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion of this course, students will be able to CO1: solve linear programming problems (LPP) using appropriate techniques and optimization solvers, interpret the**

Syllabus:

Unit -1: Linear Programming Problems [Credit: 4, 60L]

- Canonical & Standard form of L.P.P, Basic solutions, feasible, basic feasible & optimal solutions, Reduction of a feasible solution to basic feasible solution, Hyperplanes and Hyperspheres, Convex sets and their properties, convex functions, Extreme points, Convex feasible region, Convex polyhedron, Polytope, Graphical solution of L. P.P.

- Fundamental theorems of L.P.P., Improved basic feasible solutions, Bounded and Unbounded solution, Condition of optimality, Simplex method, Simplex algorithm, Artificial variable technique (Big M method, Two phase method), Inversion of a matrix by Simplex method. Degeneracy in L.P.P. and its resolution.
- Duality in L.P.P.: Concept of duality, Fundamental properties of duality, Fundamental theorem of duality, Duality & Simplex method.
- Dual Simplex method, modified dual simplex method, and revised simplex method.
- Transportation Problem (T.P.): Matrix form of T.P., the transportation table, Initial basic feasible solutions (different methods like North West corner, Row minima, Column minima, Matrix minima & Vogel's Approximation method), Loops in T.P. table and their properties, Optimal solutions, Degeneracy in T.P., Unbalanced T.P.
- Assignment Problem, Mathematical justification for optimal criterion, optimal solution by Hungarian Method, Travelling Salesman Problem.

Unit -2: Game Theory [Credit: 1, 15 L]

- Theory of Games: Introduction, Two person zero-sum games, Minimax and Maximin principles, Minimax and Saddle point theorems, Mixed Strategies games without saddle points, Minimax (Maximin) criterion, The rules of Dominance, Solution methods of games without Saddle point; Algebraic method, Matrix method, Graphical method and Linear Programming method.

Reading References:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
4. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.
5. Ghosh & Chakraborty, An Introduction to Linear Programming & Game Theory, Maulik Library
6. Karak, P. M., Linear Programming with Game Theory, New Central Book Agency
7. Sharma, J. K., Operations Research – Theory and Applications
8. Swarup, Gupta & Man Mohan – Operations Research

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BMTMMAJ09T**
Course Title: **Probability & Statistics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion of this course, students will be able to CO1: calculate the expectation and moments of one and two dimensional random variables. CO2: use of some important**

Syllabus:

Unit -1: Probability [Credit: 3, 45L]

- Sample space and Axiomatic definition of probability, Compound experiment.
- One and two dimensional random variables (Discrete and Continuous): Distribution function and its basic properties, Probability density function, Marginal distribution and density function, Conditional density function.
- Transformation of one and two dimensional random variables.
- Mathematical expectation, Median, Mode, Moments, Variance.

- Expectation for two dimensional case, Moments, Covariance, Correlation coefficient and its properties, Addition and multiplication rule for expectation and variance, Independent random variables. Moment generating function, Characteristic function.
- Conditional expectation and regression – Least square regression lines and basic properties.
- Some important distributions: Binomial, Poisson, Uniform, exponential, Cauchy, Normal, Gamma, Beta and their basic property.
- Tchebycheff's inequality, Convergence in probability, Bernoulli's limit theorem, Central limit theorem.
- Approximations – Binomial to Poisson, Central limit theorem (statement only). Binomial to Normal (De Moivre-Laplace limit theorem)

Unit -2: Statistics [Credit: 2, 30L]

- Concept of statistics, Sampling distribution of sample mean for finite population with examples.
- Sampling distribution for infinite population, Exact sampling distribution-for mean of normal population, Chi-square and t-distribution.
- Point Estimation – consistent, unbiased, MVUE. Method of maximum likelihood and application to different population.
- Interval estimation- Method of finding confidence interval- Application to normal population
- Testing of hypothesis: Critical region, Type-I and Type-II error, Power of test, Large sample test related to Binomial proportion, Chi-square test on multinomial distribution, Exact tests for mean and variance of univariate Normal distribution.

Reading References:

1. A.P. Baisnab and M. Jas; Elements of Probability and Statistics ; Tata McGraw Hill Co. Ltd
2. Amritava Gupta; Groundwork of Mathematical Probability and Statistics; Academic Publishers.
3. Gun, Gupta, Dasgupta; Fundamentals of Statistics; World Press.
4. S.C. Gupta, V .K. Kapoor; Fundamentals of Mathematical Statistics; S Chand & Sons.
5. N.G. Das; Statistical Methods; M Das & Co.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BMTMMAJ10T**
Course Title: **Numerical Methods & Computer Programming in C**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon completing this course, students will be able to: CO1: Understand the concepts of approximation and round-off errors, including the significance of decimal places and significan**

Syllabus:

Unit -1: Numerical Methods [Credit: 3, 45L]

- Approximation of numbers, decimal places, significant figures, Round off Errors: Relative, Absolute and Percentage. Truncation, Inherrent.
- Solution of Transcendental and Polynomial equations using Bisection method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Geometrical interpretation, convergency conditions, Rate of convergence of these methods.
- System of linear algebraic equations: Gaussian Elimination, Gauss Seidel method and their convergence analysis.
- Interpolation: Finite difference operators, Lagrange's interpolation formula, Newton's forward and backward interpolation formula, divided difference, Newton's general interpolation formula, Interpolating

Errors.

- Numerical Integration: Newton-Cotes' formula, Trapezoidal rule, Simpson's 1/3rd rule, Composite Trapezoidal rule, Composite Simpson's 1/3rd rule, Inherent errors, degree of precision.
- Ordinary Differential Equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four (Proof of order four is not required).

Unit -2: Computer Programming in C [Credit: 2, 30L]

- Computer Languages: Machine language, Assembly language, computer-high level languages, Compiler, Interpreter, Operating system, Source programs and objects programs.
- Binary number system, Conversions and arithmetic operation, Representation for Integers and Real numbers, Fixed and floating point.
- **Introduction to C programming:** Basic structures, Character set, Keywords, Identifiers, Constants, Variable-type declaration

  Operators: Arithmetic, Relational, Logical, assignment, Increment, decrement, Conditional. Operator precedence and associativity, Arithmetic expression,
  Statement: Input and Output, Define, Assignment, User define, Decision making (branching and looping) – Simple and nested IF, IF – ELSE, LADDER, SWITCH, GOTO, DO, WHILE – DO, FOR, BREAK AND CONTINUE Statements. Arrays- one and two dimensions, user defined functions.

- **Statistical and other simple programming:**

  (a) To find mean, median, mode, standard deviation
  (b) Ascending, descending ordering of numbers
  (c) Finite sum of a series
  (d) Fibonacci numbers
  (e) Checking of prime numbers
  (f) Factorial of a number
  (g) Solution of a quadratic equation
  (h) L.C.M. & G.C.D. of two positive integers.
  (i) Conversion of temperature from Fahrenheit to Centigrade and vice versa
  (j) Area of a triangle
  (k) To find simple and compound interest

Reading References:

1. S.A. Mollah; Numerical Analysis and Computational Procedures.
2. Yashavant Kanetkar; Let Us C; BPB Publications.
3. K.E. Atkinson; An Introduction to Numerical Analysis; John Wiley and Sons; 1978.
4. C. Xavier; C Language and Numerical Methods; New Age Intl (P) Ltd. Pub.
5. B.S. Gottfried; Programming with C; TMH.
6. E. Balaguruswamy; Programming in ANSI C; TMH.
7. N. Datta; Computer Programming and Numerical Analysis-An Integrated Approach (Revised edition with C); Universities Press.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BMTMMAJ11T**
Course Title: **Metric Space & Complex Analysis**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**

Course Objective: **To be done.**

Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: CO1: The course is aimed at exposing the students to foundations of analysis, which will be useful in understanding various physical phenomena and give the students the foundation in**

Syllabus:

Unit-1: Metric Spaces [Credit: 3, 45L]

- Metric, examples of standard metric spaces including Euclidean and Discrete metrics; open ball, closed ball, open sets; metric topology; closed sets, limit points and their fundamental properties; interior, closure and boundary of subsets and their interrelation; denseness; separable and second countable metric spaces and their relationship.
- **Continuity:** Definition of continuous functions, algebra of real/complex valued continuous functions, distance between a point and a subset, distance between two subsets, Homeomorphism (definitions with simple examples)
- **Sequence and completeness:** Sequence, subsequence and their convergence; Cauchy sequence, Cauchy's General Principle of convergence, Cauchy's Limit Theorems. Completeness, completeness of R; Cantor's theorem concerning completeness, Definition of completion of a metric space, construction of the real as the completion of the incomplete metric space of the rational with usual distance (proof not required). Continuity preserves convergence.
- **Compactness**: Sequential compactness, Heine-Borel theorem in R. Finite intersection property, continuous functions on compact sets.
- **Connectedness:** Connected subsets of the real line R , open connected subsets in $R2$, components; components of open sets in R and $R2$; Structure of open set in R , continuity and connectedness; Intermediate value theorem.

Unit-2: Complex Analysis [Credit: 2, 30L]

- Introduction of complex number as ordered pair of real numbers, geometric interpretation, metric structure of the complex plane **C**, regions in **C.** Stereographic projection and extended complex plane $\mathbf{C}_\infty$ and circles in $\mathbf{C}_\infty$.
- Limits, Continuity and differentiability of a function of complex variable, sufficient condition for differentiability of a complex function, Analytic functions and Cauchy-Riemann equation, harmonic functions, Conjugate harmonic functions, Relation between analytic function and harmonic function.
- Transformation (mapping), Concept of Conformal mapping, Bilinear or Mo bius transformation and its geometrical meaning, fixed points and circle preserving character of Mo bius transformation.
- Power series: Cauchy-Hadamard theorem. Determination of radius of convergence. Uniform and absolute convergence of power series. Analytic functions represented by power series. Uniqueness of power series.
- Contours, complex integration along a contour and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem (statement only) and its consequences, Cauchy integral formula.

Reading References:

1. Satish Shirali and Harikishan L. Vasudeva; Metric Spaces; Springer Verlag, London; 2006.
2. S. Kumaresan; Topology of Metric Spaces, 2nd Ed.; Narosa Publishing House; 2011.
3. J. Sengupta; Metric Spaces; U.N. Dhur & Sons Private Limited.
4. P. K. Jain and K. Ahmad; Metric Spaces; Narosa Publishing House.
5. G.F. Simmons; Introduction to Topology and Modern Analysis; McGraw-Hill; 2004.
6. James Ward Brown and Ruel V. Churchill; Complex Variables and Applications, 8th Ed.; McGraw – Hill International Edition; 2009.
7. J.B. Conway; Functions of one Complex Variable, 2nd Ed.; Undergraduate Texts in Mathematics; Springer-Verlag New York, Inc.
8. S. Ponnusamy; Foundations of complex analysis; Narosa Publishing House
9. E.M. Stein and R. Shakrachi; Complex Analysis, 2nd Ed; Princeton University Press.
10. Joseph Bak and Donald J. Newman; Complex Analysis, 2nd Ed.; Undergraduate Texts in Mathematics; Springer-Verlag New York, Inc., New York; 1997.

11. R. Roopkumar; Complex Analysis; Pearson.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BMTMMAJ12T**
Course Title: **Abstract Algebra-II & Linear Algebra-II**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: At the end of the course the students will be able to CO1: get concepts of direct product of finite number of group and group action etc. CO2: deal with ideal and isomorphism of ring**

Syllabus:

Unit -1: Abstract Algebra-II [Credit: 3, 45L]

- Direct product of a finite number of groups, Group Actions, Orbit, Stabilizer, Class Equation, Cauchy's Theorem, Sylow Theorems.
- Solvable group, Prime and Maximal ideal.
- Polynomial rings over commutative rings, Irreducibility of polynomials, Division Algorithm, Principal ideal domain, Euclidean domain.
- **Field Extensions:** Field extension, finite extension, simple extension, algebraic and transcendental extension and their characterizations. Splitting field, algebraic closure and algebraically closed field. Separable and normal extensions. Construction with straightedge and compass, finite fields and their properties, Galois group, Galois theory, Solvability by radicals, insolvability of the general equations of degree five (or more) by radicals.

Unit -2: Linear Algebra-II [Credit: 2, 30L]

- Introduction to linear transformations, algebra of linear transformation, rank and nullity of a linear transformation, matrix representation of a linear transformation.
- Dual Spaces, Dual Basis, Double Dual, Transpose of a linear transformation.
- Eigen Value, Eigen Vector and Eigen space of linear operator, diagonalizability, Cayley-Hamilton theorem for linear operator (Statement only), minimal polynomial for linear operator.
- Bilinear Form, Real Quadratic Form involving three variables, Reduction to Normal Form (Statements of relevant theorems and applications).
- Inner product spaces and norms, orthogonal & orthonormal set, triangular inequality, Schwartz inequality, Parallelogram law, Gram-Schmidt orthogonalization process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator.

Reading References:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.
4. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
5. Gilbert, Linear Algebra and its Applications, Thomson, 2007.
6. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.
7. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of Abstract Algebra, McGraw-Hill Education-Europe.
8. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.

9. S. K. Mapa, Higher Algebra (Abstract and Linear), Levant Books.
10. M.K. Sen, S. Ghosh, P Mukhopadhyay, S. Maity, Topics in Abstract Algebra, Universities Press.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BMTMMAJ13T**
Course Title: **Computer Aided Numerical Practical in C (P)**
(L-P-Tu): **0-6-0**
Credit: **6**
Practical/Theory: **Practical**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion, students will be able to CO1: write the algorithms and sketch the flowcharts of the given numerical problems. CO2: develop a C program for a given algorit**

Syllabus:

Unit -1: Problem-I: Known Problems [Credit: 6, 180L]

List of Problems for C Programming:
1. Finding a real Root of an equation by,
(a) Fixed point iteration.
(b) Newton-Rapson's method.
2. Interpolation (Taking at least six points) by,
(a) Lagrange's formula.
(b) Newton's Forward Formula.
(c) Newton's Backward Formula.
3. Integration by
(a) Trapezoidal rule.
(b) Simpson's $1/3^{rd}$ rule (taking at least 50 sub-intervals).
4. Solution of a 1storder ordinary differential equation by
(a) Modified Euler's Method.
(b) Fourth-order R. K. Method (taking at least four steps).

Unit -2: Problem-II: Unknown Problems

Statistical and other simple programming like
(a) To find mean, median, mode, standard deviation
(b) Ascending, descending ordering of numbers
(c) Finite sum of a series
(d) Fibonacci numbers
(e) Checking of prime numbers
(f) Factorial of a number
(g) Solution of a quadratic equation
(h) L.C.M. & G.C.D. of two positive integers etc.

Unit -3: Viva-voce

Viva-voce to be given on the day of examination.

Reading References:

1. S.A. Mollah; Numerical Analysis and Computational Procedures.
2. Yashavant Kanetkar; Let Us C; BPB Publications.
3. K.E. Atkinson; An Introduction to Numerical Analysis; John Wiley and Sons; 1978.
4. C. Xavier; C Language and Numerical Methods; New Age Intl (P) Ltd. Pub.

5. B.S. Gottfried; Programming with C; TMH.
6. E. Balaguruswamy; Programming in ANSI C; TMH.
7. N. Datta; Computer Programming and Numerical Analysis-An Integrated Approach (Revised edition with C); Universities Press.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BMTMMAJ14T**
Course Title: **General Topology**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion of this course students will, CO1: Understand terms, definitions and theorems related to topology. CO2: Demonstrate knowledge and understanding of concep**

Syllabus:

General Topology [Credit: 4, 60L]

- Countable and Uncountable Sets, Schroeder-Bernstein Theorem, Cantor's Theorem. Cardinal Numbers and Cardinal Arithmetic. Continuum Hypothesis, Zorns Lemma, Axiom of Choice.
  Well-Ordered Sets, Hausdorff's Maximal Principle. Ordinal Numbers.
- **Fundamentals of Topological Spaces:** Topological spaces. Bases and sub-bases. Closure & interior; exterior, boundary, accumulation points, derived sets, dense set, Gδ and Fσ sets. Neighbourhood system. Order Topology. Discrete space.
- **Subspace Topology:** Subspace topology and its properties; Alternative way of defining a topology using Kuratowski closure operator, interior operator and neighbourhood systems; Continuous Functions, Open maps, Closed maps and Homeomorphisms, topological property, metric topology.
- **Product Spaces:** Product and box topology, Projection maps. Quotient topology. Tychonoff theorem. Separation axioms, Countability axioms and Connectedness in product spaces.
- **Countability Axioms:** First and Second countability axioms, Separability and Lindeloffness. Characterizations of accumulation points, closed sets, open sets in a First countable space w.r.t. sequences. Heine's continuity criterion.
- **Separation Axioms:** Ti spaces (i = 0, 1, 2, 3, 3½, 4, 5), their characterizations and basic properties. Urysohn's lemma and Tieze's extension theorem (statement only) and their applications.
- **Compactness:** Compactness and its basic properties, Alexander sub-base theorem, Continuous functions and compact sets. Compactness of R . Sequential compactness, BW Compactness and countable compactness. Lebesgue Number. Local compactness, compactness in metric space, totally bounded space, Arzela-Ascoli theorem.
- **Connectedness:** Connected and disconnected spaces, Path Connected Spaces, Connected Sets in R , Rn(n>1), Local connectedness, Components and Path Components, Totally disconnected.

Reading References:

1. John L. Kelley; General Topology; D. Van Nostrand Company, Inc.; 1995.
2. Stephen Willard; General Topology; Addison Wesley Publishing Company; 1970.
3. James Dugundji; Topology; Allyn and Bacon, Inc.; 1978.
4. James R. Munkres, Topology: A first course; Prentice Hall, India; 1974.
5. G.F. Simmons; Introduction to Topology and Modern Analysis; McGraw Hill.
6. K.D. Joshi; Introduction to General Topology; Wiley Eastern Ltd.
7. Engelking; General Topology; Polish Scientific Publishers, Warszawa.

8. L.A. Steen and J.A. Seebach; Counterexamples in Topology; Dover Publication, Inc. New York.
9. B.C. Chatterjee, M. R. Adhikari and S. Ganguly; A text book of Topology; Asian Books; 2002.
10. W.J. Thron; Topological Structures; Holt, Rinehart and Winston, Inc., New York, 1966.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BMTMMAJ15T**
Course Title: **Integral Transforms & Integral Equations**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion, the students will be able to CO1: understand the ideas and importance of the Integral transforms that are used to map one domain into another in which th**

Syllabus:

Unit -1: Laplace Transform [Credit: 1, 15L]

Definition and properties of Laplace transforms, Sufficient conditions for the existence of Laplace Transform (proof not required), Laplace Transform of some elementary functions, Laplace Transforms of derivatives and integrals. Derivatives and integrals of Laplace transform. Initial and final value theorems, Convolution theorems, Inverse of Laplace Transform, Application to ordinary and partial differential equations.

Unit-2: Fourier Transform [Credit: 1, 15L]

Fourier integral theorem, Definition and Properties, Fourier transform of some elementary functions, Fourier transform of the derivative, Derivative of Fourier transform, Fourier sine and cosine transforms, Inverse of Fourier transform, Convolution, Properties of convolution functions, Convolution theorem and applications. Application to ordinary and partial differential equations.

Unit -2: Integral Equations [Credit: 1, 15L]

Linear Integral Equations of 1^{st} and 2^{nd} kinds- Fredholm and Volterra types, Relation between integral equations and initial boundary value problems, Existence and uniqueness of continuous solutions of Fredholm and Volterra's integral equations of 2^{nd} kind, Iterated Kernels, Reciprocal Kernels, Solution by the method of successive approximations, Solution by Resolvent kernel method and iterated kernel method. Volterra's solution of Fredholm's integral equations. Reduction of boundary value problem of an ordinary differential equation to an integral equation and vice-versa.

Reading References:

1. Sneddon, I. N., Fourier Transform, McGraw Hill.
2. Miller, F. H., Partial Differential Equations, John Wiley and Sons
3. Sneddon, I.N., Use of Integral Transforms, McGraw-Hill Pub.
4. Tranter, C. J., Integral Transforms
5. Tricomi, Integral Equations
6. Andrews, L.C., Shivamoggi, B., Integral Transforms for Engineers, PHI.
7. Debnath, L., Bhatta,D., Integral Transforms and Their Applications, CRC Press, 2007.
8. G. C. Gorain, Laplace Transformations, Narosa Publishing House, New Delhi.
9. Lovitt, Linear Integral Equations

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-16**

Semester: **8**
Course Code: **BMTMMAJ16T**
Course Title: **Elementary Differential Geometry**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion, the students will be able to CO1: describes a multilinear relationship between sets of algebraic objects related to a vector space. CO2: do computations w**

Syllabus:

Elementary Differential Geometry [Credit: 3, 45L]

Tensors:

- Definition of a tensor as a generalization of vectors in a vector space V. Tensor and their transformation laws, Covariant and contravariant vectors to Covariant and contravariant tensors, Tensor algebra, Contraction, Quotient law, Reciprocal tensors, Kronecker delta, Symmetric and skew-Symmetric tensors, fundamental metric tensor, Riemannian space, Christoffel symbols and their transformation law, Covariant differentiation of vector and tensor.
- **Curves in Space:** level curves and parametrized curves in R^n, arc length of curve, reparametrization, plane curves and space curves and their curvature and properties and tangent and normal at a point on the curves. Torsion of space curves, Helix, Serret- Frenet formulae for curves in space. Simple closed curves with periods. Isoperimetric inequality, Intrinsic differentiation and Curvilinear coordinates Geodesic.
- **Surfaces:** Surfaces and its parametric representation, Regular surfaces and example. Tangent, normal and orientability of surfaces. Smooth functions on a surface, Differential of a smooth function defined on a surface. Angle between two curves on a surface, The first and second fundamental form of surface, Geodesic curvature, normal curvature and principal curvature of a surface curve, Meusnier's theorem, The third fundamental form, Gaussian and mean curvature, Riemann curvature tensor and Ricci tensor. Riemannian metric, Isometry of surfaces, Developable surfaces, Weingarten formula, Equation of Gauss and Codazzi.

Reading References:

1. M. C. Chaki; Tensor Analysis; The Calcutta Publishers.
2. B. Spain, Tensor Calculus: A Concise Course, Dover Publication, 2003.
3. U.C. De, A. A. Shaikh, J. Sengupta; Tensor Calculus; Narosa.
4. M. Majumder, A. Bhattacharyya; Differential Geometry; Books & Allied Pub.
5. I. S. Sokolnikoff; Tensor Analysis; Wiley, New York; 1951.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BMTMMAJ17T**
Course Title: **Advanced Mechanics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To be done.**
Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion, the students will be able to CO1: determine resultant of various force systems. CO2: determine centroid, moment of inertia and solve problems related to t**

Syllabus:

Unit -1: Dynamics of Rigid Bodies [Credit: 2, 30L]

- Moments and Products of inertia (in three-dimensional rectangular co-ordinates), Inertia matrix, Principal values and principal axes of inertia matrix, Principal moments and principal axes of inertia for (i) a rod, (ii) a rectangular plate, (iii) a circular plate, (iv) an elliptic plate, (v) a sphere, (vi) a right circular cone, (vii) a rectangular parallelepiped and (viii) a circular cylinder, Momental Ellipsoid.
- Equation of motion of a rigid body about a fixed axis. Expression for kinetic energy and moment of momentum of a rigid body moving about fixed axis.
- Equations of motion of a rigid body moving in two-dimension, Expression for kinetic energy and angular momentum about the origin of rigid body moving in two dimensions, Necessary and sufficient condition for pure rolling, Two-dimensional motion of a solid of revolution moving on a rough horizontal plane, the following examples of the two-dimensional motion of a rigid body to be studied:

(i) Motion of a uniform heavy sphere (solid and hollow) along a perfectly rough inclined plane;

(ii) Motion of a uniform heavy circular cylinder (solid and hollow) along a perfectly rough inclined plane:

(iii) Motion of a rod when released from a vertical position with one end resting upon a perfectly rough table or smooth table.

(iv) Motion of a uniform heavy solid sphere along an imperfectly rough inclined plane;

(v) Motion of a uniform circular disc, projected with its plane vertical along an imperfectly rough horizontal plane with a velocity of translation and angular velocity about the centre.

Unit-II: Statics [Credit: 1, 15L]

- Forces in three dimensions: Forces, concurrent forces, Parallel forces, Moment of a force, Couple, Resultant of a force and a couple (Fundamental concept only), Reduction of forces in three-dimensions, Pointsot's central axis, conditions of single resultant, conditions of equilibrium.
- Virtual work: Principle of Virtual work, Deduction of the conditions of equilibrium of a particle under coplanar forces from the principle of virtual work, Simple examples of finding tension or thrust in a two-dimensional structure in equilibrium by the principle of virtual work.
- Stable and unstable equilibrium, Coordinates of a body and of a system of bodies, Field of forces, Conservative field, Potential energy of a system, Dirichlet's Energy test of stability, stability of a heavy body resting on a fixed body with smooth surfaces- simple examples.

Unit -3: Elements of Continuum Mechanics & Hydrostatics [Credit: 2, 30L]

- Deformable body, Idea of a continuum (continuous medium), Surface forces or contact forces, Stress at point in a continuous medium, stress vector, components of stress (normal stress and shear stress) in rectangular Cartesian co-ordinate system; stress matrix.
- Definition of ideal fluid and viscous fluid.
- Pressure (pressure at a point in a fluid in equilibrium is same in every direction), Incompressible and compressible fluid, Homogeneous and non-homogeneous fluids.
- Equilibrium of fluids in a given field of force; pressure gradient, Equipressure surfaces.
- Pressure in a heavy homogeneous liquid, Thrust on plane surfaces, Center of pressure, effect of increasing the depth without rotation, Centre of pressure of a triangular & rectangular area and of a circular area immersed in any manner in a heavy homogeneous liquid, Simple problems.
- Thrust on curved surfaces: Archemedes' principle, Equilibrium of freely floating bodies under constraints. (Consideration of stability not required).
- **Gas :** Equation of state of a 'perfect gas', Isothermal and adiabatic processes in an isothermal atmosphere, Pressure and temperature in atmosphere in convective equilibrium

Reading References:

1. I.H. Shames and G. Krishna Mohan Rao, Engineering Mechanics: Statics and Dynamics, (4th Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.
2. R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
3. Chorlton, F., Textbook of Dynamics.
4. Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies

5. Loney, S. L., Elements of Statics and Dynamics I and II.
6. Ramsey, A. S., Dynamics (Part I).
7. I.H. Shames and G. Krishna Mohan Rao, Engineering Mechanics: Statics and Dynamics, (4th Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.
8. R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
9. Chorlton, F., Textbook of Dynamics.
10. Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies
11. Loney, S. L., Elements of Statics and Dynamics I and II.
12. Ghosh, M. C, Analytical Statics.
13. G. C. Gorain, Mathematical Hydrostatics, New Central Book Agency, Kolkata
14. Verma, R. S., A Textbook on Statics, Pothishala, 1962.
15. Matiur Rahman, Md., Statics.
16. Ramsey, A. S., Dynamics (Part I).
17. Chatterjee, R.N.-Elements of Continuum Mechanics.
18. Love, A.E.H.-Conitnuum Mechanics.

Syllabus *(MATHEMATICS)*

Course Type: **MAJ-18**

Semester: **8**

Course Code: **BMTMMAJ18T**

Course Title: **Operations Research & Calculus of Variations**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **To be done.**

Learning Outcome: **Course Outcomes (CO): The whole course will have the following outcomes: Upon successful completion, the students will be able to CO1: formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms**

Syllabus:

Unit -1: Operations Research [Credit: 3, 45L]

- Replacement Problems: Introduction, Replacement policies for items whose efficiency deteriorates with time, Individual and group replacement, Replacement policies for items that fail completely.
- Job sequences: Processing of n jobs through two machines, The Algorithm, Processing of n jobs through m machines.
- Project Network: Introduction, Basic differences between PERT and CPM, Steps of PERT/CPM Techniques, PERT/CPM network Components and Precedence Relationships, Critical Path analysis, Probability in PERT analysis, Project Crashing, Time cost Trade-off procedure, Updating of the Project.
- Flow Network: Max-flow min-cut theorem, Generalized Max flow min-cut theorem, Linear Programming interpretation of Max-flow min-cut theorem, Minimum cost flows, Min-flow max-cut theorem.
- Inventory control Models: Classification of Inventories, Advantage of Carrying Inventory, Features of Inventory System, Deterministic inventory models including price breaks, Discrete and Continuous probabilistic inventory models, Safety stock and Buffer Stock, Concept of just in time inventory
- Queuing Theory: Introduction, characteristic of Queuing systems, operating characteristics of Queuing system. Probability distribution in Queuing systems. Classification of Queuing models. Poisson and non-Poisson queuing models (M/M/1:∞/FCFS/∞), (M/M/C:∞/FCFS/∞), (M/M/1:N/FCFS/∞), (M/M/C:N/FCFS/∞).

Unit -2: Calculus of Variations [Credit: 2, 30L]

Variation, Linear functional, Deduction of Euler-Lagrange differential equation and some special cases of it, Euler-Lagrange differential equation for multiple dependent variables, Functional dependent on higher order derivatives,

Functional dependent on functions of several variables. Application of Calculus of variations for the problems of shortest distance, minimum surface of revolution, Brachistochrone problem, geodesic, Isoperimetric problem, Calculus of variations for problems in parametric form, Variational problems with moving boundaries. Sturm-Liouville problems, Hamilton's principle, Lagrange's equations, Generalized dynamical entities, vibrating string, vibrating membranes, theory of elasticity – The variational problem of a vibrating elastic plate.

Reading References:

1. J. K. Sharma; Operations Research (Theory and Applications); Macmillan.
2. A. K. Bhunia, Shri L. Sahoo; Advanced Operations Research; Asian Books Pvt. Ltd.
3. J. D. Weist, F. K. Levy: A Management Guide to PERT/ CPM. 2nd Edition, PHI, 1967 (Reprint 2007).
4. Ronald L. Rardin: Optimization in Operations Research, Prentice Hall, 1998.
5. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.
6. Donald Gross, John F. Shortle, James M. Thompson, Carl M. Harris: Fundamentals of Queueing Theory, 4th Edition, 2008.
7. Donald Waters: Inventory Control and Management, John Wiley, 2010.
8. R Weinstock, Calculus of Variation, Dover, 1970.
9. M. Gelfand and S. V. Fomin, Calculus of Variations, Dover Publications, 2000
10. Advanced Engineering Mathematics, E Kreyszig, John Wiley and Sons, Ninth Edition, 2012
11. A. S. Gupta, Calculus of Variations with Applications, Prentice Hall of India, 1997
12. Gelfand, J.M., Fomin, S.V., Calculus of Variations, Prentice Hall, New Jersey, 1963.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BMCBMAJ01T**
Course Title: **FUNDAMENTALS OF MICROBIOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To enrich students with knowledge and understanding on the fundamentals of microbiology along with different disciplines of microbiology like medical microbiology, food and industrial microbiology, recombinant DNA technology etc. 2. To enrich students**
Learning Outcome: **1. Acquire knowledge and understanding of the microbiology concepts and their application in diverse areas such as medical, agriculture, environment, genetics, industrial, food etc. 2. Acquire basic practical skills/competencies in working with microbes,**

TOTAL HOURS:60 CREDITS:4

Unit 1. History of Development of Microbiology No. of hours: 10

Development of microbiology as a discipline, Spontaneous generation *vs*. biogenesis.Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming.Germ theory of disease, Development of various microbiological techniques and golden era of microbiology.

Unit 2. An overview of Scope of Microbiology No. of hours: 4

Unit 3. Systems of classification No. of hours: 8

Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classificationsystems and their utility. Difference between prokaryotic and eukaryotic microorganisms

Unit 4. Microscopy and staining techniques No. of hours: 12

Principle of optics, compound microscope, Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Electron Microscope- SEM & TEM. Classification of stains; Principles of staining; Negative, Simple & Differential staining.

Unit 5. Bacteriological techniques No. of hours:10

Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing non-culturable bacteria.

Unit 6. Nutrition and Media No. of hours: 8

Nutritional requirements in bacteria and nutritional categories; Culture media: components of media, natural and synthetic media, complex media, selective, differential, transport, enriched and enrichment media

Unit 7. Control of microorganism No. of hours: 8

Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation.

Chemical methods of microbial control: disinfectants, types and mode of action

SUGGESTED READING

1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. PearsonEducation
2. Ansuman Ray and Ratul Mukherjee (2019). Basic Lab Manual of Microbiology, Biochemistry and Molecular BiologyTaurean Publications, New Delhi.
3. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.14th edition. Pearson International Edition
4. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. PearsonEducation Limited
5. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology.9th Edition. McGrawHill International.
6. Atlas RM. (1997). Principles of Microbiology.2nd edition.WM.T.Brown Publishers.
7. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology.5th edition. McGrawHill Book Company.
8. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). GeneralMicrobiology.5th edition. McMillan.

COURSE TITLE: FUNDAMENTALS OF MICROBIOLOGY (PRACTICALS)
TOTAL HOURS: 60 CREDITS:2

1. Microbiology Good Laboratory Practices and Biosafety
2. To study the principle and applications of important instruments (laminar air flow,autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in themicrobiology laboratory.
3. Preparation of culture media for bacterial cultivation.
4. Sterilization of medium using Autoclave and assessment for sterility
5. Staining Techniques:Simple Staining,Negative Staining, Gram Staining,Endospore Staining

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)
Definition, Nature, Scope and Importance; Components of environment: Environmental education
Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)
Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining

- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BMCBMAJ02T**
Course Title: **MICROBIAL DIVERSITY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To study the diversity of microbial world. 2. To study the structural and economical importance of prokaryotes and eukaryotes 3. To learn about the concept of virus and its replication.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to – 1. Identify and classify diverse group of prokaryotic and eukaryotic organisms. 2. Understand the structure of viruses, their mode of replication and viral assay.**

SEMESTER II

MAJOR COURSE 01

COURSE TITLE: MICROBIAL DIVERSITY (THEORY)

TOTAL HOURS:60 CREDITS:4

Unit 1. General characteristics of prokaryotes No. of hours: 10

General account & economic importance of Mycoplasma, Actinomycetes, Cyanobacteria and Archaea

Unit 2. Fungi No. of hours: 10

General characteristics of fungi including habitat, distribution, structure and reproduction and economic importance

Unit 3. Algae No. of hours:10

General characteristics of algae including habitat, distribution,structure and reproduction and economic importance

Unit 4. Protozoa No. of hours:10

General characteristics of protozoa with special reference to *Amoeba, Paramecium, Plasmodium* and *Giardia*

Unit 5. Nature and properties of viruses No. of hours:10

Physiochemical properties of virus, Classification system (ICTV, Baltimore), Chemistry and structural organisation of viruses (TMV, Animal viruses and Bacteriophage). Concept of viroid, virusoids, satellite viruses and prions. Viral assay (plaque assay)

Unit 6. Lytic and lysogenic cycle No. of hours:10

Life cycle of Bacteriophages with special reference to *E. coli* and T4, Lysogenic conversion, induction and significance, one step multiplication curve.

SUGGESTED READING

1. Atlas RM. (1997)Principles of Microbiology.2nd edition.WM.T.Brown Publishers.

2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and MartinkoJM.(2014). Brock Biology of Micro-organisms.14th edition.ParkerJ.Prentice Hall International, Inc.
4. PelczarJr MJ, Chan ECS, and Krieg NR.(2004). Microbiology.5th edition Tata McGraw Hill.
5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers,Dordrecht
6. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th editionMcMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition PearsonEducation.
8. Willey JM, Sherwood LM, and Woolverton CJ.(2013). Prescott's Microbiology.9th edition.McGraw Hill Higher Education
9. Dimmock, NJ, Easton, AL, Leppard, KN (2007). Introduction to Modern Virology. 6th edition,Blackwell Publishing Ltd.
10. Carter J and Saunders V (2007). Virology: Principles and Applications. John Wiley and Sons.
11. Levy JA, Conrat HF, Owens RA. (2000). Virology.3rd edition. Prentice Hall publication, NewJersey.
12. Wagner EK, Hewlett MJ. (2004). Basic Virology.2nd edition.Blackwell Publishing.
13. Nayudu MV. (2008). Plant Viruses. Tata McGraw Hill, India.
14. Bos L. (1999) Plant viruses-A text book of plant virology by. Backhuys Publishers.
15. Versteeg J. (1985). A Color Atlas of Virology.Wolfe Medical Publication.

COURSE TITLE: MICROBIAL DIVERSITY (PRACTICAL)
TOTAL HOURS:60 CREDITS:2

1. Study of *Spirogyra* ,*Chlamydomonasand Volvox* using permanent Mounts.
2. Study of *Amoeba, Paramecium and Euglena* using permanent Mounts.
3. Study of *Penicillium, Aspergillus* using permanent mounts
4. Study of Staphylococcus *aureus* and *Lactobacillus* using permanent mounts
5. Determination of motility of bacteria by Hanging Drop Technique
6. Determination of viral plaque assay.
7. Isolation of pure cultures of bacteria by streaking method.
8. Estimation of CFU count by spread plate method/pour plate method.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BMCBMAJ03T**
Course Title: **BIOCHEMISTRY (THEORY)**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To learn about the structural and functional role of vital biomolecules like carbohydrates, proteins, fats, and nucleic acids in biological system 2. To study the bioenergetics and enzyme kinetics.**
Learning Outcome: **After completing this course, the students will be able to – 1. Understand the chemistry of carbohydrates and its classification. 2. Understand the chemistry of amino acids and hierarchy of protein structure – primary, secondary, tertiary and quatern**

SEMESTER III

MAJOR COURSE 01

COURSE TITLE: BIOCHEMISTRY (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Unit 1. BioenergeticsNo. of hours:8

First and second laws of Thermodynamics. Definitions of Gibb's Free Energy, enthalpy, and Entropy and mathematical relationship among them, Standard free energy change and equilibrium constant, high energy bond, biological applications of thermodynamics.

