

Lesson plan: Mr.Ratul Mukherjee
Mode: online
Session 2020 -2021(November 2020 to 31st August 2021)
CC – 01
Semester - I
Course Title: Introduction to microbiology and microbial diversity.
Course Code: BMCBCCHT101

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
History of development of Microbiology Duration of each class is 1hr	15	Development of Microbiology as a discipline.	3	Lecture (2classes), Feedback & Power Point presentation (1 class)
		Spontaneous Generation vs Biogenesis.	2	Lecture(2 classes)
		Contributions of Antony Von Leeuwenhoek, Louis Pasteur,Robert Koch, Joseph Lister, Alexander Fleming.	5	Lecture (4 classes) & Feedback (1 class)
		Germ Theory of Disease, development of Microbiological Techniques and Golden Era of Microbiology.	3	Lecture (3 classes)
		Question -Answer Discussion.	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee Mode: online Session 2020 -2021 (November 2020 to 31 st August 2021) CC – 03 Semester - II Course Title: Biochemistry Course Code: BMCBCCHT201
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Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Carbohydrates Duration of each class is 1hr	18	Families of Monosaccharides: Aldoses, ketoses, trioses, tetroses, Pentoses And Hexoses.	2	Lecture (2 classes),
		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.	8	Lecture (6 classes) and Feedback (2 classes)
		Disaccharides; concept of reducing and non-reducing sugars, occurrence and Haworth projections of maltose, lactose, and sucrose, Polysaccharides, storage polysaccharides, starch and glycogen.	3	Lecture (3 classes)
		Structural Polysaccharides, cellulose and chitin, reactions of carbohydrates..	2	Lecture (2 classes)
		Question -Answer Discussion	1	1 class
		Internal Assessment	2	2 classes

Lesson plan: Mr.Ratul Mukherjee
Mode: offline
Session 2020 -2021(November 2020 to 31st August 2021)
CC – 05
Semester - III
Course Title: Microbial Physiology and Metabolism
Course Code:BMCBCCHT301

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation Duration of each class is 1hr	8	Anaerobic respiration with special reference to dissimilatory nitrate reduction (Denitrification; nitrate/nitrite and nitrate/ammonia respiration; fermentative nitrate reduction)-	4	Lecture (2classes) & Power Point Presentation(2 classes)
		Fermentation-Alcohol fermentation and Pasteur effect; Lactate fermentation (homofermentative and heterofermentative pathways)	2	Lecture (2 classes)
		Question and Answer Discussion	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
Mode: Online & Offline Mode
Session 2020 -2021(November 2020 to 31st August 2021)
CC – 06
Semester- III
Course Title: Cell Biology and Molecular Biology
Course Code : BMCBCCHT302

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Replication of DNA Duration of each class is 1hr	12	Bidirectional and unidirectional replication,semi-conservative,semi-discontinuous Replication	2	Lecture (2classes)-Online Mode
		Mechanism of DNA replication:Enzymes and proteins involved in DNA replication –DNA polymerases, DNA ligase, primase, telomerase–for replication of linear ends.	4	Lecture (2classes) & Power Point Presentation(2 classes)
		Various models of DNA replication including rolling circle, D-loop (mitochondrial), Θ (theta)mode of replication and other accessory protein.	3	Lecture(2 classes) & Feedback session(1 class)
		Comparative study of DNA Replication of Prokaryotes and eukaryotes (2L)	2	Lecture (2 classes)
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee

Mode: offline

Session 2020 -2021(November 2020 to 31st August 2021)

CC – 07

Semester-III

Course Title: Laboratory Techniques in Microbial Physiology, Molecular and Cell Biology of Microbes

Course Code: BMCBCCHS303

Name of the experiments	Alloted Hours
1. Isolation of Genomic DNA from <i>E.coli</i>. 2. Demonstration of thermal death time and decimal reduction time of <i>E.coli</i>. 3. Demonstration of alcoholic fermentation.	Work out: 3Hrs; Incubation period: 24-48 Hrs; Result & observation: 3 Hrs, Recapitulation

Lesson plan: Mr.Ratul Mukherjee
Mode: offline
Session 2020 -2021(November 2020 to 31st August 2021)
SEC-1
Semester - III
Course Title: Biofertilizer and Biopesticides
Course Code: BMCBSEHT305

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Phosphate Solubilizer Duration of each class is 1hr	4	Phosphate solubilizing microbes-Isolation, characterization	2	Lecture (2classes)
		Mass inoculum production Field Application	1	Lecture (1classes)
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
Mode: online
Session 2020 -2021(November 2020 to 31st August 2021)
CC – 08
Semester: IV
Course Title: Microbial Genetics and Recombinant DNA Technology(RDT)
Course Code: BMCBCCHT401