Unit 2. Carbohydrates No. of hours:10

Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereoisomerism of monosaccharides, epimers, Mutarotation and anomers of glucose. Furanose and pyranose forms of glucose and fructose, Haworth projection formulae for glucose; chair and boat forms of glucose, muramic acid, N-acetyl neuraminic acid. Disaccharides; concept of reducing and non-reducing sugars, occurrence and Haworth projections of maltose, lactose, and sucrose, Polysaccharides, storage polysaccharides, starch and glycogen. Structural Polysaccharides, cellulose and chitin, reactions of carbohydrates.

Unit 3. Structures of DNA and RNA/Genetic Material No. of hours:8

DNA Structure: Miescher to Watson and Crick-historic perspective (1 lecture) DNA structure, Salient features of double helix, Types of DNA. Types of genetic material, denaturation and renaturation, cot

curves. DNA topology–linking number, topoisomerases. Organelle DNA- mitochondria and chloroplast DNA.

Unit 4. Lipids No. of hours:10

Definition and major classes of storage and structural lipids. Storage lipids. Fatty acid's structure and functions. Essential fatty acids. Triacylglycerols structure, functions and properties. Saponification Structural lipids. Phosphoglycerides: Building blocks, General Structure functions and properties. Structure of phosphatidyl ethanol amine and Phosphatidyl choline, Sphingolipids: building blocks, structure of sphingosine, Special. mention of sphingomyelins, cerebrosides and gangliosides Lipid functions: cell signals, cofactors, prostaglandins, Introduction of lipid micelles, monolayers, bilayers.

Unit 5. Amino Acids and Proteins No. of hours :10

Functions of proteins, Primary structures of proteins: Amino acids, the building blocks of proteins, General formula of amino acid and concept of zwitterion. Titration curve of Amino acid and its Significance.

Classification, biochemical structure of Amino acids, Ninhydrin reaction. Non protein amino acids: Gramicidin, beta-alanine, D alanine and D-glutamic acid.

Secondary structure of proteins: Peptide unit and its salient features. The alpha helix, the beta pleated sheet and their occurrence in proteins, Tertiary and quaternary structures of proteins. Forces holding the polypeptide together. Human haemoglobin structure.

Unit 6. Enzymes: No. of hours :10

Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, Coenzyme NAD, metal cofactors, Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.

Significance of hyperbolic, double reciprocal plots of enzyme activity, Km and allosteric mechanism Definition soft Terms–enzyme unit, specific activity and turnover number, Multi enzyme complex: pyruvate dehydrogenase; isozyme: lactate dehydrogenase, Effect of pH and temperature on. Enzyme activity. Enzyme inhibition: competitive, non-competitive and mixed inhibition.

Unit 7. Vitamins No. of hours: 4

Classification and characteristics with suitable examples, sources and importance.

SUGGESTED READING

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freemanand Company,
6. Willey MJ, Sherwood, LM &Woolverton C J (2013) Prescott, Harley and Klein's Microbiologyby. 9th Ed., McGrawHill
7. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons

COURSE TITLE: BIOCHEMISTRY(PRACTICAL) CREDITS : 2

Biochemical Estimation: DNA (DPA Method), RNA (Orcinol Method), Sugar (DNSA Method), Amino Acid (Ninhydrin Method) and Protein (Lowry's Method).

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BMCBMAJ04T**

Course Title: **MICROBIAL PHYSIOLOGY AND METABOLISM (THEORY) MAJOR COURSE 02 COURSE TITLE: INSTRUMENTATION AND BIOTECHNIQUES (THEORY)**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. To learn about microbial growth pattern and effect of environmental factors on microbial growth. 2. Tostudy the microbial metabolism in detailand learn how microbes do catabolism to get energy and metabolism to build structure. 1. To learn the working**

Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. To recognize how fundamental chemical principles and reactions are utilized in biochemical processes. 2. To differentiate microbesbased on the metabolism 3. To understand the princ**

MAJOR COURSE 01

COURSE TITLE: MICROBIAL PHYSIOLOGY AND METABOLISM (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Unit1: Microbial Growth and Effect of Environment on Microbial Growth No. of hours:20

Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curve. Microbial growth in response to environment-Temperature (psychrophiles, Mesophiles, thermophiles, extremophiles, thermoduric, psychographs), PH (acidophiles, Alkaliphiles), solute and water activity (halophiles, xerophilies, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe), barophilic. Microbial growth in response to nutrition andenergy– Autotroph/Phototroph, heterotrophy,Chemolithoautotrophic, Chemolithoheterotrophic, Chemoheterotroph, Chemolithotroph, photolithoautotroph, Photo organoheterotroph.

Unit2: Nutrient uptake and Transport No. of hours:12

Passive and facilitated diffusion, Primary and secondary active transport, concept of uniport, symport and antiport, Group translocation.

Unit3: Respiration, concept of aerobic and anaerobic respiration No. of hours:15

Glycolysis, TCA, EMP, ED, PPP, Electron transport chain. Components of mitochondrial and bacterial ETC. Phosphorylation, Uncouplers and inhibitors.

Unit 4. Chemo lithotrophic and Phototrophic Metabolism No. of hours:13

Introduction to aerobic and anaerobic chemolithotroph with an example each. Hydrogen oxidation (definition and reaction) and methanogenesis (definition and reaction), anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria, purple bacteria and cyanobacteria.

SUGGESTED READING

1. Voet&Voet. Fundamentals of biochemistry Wiley
2. M.M. Cox, D. L. Nelson. Lehninger's principles of biochemistry. W H Freeman
3. Stryer. Biochemistry W H Freeman
4. Fundamentals of Biochemistry (2016) by J L Jain, Sunjay Jain, Nitin Jain. S. Chand
5. Madigan, Martinko, Bender, Buckley, Stahl. Brock Biology of Microorganisms. Pearson
6. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB McGrawHill, New York
7. Madigan MT, and Martinko JM (2014). Brock Biology of Microorganisms.14th edition. Prentice Hall International Inc.
8. Moat AG and Foster JW. (2002). Microbial Physiology.4th edition. John Wiley &Sons
9. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
10. Gottschalk G. (1986). Bacterial Metabolism.2nd edition. Springer Verlag
11. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology.5th edition, Mc Millan Press.
12. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology.9Th edition.

MAJOR COURSE 02

COURSE TITLE: INSTRUMENTATION AND BIOTECHNIQUES (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Unit1. Microscopy No. of hours: 10

Idea about numerical aperture, angular aperture, limit of resolution, refractive index etc. Principle and application of Bright field and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.

Unit2. Chromatography No. of hours: 20

Principles and applications of paper chromatography (including descending and ascending, radial). Thin layer chromatography. Gel filtration chromatography, ion exchange chromatography and affinity chromatography, GLC, HPLC.

Unit3. Electrophoresis No. of hours: 10

Principle and applications of native polyacrylamide gel electrophoresis, SDS polyacrylamide gel electrophoresis, 2D gel electrophoresis, isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis,

Unit4. Spectrophotometry No. of hours: 10

Principle and use of study of absorption spectra of biomolecules. Analysis of Biomolecules using UV and visible range. Colorimetry and turbidometry.

Unit 5. Centrifugation No. of hours: 10

Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF And Sedimentation coefficient, differential centrifugation, density gradient Centrifugation and Ultracentrifugation

SUGGESTED READING

1. Wilson & Walker. Principles and Techniques in Practical Biochemistry. 5th Edition. Cambridge University Press (2000).

2. Murphy D.B. Fundamental of Light Microscopy & Electron Imaging. 1 st Edition. Wiley- Liss. (2001).

3. K L Ghatak. Techniques And Methods In Biology. PHI Publication (2011)

4. Pranav Kumar. Fundamentals and Techniques of Biophysics and Molecular Biology (2016).

5. Aurora Blair. Laboratory Techniques & Experiments In Biology. Intelliz Press

6. D.T Plummer. An Introduction to Practical Biochemistry. McGraw Hill Publication 1987

7. Beckner, W.M., Kleinsmith L.J and Hardin J. The world of cell. IV edition. Benjamin Cummings (2000)

8. Biophysical Chemistry by Upadhyay, Upadhyay, Nath. Himalaya Publishing House

COURSE TITLE: MICROBIAL PHYSIOLOGY AND METABOLISM (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2

1. Study and plot of bacterial growth curve by turbidimetric method.
2. Effect of temperature on growth of E. coli.
3. Effect of pH on growth of E. coli.
4. Effect of Heavy metals on growth of E. coli.
5. Effect of osmotic pressure on growth of E. coli
6. Demonstration of alcoholic fermentation.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BMCBMAJ04T**
Course Title: **INSTRUMENTATION AND BIOTECHNIQUES (THEORY)**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**

Course Objective: **1. To learn the working principles, construction and applications of the instruments used in the studies related to various disciplines of biological sciences. 2. To perform biotechniques in the laboratory.**

Learning Outcome: **Upon successful completion of the course the candidate will be able to - 1. Understand the working principles of different instruments widely used in biological science. 2. Acquaint oneself with different biotechniques used in biological science. 3. Separ**

MAJOR COURSE 02

COURSE TITLE: INSTRUMENTATION AND BIOTECHNIQUES (THEORY)

TOTAL HOURS: 60 CREDITS: 4

Unit1. Microscopy No. of hours: 10

Idea about numerical aperture, angular aperture, limit of resolution, refractive index etc. Principle and application of Bright field and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.

Unit2. Chromatography No. of hours: 20

Principles and applications of paper chromatography (including descending and ascending, radial). Thin layer chromatography. Gel filtration chromatography, ion exchange chromatography and affinity chromatography, GLC, HPLC.

Unit3. Electrophoresis No. of hours: 10

Principle and applications of native polyacrylamide gel electrophoresis, SDS polyacrylamide gel electrophoresis, 2D gel electrophoresis, isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis,

Unit4. Spectrophotometry No. of hours: 10

Principle and use of study of absorption spectra of biomolecules. Analysis of Biomolecules using UV and visible range. Colorimetry and turbidometry.

Unit 5. Centrifugation No. of hours: 10

Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF And Sedimentation coefficient, differential centrifugation, density gradient Centrifugation and Ultracentrifugation

SUGGESTED READING

1. Wilson & Walker. Principles and Techniques in Practical Biochemistry. 5th Edition. Cambridge University Press (2000).
2. Murphy D.B. Fundamental of Light Microscopy & Electron Imaging. 1 st Edition. Wiley- Liss. (2001).
3. K L Ghatak. Techniques And Methods In Biology. PHI Publication (2011)
4. Pranav Kumar. Fundamentals and Techniques of Biophysics and Molecular Biology (2016).
5. Aurora Blair. Laboratory Techniques & Experiments In Biology. Intelliz Press
6. D.T Plummer. An Introduction to Practical Biochemistry. McGraw Hill Publication 1987
7. Beckner, W.M., Kleinsmith L.J and Hardin J. The world of cell. IV edition. Benjamin Cummings (2000)
8. Biophysical Chemistry by Upadhyay, Upadhyay, Nath. Himalaya Publishing House

COURSE TITLE: INSTRUMENTATION AND BIOTECHNIQUES (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2

1. Ascending and radial paper chromatography of sugars, amino acids.
2. Thin layer chromatography of sugars and amino acids.
3. SDS-PAGE electrophoresis method.

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Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BMCBMAJ05T**
Course Title: **MOLECULAR BIOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**

Course Objective: **1. To study the process of replication, transcription and translation in both prokaryotes and eukaryotes. 2. To study the mechanism of gene regulation in prokaryotes.**

Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Acquaint oneself with the knowledge on DNA replication in prokaryotes. 2. Knowthe mechanism of process of transcription and translation in prokaryotes. 3. Learn the comparative stu**

MAJOR COURSE 01

COURSE TITLE: MOLECULAR BIOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS:4

Unit 1. Replication of DNA in ProkaryotesNo. of hours: 15

Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication Mechanism of DNA replication: Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase – for replication of linear ends, Various models of DNA replication including rolling circle, D- loop (mitochondrial), Θ (theta) mode of replication and other accessory protein, Comparative study of DNA replication of Prokaryotes and eukaryotes.

Unit 2. Transcription in Prokaryotes No. of hours: 12

Transcription: Definition, difference from replication, promoter - concept and strength of promoter, RNA Polymerase, Comparative study of transcription of prokaryotes and eukaryotes, Inhibitors of RNA synthesis.

Unit 3. Translation in Prokaryotes No. of hours: 15

Genetic code and its characteristics, Charging of tRNA, aminoacyltRNAsynthetases, Mechanisms of initiation, elongation and termination of polypeptides in prokaryotes, comparative study of translation of prokaryotes with that of eukaryotes, Inhibitors of protein synthesis in prokaryotes and eukaryote.

Unit 4. Post transcriptional modifications & post translational modifications No. of hours: 8

Post transcriptional modifications -Split genes, concept of introns and exons, RNA splicing, spliceosome machinery, concept of alternative splicing, Polyadenylation and capping, Processing of rRNA, RNA interference: si RNA, miRNA and its significance. Post-translational modifications-chemical modification, proteolytic cleavage, protein splicing

Unit 5. Gene Regulation No. of hours: 10

Positive control and negative control, Inducible system and repressible system, Lac operon, Catabolite repression., Trp operon

SUGGESTED READING

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of theGene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition,Pearson Benjamin Cummings Publishing, San Francisco
3. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
4. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley &Sons. Inc.
5. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4 th Edition, ColdSpring Harbour Laboratory press.
6. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and BartlettLearning
7. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India

COURSE TITLE: MOLECULAR BIOLOGY (PRACTICALS)

TOTAL HOURS: 60 CREDITS:2

1. Study of different types of DNA and RNA using micrographs and model/ schematic representations
2. Isolation of plasmid DNA.

3. Isolation of genomic DNA from *E. coli.*
4. Study of DNA brand by Agarose Gel Electrophoresis.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BMCBMAJ05T**
Course Title: **FOOD AND DAIRY MICROBIOLOGY (THEORY)**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To provide understanding about the general principles of food microbiology. 2. To learn about the food spoilage microorganisms and the microbiology of food preservation. 3. To appreciate the role of microbes in fermented foods.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to – 1. Knowthe concepts and scope of dairy and food microbiology. 2. Understand the factors affecting the growth of microorganisms in food. 3. Understand the microbial spoilage of vari**

SEMESTER V

MAJOR COURSE 02

COURSE TITLE: FOOD AND DAIRY MICROBIOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS:4

Unit 1. Foods as a substrate for microorganisms No. of hours: 10

Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general

Unit 2. Microbial Contamination & Spoilage of various foods No. of hours: 12

Principles, Spoilage of vegetables, fruits, meat, eggs, fish, milk and milk products, bread, canned foods. Detection of spoilage and characterization

Unit 3. Principles and methods of food preservation No. of hours: 14

Principles, physical methods of food preservation: temperature (low, high, canning, drying), Irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging. Chemical methods of food preservation: salt, sugar, organic acids, SO_2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins

Unit 4. Fermented food No. of hours:12

Dairy starter cultures, fermented dairy products: yogurt/curd, cheese, other fermented foods: dosa, sauerkraut, soy sauce, Probiotics: Health benefits, types of microorganisms used, microbial cell as food (single cell protein)

Unit 5. Food borne diseases (causative agents, foods involved, symptoms and preventivemeasures) No. of hours:12

Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and mycotoxins;

Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*,Salmonellosis, Shigellosis, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*

SUGGESTED READING

1. Stanbury PF, Whitaker A and Hall SJ.(2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
2. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.

3. Banwart JM. (1987). Basic Food Microbiology.1st edition. CBS Publishers and Distributors, Delhi, India.
4. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.
5. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.
6. Frazier WC and Westhoff DC. (1992). Food Microbiology.3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
7. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London
8. Jay JM, Loessner MJ and Golden DA.(2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
9. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods.Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
10. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition.Pearson Education.

COURSE TITLE: FOOD AND DAIRY MICROBIOLOGY (PRACTICAL)
TOTAL HOURS: 60 CREDITS:2

1. Examination of milk quality by methylene blue reduction test.
2. Preparation of curd and microscopic observation of its normal microflora.
3. Assay for the presence of antibiotic residue in milk.
4. Isolation and characterization of spoilage microorganisms (bacteria) from spoiled vegetables/fruits and bread.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BMCBMAJ06T**
Course Title: **RECOMBINANT DNA TECHONOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To learnthe scope and importance of recombinant DNA technology. 2. To study the different molecular methods and vectors used widely used in RDT.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to - 1. Understand the importance of genetic engineering and its application in various fields. 2. Gain knowledge ofbasic molecular tools and molecular methods used in recombinant DNA technology. 3. Understand the different gene cloning vectors and the techniques in transformation of recombinant DNA into target host organisms. 4. Gain the concept of DNA amplification, gene sequencing, blotting techniques and construction of cDNA and genomic libraries.**

MAJOR COURSE 01

COURSE TITLE: RECOMBINANT DNA TECHNOLOGY (RDT)(THEORY)

TOTAL HOURS:60 CREDITS:4

Unit 1. Molecular Cloning- Tools and Strategies No. of hours: 14

Basic concepts of genetic engineering, Cloning Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyltransferase, kinases and phosphatases, and DNA ligases, Cloning Vectors: Definition and Properties Plasmid vectors: pBR and

pUC series, Bacteriophage lambda and M13 based vectors Cosmids, BACs, YACs, Use of linkers and adaptors, Expression vectors: *E. coli* lac and T7 promoter-based vectors.

Unit 2. Methods in Molecular Cloning No. of hours:12

Transformation of DNA: Chemical method, Electroporation, Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery, *Agrobacterium* - mediated delivery, DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern – blotting techniques, dot blot, DNA microarray analysis, SDS-PAGE and Western blotting.

Unit 3. DNA Amplification, DNA sequencing No. of hours: 12

PCR: Basics of PCR, RT-PCR, Real-Time PCR, Sanger's method of DNA Sequencing: traditional and automated sequencing, primer walking and shotgun sequencing

Unit 4. Construction and Screening of Genomic and cDNA libraries No. of hours:12

Genomic and cDNA libraries: Preparation and uses, Screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping

Unit 5. Applications of Recombinant DNA Technology No. of hours: 10

Products of recombinant DNA technology: Products of human therapeutic interest - insulin, *hGH*, antisense molecules. *Bt* transgenic - cotton, Gene therapy, recombinant vaccines, protein engineering and site directed mutagenesis

SUGGESTED READING

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford,U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. ElsevierAcademic Press, USA
2. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition, Blackwell Publishing, Oxford, U.K.
3. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. ColdSpring Harbor Laboratory Press
4. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology.McGraw Hill Higher Education
5. Brown TA. (2007). Genomes-3. Garland Science Publishers
6. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. BlackwellPublishing, Oxford, U.K
7. Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings

COURSE TITLE: RECOMBINANT DNA TECHNOLOGY (RDT) (PRACTICALS)
TOTAL HOURS: 60 CREDITS:2

1. Isolation of plasmid DNA.
2. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis.
3. Demonstration of blue-white screening.
4. Demonstration of Southern blotting.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BMCBMAJ06T**
Course Title: **CELL BIOLOGY & MICROBIAL GENETICS**
(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. To learnthe scope and importance of recombinant DNA technology. 2. To study the different molecular methods and vectors used widely used in RDT. 1. To study the types and functioning of different organelles and mechanisms in eukaryotic and prokaryotic cells. 2. To provide detailed knowledge on fine structure and function of the cell. 3. To study mechanisms of gene transfer, expression and regulation. 4. To comprehend the types and effects of mutations and recombination.**

Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Gain knowledge of functioning of different part of cells and understand differences between normal and diseased cells. 2. Understand the organization of cell mechanisms of cell-to-cell communication. 3. Gain knowledge of prokaryotic gene transfer mechanisms. 4. Understand mutations and recombination.**

MAJOR COURSE 02

COURSE TITLE: CELL BIOLOGY AND MICROBIAL GENETICS (THEORY)

Total hours: 60 Credits: 4

Unit 1. Structure and organization of Cell No. of hours: 12

Cell Organization–Eukaryotic (Plant and animal cells) and prokaryotic Plasma membrane: Structure and transport of small molecules, Cell Wall: Eukaryotic cell wall, Extracellular matrix and cell matrix interactions, Cell-Cell Interactions and plasmodesmata (only structural aspects) Mitochondria, chloroplasts peroxisomes and Cytoskeleton.

Unit 2. Cell Signalling No. of hours: 8

Signalling molecules and their receptors, Function of cell surface receptors, Pathways of intra-cellular receptors–Cyclic AMP pathway, cyclic GMP and MAP kinase pathway.

Unit 3. Mutations No. of hours: 9

Mutations and mutagenesis: Definition and types of Mutations. Physical and chemical Mutagens.Uses of mutations, DNA damage and repair mechanisms.

Unit 4.Plasmids and Transposable Elements No. of hours: 12

Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids, yeast- 2 µ plasmid, Host range, plasmid-incompatibility, plasmid amplification, Regulation of copy number, curing of plasmids. Prokaryotic transposable elements – Insertion Sequences, composite and non-composite transposons, Replicative and Non replicative transposition, Uses of transposons and transposition.

Unit 5. Mechanisms of Genetic Exchange No. of hours: 12

Transformation, Conjugation, Hfr and F'strains, Interrupted mating technique Transduction-Generalized transduction, specialized transduction, LFT & HFT lysates.

SUGGESTED READING

1. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings.
2. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning.
3. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning.
4. Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings.
5. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India.
6. Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings.
7. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
8. Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd EDITION., Jones and Barlett Publishers.

COURSE TITLE: Cell biology and Microbial Genetics (PRACTICAL)

Total hours: 60 Credits: 2

1. Preparation of Master and Replica Plates
2. Study the effect of chemical (HNO_2) and physical (UV) mutagens on bacterial cells
3. Study survival curve of bacteria after exposure to ultraviolet (UV) light
4. Demonstration of Bacterial Conjugation
5. Demonstration of bacterial transformation and transduction
6. Demonstration of AMES test

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BMCBMAJ06T**
Course Title: **IMMUNOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To study the components of human immune system. 2. To study human defence mechanisms.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. To understand how immune system works in human. 2. Gain hands on experience of detecting his or her own blood group, WIDAL test and immunoassay.**
MAJOR COURSE 03

COURSE TITLE: IMMUNOLOGY(THEORY)

Total hours: 60 Credits: 4

Unit. Introduction to Immunology No. of hours:7

Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff and Susumu Tonegawa.

Unit 2. Immune Cells and Organs No. of hours:10

Structure, Functions and Properties of Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen.

Unit 3. Antigens and Antibodies No. of hours:10

Antigens: Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T& B cell epitopes); T-dependent and T-independent antigens; Adjuvants.

Antibodies: Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); Monoclonal and Chimeric antibodies.

Unit 4. Major Histocompatibility Complex No. of hours:5

Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways).

Unit 5.Complement System No. of hours:4

Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation.

Unit 6. Generation of Immune ResponseNo. of hours:10

Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells.

Unit 7. Immunological Disorders and Tumour Immunity No. of hours:8

Types of Autoimmunity and Hypersensitivity with examples, DiGeorge syndrome, Chediak-Higashi syndrome, Types of tumours, tumour Antigens, causes and therapy for cancers.

Unit 8. Immunological Techniques No. of hours:6

Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, Immunoassay.

SUGGESTED READING

1. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
2. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
3. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication
4. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
5. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
6. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

COURSE TITLE: IMMUNOLOGY (PRACTICALS)

TOTAL HOURS: 60 CREDITS:2

1. Identification of human blood groups. (Slide agglutination method)
2. Perform DOT ELISA.
3. WIDAL test (rapid slide test)
4. **Perform Immunodiffusion by Ouchterlony diffusion method.**
5. **Total Leukocyte count of the given blood sample. (Only demonstration)**

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-11**

Semester: **7**

Course Code: **BMCBMAJ07T**

Course Title: **ENVIRONMENTAL MICROBIOLOGY**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **1. To provide an understanding of the current views of microbial association in various environments 2. To evaluate the continuing positive and negative roles played by microbes in environment.**

Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Understand on soil characteristics and biogeochemical cycling. 2. Know on the different aspects of waste management and sewage treatment systems. 3. Acquire knowledge on bioremediation and microbial leaching.**

COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY (THEORY)

TOTAL HOURS:60 CREDITS:4

Unit 1. Microorganisms and their Habitats No. of hours: 10

Structure and function of ecosystems. Terrestrial Environment: Soil profile and soil microflora, Aquatic Environment: Microflora of fresh water and marine habitat, Atmosphere: Aero micro flora and dispersal of

microbes,Animal Environment: Micro besin /on human body (Micro biomics)& animal (ruminants) body. Extreme Habitats: Extremophiles: Microbes thriving at high &low temperatures, pH, high Hydrostatic & osmotic pressures, salinity, &low nutrient levels.

Unit 2. Microbial Interactions No. of hours: 10

Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation.

Microbe-Plant interaction: Symbiotic and nonsymbiotic interactions.

Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic Luminescent bacteria.

Unit 3. Biogeochemical Cycling No. of hours:10

Carbon cycle: Microbial degradation of cellulose, lignin and chitin.

Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate Reduction Phosphorus cycle: Phosphate immobilization and solubilisation.

Sulphur cycle: Microbes involved in sulphur cycle.

Unit 4. Waste Management No. of hours:15

Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).

Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process) and tertiary sewage treatment.

Unit5: Positive and negative role of microbes in environment No. of hours:15

Bioremediation V/S bio magnifications. Mechanisms of Microbial tolerance to heavy metal. Biodegradation of recalcitrant compounds.

Bio deterioration of paper, wood, textiles, cosmetics.

Microbial leaching: Copper, gold.

Role of microbes in microbial plastics and Bio gas production.

SUGGESTED READING

1. Medigan, M.T., Martinko, J.M. and Parker, J. Brock Biology of Microorganisms. Pearson Education Inc., New York

2. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.

3. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw-Hill publication

4. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings.

5. JACQUELYN G. BLACK. Microbiology Principles and explorations. JOHN WILEY & SONS, INC.

COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY (PRACTICAL)
TOTAL HOURS:60 CREDITS:2

1. Enrichment culture technique-enrichment and isolation of spore formers, Nitrogen fixer, Photo synthetic Bacteria.
2. Assessment of microbiological quality and Microbiological examination of water (drinking water, supply water, pond water) by following methods
    a. Presumptive test
    b. Confirmatory test
    c. Completed test for coliform
3. Determination of MPN index
4. Determination of microbial population in water by filter disc method.
5. Determination of BOD of wastewater sample.

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BMCBMAJ07T**
Course Title: **INDUSTRIAL MICROBIOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To perform in-depth study on fermentation processes, bio-reactors. 2. To provide knowledge on production of various industrial products. 3. To understand various techniques used in industries.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Understand the principles of industrial microbiology. 2. Understand screening methods for industrial microbes and idea aboutbiotechnological processes. 3. Know the industrial production of various products.**

MAJOR COURSE 02

COURSE TITLE: INDUSTRIAL MICROBIOLOGY (THEORY)

TOTAL HOURS:60 CREDITS:4

Unit1: Types of fermentation processes, bio-reactors No. of hours:15

Types of fermentation processes-Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (e.g., baker's yeast) and continuous fermentations. Components of a typical bio-reactor, Types of bioreactors Laboratory, pilot-scale and Production Fermenters. constantly stirred tank and air-lift fermenters, Measurement and Control of fermentation parameters-pH, temperature, dissolved oxygen, foaming and aeration.

Unit2. Isolation of industrially important microbial strains and fermentation. No. of hours:15

Media Sources of industrially important microbes and methods for their isolation, preservation and maintenance of industrial strains, strain improvement, Crude and synthetic media; molasses, corn-steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates.

Unit 3:Idea about Biotechnological process No. of hours:10

Upstream process and Downstream processing (filtration, centrifugation, cell disruption, solvent extraction).

Unit 4: Microbial production of industrial products No. of hours:20

Commercial production of Alcoholic beverages (beer, wine), organic acids (lactic acid, antibiotics (streptomycin), amino acids (lysine), vaccine (BCG vaccine), Enzymes (amylase), VitB_{12} production.

READING REFERENCES

1. Reed. G. Prescott and Dunn's Industrial Microbiology. CBS Publishers. (1999). 2. Demain, A. L. Industrial Microbiology and Biotechnology. 2nd Edition. (2001).
2. Waites, M.J., Morgan, N. L., Rockey, J.S. and Higton, G. Industrial Microbiology: An introduction. Blackwell Science Publishers (2002).
3. Casida LE, Industrial Microbiology, J. Wiley, (1968).
4. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.
5. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw Hill publication

2. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings

COURSE TITLE: INDUSTRIAL MICROBIOLOGY (PRACTICAL)
TOTAL HOURS:60 CREDITS:2

1. Study of different parts of the fermenter.
2. Microbial fermentations for the production and estimation (qualitative and quantitative) of Enzymes: Amylase and Protease; Amino acid: Glutamic acid; Organic acid: Citric acid; Alcohol: Ethanol
3. A visit to any educational institute/industry.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BMCBMAJ07T**
Course Title: **MEDICAL MICROBIOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To study the nature of normal microbiota of human body, the relationship between human host and different pathogens and the mechanism of pathogenesis. 2. To learn about antimicrobial agents and their mode of actions on pathogens.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Correlate disease symptoms with causative agent, isolate and identify pathogens. 2. Gain knowledge of mechanism of action of antimicrobial drugs and prophylaxis.**

MAJOR COURSE 03

COURSE TITLE: MEDICAL MICROBIOLOGY (THEORY)

TOTAL HOURS:60 CREDITS:4

Unit 1.Normal microflora of the human body and host pathogeninteraction

No. of hours :10

Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract. Host pathogen interaction: Definitions - Infection, Invasion, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection, Pathophysiologic effects of LPS.

Unit 2.Bacterial diseases No. of hours:10

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control.

RespiratoryDiseases: *Haemophilusinfluenzae, Mycobacterium tuberculosis* Gastrointestinal Diseases: *Escherichia coli*, *Salmonella typhi*, *Vibrio cholerae*, *Helicobacter pylori* Others: *Staphylococcus aureus, Bacillus anthracis, Clostridium tetani*.

Unit 3. Viral diseases No. of hours:10

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control; Polio, Hepatitis, Rabies, Dengue, AIDS, Influenza with brief description of swine flu, Ebola, Japanese Encephalitis

Unit 4.Protozoan diseasesNo. of hours:7

List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control Malaria, Kala-azar.

Unit 5. Fungal diseases No. of hours:8

Brief description of each of the following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention Cutaneous mycoses: Tineapedis (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis.

Unit 6.Antimicrobial agentsNo. of hours:15

General characteristics and mode of action of different antibacterial agents: Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin Antiviral agents:

Mechanism of action of Amantadine, Acyclovir, Azidothymidine Antibiotic resistance, MDR, XDR, MRSA.

SUGGESTED READING

1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

2. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication

3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier

4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education

COURSE TITLE: MEDICAL MICROBIOLOGY (PRACTICALS)
TOTAL HOURS: 60 CREDITS:2

1. Identify bacteria (Any two of *E. coli, Staphylococcus, Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests.
2. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar.
3. Study of bacterial flora of skin by swab method
4. Perform antibacterial sensitivity by Kirby-Bauer method
5. Determination of minimal inhibitory concentration (MIC) of an antibiotic.
6. Study of various stages of malarial parasite in RBCs using permanent mounts.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BMCBMAJ08T**
Course Title: **BIOSTATISTICS**
(L-P-Tu): **5-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **1. To introduce the concept of biostatistics. 2. To learn the application of statistics in biology.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Develop basic knowledge of mathematics as applied to biological phenomenon. 2. Understand different statistical methods used for handling biological data. 3. Develop basic concepts of statistics and its importance.**

COURSE TITLE: BIOSTATISTICS (THEORY)
TOTAL HOURS: 60 CREDITS:4

Unit 1. Introduction No. of Hours: 4

Meaning of statistics, aims of statistics, Definitions and limitation of statistics, Need and scope of statistics.

Unit 2. **Elementary StatisticsNo. of Hours: 16**

Measures of central tendency (Mean, Median and Mode), standard deviation, standard error, Measures of dispersion, Discrete and Continuous random variables, Correlation and Regression, Emphasis on examples from biological sciences, tests of statistical significance and analysis of variance.

Unit 3. Preliminary Notions on samplingNo. of Hours: 12

Sampling Parameters, Difference between sample and population, sampling errors, Difference between parametric and non-parametric statistics, Definition of sample and population, concept of variable, Frequency distribution &its graphical representation

Unit 4. Test of significanceNo. of Hours: 14

Sampling distributions, Standard error, Testing of Hypothesis, Level of significance and Degree of freedom, large sample test based on normal distribution, small sample test basedont-test, z test and f-test, Chi square test.

Unit 5.ModellingNo. of Hours: 14

Mathematical modelling of bacterial growth curve, fermentation, control of microorganism, Differential equation, Set theory, Probability.

SUGGESTED READINGS

1. H. S. Bear: Understanding Calculus, John Wiley and Sons (Second Edition); 2003.
2. E. Batschelet: Introduction to Mathematics for Life Scientists, Springer Verlag, International Student Edition, Narosa Publishing House, New Delhi (1971, 1975)
3. A. Edmondson and D. Druce: Advanced Biology Statistics, Oxford University Press; 1996.
4. W. Danial: Biostatistics: A foundation for Analysis in Health Sciences, John Wiley and Sons Inc; 2004.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-15**

Semester: **8**

Course Code: **BMCBMAJ08T**

Course Title: **BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS (IPR)& BIOETHICS (THEORY)**

(L-P-Tu): **5-0-1**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **1. To study the biosafety rules and regulations. 2. To learn about the different IPRs and their importance. 3. To provide a basic idea about bioethicsand biopiracy.**

Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Know the good microbiological practices and importance of biosafety. 2. Understand the regulation of GMOs/LMOs at national and international level. 3. Understand the concept of different types of IPRs. 4. Acquainted with bioethical concepts.**

MAJOR COURSE 02

COURSE TITLE: BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS (IPR)& BIOETHICS (THEORY)

TOTAL HOURS: 60 CREDITS:4

Unit 1. Introduction to biosafetyNo. of Hours: 10

Concept of Biosafety, Containment- Types; Biological Safety Cabinets; Different levels of Biosafety, Biosafety levels of specific microorganisms; Biosecurity, Bioterrorism

Unit 2. National and International RegulationsNo. of Hours: 12

National and International regulatory bodies, Regulation of LMOs/ GMOs at National level: RDAC, RCGM, IBSCs, GEAC, SBCC, DLC; Cartagena protocol on Biosafety; Applications, Risk assessment and management of LMOs/ GMOs

Unit 3. Introduction to Intellectual Property No. of Hours: 15

Concept of Intellectual Property- Types, Patents (Classification of patents, patent filing procedures, infringement), Trademarks, Copyright & Related Rights, Industrial Design, Geographical Indications, Plant Breeders' Rights, Traditional knowledge, Trade secret, Domain names

Unit 4. Agreements and Treaties No. of Hours: 10

Establishment and functions of GATT and TRIPS agreement; Madrid agreement; Hague agreement; WIPO treaties; Budapest treaty; PCT, Indian patent Act 1970 and recent amendments

Unit 5. Bioethics No. of Hours: 13

Introduction to ethics and bioethics, framework for ethical decision making. Ethical conflicts in biological sciences - interference with nature, bioethics in health. Artificial reproductive technologies, prenatal diagnosis, Ethics in transplantation and stem cell research, Human and animal experimentation, Agricultural

biotechnology - Genetically engineered food, environmental risk, labelling. Protection of environment and biodiversity– biopiracy, bioprospecting

SUGGESTED READING

1. Bare Act, 2007.Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt.Ltd., New Delhi.
2. Kankanala C (2007). Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd. New Delhi.
3. Mittal, D.P. (1999). Indian Patents Law, Taxmann, Allied Services (p) Ltd.
4. Singh K K (2015). Biotechnology and Intelectual Property Rights: Legal and Social Impliocations, Springer India.
5. Goel D &Prashar S (2013). IPR, Biosafety and Bioethics. Pearson
6. Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.
7. Biotechnology in the Welfare of Mankind –Ali Khan
8. Sasson A., Biotechnologies in developing countries present and future, UNESCO Publishers, 1993
9. Singh K., Intellectual Property Rights on Biotechnology, BCIL, New Delhi.
10. Ganguli, P. (2001). Intellectual property rights: Unleashing the knowledge economy. New Delhi: Tata McGraw-Hill Pub.
11. Senthil Kumar Sadasivam and Mohammed Jaabir M. S. (2008). IPR, Biosafety and Biotechnology Management, Jasen Publications, India.

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BMCBMAJ08T**
Course Title: **INTRODUCTION TO BIOINFORMATICS**
(L-P-Tu): **5-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **1. To provide concept of the fundamentals of Bioinformatics. 2. To study the different data bases, different file formats-FASTA, Genebank and Uniprot. 3. To study the different sequence alignments, phylogeny and phylogenetic trees. 4. To perform retrieval of DNA/RNA/Protein sequences from databases.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Understand the basic concept of bioinformatics and introduction to biological databases: NCBI, EMBL and SwissProt 2. Know about various file formats for bio-molecular sequences-FASTA,Genebank and Uniprot, pairwise and multiple sequence alignments, different approaches for Phylogenetic Tree Construction. 3. Understand the diversity of genomes of viruses, prokaryotes and Eukaryotes, 2D-Gel Electrophoresis. 4. Perform biological database handling and database management of different biological database and its retrieval from different public domain database.**

MAJOR COURSE 03

COURSE TITLE: INTRODUCTION TO BIOINFORMATICS(THEORY)

TOTAL HOURS: 60 CREDITS:4

Unit 1. Bioinformatics No of hours: 15

An Overview, Definition and History. Information Networks – Internet inBioinformatics, Evolution of Bioinformatics, Scope – Potentials of Bioinformatics, Human Genome Project.

Unit 2. Biological Databases No of hours: 15

Nucleic Acid, Genome, Protein sequence and structure, Gene expression Databases, Database of metabolic pathways,Mode of Data Storage-File formats- FASTA, Genebank and Uniprot, Data submission and retrieval

from NCBI, EMBL, DDBJ, Uniprot, PDB.

UNIT 3. Sequence Alignments, Phylogeny and Phylogenetic trees No of hours: 20

Local and Global Sequence alignment, Pairwise and multiple sequence alignments, scoring an alignment, scoring matrices, PAM and BLOSUM series of matrices, Types of phylogenetic trees, Different approaches of phylogenetic tree construction- Maximum parsimony, Maximum likelihood.

UNIT 4. Genome organization and analysis No of hours: 10

Diversity of genomes- Viral, prokaryotic and eukaryotic genomes, transcriptome, proteome,2 D-Gel electrophoresis, Maldi Toff spectroscopy.

SUGGESTED READINGS

1. Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery by S.C.Rastogi, P.Rastogi&N.Mendiratta.
2. A Text Book of Bioinformatics by Sharma, Munjal and Shanker.
3. **Bioinformatics: A Practical Guide to The Analysis of Genes And Proteins, 3Rd Edition by BAXEVANIS ANDREAS D ET AL, Wiley India**
4. Instant Notes on Bioinformatics by David.R.Westehead, J.Howard Perish

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BMCBMAJ08T**
Course Title: **AGRICULTURE MICROBIOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **1. To impart in-depth information on soil and agriculture 2. To study the role of microbes in agriculture for sustainable development. 3. To provide an overview on plant microbe interaction.**
Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Gain detailed idea on various micro-organisms, its harmful or beneficial effects on agriculture, how to use them in a safer way for creating a better agriculture system like using as biofertilizer, biopesticide, silage production, plant disease management etc. 2. Acquire practical knowledge in the isolation and characterization of microbes important in agriculture.**

MAJOR COURSE 01

COURSE TITLE: AGRICULTURE MICROBIOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS:4

Unit 1. Soil Microbiology and: **Microbial transformations of minerals No. of hours: 10**

Composition of Lithosphere, soil microbes, factors influencing soil microbial population.

The soil environment-Distribution and abundance, generic groups and nutrition of bacteria, actinomycetes, fungi, algae, protozoa and viruses.

Phosphorous, sulphur, iron and other elements - Chemistry, cycles, mineralization and immobilization and oxidation/reduction

Unit 2.Biological Nitrogen fixation and **biofertilizer production No. of hours: 15**

Legume-Rhizobium symbiosis, Ammonia assimilation in Nitrogen-Fixing legume nodules, factors controlling the Legume - Rhizobium symbiosis.

Non-Leguminous associations e.g*Azotobacter*sp and *Azospirillum*sp and their functions, Cyanobacteria (BGA) and their associations in Nitrogen fixation., Phosphate solubilizing microbes. Mycorrhizae and plant growth promoting rhizobacteria (PGPR).

Role of biofertilizers. Silage production, Quality control (BIS specification), marketing, Evaluation of field performance and economics of production. Role of biofertilizer in integrated nutrient management. Regulation and standards, Marketing and Monitoring field performance.

Unit 3. Plant pathology No. of hours: 20

Introduction to plant pathology: Historical developments in brief, classification of plant diseases, Spread of diseases in general. Stages in development of a disease. Virulence factors of pathogens in disease development. Défense mechanisms in plants- structural and biochemical.

Plant diseases: Study of symptoms, aetiology, epidemiology and management of diseases caused by fungi (Tikka disease of groundnut, Downy mildew of grapes, Red rot of sugarcane), bacteria (Citrus canker, blight of rice), viruses (Bunchy top of banana, Papaya ring spot) and viroid (Potato spindle tuber disease).

Unit 4. Biological control and GM cropsNo. of hours: 15

Concept of Biopesticides – Viral (NPV, CPV & GV), bacterial (*Bacillus thuringiensis*, *Bacillus popilliae*&*Pseudomonas* sp.), Fungal (*Entomophthora muscae*, *Beauveria* sp., *Metarrhizium*sp. &*Verticillium* sp.), Protozoan (*Mattesia* sp., *Nosema* sp., *Octosporamuscaedomesticae*&*Lambornella* sp.).

GM crops-advantages, social and environmental aspects of Bt crops.

SUGGESTED READINGS

1. Gupta, S.K.2014 Approaches and trends in plant disease management. Scientific publishers, Jodhpur, India.
2. Jamaluddin et al 2013 Microbes and sustainable plant productivity. Scientific Publishers Jodhpur, India. G
3. Subba Rao, N. S. 1997. Biofertilizers in Agriculture and Forestry, III Ed., Oxford & IBH Publishing Co.Pvt.Ltd., New Delhi.
4. Subba Rao, N. S. 1995. Soil microorganisms and plant growth. Oxford & IBH Publishing Co.Pvt.Ltd. New Delhi.
5. Martin Alexander 1983. Introduction to Soil Microbiology, Wiley eastern Ltd., New Delhi.
6. Newton, W.E and Orme, Johnson, W.H.1980. Nitrogen fixation vol II: Symbiotic Associations and Cyanobacteria. University Park Press Baltimore, USA.
7. Wheeler, B. E. 1976. An Introduction to Plant Disease. ELBS and John Wiley and Sons, Ltd.
8. Dubey, R.C and Maheswari, D.K. 2002. Practical Microbiology, 1st Ed., Chand and Company Ltd., India.

COURSE TITLE:AGRICULTURE MICROBIOLGY (PRACTICAL)
TOTAL HOURS: 60 CREDITS:2

1. Demonstration of Winogardsky coloumn.
2. Isolation of beneficial microbes from the soil.
3. Study the growth response of crops due to biofertilizer application.
4. Study on plant pathogens: Observation of plant diseases of local importance - Citrus canker, Tikka disease of Groundnut, Bhendi yellow vein mosaic, Rusts, Smuts, Powdery mildews, Tomato leaf curl.
5. Demonstration of Acetylene reduction assay to evaluate nitrogenase activity

Syllabus *(MICROBIOLOGY)*

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BMCBMAJ08T**
Course Title: **PHARMACEUTICAL MICROBIOLOGY**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**

Course Objective: **1. To understand the basics of pharmaceutical microbiology and microbial roles in pharmaceuticals. 2. To appraise the different products of microbial origin and their role in pharmacology. 3. To appreciate the role of secondary metabolites in pharmaceutical industry.**

Learning Outcome: **Upon successful completion of the course the candidate will be able to- 1. Understand the concept of antibiotics and their mode of action. 2. Learn about the sterilization and preservation of pharmaceutical products. 3. Gain idea about different chemotherapeutic agents. 4. Understand the importance of gene therapy and different types of vaccines.**

MAJOR COURSE- 02

COURSE TITLE: PHARMACEUTICAL MICROBIOLOGY(THEORY)

TOTAL HOURS: 60 CREDITS:4

Unit 1. Introduction to chemotherapeutic agentsNo. of hours:12

History and development of chemotherapeutic agent, properties of anti-microbial agents, types of chemotherapeutic agents- synthetic, semi-synthetic and natural antibiotics.Types of antibiotics and their classification; non-medical uses of antibiotics. Sanitizers, chemical disinfectants and antiseptics.

Unit 2. Mode of action of antibioticsand antibiotic resistance No of hours: 14

Chemical nature and mode of action of antibiotics (inhibitors of cell wall synthesis, membrane, nucleic acid and protein synthesis), anti- fungal antibiotics, anti- viralantibiotics and interferons.Development of antibiotic resistance, Mechanism of antibiotic resistance. Concept of pharmacokinetics.

Unit 3. Microbial spoilage, sterilization and preservation of pharma products No. of hours:10

Microbial contamination spoilage and hazard: Sources of contamination, factors affecting survival and growth, breakdownof active ingredient and general formulations.

Principles of sterilizations with respect to pharmaceuticalindustries. Methods of sterilizations: steam, dry heat, radiation, gaseous and filtration, sterility testing of pharmaceutical products.

Principles of preservation, antimicrobial preservatives and their properties, preservative stability and efficacy.

Unit 4. Gene therapy and vaccine designNo. of hours: 14

Gene therapy: general introduction, ex vivo and in vivo gene therapy, potential targets for gene therapy, inherited disorders.

Vaccine design and production, classification, genetically recombinant vaccines, advantages and disadvantages – examples – hepatitis B vaccines, edible vaccines, DNA vaccines – principles and mechanism, vaccine clinical trials.

Unit. 5. Regulatory aspects in pharmaceutical industriesNo. of hours: 10

Introduction to pharmacopoeia: Food and Drug Administration (FDA) regulation and India Pharmacopoeia (IP), British Pharmacopoeia (BP), United States Pharmacopoeia (USP) Good Laboratory Practices (GLP) Good Manufacturing Practices (GMP) and Current Good Manufacturing Practices (cGMP).

SUGGESTED READINGS

1. "Pharmaceutical Biotechnology", by S.S. Purohit, H.N. Kakarni and A.K. Saluja, Agrobios (India).
2. "Basic Biotechnology", edited by Colin Ratledge and Bjorn Kristiansen, 2001, Cambridge University, Press, New York.
3. "Biotechnology: A Text Book of Industrial Microbiology", 2nd edition by Wulf Crueger and Anneliese Crueger (Third Indian reprint 2005), Panima Publishing Corporation New Delhi / Bangalore.
4. Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications.
5. Quality control in the Pharmaceutical Industry - Edt. by Murray S.Cooper Vol.2. Academic Press New York.
6. Pharmaceutical Biotechnology by S.P.Vyas & V.K.Dixit. CBS Publishers & Distributors, New Delhi.
7. Good Manufacturing Practices for Pharmaceuticals Second Edition, by Sydney H.Willig, Murray M.Tuckerman, William S.Hitchings IV. Merkel Dekker NC New York.

8. Quality Assurance in Microbiology by Rajesh Bhatia, Rattan LalIchhpujani. CBS Publishers & Distributors, New Delhi.

COURSE TITLE: PHARMACEUTICAL MICROBIOLOGY(PRACTICAL)
TOTAL HOURS: 60 CREDITS:2

1. Sterility testing of pharmaceutical products.
2. Staining and biochemical test.
3. Determination of phenol coefficient.
4. Determination of.MICof antimicrobials.
5. Microbial assay of antibiotic by cup plate method and disc diffusion method.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Sidho-Kanho-Birsha University

Syllabus & Course Curriculam

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **PHIMAJ1**
Course Title: **Indian and Western Philosophy 1**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The paper provides the basic features of Indian and Western philosophy emphasizing on its origin, developments of various schools. However,it will depict three sects of Heterodox philosophy-Cārvāka, Buddhism and Jainism and two sects of orthodox philoso**
Learning Outcome: **a)This module will provide a general understanding to the students about the ancient Indian thought rooted in its philosophy. b) It will also enlighten the students about the ancient and modern philosophical reflections in western thought.**

- **Module-1:** Salient features of Indian Philosophy (10 classes)
- **Module2:** Cārvāka Philosophy (Metaphysics, Epistemology) Jain Philosophy (Dravya, Jīva, Ajīva, Syādvāda, Anekāntavāda) Buddha Philosophy (Pratityasamutpadavāda, Kṣaṇabhaangavāda) (20 classes)
- **Module-3:** Sāṃkhya Philosophy: (Prakṛti and Puruṣa), Yoga Philosophy (Astānga-yoga, Chittavṛṛtti, Chittabhūmi) (15 classes)
- **Module-4:** Plato (Theory of knowledge, Theory of Ideas), Aristotle (Criticism of Plato's Theory of Ideas, Form and Matter, Theory of Causation) (15 classes)
- **Module-5:** Descartes (Cogito ergo sum, Criterion of Truth, Theory of Ideas, Mind-Body relation) (10 classes)
- **Module-6:** Spinoza (Substance, Attributes, Modes), Leibnitz (Theory of Monads, Pre-established Harmony) (20 classes)
- **Reading References:**

- C.D Sharma: *A Critical Survey of Indian Philosophy*
- M Hiriyanna: *Outlines of Indian Philosophy*
- Jadunath Sinha: *History of Indian Philosophy (Vol.1&2)*
- D. M. Dutta and S.C. Chatterjee: *Introduction to Indian Philosophy*
- S.N. Dasgupta: *History of Indian Philosophy (Vol. I-V)*
- W.T. Stace: *A Critical History of Greek Philosophy*
- F. J. Copleston: *A History of Philosophy (Vol. I & IV)*
- Y. Masih: *A Critical History of Western Philosophy*
- D. J. O'Connor: *A Critical History of Western Philosophy*
- B. Russell: *A History of Western Philosophy*
- *Bengali Book*
- *Nirodbaran Chakrabarty: Bharatiya Darshan*
- Debabrata Sen: *Bharatiya Darshan*
- *Dipak Kumar Bagchi: Bharatiya Darshan*
- *Pradyot Kumar Mondal: Bharatiya Darshan*
- *Srikanta Samanta: Bharatiya Darshaner Ruparekha*
- *Pramodbandhu Sengupta: Paschatya Darshaner Sankhipta Itihas*
- *Kalyan Chandra Gupta: Paschatya Darshaner Itihas*

- *Nirodbaran Chakrabarty:Paschatya Darshaner Itihas*
- *Sushanta Chakrabarty: Paschatya Darshaner Itihas*
- *Chandradoy Bhattacharya: Paschatya Darshan .*

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)
Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)
Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-2**

Semester: **2**

Course Code: **PHIMAJ2**

Course Title: **Indian and Western Philosophy-2**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **The objective of this selective module is to provide the basic knowledge of three astika schools of Indian philosophy, namely Nyāya, AdvaitaVedānta and Viśiṣṭādvaita. In addition to this students could acquinted with the fundamental thought of empir**

Learning Outcome: **a. We are living in a united culture and our philosophy positively supports this view. In studying this, students will apprehend our unity with the world.. b. And in the remaining part of the module students will be enlightened about the modern epistemolo**

- **Module-1:** Nyāya Philosophy (Pratyakṣa), Vaiśeṣika Philosophy (Padārtha) (15 classes)
- **Module-2:** AdvaitaVedānta: (Brahman, Jiva, Jagat and Māyā) (15 classes)
- **Module-3:** Viśiṣṭādvaita: (Refutation of Māyāvāda, Brahma, Jiva, Jagat) (15 classes)
- **Module-4:** Locke (Refutation of Innate Ideas, Primary and Secondary qualities, Theory of Representative Realism) (10 classes)
- **Module-5:** Berkeley (Refutation of Matter, Esse est Percipi), Hume (Impression and Idea, Causality) (20 classes)
- **Module-6:** Kant: (Copernican Revolution, Critical Theory, Classification of Judgements (a-priori, a-posteriori, analytic, synthetic, synthetic a-priori), Central Problem) (15 classes)
- **ReadingReferences:**

- C.D Sharma: *A Critical Survey of Indian Philosophy*
- M Hiriyanna: *Outlines of Indian Philosophy*
- Jadunath Sinha: *History of Indian Philosophy (Vol.1&2)*
- D. M. Dutta and S.C. Chatterjee: *Introduction to Indian Philosophy*
- S.N. Dasgupta: *History of Indian Philosophy (Vol. I-V)*
- W.T. Stace: *A Critical History of Greek Philosophy*
- F. J. Copleston: *A History of Philosophy (Vol. I & IV)*
- Y. Masih: *A Critical History of Western Philosophy*
- D. J. O'Connor: *A Critical History of Western Philosophy*
- B. Russell: *A History of Western Philosophy*
- Rashbihary Das: *A Handbook of Kant's Critique of Pure Reason*

- *Bengali Book:*
- *Nirodbaran Chakrabarty: Bharatiya Darshan*
- Debabrata Sen: *Bharatiya Darshan*
- *Dipak Kumar Bagchi: Bharatiya Darshan*
- *Pradyot Kumar Mondal: Bharatiya Darshan*
- *Srikanta Samanta: Bharatiya Darshaner Ruparekha*
- *Pramodbandhu Sengupta: Paschatya Darshaner Sankhipta Itihas*
- *Kalyan Chandra Gupta: Paschatya Darshaner Itihas*
- *Nirodbaran Chakrabarty:Paschatya Darshaner Itihas*
- *Sushanta Chakrabarty: Paschatya Darshaner Itihas*
- *Chandradoy Bhattacharya: Paschatya Darshan .*
- *Rasbihari Das: Kanter Darshan.*

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement**

Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-3**

Semester: **3**

Course Code: **PHIMAJ3**

Course Title: **Ethics: Indian and Western**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **This paper presents the key ideas of morality in the Indian peninsula, such as the types of karma, re-birth, and various types of dharmas. Students will understand the meaning of Purusharthas and their interrelations. The paper also provides the basic fea**

Learning Outcome: **a. This module will bring the moral values to the students entrenched from the beginning of Vedic culture to ethical sanctions of Srimad Bhagavad Gita. b. One of the crucial significance of this module is that it will assist the readers of philosophy to**

- **Module-1:** Concept of Duty, Puruṣārtha, Classification of Dharma (Sādhāraṇa Dharma, Varnāśrama Dharma) (15 classes)
- **Module-2:** Theory of Karma, Rebirth, Ethics of Bhagvadgītā (Niṣkāma Karma, Sakāma Karma (15 classes)
- **Module-3:** Buddhist Ethics: (Eightfold Path, Pancaśila), Jaina Ethics: (Triratna, Mahāvrata, Aṇuvrata) (12 classes)
- **Module-4:** Ethics (Definition, Nature and Scope, Voluntary and Non-Voluntary Action), The Concept of Good, Right, Justice, Duty and Obligation (18 classes)
- **Module-5:** Theories of Punishment; Capital Punishment (15 classes)
- **Module-6:** Utilitarianism (Bentham and Mill); Kant's Deontology (15 classes)
- **Reading References:**

- *Śrimadbhagvadgitā*
- *Dhammapada* (Tr. by F. Max Muller)
- S. K. Maitra: *The Ethics of the Hindus*
- I. C. Sharma: *Ethical Philosophies of India*
- W. Frankena: *Ethics*
- W. Lillie: *An Introduction to Ethics*

- J. S. Mackenzie: *A Manual of Ethics*
- *Dipak Kumar Bagchi: Nitividya*
- *Amita Chatterjee: Bharatiya Dharmaniti*
- *Dikshit Gupta: Nitishastra*
- Sudhir Kumar Nandi: Nitividya.
- Somnath Chakrabarty: Nitividyar Tattvakatha
- Mrinal Kanti Bhadra: Nitividya
- Arabindo Basu: Frankenar Niti Darshana.

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **PHIMAJ4**
Course Title: **Philosophy of Religion**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **As a student of philosophy we should understand the philosophy of religion and various doctrines accordingly. That is why this paper has been included in the curriculum. Various aspects of the origin of religion, such as the concept of Mana, Totem and Tab**
Learning Outcome: **a. This module focuses on providing a rational understanding of the diverse concepts of world religion. b. As if this reading will make the students comprehend about the actual meaning of religion.**

- **Module-1:** Origin of Religion (Mana, Totem and Taboo, Ghost Theory) (15 classes)
- **Module-2:** Developments of Religion (15 classes)
- **Module-3:** Arguments for and against the existence of God (20 classes)
- **Module-4:** The Problem of Evil (10 classes)
- **Module-5:** The Problems of Religious Language (15 classes)
- **Module-6:** The Philosophy of Sufism (15 classes)
- **Reading References:**
- John Hick: *Philosophy of Religion*
- Kedar Nath Tiwari: *Comparative Religion*
- Kalidas Bhattacharya: *Alternative Religions*
- D. Miall Edwards: *The Philosophy of Religion*
- Sirajul Islam: *Sufism and Bhakti*

Bengali Book:

- *Pramodbandhu Sengupta: Dharmadarshan*
- *Dilip Kumar Mohanta: Dharmadarshaner Katipay Samasya*
- *Arabindo Basu O Nibedita Chakrabarty: Dharma Darshaner Parichay*
- *Kalyan Chandra Gupta: Dharma Darshan*
- *Sushil Kumar Chakrabarty: Dharma Darshan*

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **PHIMAJ5**
Course Title: **Indian Metaphysics and Western Epistemology**

(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **The main focus of this paper is to present the several issues regarding Indian Metaphysics and some crucial concepts of western epistemology. The debate between Nyāya and Sāṃkhya schools of philosophy in connection with causality, the debate between N**
Learning Outcome: **To develop a rational attitude towards abstract metaphysical ideas and how we cognize reality from the perspectives of Indian and Western thought.**

- **Module-1**: Causality (The Debate between Nyāya and Sāṃkhya) (15 classes)
- **Module-2:** Universals (The Debate between Nyāya - Vaiśeṣika and Bauddha) (15 classes)
- **Module-3:** Self (The Debate between Vaiśeṣika and Bauddha) (15 classes)
- **Module-4:** What is Knowing (Belief, Truth, and Evidence), The Source of Knowledge (Reason and Experience), Propositional and Non-Propositional Knowledge; Knowledge by Acquaintance and Knowledge by Description (15 classes)
- **Module-5:** Condition of knowledge (Necessary and Sufficient condition of propositional knowledge) (15 classes)
- **Module-6:** Theories of Truth (Correspondence, Coherence and Pragmatic) (15 classes)
- **Reading References:**
- C. D. Sharma: *A Critical Survey of Indian Philosophy*
- D. M. Dutta: *Six Ways of Knowing*
- S. K. Moitra: *Fundamental Questions of Indian Metaphysics and Logic*
- Satkari Mukherjee: *The Buddhist Philosophy of Universal Flux*
- Cit Ghanananda Puri (Ed): *Vedanta Darsana*
- John Hospers: *An Introduction to Philosophical Analysis*
- A. D. Woozley: *Theory of Knowledge*
- B. Russell: *The Problems of Philosophy*
- Jonathan Dancy: *An Introduction to Contemporary Epistemology.*

Bengali Books:

- *Biswanath Sen: Jnanatattva O Adhividyar Kayekti Samasya*
- Samarikanta Samanta: Darshanik Bishleshaner Ruparekha
- Phanibhushan Tarkabagis: Nyayadarshan.
- Kalikrishna Bandyopadhyay: Nyayatattva Parikrama.

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **PHIMAJ6**
Course Title: **Indian Logic and Epistemology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Under the title of "Indian Logic and Epistemology" a popular text of Nyāya philosophy namely Tarkasaṁgraha of Annaṁbhaṭṭa is introduced in this paper. Elaborate discussion of Buddhi; Smṛti; Pramā; Apramā; Karaṇa; Vyāparā; Kāraṇa; A**
Learning Outcome: **a) There is a close affinity of Indian logic with our daily activities. The existing knowledge system of Indian philosophy unremittingly and unflinchingly connected with the individuals. So in studying this paper the students will be very much benefited t**

- Textual Study: Annaṁbhaṭṭa - *Tarkasaṁgraha with Dipikatikā* (Selected Chapters)

- **Module-1:** Buddhi; Smṛti; Pramā; Apramā (15 Classes)
- **Module-2:** Karaṇa; Vyāpara; Kāraṇa and its classification (15 Classes)
- **Module-3:** Anumāna; Parāmarśa; Vyāpti (15 Classes)
- **Module-4:** Different types of Anumāna (15 Classes)
- **Module-5:** Hetvābhāsa; Upamāna (15 Classes)
- **Module-6:** Śabda (Śakti; Lakṣaṇā Different types of lakṣaṇā) (15 Classes)
- **Reading References:**
- Gopinath Bhattacharya: *Tarkasaṁgraha* (Translated and elucidated)

Bengali Books:

- Narayan Chandra Goswami: *Tarkasaṁgraha* (Translated and elucidated)
- Samarendra Bhattacharya: Tarkasamgraha
- Panchanan Shastri: Tarkasamgraha
- Kanailal Poddar: Tarkasamgraha
- Arabindo Basu: Tarkasamgraha O Tarkasamgrahadipika

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **PHIMAJ7**
Course Title: **Western Logic: Deduction**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **In this paper students will acquire the basic concepts of the logical thinking of western philosophy. Emphasis will be on deductive logic with the selected chapters of popular special text of I. M. Copi and Cohen's "Introduction to Logic."**
Learning Outcome: **a. To develop a logical brain among the students, so that they could handle any conflicting situation in their future lives. b. The outcome of logic is the elaboration of a coherent system that allows us to investigate, classify and evaluate good and bad**

- **Module-1:** Categorical Propositions (10 classes)
- **Module-2:** Categorical Syllogisms (10 classes)
- **Module-3:** Syllogisms of Ordinary Language (10 classes)
- **Module-4:** Symbolic Logic (15 classes)
- **Module-5:** Methods of deduction (25 classes)
- **Module-6:** Quantification Theory (20 classes)

Text: - "*Introduction to Logic*" (14th edition): I. M. Copi and C. Cohen (Chapters 5 to 10)
Reading References:

1. Chhanda Chakraborty: *Logic: Informal, Symbolic and Inductive*
2. রমাপ্রসাদ দাস : *নব্য যুক্তি বিজ্ঞান* (প্রথম খণ্ড থেকে চতুর্থ খণ্ড)
3. সমীর কুমার চক্রবর্তী: *সাংকেতিক যুক্তিবিজ্ঞান*
4. শুক্লা চক্রবর্তী : *তর্কবিজ্ঞান*

কান্তিলাল দাস: *পাশ্চাত্য যুক্তিবিজ্ঞান*

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **PHIMAJ8**
Course Title: **Contemporary Philosophy (Indian and Western)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **Contemporary philosophy has arisen in awareness of the need to reconcile the forces of tradition with those of modernity. The paper is about the philosophical views of Rabindranath Tagore, Swami Vivekananda, Muhammad Iqbal, B. R. Ambedkar, Sri Aurobindo,**
Learning Outcome: **Our cultural heritage is nothing but a production of thought of the truth-perceiver. Their saying is embodied with rich philosophical outgrowth. So in studying this paper the students could follow the path they have shown and apply the ideology of the see**

- **Module-1:** Rabindranath Tagore: (Nature of Man, Surplus of Man); Swami Vivekananda: (Practical Vedanta, Universal Religion) (15 classes)
- **Module-2:** Muhammad Iqbal: (Intuition, Self); Sri Aurobindo: (Mind and Supermind, Integral Yoga) (15 classes)
- **Module-3:** S. Radhakrishnan: (Absolute Reality, Human Destiny); B. R. Ambedkar: (Caste and Untouchability, Neo-Buddhism) (15 classes)
- **Module-4:** B. Russell: (Appearance and Reality, Existence of Matter) (15 classes)
- **Module 5:** B. Russell: (Idealism, On Induction) (20 classes)
- **Module 6:** A. J. Ayer: (Elimination of Metaphysics) (10 classes)

Reading References:

1. D. M. Dutta: *Chief Currents of Contemporary Philosophy*
2. B. K. Lal: *Contemporary Indian Philosophy*
3. S. Radhakrishnan: *An Idealistic View of life*
4. Sri Arobindo: *Integral Yoga*
5. Rabindranath Tagore: *The Religion of Man*
6. A. J. Ayer: *Language, Truth and Logic*
7. A. J. Ayer: *The Central Questions of Philosophy*
8. A.J. Ayer: *Russell*
9. B. Russell: *The Problems of Philosophy*

Bengali Books:

1. *Saikat Bandyopadhyay: Binshashatabdir Bharatiya Darshan*
2. Gobinda Charan Ghosh: Samasamayik Bharatiya Darshan
3. Shrabanti Bhattacharya: Adhunik Bharatiya Darshan
4. Sushil Kumar Chakrabarty: Darshan Samasya
5. Samarendra Bhattacharya: Darshaner Samasya.

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **PHIMAJ9**
Course Title: **Special Text (Indian): Vedāntasāra: Sadananda Yogindra Saraswati**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**

Course Objective: **As Advaita Vedānta is one of the major and dominant schools of Indian Philosophy, a famous text of this school, namely 'Vedānta Sāra' has been incorporated here to understand the philosophy of Sankara. Here we will discuss the notion of Anubandha c**

Learning Outcome: **Vedanta teaches the logic of unity. There was no discrimination on the basis of caste, creed, color etc and the students of all strata of society received education on an equal footing. The students through studying this paper concerning the Vaidantic kno**

- **Module-1:** Definition of Vedānta, Anubandhacatuṣtaya, Duty of Guru (15 classes)
- **Module-2:** Ajñāna, Adhyāropa to Kārya of Ajñāna, (15 classes)
- **Module-3:** Jagatsristiprakriyā, Koṣa, Pañcikaraṇprakriyā (15 classes)
- **Module-4:** Ātmā in Cārvāka, Bauddha and Mimāṃsā darśana, Apavāda (15 classes)
- **Module-5:** Tattvamasi Mahāvākya, Lakṣaṇā (15 classes)
- **Module-6:** Samādhi (Savikalpaka and Nirvikalpaka), Bighna Catuṣtaya (15 classes
- **Reading References:**

1. B. Pal : *Vedāntasāra*
2. M. Hiriyanna : *Vedāntasāra*
3. A. K. Roy Chowdhury: *Self and Falsity in Advaita Vedanta*

Bengali Books:

1. *BipadBhanjan Pal: Vedantasara*
2. *Rama Choudhury : Vedanta Darshan*
3. *Ashutosh Shastri: Vedanta Darshan*
4. *Swami Vidyaranya: Vedanta Darshan*
5. *Loknath Chakrabarty: Vedantasara*
6. *Kamalkrishna Chakrabarty: Vedantasara*

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **PHIMAJ10**
Course Title: **Western Logic: Induction**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To develop reasoning ability and experimental mentality among students this paper is introduced here. Focus will be on various Experimental methods, Causal reasoning, Science and Hypothesis and important rules of Probability from selected chapters of the**
Learning Outcome: **a) To develop a logical brain among the students, so that they could handle any conflicting situation in their future lives. b) The outcome of logic is the elaboration of a coherent system that allows us to investigate, classify and evaluate good and bad**

- **Module-1:** Analogical Reasoning (20 classes)
- **Module-2:** Causal Reasoning (20 classes)
- **Module-3:** Science and Hypothesis (20 classes)
- **Module-4:** Probability (30 classes)

Text: - *Introduction to Logic* (14th edition): I. M. Copi and C. Cohen (Chapters 11 to 14)

Reading References:

1. Chhanda Chakraborty: *Logic: Informal, Symbolic and Inductive*
2. রমাপ্রসাদ দাস : *নব্য যুক্তি বিজ্ঞান* (প্রথম খণ্ড থেকে চতুর্থ খণ্ড)

3. সমীর কুমার চক্রবর্তী : *সাংকেতিক যুক্তিবিজ্ঞান*
4. শুক্লা চক্রবর্তী : *তর্কবিজ্ঞান*
5. কান্তিলাল দাস : *পাশ্চাত্য যুক্তিবিজ্ঞান*

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **PHIMAJ11**
Course Title: **Western & Indian Logic**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **a. Logic is one of the most essential branches in Philosophy, because one cannot think without the help of rules of thoughts. Anything, whatever it may be cannot be accepted if it is devoid of logic. That is why in ancient India logic was treated as the**
Learning Outcome: **a) To develop a logical brain among the students, so that they could handle any conflicting situation in their future lives. b) The outcome of logic is the elaboration of a coherent system that allows us to investigate, classify and evaluate good and bad**

- **Module-1:** The Method of Deduction (Symbolic Logic by I.M. Copi Ch.3)
- **Module-2:** Quantification Theory (Symbolic Logic by I.M. Copi Ch.4)
- **Module-3:** Truth Tree Method (Jeffery)
- **Module-4:** Definition, constituents and process of Anumāna from Nyāya and Buddhist Perspectives
- **Module-5:** Paksatā & Parāmarṣa (Nyāya)
- **Module-6:** Definition of vyāpti

Reading References:

1. *Symbolic Logic* : I.M. Copi
2. *Formal Logic – Its Scope and Limits* : R. C. Jeffrey
3. *Tarka-Bhāsā (Anumāna Khanda)* : Keshab Mishra
4. *Nyāyabindu* (Anumāna Khanda)
5. *Vedānta Paribhāsā* (Dvitiya Pariccheda)
6. *Perception* : B. K. Motilal
7. Buddhist Logic : Stcherbatsky

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **PHIMAJ12**
Course Title: **Western & Indian Epistemology**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**

Course Objective: **a. Critique of Pure Reason deals with mainly Epistemology. This branch of Philosophy is one and only one field where the theory of knowledge is studied. It deals with the definition of knowledge conditions of knowledge, limitations of knowledge, validity**

Learning Outcome: **a. This area of Philosophy makes us alert about how far we can know and it helps us to make the distinction between true and false metaphysics. Nowadays students are interested in carrying out their research work in this field. b. Provide appropriate grou**

- **Module-1:** Kant's Critique of Pure Reason (From Preface to Transcendental deduction of categories)
- **Module-2:** Nature of Pramā and Pamāṇa, Pramāna Saṁplava and Pramāṇa Vyavasthā following Vātsyāyana Bhāṣya
- **Module-3:** Arthāpatti, anupalabdhi following Tarka-Bhāsā
- **Module-4:** a) Concept of Pratyakṣa following Nyāya (Nyāya Sutra 1.1.4)

b. Concept of Pratyakṣa following Vedānta (selections from Pratyakṣa Parichched of Vedānta Paribhāsā)
c. Concept of Pratyakṣa following Buddhism (selections from the Pratyakṣa Parichched)

- **Module-5:** Prāmaṇyavāda (Utpatti, Jñāpti following Tarka Bhāsā, Tarka Saṁgraha)
- **Module-6:** Khyātivāda

Reading References:

1. *Immanuel Kant's Critique of Pure Reason* : Norman Kemp Smith (Tr.)
2. *Handbook to Kant's Critique of Pure Reason* : Rash Bihari Das
3. *Kant's Metaphysics of Experience* : H.J. Patton
4. *Perception* : B.K. Motilal
5. *Buddhist Logic* : Stcherbatsky

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-13**

Semester: **7**

Course Code: **PHIMAJ13**

Course Title: **Western & Indian Ethics**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **a. Learners will be able to comprehend the meaning of Metaethics, its comparison with other branches of ethics such as normative ethics and applied ethics, various types of metaethical theories and their presuppositional framework, and so on. b. The pape**

Learning Outcome: **(a) Students will develop the ability to make reasonable judgments, based on morality. Moreover, they will be able to think critically about the foundation of moral judgments. It would help the students in their character-building process through mora**

- Module-1: Eudaemonism (Aristotle's Ethics), Naturalism, Intuitionism, Emotivism
- Module-2: Kant's Moral Theory
- Module-3: Prescriptivism
- Module-4: *Srimadbhāgvat Gitā* (Selected portions)2nd& 3rdChapter
- Module-5: *Nyāya Bhāsāpariccheda* (Selected portion) Cikīrṣa
- Module-6: Artha Saṁgraha (Selected portions) Dharma, Bhāvana, Vidhi, Niṣedha, Arthavāda

Suggested Readings:

1. *Groundwork of the Metaphysics of Morals* - H. J. Patton
2. *The Philosophy of Kant, his Moral and Political Writings* - Carl J. Friedrich
3. *Utilitarianism* - John Stuart Mill

4. *Modern Moral Philosophy* - W.D. Hudson
5. *Philosophical Ethics: An Introduction to Moral Philosophy* - Tom L. Beauchamp
6. *Ethics: Theory and Practice* - J. P. Theroux
7. *Artha Saṃgraha* – Lougakṣi Bhāskara
8. *Indian Ethics* - Surama Dasgupta
9. *Indian Ethics: Classical Tradition and Contemporary Challenges* - Purushottama Bilimoria (Editor)
10. *Classical Indian Ethical Thoughts* - Kedarnath Tewary
11. *Arthasaṁgraha of Laugakṣi Bhāskara* - Gajendragadkar, A.B. N Karmakar, R.D.(Ed.):
12. *The Bhāgabadgītā* - S. Radhakrishnan
13. *Bhāgabadgītā* (Vol.I) - Ranganathananda, Swami (Ed.)

Bengali Books:

1. Bhaskar Laugakshi: Arthasamgra
2. Bhaskar Laugakshi: Arthasamgra, Pattabhiram Shastri O Vacaspati Tikasaha, Caukhamba, Varanasi, 1977.
3. Mazumdar, Ramdayal (Sampadita) Shreegita (Prathamshatak), Shree Balaram Prakashani, Kolkata, 2007.
4. Jagadananda, Swami (Sampadita), Shreemadbhagavad Gita Udbodhan, Kolkata 1999.