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Molecular Cloning-Tools and Strategies Duration of each class is 1hr	20	Basic concepts of genetic engineering, Cloning Tools; Restriction modification systems: Types I, II and III	4	Lecture (4classes)
		Mode of action, nomenclature, applications of Type II restriction	2	Lecture (2 classes)
		Enzymes in genetic engineering, DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases.	4	Lecture (4 classes)
		Cloning Vectors: Definition and Properties Plasmid vectors: pBR and pUC series.	3	Lecture (2 classes) & Feedback (1 class)
		Bacteriophage lambda and M13 based vectors Cosmids, BACs, YACs Use of cloning vectors	3	Lecture (2 classes) & Feedback (1 class)
		Question -Answer Discussion.	2	2classes
		Internal Assessment	2	2 classes

Lesson plan: Mr.Ratul Mukherjee
Mode: online
Session 2020 -2021(November 2020 to 31st August 2021)
CC – 09
Semester - IV
Course Title: Industrial Food and Dairy Microbiology.
Course Code: BMCBCCHT402

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Fermented Foods Duration of each class is 1hr	10	Dairy starter cultures, fermented dairy products: yogurt, dahi and Cheese	3	Lecture (3classes),
		Other fermented foods: dosa, sauerkraut, soysauce	3	Lecture(3 classes)
		Probiotics: Health benefits Types of microorganisms used, microbial cell as food(single cell protein)	2	Lecture (2 classes)
		Question- Answer Discussion	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
Mode: online
Session 2020 -2021(November 2020 to 31st August 2021)
CC – 09
Semester - IV
Course Title: Industrial Food and Dairy Microbiology.
Course Code: BMCBCCHT402

Module 2	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Microbial production of industrial products (micro-organisms involved, media, Fermentation conditions, downstream processing and uses) Duration of each class is 1hr	10	Alcoholic beverages (beer, wine)	2	Lecture (2classes)
		Organic Acids	2	Lecture (2 classes)
		Organic Solvents	2	Lecture (2 classes)
		hormones(insulin productionHumulin	2	Lecture (2 classes)
		Question -Answer Discussion.	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
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Session 2020 -2021(November 2020 to 31st August 2021)
SEC – 2
Semester-IV
Course Title: Microbiological analysis of air and water
Course Code: BMCBSEHT405

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Air Sample Collection and Analysis Duration of each class is 1hr	7	Bioaerosol sampling, air samplers	2	Lectures(2 classes)
		Methods of analysis, CFU, culture media for bacteria and fungi	2	Lectures (2 classes)
		Identification characteristic	1	Lecture (1 class)
		Question-Answer Discussion	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee Mode: online & Offline Session 2020 -2021 (November 2020 to 31 st August 2021) CC-11 Semester-V Course Title: Immunology and Medical Microbiology Course Code: BMCBCCHT501
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Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Components of Immune System Duration of each class is 1hr	12	Antigens: Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T&B cell epitopes); T-dependent and T-independent antigens; Adjuvants	3	Lectures(2 classes)& PPT (1 Class)
		Antibodies: Structure, Types, Functions and Properties of antibodies; Antigenic Determinants on antibodies (Isotypic, allotypic, idiotypic); Monoclonal and Chimeric antibodies.	3	Lectures (2 classes)& PPT (1 Class)
		MHC: Structure and Functions of MHCI & II molecules; Antigen processing and Presentation (Cytosolic and Endocytic pathways)	3	Lecture (2classes)& PPT (1 Class)

	Question-Answer Discussion	2	2 classes
	Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
Mode: online & Offline
Session 2020 -2021(November 2020 to 31st August 2021)
CC-11
Semester-V
Course Title: Immunology and Medical Microbiology
Course Code: BMCBCCHT501

Module 2	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Normal Microflora of Human body and Host Pathogen Interaction Duration of each class is 1hr	8	Normal micro flora of the human body: Importance of normal Microflora.	1	Lectures(1 class)
		Normal Microflora of skin , throat	2	Lectures (2 classes)
		NMF of gastrointestinal tract, urogenital tract	2	Lecture (1 class) & PPT(1 Class)
		Host pathogen interaction : Definitions-Infection, Invasion, Pathogen, Pathogenicity, Virulence .	2	Lecture (2 Classes)
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
Mode: offline
Session 2020 -2021(November 2020 to 31st August 2021)
DSE-1
Semester-V
Course Title: Microbes in sustainable agriculture and development
Course Code: BMCBDSHT1