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **PHIMAJ14**
Course Title: **Western & Indian Metaphysics**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **a. Metaphysics is concerned with the outline of the categories of entity presupposed by any possible, adequate, interpretation of the World, whether of the physical world or any other characteristic of the world. Based on the nature of Philosophical queri**
Learning Outcome: **a. Metaphysical studies generally seek to explain inherent or universal elements of reality which are not easily discovered or experienced in our everyday life. As such, it is concerned with explaining the features of reality that exist beyond the physica**

- **Module-1:** Plato's Philosophy: Topics to be covered—Forms Theories of Forms, Good as the Highest Object, Allegory of the Cave
- **Module-2:** Aristotle's Metaphysics: Topics to be covered—First Philosophy, Substance, Universality, Being-qua-Being, Potentiality and Actuality.
- **Module-3:** Hegel: The concept of Geist (Spirit), The Dialectical Method, Concepts of Being, non – Being and Becoming; Absolute Idealism
- **Module-4:** *Samkhya Kārikā(Iśvarakrishna) Kārikā* 1-22
- **Module-5:** *Vedānta Paribhāsā (Dharmarājadhvarindra)—Prameya*

Suggested Readings:

1. Inquiry, Forms and Substance. A study in Plato's Metaphysics and Epistemology. Thomas A. Blackson
2. Aristotle's Metaphysics—W.D. Ross
3. Doctrine of being in Aristotle's Metaphysics— Joseph Owens
4. Articles on Aristotle—Barne, Sorabji, and Schofield
5. Hegel's Idea of Phenomenology of Spirit—Michael Foster
6. Routledge Philosophy guidebook to Hegel and the Phenomenology of Spirit—Robert Stern
7. Classical Indian Metaphysics by Stephen H. Phillips

8. Indian Realism by J.N. Sinha
9. *Nyāya-Vaiṣeṣika Metaphysics* by Sadananda Bhaduri
10. Essays in Analytic Philosophy by Gopinath Bhattacharya
11. *VedāntaParibhāsā*—Panchanan Shastri (Tr. & An.)
12. Samkhyakarika: Vedantachanchu Purnachandra
13. Ishwarkrishnakrita Samkhyakarika, Gourpadbhasya Tattvakaumudi Shahid Anubad- Ashok Kumar Bandyapadhyay sampadita.

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **PHIMAJ15**
Course Title: **Western & Indian Contemporary Philosophy**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **a. Study of Phenomenology will help to form a non-metaphysical and methodical outlook among students. In the course we focus on a close reading of selected primary sources, and explore how the material studied may connect with our lived experiences of our**
Learning Outcome: **a. It brings about an attitudinal change among students with a more realistic bent of mind. Students are getting interested to carry out research and make dissertations on this area of Philosophy. b. A considerable number of students are interested in doi**

- **Module-1:** Husserl: Phenomenological Method, Intentionality and Philosophy of the life world
- **Module-2:** Heidegger: Heidegger's Phenomenology. The Question of Being, Dasein, Being and Time, Critique of Technological Civilization
- **Module-3:** Sartre: Nothingness, Being-for itself, Being-for others
- **Module-4:** J. Krishnamurthy: Freedom from the Known, Analysis of the Self
- **Module-5:** Maulana Abul Kalam Azad: Humanism
- **Module-6:** Deen Dayal Upadhyay: Integral Humanism

Suggested Readings:

1. *Phenomenology and Existentialism* - R.C. Solomon
2. *What is Phenomenology* - P. Thevenaz
3. *An Introduction to Existentialism* - R. G. Olson
4. *Existentialism* - M. Warnock
5. *Phenomenology and Existentialism* - M.K. Bhadra
6. *From Rationalism to Existentialism* - R.C. Solomon
7. *Being and Nothingness* - Jean Paul Sartre
8. *Existentialism and Humanism* - Jean Paul Sartre
9. *Being and Time* – Martin Heidegger
10. *Annihilation of Caste* – B. R. Ambedkar
11. *Neo- Buddhism* – B. R. Ambedkar
12. *Contemporary Indian Philosophy* - B.K. Motilal
13. *Freedom from the Known* - J. Krishnamurti
14. *Tradition and Revolution* - J. Krishnamurthi
15. *India Wins Freedom* -Maulana Abul Kalam Azad
16. *Integral Humanism* - D.D. Upadhyay

Course Type: **MAJ-16**
Semester: **8**
Course Code: **PHIMAJ16**
Course Title: **Analytic Philosophy & Social Philosophy**
(L-P-Tu): **3-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **a)It is a part of Philosophy which brings a new method not only in the study of Philosophy but also in other studies. Method of analysis is applied in the form of conceptual analysis, mental Geography and therapy. b) To demonstrate an understanding of th**
Learning Outcome: **a. Students can learn how the method of analysis is important in different fields of life. b. Apart from getting awareness in social and political matters students are being inspired to take project work and dissertations on this area.**

- **Module-1:** Theories of description (Russell), Systematically Misleading Expression (Ryle)
- **Module-2:** Two Dogmas of Empiricism (Quine), Sense and Reference (Frege)
- **Module-3:** In Defense of common sense (Moore), In Defence of a Dogma (Grice & Strawson)
- **Module-4:** Nature and Scope of Social and Political Philosophy, Theories of the relation between individual and society: Individualistic theory, Organic Theory, Idealistic Theory
- **Module-5:** Concept of Welfare State, Concept of Right
- **Module-6:** Liberty, Justice and Equality

Suggested Readings

1. *Classics of Analytic Philosophy*—Robert R. Ammerman
2. *Some Main Problems of Philosophy*—G.E. Moore
3. *Contemporary Analytic Philosophy*—M. K. Munitz
4. *Russell*—A.C. Grayling
5. *Twentieth Century Analytic Philosophy*—Avrum Stroll
6. *Problems of Philosophy*—Bertrand Russell
7. *Philosophy of Language*—Gottlob Frege
8. *Society*—MacIver and Page
9. *Sociology*—Morris Ginsberg
10. *Sociology*—S.N. Shankara Rao
11. *Sociology*—P.B. Kar
12. *Introduction to Modern Political Thought*—C.E.M. Joad

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **PHIMAJ17**
Course Title: **Special Texts (Indian):Bhāṣāpariccheda with Siddhānta - Muktāvalī**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **a. To make students aware about the comprehensive treatment of most of the important topics and problems that exercised the minds of the exponents of the Navya-Nyāya school for several centuries. b. To make students understand the contribution of Bhā**

Learning Outcome: **a) Students will be familiar with the comprehensive treatment of most of the important issues and problems of Navya-Nyāya-Vaiśeṣika school that exercised their minds. (b) Students will get a forum for the discussion of issues relating to this sch**

Bhāṣāpariccheda with Siddhānta –Muktāvalī : Pratyakṣakhanda

Suggested Readings:

1. Bhāṣāpariccheda with Siddhānta –Muktāvalī- Srimat-Panchanan-Bhattacharyya-shastri, Maha Bodhi Book Agency, Kolkata, 2016.
2. Bhāṣāpariccheda with Siddhānta –Muktāvalī- Swami Madhavananda (trs.), Advaita ashrama, Kolkata, 2004.

Syllabus *(PHILOSOPHY)*

Course Type: **MAJ-18**

Semester: **8**

Course Code: **PHIMAJ18**

Course Title: **Special Text (Western)**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **(a) To introduce mmanuel Kant's Groundwork, one of the most powerful texts in the history of ethical thought. (b)To instill the fundamental principle 'morality' that governs human action.**

Learning Outcome: **(a)Students will develop the ability to make reasonable judgments, based on morality. (b) They will be able to think critically about the fundamental principles of morality. It would help the students in their character-building process through moral**

Immanuel Kant: The Moral Law: Groundwork of the Metaphysic of Morals.

Suggested Readings:

1. Immanuel Kant: The Moral Law: Groundwork of the Metaphysic of Morals, translated by H.J.Paton, routledge Classics.
2. Groundwork for the Metaphysics of Morals**:** Edited by: Allen W. Wood
3. Groundwork of the Metaphysics of Morals translated and edited by Mary Gregor, Harvard University.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus *(PHYSICAL EDUCATION)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BPEDMAJ01C**
Course Title: **INTRODUCTION OF PHYSICAL EDUCATION AND SPORTS**
(L-P-Tu): **4-1-1**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **To develop the basic knowledge of Physical Education and Sports. To learn about Sports as a social phenomenal. To understand need and importance of Physical Education and Sports. To learn about psychomotor development of individual.**
Learning Outcome: **To prepare fit individual to build fit nation**

SIDHO-KANHO-BIRSHA UNIVERSITY

NEP 2020 based Syllabus of Four-Year Degree Major Course in

PHYSICAL EDUCATION AND SPORTS

w.e.f. 2023 – 2024 Academic Session

Semester – I

Major Paper – 1:

INTRODUCTION OF PHYSICAL EDUCATION AND SPORTS

Credit – 6, Marks – …. (Minimum Classes to be allotted – 90)

Learning Objectives: -

- *To develop the basic knowledge of Physical Education and Sports.*
- *To learn about Sports as a social phenomenal.*
- *To understand need and importance of Physical Education and Sports.*
- *To learn about psychomotor development of individual.*

Learning Outcomes: -

- *To prepare fit individual to build fit nation*

Unit-I (Hour-24)

INTRODUCTION OF PHYSICAL EDUCATIO AND SPORTS

1. Definition, Meaning and importance of Physical Education and Sports.
2. Aim, Objectives & Scope of Physical Education & Sports.
3. Misconceptions about Physical Education and Modern concept of physical education.
4. Need and Importance of Physical Education and Sports in Modern Society.

Unit-II (Hour-24)

HISTORICAL DEVELOPMENT IN PHYSICAL EDUCATION AND SPORTS

1. Historical Development of Physical Education and Sports in India in Pre and Post-Independence period.
2. National Sports Awards: - Major Dhyan Chand Khel Ratna Award, Arjuna Award, Dronacharya Award, Dhyan Chand Award, Tenzing Norgay National Adventure Award.
3. Sports Schemes in India. Concept of National Games, Asian Games and Commonwealth Games.
4. Olympic Movement in India – Ancient Olympic Games and Modern Olympic Games- Objectives, Motto, Flag, Emblem, Torch, Oath, Mascot, Olympic Village, Opening & Closing Ceremony.

Unit-III (Hour-24)

BIOLOGICAL, PSYCHOLOGICAL AND SOCIOLOGICAL FOUNDATIONS OF PHYSICAL EDUCATION AND SPORTS

1. Biological Foundation: - Meaning and Principles of Growth and Development, Differences between Growth and Development, Factors affecting Growth and Development.

Different Age Characteristics: Chronological Age, Anatomical Age, Physiological Age and Mental Age. Age and Sex differences in relation to Physical Activities.

2. Body types, its meaning and importance, Classification of Sheldon's Body types.
3. Psychological foundation: - Meaning, Definition, Types, Laws and Theories of Learning, Learning Curves, Factors affecting Learning.

Definition and Meaning of Emotion, Anxiety, Stress, Personality and Self Concept. Factors of Emotional Stability and controlling factors of Anxiety and Stress.

4. Sociological Foundation: - Concept of Socialization, Socialization through Physical Education and Sports, Role of Games and Sports in National and International Integration and Sports Ethics.

Unit-IV FIELD PRACTICAL

MARCHING

1. Assemble Method: - Fall in, Attention, Stand at Ease, Stand Easy, Eyes right – Eyes front (Dressing), Right Turn, Left Turn, About Turn.
2. Marching: Arm-Leg coordination, Mark Time, Quick March, Halt, About Turn while Marching and Marching with Salute.
3. Dismissal Method.

REFERENCES

1. Graham, G. (2001) Teaching Children Physical Education: Becoming a Master Teacher. Human Kinetics, Champaign, Illinois, USA.

2. Kamlesh, M.L. & Singh, M.K. (2006) Physical Education (Naveen Publication).

3. Lau, S.K. (1999) Great Indian Players, New Delhi, Sports.

4. Lumpkin, A. (2007) Introduction to Physical Education Exercise Science and Sports Studies, McGraw Hill, New York, USA.

5. Siedentop, D. (2004) Introduction to Physical Education Fitness and Sports, McGraw Hill Companies Inc., New York, USA.
6. Shaffer, D.R. (2002) Development Psychology: Childhood and Adolescence. Thomson, Sydney, Australia.
7. Shukla. (2000) Mother on Education, National Council of Teacher Education, New Delhi.
8. Singh, A. et al. (2000) Essential of Physical Education, Kalyani Publishers, Ludhiana. Punjab.
9. Wuest, D.A.& C.A. Butcher (2006) Foundation of Physical Education

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)
Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)
Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(PHYSICAL EDUCATION)*

Course Type: **MAJ-2**

Semester: **2**

Course Code: **BPEDMAJ02C**

Course Title: **MANAGEMENT IN PHYSICAL EDUCATION AND SPORTS**

(L-P-Tu): **4-1-1**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **To learn regarding the management of programs in Physical Education and Sports in School, Colleges and Universities**

Learning Outcome: **To prepare managing expert to manage Physical Education and Sports Programs.**

Physical Education and Sports

Semester – II

Major Paper–2:

MANAGEMENT IN PHYSICAL EDUCATION AND SPORTS

Credit – 6, Marks – …. (Minimum Classes to be allotted – 90)

Learning Objectives: -

- *To learn regarding the management of programs in Physical Education and Sports in School, Colleges and Universities.*

Learning Outcomes: -

- *To prepare managing expert to manage Physical Education and Sports Programs.*

Unit – I INTRODUCTION **(Hour-18)**

1. Meaning, Definition, Importance, Scope and Principles of Management of Physical Education and Sports Programs.
2. Aims, Objectives and Management of Intramural and Extramural Competitions.
3. Management of Events, Equipment and Play Grounds/Play Fields in Physical Education and Sports.

Unit – II LEADERSHIP IN PHYSICAL EDUCATION AND SPORTS **(Hour-18)**

1. Meaning, Definition, Elements, Importance and Principles of Leadership.
2. Forms of Leadership (Autocratic, Laisser-faire, Democratic, Benevolent Dictator and qualities of administrative leader.
3. Development of organizational leadership performance.

Unit – III MANAGEMENT OF PHYSICAL EDUCATION AND SPORTS PROGRAMS **(Hour-18)**

1. Management of Physical Education Programs and Games & Sports meets in School, College and University.
2. Concept of Planning for management and factors affecting planning in Physical Education and Sports.
3. Management of Tournaments: - Meaning, Definition Types and Merits and Demerits of different types of tournaments. Drawing Fixtures of Knock out, League and Combination Tournaments. Difference between Knock out and League tournaments.

Unit – IV FINANCIAL MANAGEMENT **(Hour-18)**

1. Financial Management in Physical Education and Sports in School, College and University.
2. Budget: - Meaning, Definition, Importance, Principles and Criteria of good budget in Physical Education and Sports, Steps for preparing a Good Budget in physical

education and sports.

3. Sports Sponsorship: Meaning, aim & objectives, Trends and management Process of Sports Sponsorship.

Unit – V PRACTICAL: LAY OUT OF PLAY GROUNDS/PLAY FIELDS AND TRACK

1. Lay out of Play Grounds/Play Fields: Kabaddi, Kho – Kho, Badminton

Football, Volleyball, Handball, Basketball and Cricket.

2. Lay out of Track.

REFERENCES

1. Allen, L.A Management and organization hogakusha co. TOKYO 1988
2. Hert, renis, New Patterns of Management Me Grow Hill 1961.
3. Sivia, G.s Sports Management
4. in university New Delhi. A.I.U Deem Upadhyaya Marg 199
5. Sanddhu, K. Sports dynamics, Psychology, Sociology and Management.
6. Management Concepts in physical Education and Sports – Dr.M.L. Kamlesh
7. Singh.A et. all, Essentials of Physical Education, Kalyani Publishers.
8. Broyles, F. J. & Robert, H. D. Administration of Sports, Athletic Programme: A Managerial Approach. New York: Prentice Hall Inc.
9. Bucher, C. A. Administration of Physical Education and Athletic Programme. St. Louis:The C.V. Mosby Co.
10. Thomas, J. P. Organization & Administration of Physical Education. Madras: Gyanodayal Press.
11. Nanda, S.M. Sports Management, Friend Publications, New Delhi.
12. 5. Paul, A. Sarirsikshay Management, Classic Publishers, Kolkata.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(PHYSICAL EDUCATION)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BPEDMAJ03C**
Course Title: **HEALTH EDUCATION, PHYSICAL FITNESS, NUTRITION AND WEIGHT MANAGEMENT**
(L-P-Tu): **4-1-1**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **o learn about the Health and Health Education. To learn and understand the basic knowledge of Yoga.**
Learning Outcome: **To prepare an expert in Health Education and Sports Nutrition Management.**

Unit – I(Class hours -18)

HEALTH EDUCATION

1. Health: Concept Dimensions & Importance.
2. Health Education: Meaning, Definition, Aim, Objectives and Principles of Health Education.
3. Personal Hygiene; Care of Eyes, Ear, Nose, Nail, Skin, Hair, Mouth, Teeth, Clothes and Footwears.
4. Aim, Objectives and Functions of Health Organizations: National Institute of Health & Family Welfare (NIHFW), World Health Organization (WHO), United Nations Educational Scientific & Cultural Organization (UNESCO), United Nations International Children's Emergency Fund (UNICEF).

Unit- II (Class hours -18)

HEALTH PROBLEMS IN INDIA–PREVENTION AND CONTROL

1. Communicable Disease: Meaning, Definition and Types; Causes, Prevention and Control of Malaria, Dengue, Chicken Pox, Diarrhoea and Coronavirus.
2. Life Style – Active and Inactive lifestyle. Hazards of inactive lifestyle, prevention and controlling measures. Overweight, Junk food habits, Hypokinetic diseases (High Blood Pressure, Diabetes, Hypertension and Arthritis)
3. Types of Postural Deformities; Prevention, Causes and Corrective Exercise for Kyphosis, Lordosis, Scoliosis, Bow-Legs, Knock Knees and Flat Foot.
4. Problems associate with Postural Deformities.

Unit-IV (Class hours -18)
PHYSICAL FITNESS

1. Meaning, Definition Types and Importance of Fitness.
2. Concept and Importance of Health-Related Physical Fitness.
3. Concept and Importance of Performance/Skill Related Physical Fitness.
4. Development and Maintenance of Physical Fitness.

Unit -III (Class hours -18)
NUTRITION AND WEIGHT MANAGEMENT

1. Meaning and Definition and Importance of Nutrition and Food and effects of Malnutrition on Health.
2. Basic Nutrients: Protein, Carbohydrate, Fat, Mineral, Water and Vitamins.
3. Balance Diet, Factors affecting Diet, Athletic Diet, Mid-Day-Meal,
4. Obesity – concept, problems, causes, prevention, assessment and procedure of weight management.

Unit - IV (Class hours -18)
PRACTICAL
Yoga and Suryanamaskar

- Ardhachandrasana, Ardhachakrasana, Padahastasana, Brikshasana, Natarajasana

Paschimothanasana, Gomukhasana, Ustrasana, SuptaVajrasana, Halasana, Matsyasana, Setubandhasana, Naukasana, Karnapidasana, Bhujangasana, Salavasana, Dhanurasana, Bhekasana, Mayurasana, Sarbangasana, Shrisana, Bhagrasana, Kopotasana

- **Suryanamaskar**

REFERENCES

1. Butcher, Charles A. "Administration of Health and physical education program me."
2. Delbert, Oberteuffer, et. al. "School health education"
3. Ghosh, B. N." Treaties of Hygiene and Public Health".
4. Nutrition Encyclopedia, edited by Delores C.S.James, The Gale Group, Inc.
5. Body-Eaton S. et al(1989) The Stone health programme: Diet and Exercise Nature Intended. Angus and Robertson.
6. Terras S. (1994) Stress, How Your Diet can Help: The Practical Guide to Positive Health Using Diet, Vitamins, Minerals, Herbs and Amino Acids, Thrones.
7. SJ Brian(1997) Fitness and Health, 4th ed, Human Kinetics
8. Health and Fitness for Life (2010), Human Kinetics
9. Thygerson AL and Thygerson SM (2009), Fit to be Well, 2nd ed Jones and Bartlett Publishers, Massachusetts

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BPEDMAJ04C**

Course Title: **ANATOMY AND PHYSIOLOGY**
(L-P-Tu): **4-1-1**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **To develop the knowledge about human structure. To learn about the functions of different organs. To learn about the importance of body forms in relation to physiological functions.**
Learning Outcome: **To development of conscious men, structure and functions of body of the students.**

Unit – I (Class hours -16)
INTRODUCATION

1. Meaning and definition of Anatomy and Physiology.
2. Brief History
3. Importance of Anatomy and Physiology in Physical Education.
4. Meaning and Concept of cell, tissue, organ and system.
5. Microscopic structure and function of cell.
6. Type's structure and function of tissue.

Unit – II (Class hours-18)
MUSCULO-SKELETAL SYSTEM

1. Skeletal System, Structure of Skeletal System. Classification and location of bones and joints, Anatomical differences between male and female.
2. Muscular System- types of muscles. Location, structure and function of skeletal muscle.
3. Types of muscular contraction.
4. Effect of exercise and training on muscular system.

Unit – III (Class hours-20)
CIRCULATORY SYSTEM AND RESPIRATORY SYSTEM

1. Blood- composition and function
2. Heart- structure and functions. Mechanism of blood circulation through heart.
3. Blood Pressure, Athletic Heart and Bradycardia
4. Effect of exercise and training on circulatory system.
5. Structure and function of Respiratory organs
6. Mechanism of Respiration, vital capacity, O^2 Debt and Second Wind.
7. Effect of exercise on respiratory system.

Unit IV (Class hours-18)
NERVOUS AND ENDOCRINE SYSTEM

1. Meaning of Nervous System, Parts of Nervous System, system-structure of brain, spinal cord,

Neuron. reflex action, Reciprocal Innervations.

2. Meaning of Endocrine Gland, Function and Location of Pituitary, Thyroid and Adrenal Glands.

Unit V (Class hours – 18)
PRACTICAL

1. Anthropometric measurement (Length, wide and circumference of bones) and Measurement of WHR (Waist-to-hip ratio)
2. Measurement of Heart rate, Blood Pressure, Respiratory Rate, and Peak Flow Expiratory Rate in resting and post exercise

Reference Books

1. Amrit Kumar, & Moses, R. Introduction to Exercise Physiology. Madras: PoompugarPathipagam.
2. Clarke, D.H. (1975). Exercise Physiology. New Jersey: Prentice Hall Inc., Englewood Cliffs.
3. CC Chatterjee Human Physiology, CBS Publishers & Distributers Pvt Ltd
4. Fax EL. Sports Physiology. Tokyo: Holt Saunders; 1984.
5. Fox, E.L. & Mathews, D.K. The Physiological Basis of Physical Education & Athletics.
Philadelphia: Sanders College Pub.
6. Hill AV. Muscular Movement in man. New York: Mc Graw Hill Book Co;1927
7. McArdle WD, Katch FI, Katch VL. Essentials of Exercise Physiology 2nd ed Philadelphia: Lippincott Williams and Wikins:2000
8. Pearce Evelyn (1973) Anatomy and Physiology for Nurses, Oxford University Press, Kolkata
9. Shaver, L. G. Essentials of Exercise Physiology. New Delhi: Subject Publications.
10. William, D. McAradle. Exercise Physiology, Energy, Nutrition and Human Performance,Philadelphia: Lippincott Williams & Wilkins Co.

Syllabus *(PHYSICAL EDUCATION)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BPEDMAJ05S**
Course Title: **INDIGENOUS GAMES, GYMNASTICS AND FORMAL ACTIVITIES**
(L-P-Tu): **0-6-0**
Credit: **6**
Practical/Theory: **Practical**
Course Objective: **To develop the skill and game performance of indigenous activities. To develop the abilities in Gymnastics activities. To develop the practical experience of formal activities**
Learning Outcome: **Skill and Performance development in Indigenous games.**

INDIGENOUS GAMES

KABADDI (Hour-30)

A **Fundamental skills**

i. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line
ii. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques
iii. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense.
iv. Game practice with application of Rules and Regulations

B. **Rules and their interpretations and duties of the officials**

KHO-KHO (Hour-30)

A **Fundamental skills**

i. Skills in Chasing: Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal &Distyal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul
ii. Skills in running: Chain Play, Ring play and Chain & Ring mixed play
iii. Game practice with application of Rules and Regulations

B **Rules and their interpretations and duties of the officials**

2. **GYMNASTICS (Hour-15)**

Forward and backward roll, Dive roll, Cartwheel, Hand stand and forward roll, Arch, Cat leap Jump, Split Jump, Split Sit, V balance, T balance, Knee balance

3. **FORMAL ACTIVITIES (Hour-15)**
   - **Callisthenics** – Two count, four count, eight count, sixteen count, thirty-two count
   - **Aerobics**- Basic turns, jumps, leaps with Music

4. **PROJECT-CUM-RECORD BOOK**

REFERENCE BOOKS

1. Biswas, Abhay, Kabaddi K Jante Holay, Sobhaprokasani, Chakdah, Nadia.
2. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
3. Bandopadhyay, K. SarirSiksha Parichay, Classiq Publishers, Kolkata.
4. Roy Pranab, BharatiyoKhela Kho-Kho, Classic Books, Kolkata.
5. Saha, A. K. SarirSiksherRitiniti, Rana Publishing House, Kalyani.
6. Bandopadhyay, K. SarirSiksha Parichay, Classic Publishers, Kolkata.

Syllabus *(PHYSICAL EDUCATION)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BPEDMAJ06C**
Course Title: **Sports Training**
(L-P-Tu): **4-1-1**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **To enhancement of knowledge regarding various sports training methods. To develop the practical experience in sports training.For the development of skill and sports performance.**
Learning Outcome: **Expertise development of Sports training.**

Unit -1 (Class hours - 18):

INTRODUCTION

1.1. Sports Training: Meaning, Definition and Scope.
1.2. Aim, Objectives and Characteristics of Sports Training.
1.3. Principles of Sports Training.
1.4. Need and Importance of Sports Training.

Unit-2 (Class hours - 18)

METHODS OF TRAINING AND CONDITIONING IN SPORTS

2.1. Warming-up and Cooling-down: Meaning, Definition and Methods.

2.2. Conditioning: Meaning, Definition and Principles.

2.3. Training Methods: Principles and Characteristics of Circuit Training, Interval Training and Weight Training.

2.4. Periodisation: Meaning, Definition, Types, Aim and Contents of Different Periods.

Unit-3 (Class hours - 18)

TRAINING LOAD AND ADAPTATION

3.1 Training Load: Meaning, Definition, Types and Factors.

3.2 Training Load Components: Volume, Intensity, Repetition and Duration.

3.3 Over Load: Meaning, Causes, Symptoms and Overcoming Over-load.

3.4 Load Adaptation: Meaning and Conditions of Adaptation; Super-compensation.

Unit-4 (Class hours - 18)

TRAINING TECHNIQUES

4.1 Meaning and definition of speed strength, Flexibility and Endurance.

4.2 Need and types of strength, speed and endurance.

4.3 factors of determining of strength, speed and endurance.

4.4. Meanings and method of development of speed strength, Flexibility and endurance.

Unit-5 (Class hours - 18)

PRACTICAL

1. Weight Training – Practice with Principles.
2. Measurement of Speed, Strength, Endurance and Flexibility.
3. Circuit Training - Practice with Principles and Periodisation Chart.

Reference: -

1. Uppal, A.K. Principles of Sports Training, Friends Publications, New Delhi.
2. Singh, H. Science of Sports Training, New Delhi, DVS Publications.
3. Bunn, J.N. Scientific Principles of Coaching, New Jersey Engle Wood Cliffs, Prentice Hall Inc.
4. Cart, E. Klafs&Daniel, D. Arnheim (1999) Modern Principles of Athletic Training St. Louis C. V. Mosphy Company.
5. David R. Mottram, Drugs in Sport, School of Pharmacy, Liverpool: John Moore University.
6. Gary, T. Moran, Cross Training for Sports, Canada : Human Kinetics.
7. Jensen, C.R. & Fisher A.G. (2000) Scientific Basic of Athletic Conditioning, Philadelphia.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.

- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(PHYSICS)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BPHSMAJ01C**
Course Title: **Mechanics and Properties of Matter**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **The objective of this course is to provide students with a comprehensive understanding of mechanics and properties of matter. Through theoretical concepts, problem-solving exercises, and practical applications, students will develop a strong foundation in Mechanics and Properties of Matter, enabling them to analyze and interpret complex physical phenomena related to motion, forces, and material behavior of real world.**
Learning Outcome: **By achieving the course objectives, students will be well-prepared to solve complex problems in classical mechanics, understand the fundamental properties of materials, and interpret various physical phenomena, providing a solid foundation for further studies in physics, engineering, and related fields.**

Theory

Vector Differentiation

Directional derivatives and normal derivatives, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field with their physical significances, Del and Laplacian operators, Vector identities. **(6 Lectures)**

Fundamentals of Dynamics

Reference frames. Inertial frames; Review of Newton's Laws of Motion. Equation of motion of a particle, Galilean transformations; Galilean invariance. Momentum of variable-mass system: motion of rocket. Motion of a projectile in uniform gravitational field. Dynamics of a system of particles. Centre of Mass. Motion of Centre of Mass, Principle of conservation of momentum with applications. **(6 Lectures)**

Work and Energy

Work and Energy, Work Energy Theorem. Conservative and non-conservative forces. Potential energy. Qualitative study of one-dimensional motion from potential energy curves. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work and potential energy. Work done by non-conservative forces. Law of conservation of energy. **(4 Lectures)**

Collisions

Collisions, Centre of mass frame and Laboratory frames, Elastic and inelastic collisions between particles. Elastic collision in two-dimensional case, coefficient of restitution. **(3 Lectures)**

Rotational Dynamics

Angular momenta of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of inertia. Calculation of moment of inertia for rectangular, cylindrical, and spherical bodies, rod, lamina, ring, disc, spherical shell, solid sphere. Kinetic energy of rotation, rolling along a slope, Application to compound pendulum. Motion involving both translation and rotation. **(10 Lectures)**

Gravitational and Central Force Motion

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). **(8 Lectures)**

Non-Inertial Systems:

Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force and its effect on *g*. Coriolis force and its applications. Geophysical effects of coriolis force, Components of velocity and acceleration in Cylindrical and Spherical coordinate systems. **(6 Lectures)**

Elasticity

Elastic constants, Relation between elastic constants. Twisting torque on a cylinder or wire. Bending of beam, bending moment, Cantilever: shear force and torque, Cantilever loaded at any distance from the fixed end, Beam supported at both end and loaded at the centre, shape of Girders/ rail tracks. **(7 Lectures)**

Fluid Motion

Kinematics of moving fluids: equation of continuity, Poiseuille's equation for flow of a liquid through a capillary tube, Euler's equation, Bernoulli's theorem and its applications. **(4 Lectures)**

Oscillations

SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. **(6 Lectures)**

List of Practicals (Any six)

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the Moment of Inertia of a Cylinder.
4. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
5. To determine the Young's Modulus of a Wire by Flexural/ Optical Lever Method.
6. To determine the value of g using Kater's Pendulum.
7. To determine the Modulus of Rigidity of a Wire by Maxwell's needle/dynamical method
8. To determine the elastic Constants of a wire by Searle's method.
9. To study the Motion of Spring and calculate, (a) Spring constant, (b) g and (c) Modulus of rigidity and (d) unknown mass.

Reading References

Theory

1. An Introduction to Mechanics, D Kleppner and R J Kolenkow, McGraw Hill.
2. Physics, R Resnick, J Halliday and D Walker, 8th Edition, Wiley.
3. Mechanics, Berkeley Physics, Vol.1, C. Kittel, W. Knight, et. al. Tata McGraw Hill.
4. Introduction to Classical Mechanics, D Morin, Cambridge University Press.
5. Mechanics and Properties of Matter, A B Gupta, 5th Edition, Books and Allied Pvt Ltd.
6. Mechanics, D S Mathur and P S Hemne, S. Chand and Company Pvt Ltd.
7. Theory and Problems of Theoretical Mechanics, M R Spiegel, McGraw Hill.
8. A Treatise on General Properties of Matter, Sengupta and Chatterjee, NCBA.
9. Properties of Matter, Brij Lal and N Subrahmanyam, S. Chand and Company Pvt Ltd.
10. The Physics of Waves and Oscillations, N K Bajaj, Tata McGraw Hill.
11. Vibrations and Waves, A P French, CBS Publishers.

Practical

1. Advanced Practical Physics for Students, B L Flint and H T Worsnop, Asia Publishing House
2. An Advanced Course in Practical Physics, D Chattopadhyay and P C Rakshit, NCBA
3. Advanced Level Physics Practicals, M Nelson and J M. Ogborn, 4th Edition, Heinemann Educational Publishers
4. A Text Book of Practical Physics, I Prakash, R Krishna and A K Jha, Kitab Mahal
5. Laboratory Manual of Physics, Vol 1, M Jana, Books and Allied Pvt Ltd

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**

Practical/Theory: **Theory**

Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**

Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(PHYSICS)*

Course Type: **MAJ-2**

Semester: **2**

Course Code: **BPHSMAJ02C**

Course Title: **Electricity and Magnetism**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Combined**

Course Objective: **The objective of this course is to provide students with a comprehensive understanding of electricity and magnetism, covering vector integration, electric fields, electric potential, dielectric properties of matter, magnetic fields, magnetic properties of matter, electromagnetic induction, and electrical circuits. Through theoretical concepts, practical experiments, and problem-solving exercises, students will develop a strong foundation in the fundamental principles of electricity and magnetism. The course aims to equip students with the knowledge and skills necessary to analyze, predict, and apply electromagnetic phenomena in various engineering, scientific, and technological contexts of their surroundings.**

Learning Outcome: **On completion of the course, the student should have the following learning outcomes defined in terms of knowledge, skills and general competence: Knowledge: The student has acquired detailed knowledge of electromagnetism (electric and magnetic force and field, induction) and preliminary knowledge of electromagnetic waves. Skills: The student can solve problems with moderate mathematical complexity related to electric and magnetic force and field, electric charge, electric potential, current, voltage and resistance, capacitors. They will be expert in application of Gauss law, Faradays law, Lenz law. General competence: Enhanced ability to handle force at a distance phenomenon.**

Theory:

Vector Integration

Ordinary integrals of vectors. Multiple integrals, notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes theorems and

their applications (no rigorous proofs). **(10 Lectures)**

Electric Field and Electric Potential

Electric field: Electric field lines. Electric flux. Gauss' law with applications to charge distributions with spherical, cylindrical and planar symmetry. **(5 Lectures)**

Conservative nature of electrostatic field. Electrostatic potential. Laplace's and Poisson equations. The Uniqueness theorem (statement only). Potential and electric field of a dipole. Force and torque on a dipole. Multipole expansion. **(5 Lectures)**

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of images and its application to: (1) Plane infinite sheet and (2) Sphere. **(10 Lectures)**

Dielectric Properties of Matter

Electric field in matter. Polarization of charges. Electrical susceptibility and dielectric constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector *D*. Relations between *E*, *P* and *D*. Gauss' law in dielectrics. **(6 Lectures)**

Magnetic Field

Magnetic force between current elements and definition of magnetic field *B*. Biot-Savart's law and its simple applications: straight wire and circular loop. Current loop as a magnetic dipole and its dipole moment (Analogy with Electric Dipole). **(4 Lectures)**

Ampere's circuital law and its application to (1) infinite straight wire, (2) Infinite planar surface current, and (3) Solenoid. Properties of *B*: curl and divergence. Axial vector property of *B* and its consequences. Vector potential. Magnetic force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform magnetic field. **(4 Lectures)**

Magnetic Properties of Matter

Magnetization vector (*M*). Magnetic Intensity (*H*). Magnetic Susceptibility and permeability. Relation between *B*, *H*, and *M*. Ferromagnetism. B-H curve, hysteresis and its applications. **(3 Lectures)**

Electromagnetic Induction

Faraday's law. Lenz's law. Self-Inductance and Mutual inductance. Reciprocity theorem. Energy stored in a magnetic field. Introduction to Maxwell's equations. Charge conservation and Displacement current. **(5 Lectures)**

Electrical Circuits

AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. LC and CR circuits, Series LCR circuit: (1) Resonance, (2) Power dissipation and (3) Quality Factor, and (4) Band width. Parallel LCR circuit. **(5 Lectures)**

Network theorems

Ideal Constant-voltage and Constant-current Sources. Network theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum power transfer theorem. Applications to DC circuits. **(3 Lectures)**

Laboratory Practical

General topic to be covered

Use a Multimeter for measuring

a. Resistances
b. AC and DC Voltages
c. DC Current
d. Capacitances
e. Checking electrical fuses.

List of Practical (Any six)

1. To study the characteristics of a series RC Circuit.
2. To determine an unknown Low Resistance using Potentiometer.
3. To determine an unknown Low Resistance using Carey Foster's Bridge.
4. To determine the resistance of a galvanometer by half deflection method.
5. Measurement of field strength *B* and its variation in a solenoid (determine dB/dx)
6. To verify the Thevenin and Norton theorems.
7. To verify the Superposition, and Maximum power transfer theorems.
8. To determine self-inductance of a coil by Anderson's bridge.
9. To study response curve of a Series LCR circuit and determine its

a. Resonant frequency

b. Impedance at resonance
c. Quality factor Q
d. Band width.