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Soil Microbiology Duration of each class is 1hr	8	Soil as Microbial Habitat	2	Lectures(2 class)
		Soil Profile and Properties	2	Lectures (2 classes)
		Soil formation, Diversity and distribution of microorganisms in soil	2	Lecture (1 class) & PPT(1 Class)
		Question and Answer Discussion	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
Mode: online
Session 2020 -2021(November 2020 to 31st August 2021)
DSE-2
Semester-V
Course Title: Instrumentation and Biotechniques
Course Code: BMCBDSHT2

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Electrophoresis Duration of each class is 1hr	14	Principle and applications of native polyacrylamide gel electrophoresis	4	Lectures(2 classes) & PPT (2 Classes)
		SDS polyacrylamide gel electrophoresis	2	Lectures (2 classes)
		2D gel electrophoresis, isoelectric focusing	4	Lecture (2 classes) & PPT(2 Classes)
		Zymogram preparation and	2	Lecture (2 Classes)
		Question and Answer session	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
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Session 2020 -2021(November 2020 to 31st August 2021)
DSE-3
Semester-V
Course Title: Microbial Biotechnology
Course Code: BMCBDSHT3

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Applications of Microbes in Biotransformations Duration of each class is 1hr	4	Microbial based transformation of steroids and sterols	2	Lectures(1 class) & PPT (1 Class)
		Question and Answer Session	1	1 class
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
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Session 2020 -2021(November 2020 to 31st August 2021)
CC-13
Semester-VI
Course Title: Environmental Microbiology
Course Code: BMCBCCHT601

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Biogeochemical Cycling Duration of each class is 1hr	14	Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin	3	Lectures(2 classes) & PPT (1 Class)
		Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate Reduction	4	Lectures (2 classes) & PPT(2 Classes)
		Phosphorus cycle: Phosphate immobilization and solubilisation .	3	Lecture(2 classes) & PPT(1 Class)
		Sulphur cycle: Microbes involved in sulphur cycle	2	Lecture (2 Classes)

			1	1 class
		Question and Answer session Internal Assessment	1	1 class

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Session 2020 -2021(November 2020 to 31st August 2021)
CC-14
Semester-VI
Course Title: Applied Course in Environmental Microbiology.
Course Code: BMCBCCHS602

Name of the experiment	Alloted Hours
Assessment of microbiological quality and Microbiological examination of water (drinking water, supply water , pond water)by following methods I)Presumptive test II)Confirmatory test III)Completed test for coliform IV) Determination of MPN index.	Work out: 3Hrs; Incubation period: 24-48 Hrs; Result & observation: 3 Hrs and recapitulation

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Session 2020 -2021(November 2020 to 31st August 2021)
DSE-3
Semester-VI
Course Title: Biomathematics and Biostatistics
Course Code: BMCBDSHT5

Module 1	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Introduction Duration of each class is 1hr	12	Defination of sample and population	1	Lectures(1 class)
		Concept of variable	1	Lecture (1class)
		Frequency Distribution and its graphical representation	3	Lecture(2 classes) & PPT(1class)
		Mean,Median,Mode	4	Lecture (4 classes)
		Standard Deviation, Standard Error	2	Lecture (2 classes)
		Internal Assessment	1	1 class

Lesson plan: Mr.Ratul Mukherjee
Mode: online
Session 2020 -2021(November 2020 to 31st August 2021)
DSE-3
Semester-VI
Course Title: Biomathematics and Biostatistics
Course Code: BMCBDSHT5

Module 2	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Elementary Statistics Duration of each class is 1hr	12	Test of statistical significance	4	Lectures(2 classes) & PPT (2 Classes)
		Simple correlation and regression	3	Lectures (3 classes)
		Analysis of variance	4	Lectures(2 classes) & PPT (2 Classes)
		Internal Assessment	1	1 class

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Session 2020 -2021(November 2020 to 31st August 2021)
DSE-3
Semester-VI
Course Title: Biomathematics and Biostatistics
Course Code: BMCBDSHT5

Module 3	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Preliminary Notion on sampling Duration of each class is 1hr	6	Sampling Parameters	1	Lectures(1 class)
		Difference between sample and population	1	Lectures (1 class)
		Sampling errors, Difference between Parametric and No-Parametric statistics	4	Lectures(2 classes) & PPT (2 Classes)
		Internal Assessment	2	2 class

Lesson plan: Mr.Ratul Mukherjee
Mode: online
Session 2020 -2021(November 2020 to 31st August 2021)
DSE-3
Semester-VI
Course Title: Biomathematics and Biostatistics
Course Code: BMCBDSHT5