10. To study the response curve of a parallel LCR circuit and determine its

a. Quality factor Q.
b. Anti- resonant frequency

Reading References

Theory

1. Electricity and Magnetism, E M Purcell and D J Morin, 3rd Edition, McGraw-Hill
2. Introduction to Electrodynamics, D J Griffiths, 4th Edition, Cambridge University Press
3. Classical Electromagnetism, H C Verma, Bharati Bhawan
4. Elements of Electromagnetics, M N O Sadiku, Oxford University Press.
5. Electricity, Magnetism and Electromagnetic Theory, S Mahajan and S R Choudhury, Tata McGrawHill
6. Electricity and Magnetism, J H Fewkes and J Yarwood. Vol. I, Oxford University Press.
7. Feynman Lectures, Vol. 2, R P Feynman, R B Leighton, and M Sands, Pearson.
8. Foundations of Electricity and Magnetism, B Ghosh, 5th Edition, Books and Allied Pvt Ltd

Practical

1. Advanced Practical Physics for Students, B L Flint and H T Worsnop, Asia Publishing House
2. An Advanced Course in Practical Physics, D Chattopadhyay and P C Rakshit, NCBA
3. Advanced level Physics Practicals, M Nelson and J M Ogborn, 4th Edition, Heinemann Educational Publishers
4. Engineering Practical Physics, S Panigrahi and B Mallick, Cengage Learning.
5. Laboratory Manual of Physics, Vol 2, M Jana, Books and Allied Pvt Ltd

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course,

which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(PHYSICS)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BPHSMAJ03C**
Course Title: **Waves and Optics**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **The objective of this course is to familiarize undergraduate students with the principles of electricity and magnetism, providing a comprehensive understanding of their correlation. Students will learn about electric and magnetic fields, Gauss's Law, Ampere's Circuital Law, and Faraday's Law. Through theoretical concepts and practical applications, students will develop problem-solving skills and gain proficiency in analyzing electrical and magnetic phenomena. They will apply mathematical tools to solve complex electromagnetic problems, enhancing their quantitative abilities. By the end of the course, students will be equipped to comprehend and apply electromagnetism in various engineering, physics, and technological contexts, preparing them for advanced studies and careers in related fields.**
Learning Outcome: **By the end of this course, undergrad students will: a. Demonstrate a comprehensive understanding of electricity and magnetism principles, including electric and magnetic fields, Gauss's Law, Ampere's Circuital Law, and Faraday's Law. b. Develop problem-solving skills and apply mathematical tools to analyze and predict electrical and magnetic phenomena in various scenarios. c. Gain practical experience through laboratory experiments, enhancing their ability to conduct and interpret electrical and magnetic measurements. d. Apply electromagnetism knowledge to engineering, physics, and technological applications, fostering critical thinking and analytical abilities. e. Be prepared for advanced studies and careers in industry, physics, and related fields, equipped with a strong foundation in electromagnetism.**

Semester III

CC3: Waves and Optics (Theory: 4 Credits, Practical: 2 Credits)

Course Objective:

This course aims to provide students with a comprehensive understanding of wave motion, oscillatory phenomena, as well as the principles of optics. Students will learn about the properties of waves, wave equations, and superposition. They will study harmonic oscillations, resonance, and wave interference. The course will cover topics such as light propagation, reflection, refraction, and diffraction. By the end of the course, students will be able to analyze wave and oscillatory behavior, comprehend optical principles, and apply their knowledge to real-world applications.

Theory:

Superposition of Collinear Harmonic Oscillations:

Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N-collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. Graphicaland Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. **(7 Lectures)**

Wave Motion

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. **(4 Lectures)**

Superposition of Two Harmonic Waves

Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N-Harmonic Waves.

(7 Lectures)

Wave Optics

Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. **(3 Lectures)**

Interference

Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer. **(18 Lectures)**

Diffraction

Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. **(16 Lectures)**

Holography

Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Point source holograms. Uses of holograms. **(5 Lectures)**

Laboratory Practical

List of Practicals (Any six)

1. To study Lissajous Figures.
2. To investigate the motion of coupled oscillators.
3. Familiarization with: Schuster`s focusing; determination of angle of prism.
4. To determine refractive index of the material of a prism using sodium source.
5. To determine the unknown wavelength from the μ-λ curve using He-source.
6. To determine the wavelength of sodium source using Michelson's interferometer.
7. To determine wavelength of sodium light using Fresnel Biprism.
8. To determine wavelength of sodium light using Newton's Rings.
9. To determine wavelength of (1) Na-source and (2) spectral lines of Hg-source using plane diffraction grating.
10. To determine dispersive power and resolving power of a plane diffraction grating.
11. To determine the specific rotation of sugar solution using polarimeter.

Reading References

Theory

1. Waves: Berkeley Physics Course, Vol. 3, F Crawford, McGraw Hill.
2. The Physics of Waves and Oscillations, N K Bajaj, Tata McGraw Hill.
3. Vibrations and Waves, A P French, CBS Publishers.

4. Oscillations and Waves, S Garg, S K Ghosh, S Gupta, Prentice Hall of India
5. Principles of Optics, M Born and E Wolf, Pergamon Press.
6. Fundamentals of Optics, F A Jenkins and H E White, McGraw Hill
7. Optics, A Ghatak, McGraw Hill
8. Optics, E Hecht, Pearson Education
9. Waves and Optics, A B Gupta, Books and Allied Pvt Ltd
10. A Textbook on Optics, N Subrahamanyam, Brij Lal, and M N Avadhanulu, S Chand and Co Pvt Ltd
11. A Text Book of Light, B Ghosh and K G Mazumdar, 2nd Edition, ShreedharPrakashani

Practical

1. Advanced Practical Physics for Students, B L Flint and H T Worsnop, Asia Publishing House
2. Advanced practical physics, B Ghosh and K G Mazumdar, Shreedhar Publishers
3. Advanced Level Physics Practicals, M Nelson and J M Ogborn, 4th Edition, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for Udergraduate Classes, D P Khandelwal, Vani Pub.
5. An Advanced Course in Practical Physics, D Chattopadhyay and P C Rakshit, NCBA
6. Laboratory Manual of Physics, Vol 1, M Jana, Books and Allied Pvt Ltd

Course Outcome:

By the end of this course, students will:

a. Analyze wave properties and wave interference accurately.

b. Understand harmonic oscillations, resonance, and wave superposition effectively.

c. Apply optics principles to analyze light propagation, reflection, refraction, and diffraction.

d. Design and optimize optical systems for specific applications.

e. Proficiently use mathematical tools to solve complex wave and oscillation problems.

f. Demonstrate practical expertise in conducting precise wave and optics experiments.

g. Critically evaluate scientific literature in wave and optics.

h. Appreciate the significance of wave and optics in modern science and technology.

Overall, this course will provide students with a high level of competency in wave and optics, equipping them with the skills to analyze, predict, and apply wave and optical principles to solve complex problems and contribute effectively in scientific and technological endeavors.

Syllabus *(PHYSICS)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BPHSMAJ04C**
Course Title: **Thermal Physics**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **This course aims to provide students with a comprehensive understanding of the principles and concepts of thermal physics. Students will learn about thermodynamic laws, temperature, heat, and work. They will analyze the behavior of gases, phase transitions, and thermal properties of materials. The course will cover topics such as heat conduction in material, heat engines, entropy, and the kinetic theory of gases. Students will apply these principles to solve practical problems in engineering and everyday life. By the end of the course, students will be equipped to analyze and interpret thermal phenomena and appreciate their relevance in various scientific and technological applications.**

Learning Outcome: **By the end of this course, students will: a. Demonstrate a comprehensive understanding of the fundamental principles of thermal physics, including thermodynamic laws and heat transfer mechanisms. b. Analyze and predict the behavior of gases, liquids, and solids under varying temperature and pressure conditions. c. Comprehend the concepts of heat engines, refrigerators, and their practical applications in engineering and technology. d. Apply statistical mechanics and the kinetic theory of gases to interpret the macroscopic properties of matter at the molecular level. e. Evaluate and solve complex problems related to heat conduction, convection, and radiation in various physical scenarios. f. Develop practical skills in conducting thermal experiments and data analysis, reinforcing theoretical concepts and enhancing problem-solving abilities. g. Recognize the significance of thermal physics in various disciplines and its relevance to real-world applications in energy, environment, and technology.**

Theory:

Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases. **(5 Lectures)**

Molecular Collisions

Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance. **(4 Lectures)**

Real Gases

Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO_2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule-Thomson Cooling. **(8 Lectures)**

Heat conduction in solid

Variable and steady state of heat flow, thermal conductivity, thermal receptivity, thermometric conductivity, thermal conductivity of a composite. Fourier equation of heat conduction in one dimension. Steady state solution and application to Ingen Hausz's experiments, extension to three dimensions for spherical and cylindrical heat flow. Lee's method. Cylindrical shell method. Statement of Wiedmann-Franz's Law. **(4 Lectures)**

Zeroth and First Law of Thermodynamics

Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law. General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. **(8 Lectures)**

Second Law of Thermodynamics

Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. **(10 Lectures)**

Entropy

Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero. **(7 Lectures)**

Thermodynamic Potentials

Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Gibbs free energy and spontaneity of a process. Surface Films and Variation of Surface Tension with Temperature, Magnetic Work. Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius-Clapeyron Equation and Ehrenfest equations. **(7 Lectures)**

Maxwell's Thermodynamic Relations

Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv, (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process. **(7 Lectures)**

List of Practical (Any six)

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.

4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee andCharlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

Reading References

Theory

1. Heat and Thermodynamics, M W Zemansky, R Dittman, McGraw Hill.
2. Concepts in Thermal Physics, S J Blundell and K M Blundell, 2nd Edition, Oxford University Press.
3. An Introduction to Thermal Physics, D. V. Schroeder, Oxford University Press.
4. Thermal Physics, S. Garg, R. Bansal and S K Ghosh, 2nd Edition, Tata McGraw Hill.
5. The Kinetic Theory of Gases, L B Loeb, Radha Publication House.
6. Thermal Physics, A B Gupta and H P Roy, Books and Allied Pvt Ltd.
7. Thermodynamics, Kinetic Theory, Statistical Thermodynamics, F W Sears and G L Salinger, Narosa.
8. Thermal Physics, C Kittel and H Kroemer, W H Freeman Publisher.
9. Thermodynamics and an Introduction to Thermostatistics, H. B. Callen, Wiley.

Practical

1. Advanced Practical Physics for Students, B L Flint and H T Worsnop, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash and R Krishna, Kitab Mahal.
3. Advanced Practical Physics, B Ghosh and K G Mazumdar, Shreedhar Prakashani.
4. An Advanced Course in Practical Physics: D Chattopadhyay and P C Rakshit, NCBA.
5. Laboratory Manual of Physics, Vol 1, M Jana, Books and Allied Pvt Ltd.

Syllabus *(PHYSICS)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BPHSMAJ05C**
Course Title: **Electronics-I**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective: **This course will enable students to • Learn basic semiconductor physics and two terminal devices and its application. • Understand construction and characteristics of JFETs and MOSFETs and differentiate with BJT. • Demonstrate and Analyze Operational Amplifier circuits and their applications • Describe, Illustrate and Analyze Combinational Logic circuits, Simplification of Algebraic Equations using Karnaugh Maps and Quine McClusky Techniques. • Describe and Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops.**
Learning Outcome: **Upon completion of the Course, the students will be able to: a. Know the characteristics and utilization of various electronics components. b. Design and analyze electronic circuits for real world applications. In addition, students will also be able to design, analyze, and implement digital circuits. They will understand logic gates, Boolean algebra, and combinational and sequential circuits, gaining practical skills in building digital systems for various applications.**

Theory:

Semiconductor Diodes

P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. Current Flow Mechanism in Forward and Reverse Biased Diode.Half-wave Rectifiers. Centre-tapped and Bridge

Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter, Clipping and Clamping Circuits, Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell. (**11 Lectures**)

Bipolar Junction transistor (BJT):

n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations for BJT. Current gains α and β Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions.Transistor Biasing and Stabilization Circuits. Transistor as 2-port Network. h-parameter Equivalent Circuit. **(9 Lectures)**

Transistor as Amplifier

Transistor as an Amplifier (CE mode), Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B and C Amplifiers. Frequency response of a CE amplifier. (**5 Lectures**)

Field Effect transistor (FET)

Classification of various types of FETs, construction of JFET, drains characteristics, biasing, operating region, pinch-off voltage. MOSFET: construction of enhancement and depletion type, principle of operation and characteristics. Elementary ideas of CMOS and NMOS. (**4 Lectures**)

Operational Amplifier (OP-Amp)

Characteristics of an Ideal and Practical Op-Amp. Pin configuration of IC 741. Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground. Applications of Op-Amps: Linear - (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log and Anti-log amplifier, (7) Zero crossing detector. Non-linear – (1) inverting and non-inverting comparators, (2) Schmidt triggers. **(9 Lectures)**

Digital Circuits

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers and their conversion to other system. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers. **(5 Lectures)**

Boolean algebra

De Morgan's Theorems. Boolean Laws. 1's and 2's complement, binary number addition, subtraction and multiplication, Binary Subtraction using 2's Complement, Simplification of Logic Circuit using Boolean Algebra. Fundamental Products, SOP and POS form. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. (**6 Lectures**)

Data processing circuits

Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor. (**5 Lectures**)

Sequential Circuits

SR, JK, D- and T- Flip-Flops, Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop. Excitation table, Timing diagram for different FF.

(**6 Lectures**)

List of Practical (Any six)

1. To study V-I characteristics of PN junction diode, Light emitting diode, and Zener diode.
2. To design the circuit for Frequency response of a CE amplifier
3. To design a bridge rectifier circuit for full wave rectification and calculation of rectification efficiency, ripple factor.
4. To design an inverting, non-inverting amplifier using Op-amp (741) for dc voltage of given gain
5. To design adder, subtractor, Integrator using Op-amp.
6. To design a switch (NOT gate) using a transistor.
7. To verify and design AND, OR, NOT and XOR gates using NAND gates.
8. To design a combinational logic system for a specified Truth Table.
9. Half Adder, Full Adder and 4-bit binary Adder.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.

Reading References

Theory

1. Semiconductor Physics and Devices, S M Sze, Wiley.
2. Modern Semiconductor Devices for Integrated Circuits, C.C. Hu, Pearson.
3. Integrated Electronics, J Millman, C Halkias, and C Parikh, Tata McGraw Hill.
4. Electronic Devices and Circuit Theory, R L Bolysted and LNashelsky, Pearson.

5. Electronics: Fundamentals and Applications, J. D. Ryder, Prentice Hall.
6. Electronic Principles, A P Malvino and D J Bates, McGraw Hill.
7. Digital Fundamentals, T L Floyd, Pearson.
8. Digital Electronics, R P Jain, Tata McGraw Hill.
9. Digital Principles and Applications, A P Malvino, D P Leach and G Saha, Tata McGraw Hill.
10. Digital Electronics G K Kharate, Oxford University Press.
11. Electronics Fundamental and Application, D. Chattopadhyay and P.C. Rakshit, New Age.
12. Fundamental Principles of Electronics, B Ghosh, Books and Allied Pvt Ltd.

Practical

1. Modern Digital Electronics, R.P. Jain, 4th Edition, Tata McGraw Hill.
2. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, Mc-GrawHill.
3. Op-Amps for everyone, Mancini, NewnesPub.

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

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Syllabus & Course Curriculam

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BPLSMAJ01T**
Course Title: **Understanding Political Theory**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: Understanding Political theory is integral and indispensable for a comprehensive and critical study of political science. The course is designed to train a student in the foundational issues of political theory, which is relevant for any i**

Learning Objectives:

- The Course projects the global and interdisciplinary orientation of Political Theory. It also emphasizes the interplay of theory and practice in the political process.
- To understand the difference between ideology and thought as well as between theory and ideology.
- To understand the relationship between ideas and politics.
- To understand the core doctrines of each of the ideologies and to make sense of politics through different ideological perspectives.
- To introduce the student to the basic concept and Ideologies. To acquaint the students with the contemporary debates across the ideologies.
- To enable the students to face the competitive examinations (UPSC, PSC, NET/ SET)

Course Content: 6*6=36Classes (6 Classes per topic)

1. What is Politics & Political Theory, Approaches to the study of Politics: Liberal, Marxist, Behavoiural and Post-behavioural.
2. Critical and contemporary perspectives in political theory: Feminism & Post-modernism.
3. Basic concepts: Rights, Liberty, Equality, Justice, Democracy & Citizenship.
4. Ideology: Meaning & variants – Anarchism, Liberalism, Neo-liberalism and Socialism.
5. Theories of the State: Idealist, Marxist & Gandhian.
6. Modern Western Marxism: Gramsci's 'hegemony'.

Suggested Readings:

- Rajeev Bhargava's What is Political Theory and Why do We Need It (OUP),
- David Marsh and Garry Stoker edited Theory and Methods in Political Science,
- Macmillan etc, Catriona McKinnon(ed) Issues in Political Theory (OUP, 2008).
- Easton, David (1966), Varieties of Political Theories, New Jersey, Prentice Hall
- Joad C.E.M. (1924), Introduction to Modern Political Theory, OUP

- Sanders, D. (1995) Behavioral Analysis, in Marsh, D. and Stoker, G. (eds.) Theory and Methods in Political Science. London: Macmillan
- Debnath, Arnab and Naskar, Gobinda (2022) Rajnoitik Tottwa: Dharonasomuho, Kalyani Publishers, New Delhi.
- Mukherjee, Pradipta, (2021), Rajnaitik Tottwa: Dharana O Bitarko, Progressive Publishers, Kolkata.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)
Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)
Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*

- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BPLSMAJ02T**
Course Title: **Constitution of India**
(L-P-Tu): **5-0-1**
Credit: **6**

Practical/Theory: **Theory**

Course Objective:

Learning Outcome: **Course Outcome: Acquaintance to Constitution is indispensable for a student to make a sense of Indian Political System. The course is designed to provide an overview of key concepts of the Indian constitution to the student, which would evolve them into a**

Learning Objectives:

- The purpose of this course is to introduce to the students the basic information and analytical frame work for studying of Indian Constitution.
- To acquaint the students with the Objectives, Structure and Functions of Union Government and Union Legislature.
- It further encourages a study of state institutions in their mutual interaction, and in interaction with the larger extra-constitutional environment.
- To enable the students to qualify the competitive examination like UPSC/ MPSC etc.
- To enable the students to qualify NET/ SET examination.

Course Content: 6*6= 36 Classes (6 Classes per topic)

- Philosophy of the Indian Constitution, Significance of the Preamble, Salient features of the Indian Constitution.
- Fundamental Rights and the Directive Principles of the State Policy.
- Nature of the Indian Federation, Recommendations of Sarkaria Commission and Venkat Chellaiah Commission.
- Union Executive and Legislature: President, Vice-President, Prime Minister, Parliament-Rajya Sabha and Lok Sabha, Procedure of Amendment.
- State Executive: Governor, Chief Minister
- Judiciary: Supreme Court, High Court and Public Interest Litigation.
- **Suggested Readings:**

- Constitution of India, Government of India
- Austin G., (2010) The Constituent Assembly: Microcosm in Action', in The Indian Constitution: Cornerstone of a Nation, New Delhi: Oxford University Press, 15th print
- Basu D., (2012) Introduction to the Constitution of India, New Delhi: Lexis Nexis.
- Chaube S., (2009) The Making and Working of the Indian Constitution, Delhi: National Book Trust.
- The Constitution of India: Bare Act with Short Notes, (2011) New Delhi: Universal
- Basu, D.D., Bharater Sangbidhan parichay, Wadha and Co.
- Kashyap, Subhas C, Amader Sanbidhan, National Book Trust
- Das, Tuhin Kumar, (2019) 'Bharotiyo Songbidhaner Obhimukhe', Vijoya Publishing House, Kolkata.

Syllabus *(ENGLISH)*

Course Type: **AEC-1**

Semester: **2**

Course Code: **BAECLEN02T**

Course Title: **Communicative English**

(L-P-Tu): **4-0-0**

Credit: **4**

Practical/Theory: **Theory**

Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**

Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BPLSMAJ03T**
Course Title: **Politics in India (Issues and Challenges)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: Study of the functioning of Indian Democratic System is essential for a comprehensive understanding of the Politics in India. The course is designed to train & acclimatize the student with the Politics in India in action and explain the wo**

Learning Objectives:

- The purpose of this course is to introduce to the students the basic information and frame work for studying of Political issues and challenges in India.
- To acquaint the students with the contemporary issues.
- It further encourages a study of state institutions in their mutual interaction, and in interaction with the larger extra-constitutional environment.
- To develop the skills of debate/ discussions/ newspaper reading among the students.

Course Content: 6*6= 36 Classes (6 Classes per topic)

1. Party System- Coalition Politics
2. Communities and community-based politics—role of caste, class & ethnicity.
3. Regionalism & Regional movements: Gorkhaland and Bodoland Movement.
4. Election Commission – Electoral Reforms.
5. Critique of secularism, communal politics & communal violence.
6. Political Culture in India.

Suggested Readings:

- Basu D.D., 'An Introduction to the Constitution of India', Prentice Hall, New Delhi. (Latest Edition)
- Frankel Francine, Hasan Zoya, Bhargava Rajeev, Arora Balveer (eds.), Transforming India, Oxford University Press, New Delhi, 2000.
- Granville Austin, Working a Democratic Constitution: The Indian Experience, Oxford University Press, New Delhi, 1999
- Jayal Niraja Gopal (Ed.): Democracy in India' Oxford India Paperbacks, New Delhi 2012
- Kothari Rajni, 'Politics in India' Orient Blackswan Hyderabad, 2014
- Kothari Rajni, 'Bharat mein Rajneeti: Kal aurAaj' Vani Prakashan New Delhi, 2007
- Narang A.S., Indian Government and Politics, Geetanjali Publishing House, New Delhi, 1996 (Latest edition)
- Singh, M.P., and Sexen aRekha, Indian Politics: Contemporary Issues &Concerns' Prentice Hall of India Pvt. Ltd. New Delhi, 1998.

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BPLSMAJ04T**
Course Title: **Indian Political Thought**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: This course is to familiarize the students with the larger political and social thinking and ideas in Ancient, medieval and Modern India. Designed in a way to help students engage with various ideological dispensations that came to shaped**

Learning Objectives:

- To systematically explain the major strands in modern Indian Political Thinkers.
- To apprise students with the basic thought of these thinkers with reference to their perception of colonial rule, ideas of nationalism, critique of western civilization and ideas regarding reconstruction of society.
- To enable the students to qualify the competitive examination like UPSC/PSC, NET/ SET examination.

Course Content: 6*6= 36 Classes (6 Classes per topic)

1. Ancient Indian Political Thought: Basic Features, Kautilya's Saptanga theory & Dandaniti.
2. Main features of Political thought of medieval India.
3. Raja Rammohun Roy—his social activism and liberal thought.
4. Swami Vivekananda: concept of nation-making & socialism.
5. Rabindra Nath Tagore: concept of Atmasakti & shift from nationalism to humanism.
6. Gandhi: Trusteeship and Sarvodaya, Ambedkar: social Justice.

Suggested Readings:

- Mehta, V. R. Foundations of Indian Political Thought, Manohar, 1992
- T. Pantham and K Deustch (eds), Political thought in Modern India, Sage Publications, Delhi, 1986
- Guha Ramachandra, Makers of Modern India, Penguin Viking, 2010.
- Thomas Pantham,Politicaldiscourse:Expoloration in Indian and western political thought
- Bidyut Chakarabarty and RK Pandey, Modern Indian Political Thought

- H.R. Mukhi: History of Modern Indian Political Thought

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BPLSMAJ05T**
Course Title: **Indian Administration**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: It aims to provide interface between public policy and administration in India. The essence of this paper is to appreciate the translation of governing philosophy into programmes and policies. Students will able to understand Political Pro**

Learning Objectives:

- To gain knowledge about the evolution and growth of Indian Administration.
- Familiarity with the constitutional framework on which Indian Administration is based.
- Grasping the role of Union Executive.
- Understanding the in-built control mechanisms over constitutional bodies in particular and administration in general.
- Delineating the constitutional provisions and dynamics of union -state relationships.
- Awareness about the institutions and mechanism in force for citizen-state interface.

Course Content: 6*6= 36 Classes (6 Classes per topic)

1. British legacy in Indian Administration: 1858 to 1947.
2. Union Administration - PMO-Cabinet Secretariat, Distinction between Secretariat & Directorate.
3. Administrative reforms since Independence – 1st Administrative Reforms Committee and 2nd Administrative Reforms Committee: Major recommendations.
4. UPSC: Composition & Functions.
5. State Administration: Composition of State Secretariat, Role of Chief Secretary, Divisional Commissioner, DM.
6. Significant issues in Indian Administration: administrative Corruption, Bureaucratic Neutrality.

Suggested Readings:

- Arora R.K. & Goyal R. 'Indian Public Administration', Vishwa Prakashan 2008 New Delhi
- Basu Rumki (ed. 2015) 'Democracy and Good Governance: Reinventing the Public Service Delivery System in India' Bloomsbury, New Delhi.
- Basu, Rumki (2015) 'Public Administration in India Mandates, Performance and Future Perspectives', Sterling Publishers, New Delhi
- Chakrabarty Bidyut & Chand Prakash (2017) 'Public Administration: From Government to Governance' Orient Blackswan Pvt. Ltd. Hyderabad
- Chakrabarty Bidyut& Chand Prakash (2017) 'Public Administration in a Globalizing World: Theories & Practices' SAGE, New Delhi
- Jayal, N.G (1999) 'Democracy and The State: Welfare, Secular and Development in Contemporary India', Oxford, Oxford University Press, New Delhi
- Singh H. & Singh M. 'Public Administration in India, Theory and Practice', Sterling Publication 1990 New Delhi.

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BPLSMAJ06T**
Course Title: **Western Political Thought**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: This course introduces the students to the ancient, medieval and modern political thinking in the West. This would help them understand the manner in which ideas pertaining to ideal state, kingship, duties of the ruler and the ruled, right**

Learning Objectives:

- To familiarize the students with the major phases in the evolution of western political Thinking Namely the Classical Tradition, Liberal Tradition.
- To make the students familiar with the major theoretical issues in the discipline of Political Science as problematized by these western political thinkers.
- To enable the students to qualify the competitive examination like UPSC, PSC, NET/ SET examination.

Course Content: 6*6= 36 Classes (6 Classes per topic)

1. Ancient Political Thought: Plato's theory of Justice, Aristotle's origin and nature of State.
2. Medieval Political Thought: Main features with reference to St. Augustine, St. Thomas Acquinas & Marsilius of Padua.
3. European Renaissance & Machiavelli: His concepts of Power & Secularization of Politics.
4. Hobbes's Materialism and John Locke's ideas of liberalism and natural rights.
5. Rousseau: General Will.
6. Karl Marx: Dialectical and Historical Materialism.

Suggested Readings:

- E. Baker, The Political Thought of Plato and Aristotle, Metheun, 1906.
- J. Coleman. A History of Political Thought: From Ancient Greece to Early Christianity, Oxford: Blackwell Publishers, 2000.
- K. Nelson, Brian, Western Political Thought: From Socrates to the Age of Ideology, Pearson. 1996
- Jha, Shefali, Western Political Thought (From Plato to Marx), Pearson.
- C. Macpherson, The Political Theory of Possessive Individualism: Hobbes to Locke. Oxford University Press, Ontario.
- Kolakowski, Leszek, Main Currents of Marxism, Oxford University Press, 1978.
- Okin, Susan Moller, Women in Western Political Thought, Princeton University Press,
- H. R. Mukhi : A Simple History of Political thought, Surjeet Book Depot.

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BPLSMAJ07T**
Course Title: **Comparative Politics**
(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective:

Learning Outcome: **Course Outcome: Politics is the mirror of the society. This paper will help the student in furthering his understanding of the world around. This would help him to appreciate other systems and make him critically analyze the pros and cons of these systems**

Learning Objectives:

- To understand constitutional frameworks for procedures and policies
- To examine the historical evolution of constitutional doctrines, standards, and tests
- To analyze both early and contemporary judiciary
- To articulate informed opinion over important, controversial, constitutional issues
- To enable the students to qualify the competitive examination like UPSC, MPSC, NET/ SET examination.

Course Content: 6*6= 36 Classes (6 Classes per topic)

- Meaning, Nature and Scope of Comparative politics.
- Approaches to the study of Comparative Politics: Institutionalism, Developmentalism & Neo-Institutionalism.
- Comparative study between British Prime Minister and American Presidency.
- Judiciary System: UK, USA, People's Republic China.
- Party System: UK, USA, People's Republic China.
- Electoral Process: USA (President), UK (Prime Minister), People's Republic China (President).
- **Suggested Readings:**
- A.C. Kapoor & K. K. Mishra, Select Constitituons, S.Chand 2001 New Delhi
- V.D. Mahajan, Constitution of the world, S.Chand 2001 New Delhi.
- J.C. Johari: New comparative govt. lotus, 2008
- S.E. Finer, Compartivegovts.
- Bryce, Modern democracies
- Herman finer,Theory and practice of Modern government
- Vidya Bhushan & Vishnu Bhagwan.World constitution, sterling publications 1998.
- J. Kopstein and M. lichbach, comparative politics: Interests identities and institutions in a changing global order.
- M. Mohanty, comparative political theory and third world sensitivity

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-8**

Semester: **6**

Course Code: **BPLSMAJ08T**

Course Title: **Political Sociology**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective:

Learning Outcome: **Course Outcome: The course equips students to grasp the essential historicity of political processes, political institutions and political change to facilitate an understanding of the dynamic nature of political phenomena. The course deals with theoretic**

Learning Objectives:

- Political Sociology is one of the core areas of sociology. It is a thriving subfield of sociology with important theoretical and practical consequences. The endeavor in this course is to render it compact,

contemporaneous and make it contextual for Indian students, while familiarizing them with enduring conceptual and theoretical concerns. It is rigorously theoretical yet relatable.

- To examine the bases of social power and the relationship between politics and society both analytically as well as in specific empirical contexts. The course is an intensive introduction to the theoretical debates extant in the sub-field and equips students to learn both classical and contemporary arguments about age old questions of power, authority and resistance and their manifestations in political institutions and political systems.
- The course equips students to grasp the essential historicity of political processes, political institutions and political change to facilitate an understanding of the dynamic nature of political phenomena.

Course Content: 6*6= 36 Classes (6 Classes per topic)

- Political Sociology: Nature, Scope and Emergence.
- Political Culture & Political Socialization—Key Aspects & Classification.
- Elite theories: Mosca, Pareto, Mitchels & C.Wright Mills.
- Authority: Weberian Classification.
- Political party and Pressure groups.
- Political Development and Modernization.
- **Suggested Readings:**

- Nash, Kate. (2009). Contemporary Political Sociology: Globalization, Politics and Power. Singapore. Blackwell Publishers.
- Gupta, Dipankar(1996). Political Sociology in India: Contemporary Trends. New Delhi. Orient Longman Limited.
- Lenski, Gerhard E.(2013). Power and Privileges: A Theory of Social Stratification. USA. University of North Carolina Press.
- Scott, John. (2014). Stratification and Power: Structures of Class, Status and Command. USA. Polity Publishers.

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BPLSMAJ09T**
Course Title: **Public Administration**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: Administration being essential to every organization, this course aims to acquaint a student with fundamentals of public administration to. This would provide him an insight regarding the principles of administration in general and help hi**

Learning Objectives: After studying the course students will have a capacity to understand:

- Understand the approaches of study of public administration.
- Apply the scientific thoughts in organization.
- Demonstrate the thoughts in the society.
- **Course Content: 6*6= 36 Classes (6 Classes per topic)**
- Public Administration: Definition & Evolution; Contribution of Woodrow Wilson, Distinction between Public & Private Administration.
- Scientific Management School & Human Relations approach.
- New Public Administration & Comparattive Public Administration with special reference to Riggs.
- Major concepts: Hierarchy, Unity of Command, Span of Control, Authority, Centralization, Decentralization, Line & Staff.

- Bureaucracy: Views of Karl Marx & Max Weber.
- New public Management.
- **Suggested Readings:**
- Maheshwari & Awasthi, Public Administration, Agra
- Mohit Bhattacharya, Public admin, Jawahar , New Delhi
- A.Avasthi & S.R Maheshwari, Public Administration, Agra
- F.A Nigro & G.I Nigro, Modern Public Administration, New York, 1980
- Dimock & Dimock Public Administration.
- W.F. Willoughby, Principles of Public Administration.
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Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BPLSMAJ10T**
Course Title: **International Relations: Concepts and Theories**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: This course seeks to equip students the basic tools for understanding International relations. It also introduces major events and developments that have shaped the contemporary international system. It aims to capture the changing dynamic**

Learning Objectives:

- Apply the knowledge base from many disciplines to the study of the international Relations;
- Demonstrate an awareness of international career and study opportunities in government, business, education, and in organizations servicing international concerns.
- To enable the students to qualify the competitive examination like UPSC, MPSC, NET/ SET exam.
- **Course Content: 6*6= 36 Classes (6 Classes per topic)**
- International Relations: Meaning, Nature and Scope.
- Realism: Classical and Neo Realism.
- Liberalism: Classical & Modern.
- Marxist theories of International Relations: World System theory, Critical theory & Neo- Marxists.
- Balance of Power and Collective Security.
- Feminism as an alternative perspective.
- **Suggested Readings:**
- Basu, Rumki (2012) (ed.) 'International Politics: Concepts, Theories and Issues', New Delhi.
- Baylis & S. Smith (2002) (eds.), 'The Globalization of World Politics', Oxford University Press, UK.
- Ghosh, Peu (2017) 'International Relations' PHI Learning Pvt. Ltd. NewDelhi
- Heywood, Andrew (2014) 'Global Politics' 2ndEdition, Palgrave Macmillan Foundations, NewYork
- BiswalTapan (2016) 'International Relations' Orient Blackswan Pvt. Ltd.Hyderabad
- Khanna, V. N (2014) 'International Relations' Vikas Publishing House Noida,U.P.
- Virmani, R.C. (2007) 'Contemporary International Relations' Geetanjali Publishing House New Delhi
- Heywood, Andrew (2014) 'Global Politics' Palgrave Macmillan New York.

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-11**

Semester: **7**
Course Code: **BPLSMAJ11T**
Course Title: **Enlightenment and its Critics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: Students will have the knowledge and skills to demonstrate critical understanding of key themes and issues in the study of the Enlightenment; analyse and explicate major ideas associated with the history of the Enlightenment; examine relat**

Learning Objectives:

The primary aim of this course is to spark and nourish your fascination with the fields of Enlightenment studies and European intellectual history. If you invest time, thought, and hard work in the course, you can also expect to:

- learn how to think historically, growing attuned to the importance of context, causality, contingency, complexity, and change over time for understanding the past.
- understand how and why scholars debate the past and how such debates relate to presentday concerns
- become a sharper, more perceptive reader of writings from the past in light of their historical contexts.

- **Course Content: 6*6= 36 Classes (6 Classes per topic)**
- Background to European Enlightenment.
- Kant and Enlightenment.
- Hegel's criticism-concept of civil society, concept of state.
- Marx & Hegelians.
- Right Hegelians-Nietzsche & his theory of Superman.
- Modernity & its criticism - rise of Post-modernism, Feminist critique of Enlightenment.
- **Suggested Readings:**
- J. K. W. Möhsen, "What is to be Done Toward the Enlightenment of the Citizenry?", in James Schmidt, ed.
- Moses Mendelssohn, "On the Question: What is Enlightenment? in James Schmidt, ed.

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BPLSMAJ12T**
Course Title: **Political and Social Movements**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: students would be able to show knowledge of development policies and planning in India since independence; understand the development strategies and their impact on industrial and agricultural sphere; understand the emergence of social mov**

Learning Objectives:

- Demonstrate awareness of political and social movements on a state, national, and global level.
- Distinguish between different types of political and social movements.
- Identify stages of political and social movements.
- Discuss theoretical perspectives on political and social movements, like resource mobilization, framing, and new social movement theory.
- **Course Content: 6*6= 36 Classes (6 Classes per topic)**
- Meaning of Political and Social Movements, Distinguish between Social Movements and Political Movements.
- Non-Governmental Organizations (NGO), Civil Society Campaigns –the Community versus Civil Society debate.
- Dalit and Tribal Movements.
- Identity Movements: Religious and Linguistic Minority Movements.
- Agrarian and Working class movements in post-colonial India.
- Anti- Corruption Movement, Human Rights Movements and Environmental Movements.
- **Suggested Readings:**
- ***Harish K. Puri and Paramjit S. Judge (Eds.) (2019) Social and Political Movements, Rawat Publication, New Delhi.***
- ***Mohanty Manoranjan (ed), 2004, Caste, Class and Gender, New Delhi, Sage.***
- ***Mohanty Manoranjan, Partha Nath Mukherjee and Olle Tornquist (eds), 1998, People's Rights: Social Movements and the State in the Third World, New Delhi, Sage.***
- ***Omvedt Gail, 1993, Reinventing Revolution: New Social Movements and the Socialist Tradition in India, New York, ME Sharpe***
- ***Oommen T K (ed), 2010, Social Movements (Vol I and II), New Delhi, OUP***
- ***Rav Raka and Mary Fainsod Katzenstein (eds.), 20 05, Social Movements in India: Poverty, Power and Politics, New Delhi, OUP***
- ***G. Almond and G. B. Powell, Comparative Politics Today: A World View, 6th edn., New York, Harper Collins, 2000.***
- ***A. Bentley, The Process of Government, Chicago, University of Chicago Press, 1908.***

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BPLSMAJ13T**
Course Title: **International Organizations and Issues**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: students will have the knowledge and skills to demonstrate knowledge and critical understanding of the major raditional and critical theories of International Relations on international organizations; understand the historical development**

Learning Objectives:

- To allow a better understanding of the structure of international relations;
- To provide a general understanding of the major international organizations, with particular emphasis on the analysis of its powers and areas of operation;
- To promote further study of the European Union and the United Nations.
- **Course Content: 6*6= 36 Classes (6 Classes per topic)**
- UN: General Assembly, Security Council, Secretary General.

- World Bank, IMF, WTO.
- Regional organizations: EU, SAARC, ASEAN, OPEC.
- Environment and Climate change.
- International migration in Globalizing World.
- Terrorism and humanitarian interventions in post-globalization period.
- **Suggested Readings:**

- Barnard, Catherine – The Substantive Law of the EU. The Four Freedoms. Oxford, Oxford University Press, 2007.
- Craig, Paul & De BÚRCA, Gráinne – EU Law. Text, Cases and Materials. Oxford, Oxford University Press, 2007.
- Zorgbibe, Charles – Les Organizations Internationales. 4.ed. Paris, PUF, 1997.
- Borchardt, Klaus-D. – The ABC of European law. Brussels, Publications Office of the EU, 2010. (http://europa.eu/documentation/legislation/pdf/oa8107147_en.pdf)
- Hurd, Ian – International Organizations. Politics, Law Practice. 2ª ed. Cambridge, Cambridge University Press, 2013.