Module 4	Alloted Lectures	Sub Module	Classes needed	Teaching- Learning Methodology
Test of significance Duration of each class is 1hr	16	Sampling distribution and Standard Error	2	Lectures(2 classes)
		Testing of hypothesis, Level of significance and Degree of freedom	4	Lectures (4 class)
		Large sample test based On normal distribution	4	Lectures(2 classes) & PPT (2 Classes)
		z-test,f-test and chi-test	4	Lecture(4 classes)
		Internal Assessment	2	2 classes

LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FIRST SEMESTER PAPER-BMCBCCHT-101
LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPIC TO BE COVERED	Allotted lectures	No of hours allotted
Unit 2.Bacteria: General account & Economic importance of Low G+C(Firmicutes)	Students will be able to comprehend about general characteristics of Mycoplasma and diseases caused by mycoplasmas different species.	Lecture method,ppt,pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1. Scientific classification of Firmicutes, its characteristics, and its importance.	3 lectures.	1 hours X 3= 3 hours
Unit 2.Bacteria: General account & Economic importance of chlamydia	Students will be able to comprehend about general characteristics of chlamydia, diseases caused by chlamydia. Its life cycle .	DO	1.Scientific classification of chlamydia 2. Its characteristics. Lifecycle of Chlamydia 3. Pathogenic nature, obligate intracellular parasitism. 4. Diseases caused by different species of Chlamydia.	4 Lectures	1 hours X 4= 4 hours
Unit 2.Bacteria: General account & Economic importance of Rickettsia.	Students will be able to comprehend about general characteristics of Rickettsia, diseases caused by this. Its life cycle.	DO	1.Scientific classification of Rickettsia 2. General characteristics and Lifecycle of Rickettsia 3. Pathogenic nature, obligate intracellular parasitism. 4.Diseases caused by different species of Rickettsia	4 Lectures	1 hours X 4= 4 hours
Unit 2.Bacteria: General account & Economic importance of High G+C Actinobacteria.	Students will be able to comprehend about general characteristics of Actinobacteria. Diseases caused by this. Its life cycle.	DO	1.Scientific classification of Phylum Actinobacteria 2. General characteristics and Lifecycle of Actinobacteria. 3. Pathogenic nature, obligate intracellular parasitism. 4. Diseases caused by different species of Actinobacteria.	4 Lectures	1 hours X 4= 4 hours
Unit 2.Bacteria: General account & Economic importance of Cyanobacteria.	Students will be able to comprehend about general characteristics of Cyanobacteria and Why are cyanobacteria important to Humans.	DO	1. Scientific classification of Cyanobacteria. 2. General characteristics Cyanobacteria. 3. CYANOBACTERIA: Precious Bio-resource in agriculture.	4 Lectures	1 hours X 4= 4 hours
Unit 2.Bacteria: General account & Economic importance of Archae bacteria.	Students will be able to comprehend about general characteristics and types of Archaeobacteria, its importance.	DO	1. Eubacteria v/s Archaeobacteria. 2. Special feature of Archaeobacteria. 3. History of domain Archae. 4.Differenttypes of Archeae bacteria. 5.Importance of Archaeobacteria.	5 Lectures	1 hours X 5= 5 hours

LESSON PLAN SCHEME OF WORK 2021-22 J.K. COLLEGE DEPARTMENT OF MICROBIOLOGY SUBJECT :MICROBIOLOGY FIRST SEMESTER PAPER-BMCBCCHT-102 LECTURER NAME : SWARUP MUKHERJEE					
Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 3 Microscopy &stain and staining techniques	Students will be able to comprehend about microscopy and different types and working principles about e.g light microscopy, and electron microscopy, fluorescent microscopy	Lecture method,ppt,pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1. Different types of microscope, history, diagram, principle of of optics. 2. Bright field and dark field microscope. 3. Phase contrast, fluorescent microscope principle and uses. 4. Electron microscope principle, schematic diagram, uses. 5. EM VS light & SEM and tem differences.	4 Lectures	1 hours X 4= 4 hours
	Students will be able to comprehend about stains and staining techniques in microbiology	DO	1. Classification of stains. Dye vs Stain 2. Principle of different staining technique.	4 Lectures	1 hours X 4= 4 hours