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BPLSMAJ14T**
Course Title: **Indian Foreign Policy**
(L-P-Tu): **5-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: After successful completion of this course, • Students will be able to understand and explain the concept, nature and scope of foreign policy. • Students will be able to explain the elements influencing India's foreign policy. •**

Learning Objectives:

- To help the students to understand meaning nature and scope of foreign policy of a state.
- To help the students to understand the factors influencing the India's foreign police.
- To help the students to understand India's relations with neighboring countries.
- To help the students to know the special relations of India with super powers
- **Course Content: 6*4= 24 Classes (6 Classes per topic)**
- Evolution of Indian foreign policy: Nehru and non-alignment, post-Nehru shift to state-centrism, impact of the end of the Cold War and globalization.
- Process of making foreign policy: Role of the Executive – political and bureaucratic, Role of the Parliament, Role of political parties, pressure groups, media.
- National Security: Concept and dynamics of national security, threat perceptions, power projection, Defence preparedness: purchases, indigenization and Nuclear Policy.
- Economic Power and "Soft" Power: Trade as an instrument of foreign policy – trade blocs, FTAs, role in the WTO, Quest for Energy Security and Maritime Security, "Soft Power" in foreign policy – cultural-historical linkages, diaspora.
- **Suggested Readings:**

- Basrur, Rajesh Minimum Deterrence and India's Nuclear Security, (2005: Palo Alto, CA, Stanford University Press)
- Cohen, Stephen India Emerging Power, (2002: New Delhi, Oxford University Press)
- Dash, P.L. And Andrei Nazarkin, eds. India and Russia: Strategic Synergy Emerging, (2007: New Delhi, Authors Press)
- Devare, Sudhir – India and Southeast Asia; (2006: Singapore & New Delhi; ISEAS & Capital Publishing Co.)
- Dixit, J.N. External Affairs: Cross-Border Relations, (2003: New Delhi, Lotus Collections)
- Dutt, V.P. Foreign Policy of India
- Frankel, Francine and Harry Harding, eds. The India-China Relationship: Rivalry and Engagement, (2004: New Delhi, Oxford University Press)
- Harshe, Rajen and K.M. Seethi, eds. Engaging with the World: Critical Reflections on India's Foreign Policy, (2005: New Delhi, Orient Longman)
- Mohan, C. Raja Crossing the Rubicon: The Shaping of India's New Foreign Policy, (2005: New Delhi, Viking – Penguin Books)
- Nayar Baldev Raj and T.V. Paul India in the World Order: Searching for MajorPower Status, (2004: New Delhi, Foundation Books/Cambridge University Press)
- Perkovich India's Nuclear Bomb, (2002: Berkley, University of California Press)
- Thakkar, Usha and Mangesh Kulkarni, eds. India in World Affairs: Towards the 21st Century, (1999: Mumbai, Himalaya Publishing House)

Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BPLSMAJ15T**
Course Title: **Governance**
(L-P-Tu): **5-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: • To understand the nature and scope of Governance; • To appreciate the methodological pluralism and synthesizing nature of knowledge in Governance; • To comprehend the changing paradigms of Governance; • To acquaint with the th**

Learning Objectives:

- To discuss the ways in which governments are composed of institutions and the qualities of those institutions.
- Identify different types of collective action problems.
- Explain the costs of collective action.
- Define the five design principles that contribute to the framework and functions of our government.
- Relate how representative government works.
- Explain what motivated the founders to try to solve collective action problems.
- **Course Content: 6*4= 24 Classes (6 Classes per topic)**
- Governance: Meaning and Evolution.
- Good Governance: Meaning and features.
- Corporate Governance and Corporate Social Responsibility (CSR).
- E-Governance and Environmental Governance.
- **Suggested Readings:**

- Maheshwari & Awasthi, Public Administration, Agra
- Mohit Bhattacharya, Public admin, Jawahar , New Delhi
- A.Avasthi & S.R Maheshwari, Public Administration, Agra
- F.A Nigro & G.I Nigro, Modern Public Administration, New York, 1980
- Dimock & Dimock Public Administration.
- W.F. Willoughby, Principles of Public Administration.
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Syllabus *(POLITICAL SCIENCE)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BPLSMAJ16T**
Course Title: **Research Methodology**
(L-P-Tu): **5-0-1**
Credit: **4**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: This paper intends to train students in carrying out empirical studies and field work which would help him in research. This would sensitize him to the precautions that are required to carry a empirical study on socially relevant topics.**

Learning Objectives:

- To help the students to understand the concept of research in Political Science, how to frame a research question, to frame a research design and how to take review of research literature.
- To help the students to know the concepts in research process viz hypothesis, variables, sampling etc.
- To help the students to know and apply the ethical issues in research process.
- To help the students to know the data collection tools, techniques and methods in social research.
- To help the students to learn the skill of report writing data presentation, biography, writing footnotes, references, cauterization and to know the characteristics of a good report.

Course Content: 6*4= 24Classes (6 Classes per topic)

1. Research Methodology: meaning, Types, Difference between Method and methodology.
2. Steps in Social Science Research.
3. Review of Literature: Conducting a literature review.
4. Qualitative and Quantitative Research Method- Basic Differences.

Suggested Readings:

- Techniques of Social Research: Dr. P.L. Bhandarkar and Wilkinson, Himalaya Publishing House.
- Research Methodology Methods/Techniques. C.R. Kothari, Vishwa Prakashan, New Delhi.
- Methodology & Social Science Research. Dr. Raj Kumar, Book Enclave- Jaipur.
- Research Methodology in Political Science. Theory and Analysis. S. L. Verma, Rawat Publication-Jaipur.
- H.N. Blalock, An Introduction to Social Research, Englewood Cliffs NJ, Prentice Hall, 1970.
- M.J. Brenner, J. Brown and D. Canter (eds.), The Research Interview: Uses and Approaches, London, Academic Press, 1985.
- Bryman, Quantity and Quality in Social Research, London, Unwin Hyman, 1988.
- M. Bulmer (ed.), Sociological Research Methods : An Introduction, London, Macmill an, 1984.
- De D.A. Vaus, Surveys in Social Research, 2nd edn., London, Unwin Hyman 1991.
- N. Gilbert (ed.), Researching Social Life, London, Sage, 1993.

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BPLSMAJ17T**
Course Title: **Human Rights in India**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: o The course provides the students with the capacity to identify issues and problems relating to the realization of human rights. o Students will be able to contribute to the resolution of human rights issues and problems. o This paper a**

Learning Objectives:

- Promote respect and observance of human rights and democracy.
- Promote respect and observance of the rule of law and due processes.
- Create networks with public interest and human rights organizations, nongovernmental organisations, universities, relevant research institutions, religious associations and legal associations' societies.
- To enable the students to qualify the competitive examination like UPSC, MPSC, NET/SET examination.
- **Course Content: 6*6= 36 Classes (6 Classes per topic)**
- Human Rights and Duties: Concept, generational classification of human rights. Difference between rights and human rights.
- Institutional aspects of Human rights in India: National and State Human Rights Commission, Constitutional provisions of Human Rights.
- Human Rights & Women in contemporary society: Gender discrimination with special reference to female feticide, Domestic violence, Sexual harassment in workplace(with special reference to Bishaka guideline).
- Human Rights and children in contemporary Indian society: Child Labour, Child abuse inside and outside home and Child trafficking.
- Human rights and minority groups in India: LGBTQIA.
- Environmental rights in India: right to healthy environment, and principles of Sustainable Development.
- **Suggested Readings:**

- Conor Greaty and Adam Tomkins (Eds).Understanding Human Rights, London: Manshell, 1996.
- David Beetham, Politics and Human Rights, Oxford: Blackwell, 1995
- Gurpreet Mahajan Ed., Democracy, Difference and Social Justice, New Delhi: Oxford University Press, 1998.
- James Nickel, Making Sense of Human Rights: Philosophical Reflections on the Universal Declaration of Human Rights, Berkeley: University of California Press, 1987.
- Michael Freeman, Human Rights: An Interdisciplinary Approach, Oxford: Polity, 2002.
- R.J. Vincent, Human Rights and International Relations, Cambridge: Cambridge University Press, 198
- Ronald Dworkin, Taking Rights Seriously, London: Duckworth, 1978
- SAHRDC, Human Rights and Humanitarian Law, New Delhi: South Asian Human Rights Documentation Centre, 2002
- Stephen Shute and Susan Herley (Eds), On Human Rights, New York: Basic Books, 1993
- Upendra Baxi: The Future of Human Rights, New Delhi: Oxford University Press.

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BPLSMAJ18T**
Course Title: **Local Self- Government in India**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective:
Learning Outcome: **Course Outcome: o Develop a local leadership. o Exhibit the efforts for rural development. o Apply the management and theory at local level. o Awareness of the basic governing system as well as development measures. o Conceptualization of the developm**

Learning Objectives: After studying the course students will have a capacity to understand:

- Community development concentration,
- Understand conventional development and planning theories at rural level.
- Apply village developmental resources properly.
- Demonstrate the implementation of schemes, programmes at local to national level.
- Familiar with the rural local governance.
- **Course Content: 6*6= 36 Classes (6 Classes per topic)**
- Concept of Local Govt.—its objectives & rationale.
- Evolution—Constitutional provision, different Committees & Commissions on PRIs, Peoples' participation.
- 73 rd Constitution Amendment Act, Panchayet after post-colonial amendment Acts.
- Evolution of Municipal Govt., types, Constitutional position, different Committees & Commissions.
- 74^{th} Constitution Amendment Act: its significance, metropolitan personnel, relation with Govt.
- Impact of Globalization on Local Government in India.
- **Suggested Readings:**
- D.Y. Raghava Rao : Panchayats and Rural Development, Ashish Publishing House, New Delhi.
- G.Palanithurai, Dynamics of New Panchyati Raj System in India, Concept Publishing Company, New Delhi.
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Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(SANSKRIT)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BSNSMAJ01T**
Course Title: **A Brief Introduction to Sanskrit Literature**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To get the students acquainted with the journey of Sanskrit literature from Vedic literature to Classical and Purāṇic Sanskrit literature. To give an outline of different shastric traditions, (technical & scientific) through which students will be able**
Learning Outcome: **This course will help the students to get the basic knowledge of Vedic literature, Rāmāyaṇa, Mābhārata, Purāṇas and classical Sanskrit literature. Students will gain a clear idea of human values, ethics in Sanskrit literature and different shastr**

Module-1:

- Vedic Literature:
- time, subject matter, saṁhitā, brāhmaṇa, āraṇyaka, upaniṣad, vedāṅga

Module-2:

- Classical Literature:Rāmāyaṇa, Mahābhārata, Purāṇas, Dṛśya-kāvya & Śravya-kāvya
- Rāmāyaṇa :time, subject matter, literary, social & cultural importance
- Mahābhārata :time, subject matter, literary, social & cultural importance
- Purāṇas :time, subject matter, characteristics, literary, social & cultural importance
- Time, Texts& Authors:Bhāsa, Aśvaghoṣa, Kālidāsa, Bhāravi, Māgha, Bhaṭṭi, Harṣa, Śūdraka, Viśākhadatta, Bāṇabhaṭṭa, Daṇḍīn, Bhavabhūti, Bhaṭṭaṇārāyaṇa, Śrīharṣa, Ambikādattavyāsa, Revāprasāda Dvivedin, Prabhāśaṁkara Jośī, Haridāsa-siddhānta-vāgīśa, Sītānātha Ācārya, Śrījīva Nyāyatīrtha, Rādhāvallabha Tripāṭhin, Yatīndra-vimala Caudhurī, Vīrendra-kumāra Bhaṭṭācārya, Kālipada Tarkācārya

Module-3:

- Technical Literature: General Introduction to Vyākaraṇa, Darśana and Sāhitya-śāstra
- Time, Texts& Authors :Pre-Pāṇinian Grammarians, Kātantra-vyākaraṇa, Kalāpa-vyākaraṇa, Mugdhabodha-vyākaraṇa, Sārasvata-vyākaraṇa
- Time, Texts & Authors :Cārvāka,Bauddha, Jaina, Sāṁkhya, Nyāya, Vaiśeṣika
- Time, Texts & Authors :Bharata, Bhāmaha, Daṇḍin, Vāmana, Ānandavardhana, Kuntaka, Kṣemendra, Rājaśekhara, Mammaṭa, Rūyyaka, Jayadeva, Dhanañjaya, Viśvanātha, Jagannātha

Module-4:

- Scientific Literature:

- Maya-mata, Saṅgīta-ratnākara, Sūrya-siddhānta, Aṣṭāṅga-hṛdaya, Caraka-saṁhitā, Suśruta-saṁhitā

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)
Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)
Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)
Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)
Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment- Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Syllabus *(SANSKRIT)*

Course Type: **MAJ-2**

Semester: **2**

Course Code: **BSNSMAJ02T**

Course Title: **Applied Sanskrit Grammar & Metre**

(L-P-Tu): **5-0-1**

Credit: **6**

Practical/Theory: **Theory**

Course Objective: **To teach Sanskrit from the very beginning. Essential Sanskrit grammar will be introduced (without reference to Pāṇini's sūtras) through the multiple example and applied method with emphasis on students'ability to construct sentences. To make the**

Learning Outcome: **This course will help the students to be able to write flawless simple Sanskrit and translate from English/Bengali to Sanskrit and Sanskrit to English/Bengali. It will help Critical evolution of theoretical approaches.**

Module-1:

- Śabda-rūpa:
- nara, muni, sādhu, latā, mati, nadī, pitṛ, mātṛ, phala, vāri, madhu, asmad, yuṣmad, tad, yad, kim, idam, adas, etad, eka, dvi, tri, catur, pañcan, ṣaṣ, saptan, aṣṭan
- Dhātu-rūpa:
- bhū, sev, kṛ (laṭ, lṛṭ, loṭ,laṅ, vidhi-liṅ)
- Avyaya:
- yadā, tadā, kadā, sadā, sarvadā, yatra, tatra, kutra, hyas, śvas, prātar, sāyam, ām, na, tu, kintu, api, katham, nyūnam
- Translation: From English/Bengali to Sanskrit
- prathamā-vibhakti with kriyā-pada
- prathamā-vibhakti and dvitīyā-vibhakti with kriyā-pada
- prathamā-vibhakti, dvitīyā-vibhakti and tṛtīyā-vibhakti with kriyā-pada
- Voice Change:
- prathamā-vibhakti, dvitīyā-vibhakti, ttṛtīyā-vibhakti and caturthī-vibhakti with kriyā-pada
- prathamā-vibhakti,dvitīyā-vibhakti, tṛtīyā-vibhakti, caturthī-vibhakti and pañcamī-vibhakti with kriyā-pada
- prathamā-vibhakti, dvitīyā-vibhakti, tṛtīyā-vibhakti, caturthī-vibhakti, pañcamī-vibhakti and ṣaṣṭhī-vibhakti with kriyā-pada
- prathamā-vibhakti, dvitīyā-vibhakti, tṛtīyā-vibhakti, caturthī-vibhakti, pañcamī-vibhakti, ṣaṣṭhī-vibhakti and saptamī-vibhakti with kriyā-pada
- Pratyaya:
- kta, ktavatu, ktvā, lyap, śatṛ, śānac, tavya, anīyar

Module-2:

- Metre (Chāndo-mañjarī):
- padya, vṛtta, jāti, yati, gaṇa, akṣara
- anuṣṭup, indravajrā, upendravajrā, upajāti, drutavilambita, vaṁśasthavila, vasantatilaka, mālinī, śālinīmandākrāntā, śikhariṇī, sragdharā, śārdūlavikrīḍita

Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**

Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(SANSKRIT)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BSNSMAJ04T**
Course Title: **Classical Sanskrit Literature (Prose)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To acquaint the students with classical prose literature. Origin and development of prose, important fables are also included here for students to get acquainted with the beginnings of Sanskrit prose literature. To help the students negotiate texts indep**
Learning Outcome: **It intends to provide the knowledge about the social and political thoughts in Śukanāsopadeśa.It intends to provide the knowledge about Viśruta-carita. Understanding the importance of fables.**

Module-1:

- Kādambarī: Śukanāsopadeśa

Module-2:

- Daśakumāra-carita

Module- 3:

- Sanskrit Fables:-
- Dharma-buddhi-pāpa-buddhi-kathā (Pañca-tantra: Mitra-bheda{Story no. 19})
- Muni-mūṣika-kathā (Hitopadeśa: Sandhi {Story no. 5})

Syllabus *(SANSKRIT)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BSNSMAJ05T**
Course Title: **Classical Sanskrit Literature (Drama)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To acquaint the students with three most famous dramas of classical Sanskrit literature which represent different stages in the growth of Sanskrit drama.**
Learning Outcome: **This section provides the data based on Abhijñāna-śakuntala by Kālidāsa regarding environment and sustainability.This section mentioned the clear idea regarding human values in the society during the time of Bhāsa in Svapna-vāsavadatta.**

Module-1:

- Abhijñāna-śakuntala

Module-2:

Svapna-vāsavadatta

Syllabus *(SANSKRIT)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BSNSMAJ06T**
Course Title: **Dharma-śāstra**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To study the social institutions and Indian polity which have been highlighted in Dharma-śāstra literature. To make the students acquainted with various aspects of social institutions and Indian polity as propounded in the ancient Sanskrit texts such a**
Learning Outcome: **This course enlightens us the sources of Indian Social ancient institution such as Manu-saṁhitā,Yājñavalkya-smṛti, Kauṭilya's Artha-śāstra. This section pins the cardinal theory of Indian polity.Professional ethics are also reflected in electio**

Module-1:

- Manu-saṁhitā (Rāja-dharma):
- rājotpotti, daṇḍa-nīti, dūrga, kara-nīti, byasana, ṣāḍ-guṇya & dūta
- Yājñavalkya-smṛti:
- Vyavahārādhyāya (up toṛṇādāna)

Module-2:

- Artha-śāstra (Vinayādhikārika):
- vidyā-samuddeśa, indriya-jaya, amātya-niyoga, gūḍha-puruṣa, dūta-praṇidhi, ātma-rakṣita & śāsanādhikāra

Syllabus *(SANSKRIT)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BSNSMAJ07T**
Course Title: **Vedic Literature**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **This section introduces various types of Vedic texts. Covers the conceptions of professional ethics as reflected in Atharvaveda-Sāṁmanasya. It also mentioned the clear idea regarding Human Values in akṣa-sūkta.Understanding the knowledge about the**
Learning Outcome: **Through the comprehensive knowledge of the Vedas the students will be able to learn the Vedic values, education and the essence of Indian culture. Thus, the Vedic values will be transmitted from one generation to another generation.**

Module-1:

- Ṛg-veda:
- indra-sūkta 2.12, uṣas-sūkta 3.61, akṣa-sūkta 10.34, hiraṇya-garbha-sūkta 10.121, śukla-yajur-veda- rudrādhyāya 16 (1-16)
- Atharva-veda:
- sāṁmanasya 3.30 & Varuṇa-sūkta 4.4.1 (1-9)

Module-2:

- Vedic Grammar:
- declensions, śabda-rūpa, subjunctive mood (leṭ), gerunds ktvārthaka,tumarthaka, vedic accent and pada-pāṭha

Module-3:

- Bṛhadāraṇyakopaniṣad:(2. 3. 4-5)
- Nirūkta:
- ṣaḍ-bhāva-vikāra, nāman, ākhyāta, upasarga and nipāta

Syllabus *(SANSKRIT)*

Course Type: **MAJ-8**
Semester: **6**

Course Code: **BSNSMAJ08T**
Course Title: **Pāṇinian Grammar &Śikṣā**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To equip the students with some important technical terms of Pāṇinian Grammar to start studying Siddhānta-kaumudī. To give some ideas to the students about some basic rules of interpreting rules of Pāṇinian Grammar. To make the students understoo**
Learning Outcome: **Students can develop and acquire the knowledge to study the rest of the Siddhānta-kaumudī. They will have a good idea about the types of rules and how to interpret them and apply them in examples.**

Module-1

- Siddhānta-kaumudī:
- Saṁjñā-paribhāṣā-prakaraṇa

Module-2

- Laghu-siddhānta-kaumudī:
- Ac-sandhi-prakaraṇa

Module-3

- Pāṇinīya-śikṣā

Syllabus *(SANSKRIT)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BSNSMAJ09T**
Course Title: **Nyāya-vaiśeṣika and Epigraphy**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To get the students acquainted with the cardinal principles of the Nyāya-vaiśeṣika philosophy through Tarka-saṁgraha. To enable the students to handle philosophical texts in Sanskrit. To give them an understanding of essential aspects of Indian phil**
Learning Outcome: **This unit puts a great idea about introduction of Epigraphy, Paleography. This Section deals with essential aspects of Indian philosophy. It provides the knowledge of Nyāya-vaiśeṣika philosophy through Tarka-saṁgraha. This section deals with experim**

Module-1:

- Tarka-saṁgraha

Module-2

- Epigraphy:
- Introduction to Epigraphy and types of inscriptions. Importance of Indian inscriptions in the reconstruction of ancient Indian history and culture. History of Epigraphical studies in India. History of decipherment of ancient Indian scripts (contribution of scholars in the field of epigraphy): Fleet, Cunninghum, Princep, Bühler, Ojha, D.C.Sircar
- Paleography:

- Antiquity of the art of writing, writing materials, inscribers and introduction to ancient Indian scripts

Syllabus *(SANSKRIT)*

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BSNSMAJ10T**
Course Title: **Alaṁkāra-śāstra (Literary Criticism)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To the study of the Sāhitya-śāstra (Sanskrit poetics) embraces all poetic arts and includes concepts like alaṁkāra, rasa, rīti, vakrokti, dhvani, aucitya etc. The entire domain of Sanskrit poetics has flourished with the topics such as definition o**
Learning Outcome: **This develops the capacity for creative writing and literary appreciation, experimental learning and critical thinking, critical evolution of theoretical approaches.**

Module-1:

- Kāvyālaṁkāra-sūtravṛtti:
- definition (lakṣaṇa), objectives (prayojana) & causes (hetu) of poetry

Module-2

- Kāvya-prakāśa: (1^{st} Ullāsa & 2^{nd} Ullāsa)

Module: 3

- Sāhitya-darpaṇa (6^{th} Chapter):
- avasthā, artha-prakṛti, sandhi, patāka-sthāna, arthopakṣepaka, vṛtti

Module 4

- Sāhitya-darpaṇa: (10^{th} Chapter):
- anuprāsa, yamaka, śleṣa, upamā, rūpaka, sandeha, bhrāntimān, apahnuti, utprekṣā, atiśayokti, tulyayogitā, dīpaka, prativastūpamā, dṛṣṭānta nidarśanā,vyatireka, samāsokti, aprastuta-praśaṁsā, arthāntaranyāsa, kāvyaliṅga, vibhāvanā, viśeṣokti

Syllabus *(SANSKRIT)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BSNSMAJ11T**
Course Title: **Vedic Studies**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To understand the Vedic knowledge and its implications in our society to hold and restore the Vedic values and to transmit the knowledge among the people to understand the ethos and culture of India in the light of Vedas.**

Learning Outcome: **Through the comprehensive knowledge of Vedas, the students will be able to learn the Vedic values, education and the essence of Indian culture. Thus, the Vedic values will be transmitted from one generation to another generation.**

Module- 1:

- Ṛg-veda:
- agni-sūkta (1:1 with Sāyaṇa-bhāṣya), viśvāmitra-nadī-saṁvāda (3:33), puruṣa-sūkta (10:90), nāsadīya-sūkta (10:129) vāk-sūkta(10.125)

Module-2:

- śiva-saṁkalpa-sūkta (34:1 to 6), kāla-sūkta (19:53), pañca-mahā-yajña

Module- 3:

- Ṛg-veda-bhāṣya-bhūmikā of Sāyaṇa

Syllabus *(SANSKRIT)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BSNSMAJ12T**
Course Title: **Pāṇinian Grammar(Case-endings &Samāsa)**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To get the students know the sūtras of kāraka based on Siddhānta-kaumudī and the sūtras of Samāsa based on Laghu-siddhānta-kaumudī. This course aims to develop the grammatical skills to construct Sanskrit sentences and to be acquainted with the st**
Learning Outcome: **This section provides disciplinary knowledge. Understanding the sūtras of kāraka and also developing skills in scientific writing and effective presentation skills. Understanding the sūtras of samāsa also developing conversational competence and commu**

Module-1:

- Siddhānta-kaumudī:
- Kāraka-prakaraṇa

Module-2:

- Laghu-siddhānta-kaumudī:
- Samāsa-prakaraṇa

Syllabus *(SANSKRIT)*

Course Type: **MAJ-13**
Semester: **7**
Course Code: **BSNSMAJ13T**
Course Title: **Khaṇḍa-kāvya & Vedānta Philosophy**
(L-P-Tu): **5-0-1**
Credit: **6**

Practical/Theory: **Theory**
Course Objective: **To make the students aware of the khaṇḍa-kāvyas. To give a conception of the Vedānta philosophy.**
Learning Outcome: **The students will be acquainted with dūta-kāvyas and advaita-vedānta philosophy advocated by Śaṁkarācārya.**

Module-1:

- Megha-dūta

Module-2:

- Vedānta-sāra

Syllabus *(SANSKRIT)*

Course Type: **MAJ-14**
Semester: **8**
Course Code: **BSNSMAJ14T**
Course Title: **Philosophy of Grammar & Linguistics**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To give the students some ideas about philosophical aspects Sanskrit grammarrevealed in thetime of Patañjali. To make the students aware about the contribution of Indian and western linguists in its field. To give some basic ideas about modern linguisti**
Learning Outcome: **Students will gain a basic knowledge of the philosophical ideas of Pāṇinian school of Sanskrit grammar. It will create a skill to pronounce the language in a correct way. The students will gain knowledge about the basics of modern linguistics. Studying**

Module-1:

- Mahābhāṣya:
- Paspaśāhnika

Module-2:

- Contribution of Indian and Western Philologists

Module-3:

- Language:
- definition & classification
- Family of Languages:
- outline, details of Indo-European language family, special emphasis on Indo-Aryan branch& its stages of development and characteristics
- Speech Mechanism and Classification of Sounds
- Phonetic Law:
- definition, causes of phonetic change, J. Grimm, H. Grassmann, K. Verner & Colitz

Syllabus *(SANSKRIT)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BSNSMAJ15T**
Course Title: **Śāṁkhya&Yoga**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To familiar with the philosophical system. To familiar with the Yoga philosophical system. To compare between Śāṁkhya and Yoga concepts.**
Learning Outcome: **Students will gain a basic knowledge of the philosophical ideas of Sāṁkhya and Yoga schools of Sanskrit philosophy. It will create a skill to lead a peaceful and idealistic lifestyle in a desired dimension of social tolerance and equity.**

Module-1:

- Śāṁkhya-kārikā

Module-2:

- Yoga-darśana:
- Samādhi-pāda

Syllabus *(SANSKRIT)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BSNSMAJ16T**
Course Title: **Mīmāṁsā & Nyāya**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To make the students acquainted with the Mīmāṁsāphilosophy. To make the students acquainted with anumāna pramāṇa, śābda-bodha according to Nyāya-vaiśeṣika.**
Learning Outcome: **By studding this course, the students will be able to know how to determine the vākyārtha as per the theories of Mīmāṁsā philosophy in comparison with that of the Nyāya-vaiśeṣika philosophy and will be acquainted with the glimpses of Indian log**

Module-1

- Artha-saṁgraha of Laugākṣi Bhāskara

Module-2:

- Bhāṣā-pariccheda:
- Anumāna-khaṇḍa and Śabda-khaṇḍa (with the general acquaintance of Siddhānata-muktavalī)

Syllabus *(SANSKRIT)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BSNSMAJ17T**
Course Title: **Veda & Grammar**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To make the students to aware different interpretation of Vedic texts. To make the students aware of the formation of sub-anta and tiṅ-anta words in**
Learning Outcome: **This course will help the students to understand various meanings of the same Vedic texts and acquire about the detail formation of sub-anta and tiṅ-anta words.**

Module-1

- Schools of Vedic Interpretation:
- Indian: Yāska, Anirvāṇa, Rameśachandra Datta, Madhusūdana Ojhā, Sāyaṇa, Dayānanda Sarasvatī, Uvaṭa, Mahīdhara, Aravinda, Tilaka, Sātavalekara, R. N. Dandekar, Sri Aurovinda and Satyabrata Samashramin etc.
- Western: Friedrish Rogan, Theodor Aufretch, A. B. Kieth, MaxMüller, Bloomfield, Weber, Jacobi, Winternitz, Roth, Griffith, Wilson, Whitney, Jan Gonda etc.

Module-2

- Formation of Subanta:
- sub-anta:-rāma, sarva (in three genders)

Module-3

- Formation of tiṅ-anta:-
- tiṅ-anta- Bhū, Edh.

Syllabus *(SANSKRIT)*

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BSNSMAJ18T**
Course Title: **Kāvya & Darśana**
(L-P-Tu): **5-0-1**
Credit: **6**
Practical/Theory: **Theory**
Course Objective: **To understand the nature of Rasa, to make the students acquainted with modern Sanskrit drama to provide general ideas about the doctrines of Nāstika philosophy.**
Learning Outcome: **By studying this course students will be able to get ideas about the nature of rasa, modern Sanskrit drama and nāstika philosophy.**

Module-1

- Sāhitya-darpaṇa: (3^{rd}chapter)

Module-2

- Cipiṭaka-carvaṇa of Śrījīva Nyāyatīrtha

Module-3

- Ṣaḍ-darśana-samuccaya of Haribhadrasūri (Bauddha, Jaina and Cārvāka)

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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Syllabus & Course Curriculam

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-1**
Semester: **1**
Course Code: **BZOOMAJ01C**
Course Title: **Non-chordates and Cytogenetics**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **1. Understand basics of classification of non-chordates. 2. Learn the diversity of habit and habitat of these species. 3. Study the functional biology of non-chordates through their body organization and its function. 4. Develop the skills to identify**

Non-chordates and Cytogenetics
Theory=4 credits

Course objective: It is required to generalize about certain things and to dismiss others because the field of invertebrate biology is so extensive and runs across so many disciplinary lines that it is necessary to generalize about some topics. Classification, Structure and function were chosen as the primary focus for the curriculum that we devised for studying invertebrates so that we could establish common threads of interest. As a result, the most important objective that we have set for ourselves is to pique the students' interest in learning about the mystical world inhabited by animals that do not possess any notochords.

Genetics is one of the fastest-moving fields of science, with new discoveries being made every month. The study of genetics is timely, important, and fascinating because of the many new discoveries and applications of genetics that have substantial economic and ethical implications.

Group- A:
Non-chordates

Protozoa

1. General characteristics and Classification with examples up to phylum (according to Levine et. al., 1981)
2. Conjugation in *Paramoecium*.

Porifera

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
2. Canal system in sponges

Cnidaria

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
2. Metagenesis in *Obelia*

Ctenophora

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)

Platyhelminthes

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
2. Life cycle and pathogenicity and control measures of *Fasciola hepatica*

Nematoda

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
2. Life cycle, pathogenicity and control measures of *Wuchereria bancrofti*

Annelida

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
2. Excretion in Annelida through nephridia.

Arthropoda

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
2. Metamorphosis in Lepidopteran Insects.
3. Respiration in Arthropoda (Gills in prawn and trachea in cockroach)

Mollusca

1. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
2. Nervous system and Torsion in Gastropods

Onychophora

1. General characteristics and Evolutionary significance

Echinodermata

2. General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)
3. Water-vascular system in Asteroidea

Hemichordata

General characteristics and Classification with examples up to classes (Ruppert and Barnes, 1994, 6th Edition)

Different larval forms of Invertebrates

Group B:
Cytogenetics

Overview of Cells

Basic structure of Prokaryotic and Eukaryotic cells

Nucleus

1. Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus
2. Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome)

Cell Division: Mitosis and Meiosis: Basic concept and their significance.
Mendelian Genetics and its Extension

1. Principles of inheritance, Incomplete dominance and co-dominance, Epistasis Multiple alleles, Lethal alleles, Pleiotropy.
2. Sex-linked, sex- influenced and sex-limited inheritance, Polygenic Inheritance.

Linkage, Crossing Over and Chromosomal Mapping

1. Linkage and Crossing Over, molecular basis of crossing over, Measuring Recombination frequency and linkage intensity using three factor crosses, Interference and coincidence

Sex Determination

1. Mechanisms of sex determination in *Drosophila*
2. Sex determination in mammals
3. Dosage compensation in *Drosophila* & Human

Chromosomal disorder

1. Down syndrome, Turner syndrome, Klinefelter syndrome

Practical 2 Credits

Group A: Non-chordates

1. **Identification with reason:**

Protozoa: *Amoeba, Euglena, Opalina, Paramecium*
Porifera: *Sycon,* Neptune's Cup
Cnidaria: *Obelia, Physalia, Aurelia, Gorgonia, Metridium, Pennatula, Fungia*
Platyhelminthes: *Fasciola hepatica, Taenia solium*
Nematoda: *Ascaris lumbricoides*
Annelida: *Aphrodite, Nereis, Sabella, Serpula, Hirudinaria*
Arthropoda: *Limulus, Daphnia, Balanus, Cancer, Eupagurus, Bombyx, Periplaneta*
Mollusca: *Chiton, Pila, Doris, Unio, Pinctada, Sepia, Octopus*
Echinodermata: *Pentaceros/Asterias, Ophiura, Cucumaria*
Hemichordata: *Balanoglossus*
2. Study of digestive system and septal nephridia of earthworm
3. Mount of mouth parts and dissection of digestive system of cockroach
4. Staining/mounting of any protozoa from gut of cockroach

Group B: Cytogenetics

1. Chi-square analyses
2. Pedigree analysis of some human inherited traits
3. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
4. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.

Laboratory Note Book must be prepared on day-to-day basis and should be signed by the concerned teacher immediately after the laboratory work. The Laboratory Note Book should contain all the items in the syllabus and must be submitted on the day of examination.

Reference Books:

Group A: Non-chordate

Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.

Invertebrates by Brusca & Brusca. Second edition, 2002.
The Invertebrates: A New Synthesis, III Edition, Blackwell Science.

Group B: Cytogenetics

Lewin's Cells – 3rd Edition – Cassimeris/Lingappa/Plopper – Johns & Bartlett Publishers
Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc
Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition.
Benjamin Cummings

- Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition. Benjamin Cummings
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.

Syllabus *(ENVIRONMENTAL SCIENCE)*

Course Type: **VAC-1**
Semester: **1**
Course Code: **BVACENV01T**
Course Title: **ENVIRONMENTAL STUDIES**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **To develop Basic concept and awareness on environment, different environmental issues To develop understanding of Natural resources, ecology ecosystem, To impart knowledge on biodiversity and its conservation To enhance knowledge about envir**
Learning Outcome: **This compulsory paper has been introduced to produce general awareness regarding Environment, its problems, possible management processes, basic need for environmental studies, practical knowledge of environment related project works etc. among students**

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & Tribal population, Deforestation and its effects
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification
- Use of resources for sustainable development

Unit 3: Ecology and Ecosystems (08)

Concept of ecology, Population ecology, Community ecology

- Concept of an ecosystem, different types of ecosystem
- Food chains, food weds and ecological succession
- Energy flow in the ecosystem and energy flow models

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (*In- situ* and *Ex-situ)*
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

(a) Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution

(b) Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid wastes

Disaster management: Floods, Earthquake, Cyclone and Landslides

Unit 6: Environmental Policies and Practices (10) Constitutional Provisions for protecting environment-Article 48 (A), 51A (g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980
- The wildlife Protection Act, 1972
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Public awareness
- Environment movements in India: Chipko Movements, Silent Valley Movement, *Narmada Banchao Aandolan*.

Unit 8: Field Work Report/Project Report/Term paper (based on any one of the following topics and to be evaluated by internal teachers only) (05)

- Environmental assets - River/Forest/Grassland/Hill/Mountain *etc*.
- Environmental pollution - Urban/Rural/Industrial/Agricultural
- Study of common Plants/Insect /Birds/Wild life *etc*.
- Study of simple ecosystems: Pond/River/Hill slope *etc*.

Suggested Books

1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma., Rastogi Publication.
3. Fundamentals of Environmental Studies-Mahua Basu (Cambridge University Press)
4. Agrawal, Sikdar and Deb (2002): A Text book of Environment; MacMillan
5. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press2013
6. Environmental Studies; Anindita Basak; Pearson India
7. A Text Book on Environmental Studies, Goswami, Mandal, Singh; Ashok Book Stall

Course Type: **MAJ-2**
Semester: **2**
Course Code: **BZOOMAJ02C**
Course Title: **Chordate and Physiology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **1. Learn about the diversity, morphology, anatomy, and physiology of different chordate groups. 2. Comprehend the identification of species and their evolutionary relationships. 3. Understand the animal world and pursuing further studies and research th**

Semester II

Chordate and Physiology

Theory= 4 credits

Course objective: Chordate biology helps students gain an awareness and comprehension of scientific concepts that combine and reflect on how science works. As John A. Moore put it, science is the "way of knowing". The comparative anatomy of vertebrates reveals distinct differences and similarities between the organisms. Using this section of the lesson, students will learn about the exciting journey of vertebrates and how evolution has shaped them to fit the demands of their surroundings.

The study of the structural and functional plans found in animals is known as animal physiology. Understanding how animals' function on all levels as a whole integrated organism, from cells to tissues to organs, can be aided by knowledge gained through the study of animal physiology. Clarifying the functions of all cells in all organs and all animals in relation to the neurological, respiratory, circulatory, muscular, cellular communication, and transport systems, as well as any other physiological systems, falls under the purview of the scientific discipline known as physiology.

Group A:

Chordate

1. General characteristics of Phylum Chordata

2. Classification with characteristic features and examples with scientific names of:

a. Up to Classes: Sub-Phyla Urochordata and Cephalochordata – as per J. Z. Young (1981)
b. Up to Order: Superclass Agnatha – as per J. Z. Young (1981)
c. Up to Sub-classes: Series: Pisces– as per J. S. Nelson (1994); and Aves – as per J. Z. Young (1981)
d. Up to living Orders: Amphibia – as per Duellman and Trueb (1986),
e. Up to living Orders: Reptilia and Mammalia – as per J. Z. Young (1981)
    1. Retrogressive metamorphosis in *Ascidia.*

3. Type study of Chordata: *Branchiostoma*
4. Anatomical peculiarities, distribution and evolutionary significance of Dipnoi
5. Metamorphic Events in Frogs Life cycle
6. Neoteny and Paedogenesis
7. Anatomical peculiarities, distribution and importance of Sphenodon
8. Salient features and affinities of Monotremata

Group B:

Physiology

1. **Physiology of Digestion**

Structural organization and functions of gastrointestinal tract and associated glands, Physiology of digestion and absorption of protein, carbohydrates and lipid

2. **Physiology of Respiration**

Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it

3. **Physiology of Circulation**

Composition and constituents of blood, Blood groups and Rh factor, Factors and mechanisms of coagulation, Structure of heart, Origin and conduction of the cardiac impulse and Cardiac cycle

4. **Physiology of Excretion**

Structure of nephron and urine formation, Counter current mechanism

5. **Physiology of Nerve**

Structure of neuron, conduction of nerve impulse, Synaptic transmission, Neurotransmittors

6. **Physiology of Muscles**

Types of muscles and mechanism of contraction of skeletal muscles, Effects of exercise on muscles.

7. **Physiology of Reproduction**

Histology of testis and ovary (mammalian), Physiology of Reproduction (mammalian)

8. **Endocrine System**

Histology and hormonal function of pituitary, thyroid, pancreas and adrenal

UGZOOMJP201: Practical 2 Credits

Group A: Chordate

1. **Identification with reason:**

Protochordata: *Ascidia, Doliolum, Branchiostoma*
Agnatha: *Petromyzon, Myxine*, Ammocoete larva
Chondrichthyes & Osteichthyes: *Scoliodon, Torpedo, Hippocampus, Heteropneustes, Clarias, Exocoetus, Syngnathus*
Amphibia: Tadpole*, Bufo, Rana, Ambystoma, Rhacophorus, Necturus, Hyla, Alytes, Axolotl* larva*, Pleurodeles (=Tylototriton)*
Reptilia: Chelone, *Trionyx, Hemidactylus, Varanus, Draco, Typhlops, Chamaeleo, Naja , Ptyas, Daboia (=Vipera), Hydrophis*
Aves: *Psittacula, Passer, Pycnonotus, Alcedo*
Mammalia: *Pteropus, Funambulus, Suncus*

2. Pecten of Fowl
3. Dissection of Tilapia: Digestive system, Brain, pituitary, urinogenital system

Group B: Physiology

1. Preparation of temporary mounts: Squamous epithelium
2. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues
3. Differential count of blood of man

4. ABO and Rh Blood group testing

5. Recording of blood pressure using a sphygmomanometer

Laboratory Note Book must be prepared on day-to-day basis and should be signed by the concerned teacher immediately after the laboratory work. The Laboratory Note Book should contain all the items in the syllabus and must be submitted on the day of examination.

Reference Books:

Group A: Chordate

Hildebrand, M. (1995). Analysis of Vertebrate Structure. John Wiley & Sons.

Chaki, K.K. Kundu, G. & Sarkar, S. (2005). Introduction to General Zoology. Vol. 1. New Central Book Agency (P) Ltd. Kolkata.

Jordan, E.L. & Verma, P.S. (2003). Chordate Zoology. S. Chand & Company Ltd. New Delhi.

Sinha, K. S., Adhikari, S., Ganguly, B. B. & Bharati Goswami, B. D. (2001). Biology of Animals. Vol. II. New Central Book Agency (p) Ltd. Kolkata.

Parker, T. J. & Haswell, W. (1972). Text Book of Zoology, Volume II: Marshall and Willam (Eds.) 7th Ed. Macmillan Press, London.

Young, J. Z. (1981). The Life of Vertebrates. 3rd Ed. ELBS.

Chatterjee and Chatterjee Practical Zoology

Ghosh, K.C. and Manna, B. (2015): Practical Zoology, New Central Book Agency, Kolkata

Sinha, J.K. , Chatterjee, A.K. and P. Chattopadhyay Advanced Practical Zoology

Group B: Physiology

Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.

Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons

Christopher D. Moyes, Patricia M. Schulte 2016 Principles of Animal Physiology. 3rd Edition, Pearson Education.

Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

Semester II

Chordate and Physiology

Theory= 4 credits

Course objective: Chordate biology helps students gain an awareness and comprehension of scientific concepts that combine and reflect on how science works. As John A. Moore put it, science is the "way of knowing". The comparative anatomy of vertebrates reveals distinct differences and similarities between the organisms. Using this section of the lesson, students will learn about the exciting journey of vertebrates and how evolution has shaped them to fit the demands of their surroundings.

The study of the structural and functional plans found in animals is known as animal physiology. Understanding how animals' function on all levels as a whole integrated organism, from cells to tissues to organs, can be aided by knowledge gained through the study of animal physiology. Clarifying the functions of all cells in all organs and all animals in relation to the neurological, respiratory, circulatory, muscular, cellular communication, and transport systems, as well as any other physiological systems, falls under the purview of the scientific discipline known as physiology.

Group A:

Chordate

1. General characteristics of Phylum Chordata

2. Classification with characteristic features and examples with scientific names of:

a. Up to Classes: Sub-Phyla Urochordata and Cephalochordata – as per J. Z. Young (1981)

b. Up to Order: Superclass Agnatha – as per J. Z. Young (1981)
c. Up to Sub-classes: Series: Pisces– as per J. S. Nelson (1994); and Aves – as per J. Z. Young (1981)
d. Up to living Orders: Amphibia – as per Duellman and Trueb (1986),
e. Up to living Orders: Reptilia and Mammalia – as per J. Z. Young (1981)
    1. Retrogressive metamorphosis in *Ascidia.*

3. Type study of Chordata: *Branchiostoma*
4. Anatomical peculiarities, distribution and evolutionary significance of Dipnoi
5. Metamorphic Events in Frogs Life cycle
6. Neoteny and Paedogenesis
7. Anatomical peculiarities, distribution and importance of Sphenodon
8. Salient features and affinities of Monotremata

Group B:
Physiology

1. **Physiology of Digestion**

Structural organization and functions of gastrointestinal tract and associated glands, Physiology of digestion and absorption of protein, carbohydrates and lipid

2. **Physiology of Respiration**

Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it

3. **Physiology of Circulation**

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7. **Physiology of Reproduction**

Histology of testis and ovary (mammalian), Physiology of Reproduction (mammalian)

8. **Endocrine System**

Histology and hormonal function of pituitary, thyroid, pancreas and adrenal

Practical 2 Credits

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Protochordata: *Ascidia, Doliolum, Branchiostoma*
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Semester II

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Practical 2 Credits

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Syllabus *(ENGLISH)*

Course Type: **AEC-1**
Semester: **2**
Course Code: **BAECLEN02T**
Course Title: **Communicative English**
(L-P-Tu): **4-0-0**
Credit: **4**
Practical/Theory: **Theory**
Course Objective: **The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.**
Learning Outcome: **In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.**

Ability Enhancement Course (AEC)- 4 credits

Semester II

Communicative English

The purpose of this course is to introduce students to the tools of English communication and to develop in them vital communication skills.

In the backdrop of fast globalization and growing recognition of socio-cultural pluralities, the implication of clear and effective communication has considerably enhanced. The present Ability Enhancement Course, which are compulsory for all the UG students of aii the streams and all the major subjects, hopes to address this aspect through a re-emphasizing and re-focusing on various aspects of grammar and comprehension.

Grammar:

1. Voice Change
2. Narration Change
3. Transformation of Sentences
4. Error Correction

Comprehension: Comprehension test from unseen passages

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-3**
Semester: **3**
Course Code: **BZOOMAJ03C**
Course Title: **Ecology and Evolution**
(L-P-Tu): **4-2-0**

Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **• Become familiar with the variety of ways that organisms interact with both the physical and the biological environment. • Develop an understanding of the differences in the structure and function of different types of ecosystems. • Learn techniqu**

Ecology and Evolution

Theory - 4 credits

Objectives:

Ecology deals with concept of ecosystem. The goal of this course to understand the basics of ecology. It includes population growth models, population genetics, community characteristics ecological succession etc. These disciplines of ecology help to develop an appreciation of the modern scope of scientific inquiry in the field of ecology and develop an understanding of the differences in the structure and function of different types of ecosystems.

In evolutionary study it aims to acquire knowledge about the evolutionary history of earth - living and non-living, to acquire basic understanding about evolutionary concepts and theories. It also includes the distribution of animals on earth, its pattern, evolution and causative factors which impart basic knowledge on animal behavioural patterns and their role.

. Group A:
Ecology

Theory

- Concept of ecosystem – Structure and function.

Autecology and synecology, levels of organization, laws of limiting factors.
Linear and Y-shaped food chains, food web, energy flow, ecological pyramids and ecological efficiencies.

- Population attributes – Demographic factors.

Life tables, fecundity tables.
Survivorship curves.
Dispersal and dispersion.
Age distribution.

- Population growth models – Natality and mortality.

Geometric, exponential and logistic growth, equation, deduction and patterns.
r and K strategies.
Density dependent and independent factors.

- Population interactions – Emergence of competition by Tansley, Gause and Park.

Competition exclusion principle.
Intraspecific and interspecific competition.
Lotka-Volterra model.

- Community characteristics and resource partitioning.

Species diversity, abundance, dominance, richness, ecotone and edge effect.

- Ecological succession – Types of ecological succession with examples.

Concept of climax.
Connell and Slatyer model of succession.
Tilman’s resource ratio hypothesis.

- Types of ecosystem with an example (in detail) – Freshwater and tropical rainforest.
- Resource utilization – Coupled oscillation of predator and prey population modeling.

Group B:
Evolution

Theory

- Life's beginnings – RNA world hypothesis.

Origin of life (Chemical origin only).

- Historical review of Evolutionary concepts – Lamarkism, Darwinism and Neo Darwinism, Neutral theory of molecular evolution, punctuated equilibrium.
- Natural selection – concept of fitness, types of selection, selection coefficient, mode of selection heterozygous superiority.

Synthetic theory.
Concept of selection: stabilizing, directional and disruptive with example.

- Population genetics – Hardy-Weinberg law, statement and derivation of equation, application of law to biallelic population.

Calculating allele and genotype frequency.
Evolutionary forces upsetting H-W equilibrium.
Mathematical calculation of frequency changes in mutation, and migration.
LOD score

- Genetic drift mechanism – founder's effect and population bottleneck phenomenon.
- Species concept – Isolating mechanisms, modes of speciation.
- Zoogeographical realms – names and animal distribution according to Wallace scheme, Avian and Mammalian faunal distribution in different realms.
- Colouration and mimicry (Batesian and Müllerian mimicry).
- Adaptation – Fossorial, cursorial, scansorial and arboreal.
- Adaptive radiation/macroevolution of beak of Galapagos finches.
- Geological time scale and Zoogeographical realms.

Molecular clock.
Fossil records of hominids (from *Australopithecus* to *Homo sapiens*), molecular analysis of human origin.

- Phylogenetic trees – Construction and interpretation of phylogenetic tree using parsimony.

Convergent and divergent evolution.

Practical - 2 credits

Ecology and Evolution

- Study of life tables and plotting of survivorship curves of different types from the hypothetical / real data provided.
- Determination of population density in a natural / hypothetical community by quadrat method and calculation of Shannon-Wiener diversity index for the same community.

- Study of an aquatic ecosystem - Quantitative and qualitative estimation of freshwater zooplankton, Measurement of Temperature, Transparency of light by Secchi disc, Determination of pH, and Dissolved O_2 content (Winkler's method), Chemical oxygen demand (COD) and free CO_2.
- Report on a visit to National Park / Biodiversity Park / Wild life sanctuary / Sea coast.
- Study of fossils from models / pictures.
- Study of homology and analogy from suitable specimens.
- Study and verification of Hardy-Weinberg Law by chi square analysis.
- Graphical representation and interpretation of data of height / weight of a sample of minimum 100 humans in relation to their age and sex.

References

Group A: Ecology

Krebs, C.J. (2014). Ecology: The Experimental Analysis of Distribution and Abundance, 6th Edition.

Odum, E.P. (2008). Fundamentals of Ecology, 2nd Edition.

Smith, R.L. (1998). Ecology and Field Biology.

Stilling, P. (2012). Ecology: Global Insights and Investigations.

Bowman, W.D., Hacker, S.D. and Cain, M.L. (2017). Ecology, 4th Edition.

Ricklefs, R.E. and Miller, G.L. (2001). Ecology, 4th Edition.

Smith, T.M. and Smith, R.L. (2012). Elements of Ecology, 8th Edition.

Group B: Evolution

Campbell, N.A. and Reece, J.B. (2011). Biology, 9th Edition.

Futuyma, D.J. (2005). Evolution.

Moody, P.A. (1962). Introduction to Evolution, 3rd Edition.

Rastogi, V.B. (2012). Organic Evolution, 13th Edition.

Ridley, M. (2004). Evolution, 3rd Edition.

Russell, P.J. (2016) iGenetics: A Molecular Approach, 3rd Edition.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-4**
Semester: **4**
Course Code: **BZOOMAJ04C**
Course Title: **Molecular Biology and Developmental Biology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **On completion of this subject, students should be able to: • Describe the core principles of molecular biology. • Describe the genetic structure and types of chromatins. • Elucidate the types, damage and repair of DNA, types of RNAs, genetic code, U**

Molecular Biology and Developmental Biology

Theory - 4 credits

Practical - 2 credits

Objective

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course (Group A) will emphasize the molecular mechanisms of DNA replication, repair, protein synthesis. In the part of developmental biology (Group B) student will gain a detailed understanding of the molecular, biochemical and cellular events that regulate the development of specialised cells, tissues and organs during embryonic development. In particular, cell signalling pathways that regulate embryonic induction, tissue interactions and pattern formation, and expression of regulatory genes. A particular focus is the experimental strategies and techniques that are used to identify molecular and cellular mechanisms of development.

Group A:

Molecular Biology

Theory

- Nucleic acids - Salient features of DNA, Chargaff's Rule, Hypo and Hyperchromic shift. Watson and Crick Model of DNA. RNA types and Function.
- DNA replication - Mechanism of DNA replication in prokaryotes, Semi-conservative, bidirectional and discontinuous replication, RNA priming, Replication of telomeres.
- Transcription - Mechanism of transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.
- Translation - Genetic code, Degeneracy of the genetic code and Wobble hypothesis. Mechanism of protein synthesis in prokaryotes.
- Post transcriptional modifications and processing of eukaryotic RNA - Capping and Poly A tail formation in mRNA, Split genes, concept of introns and exons, splicing mechanism, alternative splicing and RNA editing.
- Gene regulation - Regulation of transcription in prokaryotes, *lac* operon and *trp* operon.
- Regulation of transcription in eukaryotes - Activators, enhancers, silencer, repressors, miRNA mediated gene silencing.
- Epigenetic regulation - DNA methylation, Histone methylation and acetylation.
- DNA repair mechanisms - Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair.
- Molecular techniques - PCR, Western and Southern blot, Northern Blot.

Group B:

Developmental Biology

Theory

- Basic concepts developmental biology - Phases of development, Cell - cell interaction, Differentiation and growth, Differential gene expression.
- Gametogenesis: Spermatogenesis, Oogenesis (sea urchin and mammal).
- Types of eggs, Egg membranes.
- Fertilization in sea urchin and mammal.

- Planes and patterns of cleavage, Types of Blastula (frog and chick).
- Fate map in chick embryo, fate mapping using vital dye and radioactive technique.
- Gastrulation in frog and chick.
- Embryonic induction and organizers in *Xenopus* (Spemann and Mangold's experiment).
- Extra-embryonic membranes in chick.
- Implantation of embryo in humans, Placenta (structure, types and functions of placenta).
- Development of brain and eye in chick, molecular induction in brain and eye development.
- Regeneration - Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each).

Practical - 2 credits

Group A: Molecular Biology

1. Demonstration of polytene from *Drosophila* larva and lampbrush chromosome from photograph.
2. Isolation and quantification of genomic DNA using spectrophotometer (A260 measurement).
3. Agarose gel electrophoresis for DNA.

Group B: Developmental Biology

1. Study of whole mounts of developmental stages of chick through permanent slides - 24, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages).
2. Study of different sections of placenta (photomicrograph/ slides).
3. Study of the developmental stages and life cycle of *Drosophila* (Visual simul;ation/slides/photo).

References: Group A: Molecular Biology

Lodish, H. et al. (2013). Molecular Cell Biology, 7th Edition.

Watson, J.D. et al. (2013). Molecular Biology of the Gene, 7th Edition.

Russell, P.J. (2016) iGenetics: A Molecular Approach, 3rd Edition.

Twyman, R.M. (1998). Advanced Molecular Biology.

Group B: Developmental Biology

Gilbert, S.F. and Barresi, M.J.F. (2016). Developmental Biology, 11th Edition.

Slack, J.M.W. (2013). Essential Developmental Biology, 3rd Edition.

Wolpert, L. et al. (2002). Principles of Development, 2nd Edition.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-5**
Semester: **4**
Course Code: **BZOOMAJ05C**
Course Title: **Parasitology and Immunology**
(L-P-Tu): **4-2-0**
Credit: **6**

Practical/Theory: **Combined**

Course Objective:

Learning Outcome: **At the end of the course, students should be able to: 1. Identify the different types of parasites. 2. Classify parasites causing diseases to humans. 3. Assess the reasons of infections with parasites. 4. Explain the life cycles of various parasites. 5. D**

Parasitology and Immunology

Theory - 4 credits

Course Objectives:

1. To provide students with knowledge regarding parasitological terms, types of parasites and host parasite relationship.
2. To provide students with knowledge concerning biological and epidemiological aspects of parasites causing diseases to humans.
3. To enable students to understand the pathogenesis, clinical presentations and complications of parasitic diseases.
4. To enable students to learn diagnosis and know the general outline of treatment, prevention and control of parasitic infections.
5. To provide students with knowledge regarding basic idea of zoonosis and zoonotic diseases. To provide an adequate knowledge about the basic concepts of health and diseases.
6. To provide students with knowledge regarding cells and organs of the immune system.
7. To enable students to understand the innate and adaptive immunity.
8. To provide students with knowledge about antigens and immunoglobulins.
9. To enable students to understand the antigen-antibody interactions and monoclonal antibody production.
10. To provide an adequate knowledge regarding vaccines and autoimmune diseases.

Group A:
Parasitology

Theory

- Introduction to parasitology - Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector), Host parasite relationship.
- Parasitic protists – Parasitic adaptation and study of morphology, life cycle, prevalence, epidemiology, pathogenicity, diagnosis, prophylaxis and treatment of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*, *Plasmodium* sp.
- Parasitic helminthes - Parasitic adaptation and study of morphology, life cycle, prevalence, epidemiology, pathogenicity, diagnosis, prophylaxis and treatment of *Schistosoma haematobium*, *Taenia solium, Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti.*
- Parasitic arthropods - Biology, importance and control of ticks (soft tick *Ornithodoros,* hard tick *Ixodes*), lice (*Pediculus*), and bug (*Cimex*).
- Basic idea on zoonosis and zoonotic diseases.

Group B:
Immunology

Theory

- Overview of immune system - Basic concepts of health and diseases, Historical perspective of immunology, Cells and organs of the immune system.
- Innate and adaptive immunity - Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral).

- Antigens - Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens.
- Immunoglobulins - Structure and functions of different classes of immunoglobulins, Antigen- antibody interactions, Monoclonal antibody production
- Immunology of diseases – Autoimmune diseases (rheumatoid arthrites and Type I diabetes)
- Vaccines - Various types of vaccines. Active and passive immunization (Artificial and natural).

Practical - 2 credits

Group A: Parasitology

- Study of life stages of *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*, *Taenia solium*, *Ancylostoma duodenale*, through permanent slides / micro photographs.
- Study of *Pediculus humanus*, *Xenopsylla cheopis* and *Cimex lectularius* through permanent slides / photographs.
- Study of nematode / cestode parasites from the intestines of poultry bird.

Group B: Immunology

- Demonstration of lymphoid organs.
- Histological study of spleen, thymus and lymph nodes through slides / photographs.

References

Group A: Parasitology

Arora, D.R and Arora, B. (2001). Medical Parasitology, 2nd Edition.

Noble, E.R. and Noble, G.A. (1982). Parasitology: The Biology of Animal Parasites, 5th Edition.

Ahmed, N. et al. (2007). Biology of Disease.

Parija, S.C. (2013). Textbook of Medical Parasitology, Protozoology and Helminthology, 4th Edition.

Ichhpujani, R.L. and Bhatia, R. (2003). Medical Parasitology, 3rd Edition.

Dailey, D. (1996). Meyer, Olsen and Schmidt's Essentials of Parasitology.

Chatterjee, K.D. (2009). Parasitology: Protozoology and Helminthology. 13th Edition.

Group B: Immunology

Kuby, J. et al. (2006). Immunology, 6th Edition.

Abbas, K. et al. (2003). Cellular and Molecular Immunology, 5th Edition.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-6**
Semester: **5**
Course Code: **BZOOMAJ06C**
Course Title: **Taxonomy and Biostatistics, Biophysical techniques and Bioinformatics**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Students will have learning about the basic taxonomy and systematics and classification of animal kingdom. In this course students will also learn about various data analyzing tools and techniques such as**

central tendency, t-test, chi-square, ANOVA, corre

Taxonomy and Biostatistics, Biophysical techniques and Bioinformatics

Theory=4 credits

Course objective: Taxonomy is the science of classification in general, but more specifically the classification of living and extinct organisms—i.e., biological classification. The term comes from the Greek words taxis (arrangement) and nomos (law). Taxonomy is thus the methodology and principles of systematic Botany and Zoology that organizes plant and animal species into hierarchies of superior and subordinate groups. In 1813, the Swiss botanist Augustin Pyramus de Candolle proposed the term for plant classification. This course is designed to clear the basic fundamental idea regarding traditional and molecular taxonomy. In the portion of Biostatistics, the students will have an exposure on the basic statistical tools that are an essential part of modern biological research.

The second unit of this course provides some of the most important and fundamental analytical tools used in Biological Sciences that will engorge the students with technical knowledge that could help them in better understanding of biological processes in broad range.

Group A:
Taxonomy and Biostatistics

1. **Basics of Animal Classification**
    1. Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types
    2. Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Six kingdom concept of classification (Carl Woese)
    3. Introduction to phylogenetics

2. Statistical approach to biological sciences

2.1. Concept of data and distribution

2.1.1. Definition of data.

2.1.2. Concept of qualitative, quantitative, discrete, continuous, nominal, ordinal, interval and ratio data.

2.1.3. Types of distribution: Normal, skewed, uniform, symmetric bimodal, non-symmetric bimodal, spread, spread with outlier.

2.1.4. Basic concept and types of Kurtoses.

2.2. Probability and its use in Biological Sciences

2.2.1. General concept of probability.

2.2.2. The sum rule and the product rule.

2.2.3. Usage of probability in Biological Sciences (Genetics mainly).

2.3. Analytical Methods

2.3.1. Correlation, Regression t Test, and chi square test

Group B:
Biophysical techniques and Bioinformatics

1. Biophysical techniques:

1.1. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties)

1.2. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds), stability of proteins.

1.3. Conformation of nucleic acids [helix (A, B, Z), t-RNA, micro-RNA], stability of nucleic acid

1.4. Microscopy: SEM, TEM, Confocal, Phase-Contrast, DIC, FRET, Fluorescence.

1.5. Imaging Technique: PET, CT, MRI.

1.6. Electro-measurement: ECG, EEG.

1.7. Concepts and principles of Colorimetry, Spectroscopy, & Elementary Crystallography.

2. Bio-informatics:

2.1.Basic concept of Bioinformatics: Goals, scope, application and limitations.

2.2. Biological databases: Primary, secondary, and specialized databases.

2.3. Pitfalls of biological databases

practical Group A and B- 2 credits

Biostatistics, Analytical tools and Bio-informatics:

1. Calculation of mean, median, mode, standard deviation, and standard error (both manually and using software).
2. Construction of bar diagrams and pie diagrams using software.
3. Submission of a project report on field generated data with application of at least one statistical tool (i.e. correlation, regression, t Test, mean, median, mode, standard deviation, and standard error)
4. Basic concept and demonstration of BLAST and primer design
5. Demonstration of tools used in biomedical research (Phase contrast microscope, flow cytometer FACS, GC MS, qRT PCR)
6. Basic concept and demonstration of BLAST and primer design

Reading References:

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Invertebrates by Brusca &Brusca. Second edition, 2002.
3. Essential Bioinformatics by Jin Xiong, 1st Edition, 2006, Cambridge University press
5. Biostatistics: A guide to design, analysis and discovery by Ronald Forthofer Eun Lee Mike Hernandez, 2nd Edition, 2006, Academic Press (Elsevier)
6. Nelson, D. L. & Cox. M. M. (2004). Lehninger's Principles of Biochemistry. 2nd ed., Macmillan Worth Publishers.
7. Wilson, K. & Walker, J. (1999). Practical Biochemistry: Principles and Techniques. Fifth Edition. Cambridge University Press

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-7**
Semester: **5**
Course Code: **BZOOMAJ07C**
Course Title: **Economic Zoology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Economic Zoology: In this section students will learn about the concepts and methods of aquaculture, sericulture apiculture, lac culture and poultry farming. They will also learn the methods of integrated pest management. After learning such concepts and**

Economic Zoology

Theory=4 credit

Course Objective: Mother Nature offers us a plethora of animal diversity, and if we are able to conserve them properly they could generate a source of income being exploited for the betterment of mankind. Thus, studying Aquaculture, Sericulture, Lac Culture, Apiculture and Poultry farming are the burning topics of the day especially in view of population explosion and need of more animal protein and other animal products. Additionally, pest management is another big issue that will be addressed.

Economic Zoology

Theory

1. Aquaculture

- Aquaculture resources in India
- Fish culture

- Prawn culture

Sericulture

- Types of silk
- Silkworms and their host plants
- Life cycle of *Bombyx mori*
- Structure of silk gland and secretion of silk
- Natural enemies and their control and prevention of pests and diseases.

Apiculture

- History, Classification and Biology of Honey Bees.
- Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth
- Diseases and Enemies of Honey bees
- Control and Preventive measures
- Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis)

Lac culture

- Lac insect and its life cycle
- Cultivation of lac insect host plants, processing and uses of lac.

5.Poultry

- Types of breeds (fowl)
- Rearing method
- Diseases and control measures

6. **Pest control methods**.

- Basic idea of Pest control
- Life history, damage and control of the following pests *Apion corchori* and *Sitophilus oryzae*
- Principles of Integrated Pest Management (IPM).

Reference Books

- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988
- Shukla and Upadhyaya : Economic Zoology (Rastogi Publishers, 1999-2000)
- Shrivastava: Test book of Applied Entomology, Vol. I &II (Kalyani Publishers, 1991)
- Mani: Insects, NBT, India, 2006.
- Jabde: Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture,
- Agricultural Pests and their Control , 2005 Publisher Vedams eBooks (P) Ltd. New Delhi
- Bisht D.S., Apiculture, ICAR Publication.
- Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.

Practical - 2 credits

- Visit to local fish culture site to study the fish culture methods.
- Water quality criteria for Aquaculture: Assessment of pH, conductivity, Total solids, Total dissolved solids
- Visit to Sericulture Information Linkages and Knowledge System centre to get knowledge about Sericulture.
- Study of life cycle of honey bee through chart or specimens/ Study of life cycle of lac insect through chart.

- Visit to local poultry to study the rearing methods.
- Submission of a project report on industrial visits and educational tour at least one (local fish culture site/ Sericulture Information Linkages/ local poultry)

Reference books

1. Conserving Forest Biodiversity: A Comprehensive Multiscaled Approach- David B. Lindenmayer, Jerry F. Franklin. 2013.
2. Divan Rosencraz, Environmental laws and policies in India, Oxford Publication.
3. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). *Problem-Solving in Conservation*
4. Joseph, B., Environmental studies, Tata Mc Graw Hill.
5. Michael Allabay, Basics of environmental science, Routledge Press.
6. Miller, G.T. 2002. Sustaining the earth, an integrated approach. (5th edition) Books/Cole,
7. Mohapatra Textbook of Environmental Biotechnology IK publication.
8. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole.
9. Practical Approaches to the Conservation of Biological Diversity- Richard KenithBaydack, Henry Campa, Jonathan B. Haufler. 1999
10. Rana SVS, Environmenta lpollution – Health and Toxicology, Narosa Publication.
11. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press.
12. Sutherland, W.J. (2000). *The Conservation Handbook: Research, Management and*
13. Thakur, I. S., Environmental Biotechnology, I K Publication.
14. Valuation and Conservation of Biodiversity: Interdisciplinary Perspectives… Michael Markussen, Ralph Buse, HeikoGarrelts, MaríaManez Costa, Susanne Menzel, Rainer Marggraf. 2005.
15. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). *People and Wildlife, Conflict or Co-existence? Cambridge University.*

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-8**
Semester: **6**
Course Code: **BZOOMAJ08C**
Course Title: **Clinical Physiology.**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Clinical Physiology: Students will learn about basics of histology. They will also understand the physiology of muscles, nerves, reproductive systems and bone. They will learn details of endocrinology with classification of hormones, their biosynthesis, r**

Clinical Physiology.
Theory=4 credits

Course objective: Clinical Physiology is the study of life, especially how cells, tissues and organs function. It is a core and fundamental scientific discipline that underpins the health and well-being of living organisms. This paper provides a course of study in mammalian (principally human) systems and their physiology, based on the knowledge of basic physiological principles already studied in Semester II. The main objective of this paper is to expand some areas touched in Semester II and also introduce new and more complex physiological functions.

Clinical Physiology.

Tissue types

- Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue; Structure and types of bones and cartilages, Ossification

Physiology of Digestion and absorption

- Anatomy of digestive system
- Digestion process and adsorption.

Physiology of Cardiovascular System

- Anatomy and histology of the heart. Properties of cardiac muscle. Origin and propagation of cardiac impulse.
- Cardiac cycle: Events. Heart sounds. Heart rate. Cardiac output: Determination by following Fick principle, factors affecting, regulation.
- Structure of arteries, arterioles, capillaries, venules and veins.
- Blood pressure and its regulation and factors controlling. Baro- and chemoreceptors. Vasomotor reflexes. Measurement of blood pressure. Peculiarities of regional circulations: coronary and cerebral.

Physiology of Nervous System

- A brief outline of organization and basic functions (sensory, motor and association) of the nervous system, central and peripheral nervous system.
- Ascending tracts carrying touch, kinesthetic, temperature and pain sensations. Descending tracts: pyramidal tract and brief outline of the extra-pyramidal tracts.
- Reflex action - definition, reflex arc, classification, properties. Functions of the spinal cord. Outline of functions of brain stem.
- A brief idea of the structure, connections and functions of cerebellum. Different nuclei and functions of thalamus and hypothalamus.
- Cerebral cortex: histological structure and localization of functions.
- CSF : composition, formation, circulation and functions.
- A brief description of the organization of the autonomic (sympathetic and parasympathetic) nervous system. Functions of sympathetic and parasympathetic nervous system.
- A brief idea of speech, aphasia, conditioning, learning and memory. (Recommendation for reduction)

Physiology of Special Senses

- Classification of general and special senses and their receptors.
- Olfaction and Gustation: Structure of sensory organ, neural pathway of olfactory and gustatory sensation. Physiology of olfactory and gustatory sensation. Olfactory and gustatory adaptation. After-taste.
- Audition: Structure of ear, auditory pathway, mechanism of hearing.
- Vision: Structure of the eye. Histology of retina. Visual pathway. Light and dark adaptation. Elementary idea of colour vision. and colour blindness.

Physiology of Endocrine system

- Anatomy of endocrine system.
- Hormones – classification and mechanism of actions
- Hypothalamus: Basic concept of neurohormone. Hypothalamo-hypophyseal tract and portal system. Pituitary: Histological structure, hormones, functions.
- Thyroid: Histological structure. Functions of thyroid hormones (T_4 ,T_3). Thyrocalcitonin. Hypo and hyper-active states of thyroid.
- Parathyroid: Histological structure, functions of parathyroid hormone.
- Adrenal Cortex and Medulla: Histological structure and functions of different hormones, relation of adrenal medulla with the sympathetic nervous system.
- Pancreas: Histology of islets of Langerhans. Origin and functions of pancreatic hormones.
- Endocrine diseases and disorders od Hypothalamus, Pituitary, Thyroid. Adrenal glands and pancreas.
- Elementary idea of gastrointestinal hormones.

UGZOOMJP601: Practical 2 credits

- Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Lungs, Kidney, Thyroid and Parathyroid
- Estimation of haemoglobin using Sahli's haemoglobinometer
- Enumeration of red blood cells and white blood cells using haemocytometer
- Recording of simple muscle twitch with electrical stimulation (or Virtual)
- Measurement of blood pressure using sphygmomanometer

Reading References:

Reference Books

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Eckert Animal Physiology: Mechanisms and adaptations Randall, Burggren and FrenchVander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
- Histology: A Text and Atlas. Sixth Edition. Ross &Pawlina. Lippincott Williams & Wilkins.
- Eckert Animal Physiology by David Randall and Warren Burggren. 4th edition.
- W.H.Freeman.
- Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
- Slack JMW , Essential Developmental Biology.
- Developmental Biology: A Very Short Introduction (Very Short Introductions). Lewis Wolpert. (1st Edition)

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-9**
Semester: **6**
Course Code: **BZOOMAJ09C**
Course Title: **Biochemistry**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Biochemistry: Students will understand the basic and fundamental biochemistry of carbohydrates, proteins, lipids and nucleic acids. They will also understand the nature, mechanism, and kinetics of enzyme action. The students are expected to learn to prepa**

Biochemistry

Theory=4 credits

Course Objectives: Students in this advanced course in Biochemistry and metabolic processes will learn about thermodynamics, interplay, catalysis, how cellular reactions are possible in living systems, and how important metabolic pathways work, viz: regulation and inter-dependence of the pathways on one another, their roles in both health and disease will be studied. Enzymes, enzyme kinetics of first- and second-order processes, inhibitions, and regulators are all topics covered in the course. Biochemistry courses in

undergraduate programmes expose students to advanced topics including free radicals and their roles in living systems, growth factors, and other aspects of their own biochemistry as well.

Biochemistry

Theory:

1. Basic concept of pH, normality, morality, molality, osmolality

1.1 Protein, Carbohydrates and Lipid metabolism

1.2. Proteins: Protein folding and protein stability, Ramachandran Plot, Amino acid sequencing.

1.3. Carbohydrates: Glycolysis, Glycogenolysis, Gluconeogenesis, TCA cycle

1.4. Lipids: Biosynthesis and transport of cholesterol. 1.5. Amino- acid metabolism: Urea cycle.

2. Enzymology

2.1. Kinetic analysis of enzyme – Mechanism of enzyme catalysis

2.2. Regulation of enzyme activity

2.3.: Co-enzymes and Isoenzymes.

3. Growth and growth factors

3.1. Brief knowledge of growth factors and their mechanism of action in normal cell growth.

4. Bioenergetics

4.1. Thermodynamic principles and steady-state conditions of living organisms

4.2. Energy production and utilization, redox potential, electron transfer and oxidative phosphorylation

5. Concept of free radicals and anti-oxidants

5.1. Free radicals and antioxidants. Cytochrome p45 and other haemoproteins.

Practical:- 2 Credits

Colorimetric / Spectrophotometric estimation of Glucose, RNA, DNA and Proteins.

Demonstration of proteins separation by SDS-PAGE. **(Hands on / Virtual mode of learning)**

To study the enzymatic activity of Trypsin and Amylase.

Preparation of Normal. Molar and Standard solutions, Phosphate Buffers, Serial dilutions.

Determining the effects of substrate concentration and temperature on enzyme activity.

Estimation of sugars by any standard method

Reference Books:

1. Ganong, W. F.: Review of Medical physiology. Mc. Graw Hill.
2. Greenspan, F. S. and Gardener, F. G.: Basic and Clinical Endocrinology. McGraw Hill.
3. Larsen, P. R.; Krongberg, H. M.; Melmed, S. and Polonsky, K. S.: Williams Textbook of Endocrinology. Larsen PR, Saunders.
4. Norris, D. O.: Vertebrate Endocrinology. Academic Press.
5. Sherwood, L.: Human Physiology: From cells to systems. Thomson Brooks Cole.
6. Willmer, P. *et al*.: Physiological Adaptations. W. H. Freeman.
7. Schiemdt-Nielson, K.: Animal Physiology. Cambridge University Press.
8. Berg, J. M.; Tymoczko, J. K. and Stryer, L.: Biochemistry. W. H. Freeman & Company.
9. Metzler, D. E.: Biochemistry: The Chemical reactions of living cell..Vol. 1 & 2. Academic Press.
10. Murray, R. K.; Granner, P.; Mayes A. and Rodwell, V. W.: Harper's Illustrated Biochemistry. McGraw-Hill.
11. Nelson, D. L. and Cox, M. M.: Lehninger's Principles of Biochemistry. Macmillan Worth Publishers.
12. Switzer, R. L. and Garrity, L. F.: Experimental Biochemistry. W. H. Freeman & Company.
13. Voet, D.; Voet, J. G. and Pratt, C. W.: Fundamentals of Biochemistry. John Wiley & Sons.
14. Ernest Hodgson: A text book of Modern Toxicology. Wiley-Liss, New York.
15. Duffus, J.H. and Worth H.G.J.: Fundamental Toxicology. RSC publishing.
16. Klaassen, C. D.: Casarett & Daul's Toxicology: The Basic Science of Poisons. McGraw-Hill, New York.
17. Elliot, W. H. and Elliot, D. C.: Biochemistry and Molecular Biology. Oxford University Press.
18. Devlin, T. M.: Text Book of Biochemistry with clinical correlation, Wiley-Liss, New York.

Course Type: **MAJ-10**
Semester: **6**
Course Code: **BZOOMAJ10C**
Course Title: **Adaptation and Animal Behavior**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Adaptation and Animal behavior: Students will know in details about patterns of behaviors, survival strategies, social and cooperative behaviors, design of signals and chronobiology.**

Adaptation and Animal Behaviour

Theory=4 credits

Course Objective: Animal Behavior has been associated with educational curricula for introductory courses in biological science for more than 40 years. When it comes to studying animal behavior, a more integrated approach is needed to stay up to date with the developments in this field. This course emphasizes research that links behavior to the brain, genes and hormones as well as to environmental and social factors. It also aims to test out fresh theories on how animal behavior has evolved. Finally, its fundamental objective is to provide students with a window into the multiple levels of analysis that researchers employ to explain why all living things behave, often in complex ways

Adaptation and Animal Behaviour

Theory

1. Adaptation

- Introduction, Adaptive radiation & adaptive convergence in mammals.
- Xeric adaptation (camel and lizard), Aquatic (Whale) adaptation.
- Adaptive radiation with special reference to Darwin's finches.
- Migration of fish and bird.
- Zoogeographical realms, Plate tectonic and Continental drift theory, distribution of birds and mammals in different realms.
- Mimicry: Types, Adaptive significance.

2. Animal behaviour: Concept and classification:

- Introduction, Ethology as a branch of biology, Animal psychology.
- Classification of behavioral patterns.
- Analysis of behavior (Ethogram).
- Innate Behavior

3. Control of behavior:

- Introduction
- Neural behaviour
- Hormonal behaviour

4. Developmental behavior:

- Introduction,
- Genetic components
- Environmental components

5. Communication:

- Introduction
- Chemical, Visual, Light, Audio, Specific specificity of Songs
- Evolution of Language (primates)

6. Ecological aspects of behavior:

- Introduction
- Habitat selection, Food selection
- Optimal forage theory, Anti predation defences
- Aggression, Homing, Territoriality, Dispersal

7. Social behavior:

- Introduction
- Social behavior of group living mammals
- Group selection, Kin selection
- Example of eusociality and haplodiploidy

8. Reproductive behavior:

- Introduction
- Evolution of Sex and Reproductive strategies
- Mating systems, Courtship

9. Introduction to Chronobiology

- Historical developments in chronobiology
- Biological oscillation: the concept of Average, amplitude, phase and period, Circadian and Circa-annual rhythms,

10. Learning:

- Introduction
- Conditioning
- Habituation
- Insight learning
- Association learning
- Reasoning and Cognitive skills

Practical 2 credits

- Study of homology and analogy from suitable specimens.
- To study mimicry in insect (Using photography).
- To study the behavioural responses of wood lice to dry and humid conditions.
- To study geotaxis behaviour in earthworm.
- To study the phototaxis behaviour in insects.
- Visit to Wild life Sanctuary/Biodiversity Park/National Park/ reserves of the biosphere/ Sea cost to study behavioural activities of animals and prepare a short report.
- Study of circadian functions in humans (daily eating, sleep and temperature patterns).

Reference Books

- Alcock: Animal Behaviour: An evolutionary approach (9 ed. 2009, Sinauer)
- Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.
- David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
- Drickamer, Vessey and Jacob: Animal Behaviour (5th ed. 2002, McGraw Hill)
- Goodenough et al.: Perspectives on Animal Behaviour (1993, Wiley)

- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge,University Press, UK.
- Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-11**
Semester: **7**
Course Code: **BZOOMAJ11C**
Course Title: **Non-Chordate structure and function and Enemology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **This curriculum will provide a wide and vast understanding about the evolutionary changes of the invertebrate systems which depends upon their survival and reproduction within the natural habitat**

Non-Chordate structure and function and Enemology

Group A

Non-Chordate structure and function

Course Objective: The field of invertebrate biology is so vast and runs across so many disciplinary lines so, it is necessary to make certain generalisation and to avoid others. Structure and function are the two primary focuses for the curriculum which is necessary to build up common threads of interest among students. The first topic, structure gives the general idea about the fundamentals of functional body architecture. The second group of themes emphasises on the degree to which the structure has been adapted over time to fulfil a specific function for the organism that bears it. After the completion of this course the student's interest will be widen in knowing about the complex diversity of our living world inhabited by the animals which does not have notochord in any stage of their life cycle.

1. General Organization:

1.1. Organelles in Protozoans- Cilia, flagella, pseudopodia, vacuoles, Kinetoplast, Pellicle and skeleton.

2. Feeding and Digestion:

2.1. Nutrition in Protozoa -Types and mode of feeding.

2.2. Feeding diversity in Rotifers, Bryozoans and Echinoderms (Selected major and minor phyla)- Structural diversities.

3. Movements:

3.1. Movements in Amoeba, Annelids (Earthworm); Echinoderms (Starfish).

4. Blood Circulation:

4.1. Circulation in Earthworm, and Pila.

4.2. Types of blood circulation (open and close types).

5. Excretion:

5.1. Structure and function of kidneys in cephalopods

6. Nervous System:

6.1. Brief introduction to Nervous Organization with special reference to Cephalopods

7. Reproduction:

7.1. Budding and regeneration in Hydra and Planarians.

7.2. Invertebrate hormones of reproduction with special emphasis on Crustaceans.

8. Growth and Development:

8.1. Moulting in Crustaceans: Hormonal regulation

8.2. Larval forms in echinoderms and hemichordates.

Group B: Title: Entomology

1. Insect Diversity & Classification:

1.1. Insect diversity and adaptive features.

1.2. Outline classification of Insects up to the orders with examples (After Richards and Davies, 1977 with minor revision).

2. Integument of Insects:

2.1. Basic structure and functions; structure of cuticle, types of cuticle, sclerotization, epidermis and basement membrane.

3. Feeding mechanism and feeding structure in Insects:

3.1. Insect mouth parts

3.2. Structure of the gut, digestion and absorption of food, & fat body.

4. Insect Blood Circulation:

4.1. Composition, Structure, and Function.

4.2. Diaphragm and heart, haemolymph and its functions

5. Photogenic Organ and Light Production in Insects.

6. Mechanism of Stridulation in insects:

6.1. Types of insect sound and its significance.

7. Introduction to Insect Nervous System.

7.1. Mechanism of impulse conduction.

8. Reproductive Mechanism:

8.1. Basic idea of Parthenogenesis, Viviparity, Polyandry, Hermaphroditism in Insects.

8.2. Hormonal regulation of reproduction in Insects.

9. Growth and Development:

9.1. Metamorphosis, Diapause in insects; types and hormonal regulation.

10. Insect-Plant interaction:

10.1. Insect-Plant co-evolution

10.2. Categories of insect-plant interaction

10.3. Plant defense against insects

Practical 2 credits

1. Non-Chordate Anatomy

1.1. Comparative anatomy of excretion, nervous system in Arthropoda &
Mollusca (Demonstration/ Model)

1.2. Special structure – stomatogastric nervous system in cockroach,
sting apparatus of honey bee/ant

1.3. Distinctive features and identification of non-chordate from museum specimen

1.4. Demonstration of live protozoa and Rotifer (free living and parasitic) under microscope.

2. Entomology:

2.1. Collection, preservation and identification of insects

2.2. Identification of different larval stages of mosquito

2.3. Mounting of mouthparts of mosquito and housefly

Books Recommended:

1. Barrington, E. J. W. (2012). Invertebrate structure and Function. 2nd edition, Affiliated EastWest Press Pvt. Ltd.-New Delhi.

2. Barnes, R. D. & Ruppert, E. E., (1996). Invertebrate Zoology. 6th ed. Brooks Cole.

3. Anderson, D.T. (2002). Invertebrate Zoology, 2nd edition, Oxford University Press.

4. Meglitsch, P.A., & Schram, F.R. (2020). Invertebrate Zoology, 3rd edition, Oxford University Press.

5. Pechenik, J. A. (2019). Biology of the Invertebrates, 7th edition, McGraw Hill Education. 6. Brusca, R.C., Moore, W., & Shuster, S.M. (2016). Invertebrates, 3rd edition, Sinauer Associates.
7. Schierwater & DeSalle (2018). Invertebrate Zoology, A Tree of Life Approach. 1st edition. CRC press, Taylor & Francis group, Garland Science.
8. Gillott, C. (2005). Entomology. 3rd ed. Springer Online Book - ISBN-13 978-1-4020-3183- 0 (e-book)
9. Chapman, R.F. (1998) The Insects: structure and function 5th edition, Cambridge University Press.
10. Imms, A.D., Richard, O.W., & Davies, R.G. (1977) IMMS' General Textbook of Entomology: (2 volumes), 10th edition, Springer.
11. Klowden, M. J. (2007). Physiological systems in Insects, 2nd edition, Elsevier.
12. Wigglesworth, V. B. (1984). Principles of Insect Physiology, 8th edition, Springer.
13. Gullan, P. J. and Cranston, P. S. (2014). The Insects – an outline of Entomology. 4th ed. Blackwell Publishing

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-12**
Semester: **7**
Course Code: **BZOOMAJ12C**
Course Title: **Chordate structure & function**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Course Outcome: After completion of the course students will gain knowledge about the diversity, morphology, basic anatomy, and physiology of the different groups of chordates which will help them to understand the animal world and the further studies tha**

Chordate structure & function

Theory=4 credits

Chordate structure & function

Course Objective: The biology of chordates provides awareness and understanding about the fundamental scientific concepts that reflects upon the concepts of how science of the natural world works. As John A. Moore put it, science is the "way of knowing". The comparative anatomy of vertebrates provides comparison between the organisms of the living world. The skeleton system of animals relies upon the basic anatomy while evolution of vertebrates deals with the progression and development of a complicated interrelated system of organs and their functions. The anatomy of vertebrates gives a strong example of how the evolution of an integrated organism works. From this section of the lesson, students will learn about the exciting journey of vertebrates and how evolution has shaped them to fit the demands of their surroundings.

Syllabus:

Integumentary System

Structure, function and derivatives of integument in birds and mammals

Skeletal System

Overview of axial and appendicular skeleton, Visceral arches, Vertebrate jaw suspension

Digestive System

Comparative anatomy of stomach, Ruminant stomach in Mammals, dentition in mammals

Respiratory System

Respiratory organs in fish, amphibian, birds and mammals, Accessory respiratory organ

Circulatory System

General plan of circulation, Comparative account of heart and aortic arches

Urinogenital System

Succession of kidney, Evolution of urinogenital ducts

Nervous System

Comparative account of brain, Cranial nerves in mammals

Sense Organs

Classification of receptors, Brief account of auditory receptors in vertebrate

Specialized features

Migration in Fish and parental care in fish and amphibia

Swim bladder in fishes.

Poison apparatus and biting mechanism in snakes.

Migration in bird, principles and aerodynamics of birds

Adaptive radiation in mammals with reference to locomotor appendages

Echolocation in chiropterans and cetaceans

Thermal biology of endotherms

Osmoregulation in aquatic vertebrates

Practical 2 credits

1. Dissection of brain and pituitary of Tilapia
2. Power point presentation on study of habit, habitat or behaviour of any one animal by student – for internal assessment only
3. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
4. Study of disarticulated skeleton of Toad, Pigeon and Guineapig
5. Identification of mammalian skulls: One herbivorous (Guineapig) and one carnivorous (Dog) animal

Reading References:

Reference Books

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
5. Parker, T. J. &Haswell, W. (1972). Text Book of Zoology , Volume II: Marshall and Willam (Eds.) 7th Ed. Macmillan Press,London.
6. Kardong, K. V. (2002). Vertebrates: Comparative anatomy, function evolution. Tata McGraw Hill.
7. Kent, G. C. & Carr, R. K. (2001). Comparative anatomy of the Vertebrates. 9th Ed.
8. McGraw Hill.
9. Nelson, J.S., (2006) : Fishes of the World, 4th Edn., Wiley.
10. Romer, A. S. & Parsons, T. S. (1986). The vertebrate body. 6th Ed. Saunders College Publishing.
11. Jordan, E.L. &Verma, P.S. (2003). Chordate Zoology. S. Chand & Company Ltd. New Delhi.
12. Sinha, K. S., Adhikari, S., Ganguly, B. B. &BharatiGoswami, B. D. (2001). Biology of Animals. Vol. II. New Central Book Agency (p) Ltd.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-13**

Semester: **7**

Course Code: **BZOOMAJ13C**

Course Title: **Ecosystem Structure and Function**

(L-P-Tu): **4-2-0**

Credit: **6**

Practical/Theory: **Practical**

Course Objective:

Learning Outcome: **Course Outcome: After completion of this course the student will know about the basic information about ecosystem and figure out how to use it. The following is part of this information: population growth and the factors influencing this growth, Resource**

Ecosystem Structure and Function

Theory=4 credits

Ecosystem Structure and Function

Course Objective: The term "Ecology" refers to the study of inter-relationships between organisms and their physical environment. There are various ways in which these relationships can regulate the natural ecosystem such as distribution and abundance of living organisms, the variety of species living together, and the energy flow in natural ecosystem. Since environmental change is occurring at a rapid rate in the early twenty-first century it is vital that we better comprehend the ecology of the planet. While most people associate ecologists with fieldwork, ecologists who develop theoretical models or do laboratory research have made some of the most significant contributions to ecological theory. We can clearly see that our simplistic description of ecology does not adequately convey its vastness or the diversity of its practitioners. Let's talk at this course to have a better grasp of what ecology is all about.

Theories on relation between biodiversity and ecosystem function.

1. Species complementarity
2. Sampling effect
3. Redundancy

Population growth models.

4. Population regulations.
5. Metapopulation and Metacommunity concept.
6. Resource - consumer interactions.
7. Modelling species interactions – apparent competition, intraguild predation, succession, bipartite network and application.

Natural resources and sustainable development – principles and models.

8. Environmental world views.
9. Wildlife resources, aquatic living resources, forest resources, Ecosystem services valuation, links with biodiversity.
10. Ecological footprint analysis; ecosystem health.
11. EIA and EPA
12. Ecological processes in wetland and mangrove ecosystem.
13. Decline of global biodiversity and loss of ecosystem function.
14. Functional diversity and ecosystem functioning.
15. Insurance hypothesis and habitat fragmentation and dispersal on ecosystem functioning.
16. Ecosystem services, biodiversity and ecological economics.

Practical 2Credits

1. Study of an aquatic ecosystem: Determination of Conductivity, Biochemical oxygen demand, Primary productivity (light bottle-dark bottle method), Chlorinity, Salinity, Alkalinity, and Total hardness.
2. Study of an terrestrial ecosystem: Determination of pH, Organic Carbon and Organic Matter.
3. Qualitative analysis of sampled terrestrial community.

4. Quantitative and qualitative estimation of zooplankton communities.

References:

Paper XVI: Ecosystem Structure and Function

Reference readings

Smith, T.M. and Smith, R.L. (2012). Elements of Ecology, 8th Edition.

Atlas, R.M. and Bartha, R. (1997). Microbial Ecology: Fundamentals and Applications.

Townsand, J. et al. (2006). Ecology: From Individuals to Ecosystems, 4th Edition.

Odum, E.P. (2008). Fundamentals of Ecology, 2nd Edition.

Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and Applications.

Krebs, C.J. (2014). Ecology: The Experimental Analysis of Distribution and Abundance, 6th Edition.

Faurie, C. et al. (2008). Ecology: Science and Practice.

Mackenzie, A. et al. (2001). Instant Notes in Ecology, 2nd Edition.

Walker, C.H. et al. (2012). Principles of Ecotoxicology, 4th Edition.

Saha, G.K. (2016). Wetland Crisis and Options.

Ricklefs, R.E. and Miller, G.L. (2001). Ecology, 4th Edition.

Miller, G. and Spoolman, S. (2014). Essentials of Ecology.

Gotelli, N.J. (2008). A Primer of Ecology, 4th Edition.

Hunter et al. (2021). Fundamentals of Conservation Biology.

Wilson, E.O. (1999). Biodiversity.

Laurila-Pant, M. et al. (2015). How to value biodiversity in environmental management? Ecological Indicators, 55, 1-11.

Brauman, K.A. and Daily, G.C. (2008). Ecosystem Services. In: Human Ecology, 1148-1154.

Costanza, R. (2012). Ecosystem health and ecological engineering. Ecological Engineering, 45, 24-29.

Duncan, C. et al. (2015). The quest for a mechanistic understanding of biodiversity – Ecosystem services relationships. Proceedings of Royal Scoiety B, 282, 20151348.

Dormann, C.F. et al. (2009). Indices, graphs and null models: Analyzing bipartite ecological networks. The Open Ecological Journal, 2, 7-24.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-14**

Semester: **8**

Course Code: **BZOOMAJ14C**

Course Title: **Biodiversity; Wild life Management & Conservation**

(L-P-Tu): **2-2-0**

Credit: **4**

Practical/Theory: **Combined**

Course Objective:

Learning Outcome: **Course Outcome: Biodiversity and wildlife: Student will be learning the various issues related to biodiversity loss and conservation as well as status, conditions and conservation of forests and wildlife. They will also be able to use various tools used i**

Biodiversity; Wild life Management & Conservation

Theory=2 credits

Course Objective: Due to significant loss of biodiversity and deterioration of natural ecosystems, there is little room for argument that all life on earth is currently in jeopardy. As a result, this course is available to all graduate students, regardless of their academic expertise, in order to make them aware of and sensitize them to this survival dilemma. Students who complete this course will have gained a solid foundation in the

importance of biodiversity and ecosystem services in supporting life on Earth, as well as an understanding of the dangers posed by the careless behavior of man.

Biodiversity; Wild life Management & Conservation

Theory

1. Introduction to Biodiversity:

- Concept and types of biodiversity
- Biodiversity and human welfare
- Convention on Biological Diversity (CBD)
- Megadiversity countries
- Biodiversity hotspots with special reference to India.

2. Types of conservation:

- In-situ conservation- conserving ecosystem function and management.
- Protected area -Sanctuary, National Park, Biosphere reserve, Ramsar site and World heritage site in India with special reference to West Bengal.
- Concept of Core Zone, Buffer Zone.
- Exsitu conservation of animals (captive breeding; species reintroduction, species translocation; population reinforcement).
- Bioindicators for biodiversity monitoring.

3. Concept of wildlife:

- Definition of wildlife, keystone, flagship and umbrella species
- Wildlife in India; reasons for wildlife depletion and their conservation strategies; Wildlife Protection Act, 1972
- Concept of threatened fauna, Red data book, and IUCN categories
- Joint Forest Management (JFM) model for conservation.
- Tiger reserves in India, Management challenges in Tiger reserve.

4. Tools and techniques for wildlife census and survey:

- Technologies for Wildlife Research and Management
- Faecal analysis of ungulates and carnivores
- Pug marks and census method
- Basic idea of GIS and GPS and their application in habitat & wildlife conservation.

5. Management planning of wild life in protected areas:

- Estimation of carrying capacity
- Eco tourism / wild life tourism in forests
- Concept of climax persistence
- Ecology of perturbance

Practical 2 credits

Determination of requisite size of quadrat by species area curve method.

Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)

Visit to Wild life Sanctuary/Biodiversity Park/National Park/ reserves of the biosphere/ Sea cost to study behavioural activities of animals and prepare a short report.

Reference books

1. Conserving Forest Biodiversity: A Comprehensive Multiscaled Approach- David B. Lindenmayer, Jerry F. Franklin. 2013.
2. Divan Rosencraz, Environmental laws and policies in India, Oxford Publication.

3. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). *Problem-Solving in Conservation*
4. Joseph, B., Environmental studies, Tata Mc Graw Hill.
5. Michael Allabay, Basics of environmental science, Routledge Press.
6. Miller, G.T. 2002. Sustaining the earth, an integrated approach. (5th edition) Books/Cole,
7. Mohapatra Textbook of Environmental Biotechnology IK publication.
8. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole.
9. Practical Approaches to the Conservation of Biological Diversity- Richard KenithBaydack, Henry Campa, Jonathan B. Haufler. 1999
10. Rana SVS, Environmentalpollution – Health and Toxicology, Narosa Publication.
11. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press.
12. Sutherland, W.J. (2000). *The Conservation Handbook: Research, Management and*
13. Thakur, I. S., Environmental Biotechnology, I K Publication.
14. Valuation and Conservation of Biodiversity: Interdisciplinary Perspectives… Michael Markussen, Ralph Buse, HeikoGarrelts, MaríaManez Costa, Susanne Menzel, Rainer Marggraf. 2005.
15. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). *People and Wildlife, Conflict or Co-existence? Cambridge University.*

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-15**
Semester: **8**
Course Code: **BZOOMAJ15C**
Course Title: **Reproductive Biology**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Course outcome: Reproductive Biology: In this section students will learn about the basic concept and mechanism of reproductive physiology as well as practical implications of the reproductive biology such as IVF, contraception, and how to medically manag**

Reproductive Biology

Theory=2 credits

Course Objectives: Reproductive Biology covers principles and techniques in reproduction. It also enlightens the areas including Physiology of human reproductive system and its hormonal regulation, Applications of Reproductive Biology like Artificial Reproductive Techniques (ARTs) etc**.** that will help to develop further practical skills or research ability of the students.

Reproductive Biology

Principles of Reproductive Biology

- Potency, commitment, specification, induction, competence.
- Determination and differentiation; morphogenetic gradient, cell fate and cell lineages.
- Cell to cell communication during early development.
- Environmental control of gene regulation, Epigenetic regulation of developmentally relevant genes.

Physiology of Reproduction

- Primary and accessory sex organs and secondary sex characters.
- Testis: histology, testicular hormones and their functions.
- Ovary: histology, ovarian hormones and their functions.
- Oestrous cycle and its hormonal control.
- Maintenance of pregnancy – role of hormones. Development of mammary gland and lactation - role of hormones.

Reproductive system and hormonal regulation

- Female reproductive system: Hormonal regulation of ovulation, gestation, parturition and lactation; Menstrual cycle and its hormonal control
- Male reproductive system: Hormonal regulation of spermatogenesis
- Molecular basis of male and female reproductive disorders, therapeutics, male and female infertility.
- Steroid receptors: Defects, modulators, clinical significance.

Applications of Reproductive Biology

- Artificial Reproductive Techniques (ARTs)
- Types and application of contraception; Male and female contraceptives
- Menopause, andropause and their management.

Practical- 2 Credits

1.1. Demonstration of Oestrous stages of mice.
1.2. In vitro study of motility of epididymal spermatozoa.
1.3. Demonstration androgen bioassay.
1.4. Histology of testis and ovary

Reference Books

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
3. Eckert Animal Physiology: Mechanisms and adaptations Randall, Burggren and FrenchVander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
4. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
5. Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
6. Histology: A Text and Atlas. Sixth Edition. Ross &Pawlina. Lippincott Williams & Wilkins.
7. Eckert Animal Physiology by David Randall and Warren Burggren. 4th edition.
8. W.H.Freeman.
9. Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
10. Slack JMW , Essential Developmental Biology.
11. Developmental Biology: A Very Short Introduction (Very Short Introductions). Lewis Wolpert. (1st Edition)

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-16**
Semester: **8**
Course Code: **BZOOMAJ16C**
Course Title: **Biotechnology**
(L-P-Tu): **2-2-0**
Credit: **4**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Course Outcome: The key objective of this class is to provide fundamental knowledge about the structural and functional features of biological macromolecules such as DNA, RNA, and proteins. After**

completion of this course the students will be able to use

Biotechnology

Theory=2 credits

Course Objective: Biotechnology has transformed the planet. Advances in biotechnology now can track many inherited disorders. People may now live in considerably higher population densities due to biotechnology's ability to produce more food per acre. As a result of advance biotechnology, we now know more about genomes of a wide range of creatures, from viruses to trees to people. Science has been shifted from a descriptive to a variety of fields that generate new items such as pharmaceuticals, vaccines, and meals thanks to the application of this knowledge. This course is designed to flash the spotlight of Biotechnology on student to make them equipped with the modern science

Biotechnology

Theory

Introduction

Concept and scope of Biotechnology. Organization of prokaryotic and eukaryotic genome, Concept of genomics

Molecular Techniques in Gene manipulation

1. Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics).Restriction enzymes: Nomenclature, detailed study of Type II. Transformation techniques: Calcium chloride method and electroporation. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization
2. Southern, Northern and Western blotting
3. DNA sequencing: Sanger method
4. Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

Genetically Modified Organisms

1. Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection.
2. Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock out mice.

Culture Techniques and Applications

Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)

Environmental Biotechnology

1. Bioremediation-In situ and Ex situ Bioremediation, bioremediation of industrial waste (Paper and Pulp Industry), Bioremediation of Heavy metal, phytoremediation, emerging biotechnological processes in waste water treatment.
2. Biosensor; Type of Biosensor, Environmental industrial and clinical application

Intellectual Property Right and Management of Biotechnology

1. IPR- IPP, Forms of Protection, Patenting strategy, Copy right, Plant variety protection, WIPO, GATT, WTO. Role and regulation of Indian Patent.
2. Biosafety and Bioethics-Risk for Human health, Biosafety guideline and regulation

Practical 2 credits

1. Genomic DNA isolation from E. coli/Blood genomic through virtual demonstration
2. Plasmid DNA isolation (pUC 18/19) from E. coli through virtual demonstration
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided.

6. To study following techniques through virtual demonstration
    I. Southern Blotting
    II. Northern Blotting
    III. Western Blotting
    IV. DNA Sequencing (Sanger's Method)
    V. PCR
    VI. DNA fingerprinting
7. Project report on animal cell culture

Reading References:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
2. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
3. Weaver. Molecular Biology of Gene. 5th edition.
4. Primrose & Twyman. Principles of Gene Manipulation and Genomics. 7th edition.
5. Russell, P. J. (2009). iGenetics- A Molecular Approach. III Edition. Benjamin Cummings
6. Environmental Biotechnology, Pradipta Kumar Mohapatra
7. Environmental Biotechnology – Concepts and Applications, HansJoachim Jordening and Jesef Winter
8. Wastewater Engineering – Metcalf & Eddy.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-17**
Semester: **8**
Course Code: **BZOOMAJ17C**
Course Title: **Cell, Tissue Structure and Function**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Course Outcome: The students will know more about the key concepts that underlies the cellular biochemistry. The importance of well-synchronised activity of the cell is necessary for the continued existence of a living organism.**

Cell, Tissue Structure and Function

Theory=4 credits

Course Objective: To understand the complicated cellular chemistry, a comprehensive study of sub-cellular component is prerequisite. Recently developed mathematical/computational approaches explained cellular behaviour through the generation of quantitative information, some of which have yet to be invented. Emerging approaches in the evaluation of quantitative information has now become the primary focus for cell biologists.

Title: Cell, Tissue Structure and Function

1. Cell membranes and their functions:

Ultra structure and composition of Plasma membrane: Fluid mosaic model

1.1. Membrane pumps, carriers, channels. 1.2. Transport across membrane: Diffusion, Active and Passive transport, ion pumps, uniport, symport and antiport. Facilitated transport.

2. Cytoplasmic organelles

Basic structure and functions of cell organelles:

2.1. Nucleus, Golgi apparatus, Mitochondria, Lysosome and Endoplasmic Reticulum

3. Cell adhesion molecules:

3.1. Extracellular matrix molecules, Cellular adhesion, Intercellular junctions, Connective tissues, microtubules and cytoskeleton (RBC cytoskeleton as a model).

4. Cell signalling:

4.1. G- protein and signal transduction. 4.2. Signal hypothesis, Intracellular protein trafficking.

5. Cytoskeleton and cellular motility:

5.1. Motor proteins: Actin and myosin binding proteins. 5.2. Cytoskeletal structures: microtubules, microfilaments, & intermediate filaments.

6. Cell to cell communication:

6.1. Basic structure of extracellular matrix. 6.2. Fundamental idea of: Tight Junctions, Gap junctions, Desmosomes, Hemi-desmosomes, Focal adhesion.

7. Cell cycle:

7.1. Cell cycle check-points, role of cyclins and CDKs. Regulation of CDK-Cycline activity. 7.2. Functional role of the following proteins: APC, Mcm, Aurora and Polo like Kinase, Condensins, & Kinesins.

8. Cancer biology: Basic concepts.

9. Somatic cell fusion:

9.1. Human – rodent hybrid cells, radiation hybrid mapping.

10. Programmed cell death:

10.1. Regulators of programmed cell death, cell death pathways, relationship with cancer. 10.2. Apoptotic cell detection: Annexin V Assay.

11. Histology and histological methods:

11.1. Types & Organization of Tissues. 11.2. Principle and methods of staining. 11.3. Histological stains (Haematoxylin & Eosin). 11.4. Types of fixatives & chemistry of fixation. 11.5. Tissue processing (Dehydration, Clearing, & Embedding). 11.6. Microtomy: Types of microtome, sectioning & paraffin blocks. Overview of ultra microtomy.

Practical 2 credits

1. Cell, Tissue Structure and Function:

1.1. Cell separation techniques.

1.2. Primary culture of Cells.

1.3. Determination of cell size and granularity. Annexin V staining by flowcytometry / fluorescent imaging. DAPI nuclear blabbing imaging.

1.4. Identification of different mammalian tissues.

1.5. Microtechnique.

Books Recommended:

1. Alberts, B. *et al.*: Molecular Biology of the Cell. Garland Science.

2. Becker, W. M. *et al.*: The World of the Cell. Benjamin-Cummings.

3. Cooper, G. M. and Hausman, R. E.: The Cell-A molecular approach. Sinauer Associates.

4. Townsend-Nicholson, A. *et al.*: Cell Biology: A Short Course, Wiley-Blackwell.

5. Harvey, L. *et al.*: Molecular Cell Biology. W.H. Freeman.

6. Karp, G.: Cell and Molecular Biology - Concepts and experiments. John Wiley.

7. Lodish *et al.*: Molecular Cell Biology. W. H. Freeman.

8. Ploper, G., Sharp, D. and Sikorski, E.: Lewin's CELLS, Jones & Bratlett.

9. Bancroft, J. D. and Stevens, A.: Theory and Practice of Histological techniques, Churchill-Livingstone.

10. Bancroft, J. D. and Gamble, M.: Theory and Practice of Histological techniques, Churchill Livingstone, Elsevier.

11. Bloom, W. and Fawcett, D. W.: A Textbook of Histology. 12th edition, CRC Press.

12. Junqueira, L. C. and Carneiro, J.: Basic Histology: Text and Atlas. 11th edition, McGraw Hill Lange Med. Pub.

13. Ross, M. H.; Reith, E. J.; and Romell, L. J.: Histology: a text and atlas. 2nd edition, Williams and Wilkins.

14. Robertis, De. and Robertis Jr., De.: Cell and Molecular Biology. CBS Publishers & Distributors Pvt. Ltd.

15. Pollard, T. D.; Earnshaw, W. C.; Lippincott-Schwartz, J.; and Johnson, G. T.: Cell Biology: Elsevier.
16. John, R. W. Masters (Editor): Animal Cell Culture - a practical approach. Oxford University Press.
17. Frifelder, D. M.:Physical Biochemistry: Applications to Biochemistry and Molecular Biology (Life Sciences/Biochemistry). W. H. Freeman.
18. Kumar, A.; Galaev, I. Y.; and Mattiasson, B.: Cell Separation - Fundamentals, Analytical and Preparative Methods. Springer.

Syllabus *(ZOOLOGY)*

Course Type: **MAJ-18**
Semester: **8**
Course Code: **BZOOMAJ18C**
Course Title: **Clinical Immunology and Infection Biology**
(L-P-Tu): **4-2-0**
Credit: **6**
Practical/Theory: **Combined**
Course Objective:
Learning Outcome: **Course Outcome: After completion of this elective, student will understand the fundamentals of molecular mechanism behind immunity. They will have a wide knowledge of many immunological techniques that include immunohistochemistry, ELISA, FACS etc. They w**

Clinical Immunology and Infection Biology

Theory=4 credits

Clinical Immunology and Infection Biology

Course Objective: This topic gives emphasis on the advanced immunological aspects including treatments related to immunity. The students will be able to understand the theoretical framework about the complex molecular mechanisms involved in the immunity and the related immunological methods. Along with these the students will be able to understand about tolerance, immunodeficiency and vaccination, immunology of transplantation, the immunology of tumors, immunomodulation, and immunopharmacology.

Major Histocompatibility Complex

Structure and functions of MHC molecules.

Structure of T cell Receptor and its signalling, T cell development & selection

Cytokines

Types, properties and functions of cytokines.

Complement System

Components and pathways of complement activation.

Hypersensitivity

Gell and Coombs' classification and brief description of various types of hypersensitivities.

Immunologic Tolerance and Autoimmunity

Autoimmune disorders – Rheumatoid arthritis, Systemic lupus erythematosus, Inflammatory bowel disease

Immunity to Tumors

Tumour microenvironment and immune cells- TAM, T reg cells and others, Immune check point inhibitors

Transplantation Immunology

Different types grafting, Graft rejection, Graft versus host disease (GvHD),Genetics of HLA typing and disease association

Immune Response to Infectious Diseases

Mechanism of Immune Response During: Viral Infections [Influenza, HIV, corona virus, Adenovirus], Bacterial Infections [*Corynebacteria* and *Mycobacterium*] Protozoan Infection [*Plasmodium, Trypanosoma and Leishmania*], Helminthes Infections [Ascaris and Schistosoma].

Immunotechnology

Vaccine – different types of vaccine, strategies of vaccine development - subunit vaccine, mRNA vaccine and others, Hybridoma technology, Antibody engineering Immunoassays- Types and applications, Immunophenotyping,

Principle, Methodology and Application of Following Techniques: ELISA [Enzyme Linked Immunosorbent Assay], RIA [Radio Immuno Assay], Western Blotting. Allergy Evaluation: Principle and Methodology of Skin Prick Test for Allergy.

Practical 2 credits

1. Demonstration of ELISA
2. Demonstration of macrophages.
3. Bone marrow smear preparation and staining.
4. Identification of the prepared slides:

Trypanosoma, Leishmania sp, (Promastigote and amastigote), *Opalina* sp., *Nyctotherus*, *Sicuophora, Balantidium, Stomatophora, Monocystis, Giardia, Entamoeba histolytica, Gregarina, Eimeria, Haemoproteus, Plasmodium* (*vivax & falciparum* species), *Conchophthirus, Myxobolus, Taenia solium, Taenia saginata, Raillietina sp*., (mature proglottid and scolex), *Echinococcus, Fasciola, Isoparorchis, Paramphistomum, Ascaris* (male and female), *Argulus, Pediculus, Phthirus, Cimax, Xenopsylla, Ctenocephalids, Boophilus, Phlebotomus,* mosquitoes (adult male & female, mouth parts of Anopheles, Culex, and Aedes)

Laboratory Note Book must be prepared on day-to-day basis and should be signed by the concerned teacher immediately after the laboratory work. The Laboratory Note Book should contain all the items in the syllabus and must be submitted on the day of examination.

Reference Books:

- Abbas, A. K., Lichtman, A. H. and Pillai, S. (2018).
- Cellular and molecular Immunology. 9th ed. Elsevier. Abbas, A. K. and Lichtman, A. H. (2019).
- Basic Immunology. 6thed. Elsevier. Goldsby, R. A., Kindt, T. J., Kuby, J. and Osborne, B. A. (2019). Immunology. 8thed. W. H. Freeman and Co. Murphy, K and Casey W. (2016).
- Janeway's Immunobiology. 8thed.Garland Science. Roitt, I. M. and Delves, P. J. (2017).
- Roitt's Essential Immunology. 13th ed. Blackwell Science Ltd.
- Mukhopadhyay, A. & De, A. K. (2002). Perspectives in Environmental Health: Vector and Water Borne Diseases, Section-I, ORIGINALS D.K. Publishers Distributors(P) Ltd, New Delhi-110002 70 M.SC, ZOOLOGY SYLLABUS, SKBU (W.E.F. FROM 1ST NOVEMBER, 2022)

- Roberts, L. & Janovy, J. Jr. (2008). Foundations of Parasitology. 8th edition, McGrawHill Education.
- Schmidt, G. D. & Roberts, L. S. (2001). Foundation of Parasitology, 3rd edition, McGraw-Hill Education.
- Smyth, J. D. (1994). Animal Parasitology, 3rd edition, Cambridge University Press
- Cheng, T. C. (1999). General Parasitology, 2nd edition, Academic Press, Inc.
- Chatterjee, K. D. (2009). Parasitology: Protozoology, And Helminthology in Relation to Clinical Medicine, 13th edition, CBS Publishers And Distributors Pvt. Ltd., New Delhi

Basic Features

Undergraduate degree programmes of either 3 or 4-year duration, with multiple entry and exit points and re-entry options, with appropriate certifications such as:

- UG certificate after completing 1 year (2 semesters with 40 Credits + 1 Summer course of 4 credits) of study,
- UG diploma after 2 years (4 semesters with 80 Credits + 1 Summer course of 4 credits) of study,
- Bachelor's degree after a 3-year (6 semesters with 120 credits) programme of study,
- 4-year bachelor's degree (Honours) after eight semesters (with 170 Credits) programme of study.
- 4-year bachelor's degree (Honours with Research) if the student completes a rigorous research project (of 12 Credits) in their major area(s) of study in the 8th semester.

Note: The eligibility condition of doing the UG degree (Honours with Research) is- minimum75% marks to be obtained in the first six semesters.

- The students can make an exit after securing UG Certificate/ UG Diploma and are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

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