LESSON PLAN SCHEME OF WORK 2021-22 J.K. COLLEGE DEPATMENT OF MICROBIOLOGY SUBJECT :MICROBIOLOGY THIRD SEMESTER PAPER-BMCBCCHT-301(Microbial physiology and metabolism) LECTURER NAME : SWARUP MUKHERJEE					
Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 1. Microbial growth and effect of environment on microbial growth	Students will be able to understand the bacterial growth, measurement of microbial growth in different culture method. different factors that affect microbial growth	Lecture method,ppt,pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1. Definition of growth, generation time. 2. Batch, fed batch, continuous culture techniques. 3. Mathematical calculation of microbial growth. 4. Different growth factors.	10 Lectures	1 hours X 10= 10 hours

LESSON PLAN SCHEME OF WORK 2021-22 J.K. COLLEGE DEPATMENT OF MICROBIOLOGY SUBJECT :MICROBIOLOGY					
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THIRD SEMESTER PAPER-BMCBCCHT-302(Cell biology and Molecular biology)					
LECTURER NAME : SWARUP MUKHERJEE					
Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT :4 Transcription in prokaryotes	Students will be able to comprehend about Central Dogma of Protein Synthesis, Prokaryotic and eukaryotic transcription. Basic idea about post Transcriptional modifications	Lecture method,ppt,pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1. Central dogma of protein synthesis. 2. Replication vs transcription. 3. Differences between transcription in eukaryotes and prokaryotes. 4. Study of different transcriptional factors and their function in eukaryotes and prokaryotes. 5. post Transcriptional modifications	6 Lectures	1 hours X 6= 6 hours

LESSON PLAN SCHEME OF WORK 2021-22 J.K. COLLEGE DEPATMENT OF MICROBIOLOGY SUBJECT :MICROBIOLOGY					
THIRD SEMESTER PAPER-BMCBCCHS-303(LABORATORY TECHNIQUES IN MICROBIAL PHYSIOLOGY,MOLECULAR AND CELL BIOLOGY) PRACTICAL PAPER LECTURER NAME : SWARUP MUKHERJEE					
Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ METHODOLOGY OF THE PRACTICALS	Allotted lectures	No of hours allotted
1.study and plot of bacterial growth curve by turbidometric method	Students will be able to comprehend about bacterial growth measurement techniques by tubidometric or optical density measurement technique.	Lecture about the protocol of the practical. Instrument handling (colorimeter/ spectrophotometer). Protocol writing in Lab records, Viva voce test, for internal assessment.	1.24 hours active bacterial culture preparation prior to start the practical. 2. Ascetically inoculation of cultures in sterilize nutrient broth. 3. Study the O.D half an hour time interval. 4.graph preparation according to the result	6 lectures	1 hours X 6= 6 hours
2.Effect of temperature n growth of <i>Escherichia coli</i>	Students will be able to comprehend about The cardinal temperature, different types of bacteria according to their temperature relationship.	Lecture about the protocol of the practical. Instrument handling (colorimeter/ spectrophotometer). Protocol writing in Lab records, Viva voce test, for internal assessment.	1.24 hours active bacterial culture <i>Escherichia coli</i> preparation prior to start the practical. 2. Ascetically inoculation of cultures in sterilize labeled nutrient broth. 3 Incubate conical flasks at different temperature 3.study the O.D after 24 hours incubation. 4.graph preparation according to the result	6 lectures	1 hours X 6= 6 hours
3..Effect of pH on growth of <i>Escherichia coli</i>	Students will be able to comprehend about The pH, different types of bacteria according to their pH relationship.	Lecture about the protocol of the practical. Instrument handling (colorimeter/ spectrophotometer).	1.24 hours active bacterial culture <i>Escherichia coli</i> preparation prior to start the practical and different broth preparation. 2. Ascetically inoculation of cultures in sterilize labeled nutrient broth.	6 lectures	1 hours X 6= 6

		Protocol writing in Lab records, Viva voce test, for internal assessment.	3 Incubate conical flasks at 37 degree centigrade. 3. Study the O.D after 24 hours incubation. 4.graph preparation according to the result		hours
4.Effect of heavy metals on growth of <i>Escherichia coli</i>	Students will be able to comprehend about The oligodynamic action of different heavy metals	Lecture about the protocol of the practical. Instrument handling (colorimeter/ spectrophotometer). Protocol writing in Lab records, Viva voce test, for internal assessment.	1.24 hours active bacterial culture <i>Escherichia coli</i> preparation prior to start the practical and different broth/solid media preparation. 2. carry out the practical ascetically according to the protocols provide.	6 lectures	1 hours X 6= 6 hours
4.Effect of osmotic pressure on growth of <i>Escherichia coli</i>	Students will be able to comprehend about The osmosis ,plasmolysis,deplasmolysis, Effect of different heavy metals on <i>Escherichia coli</i> .	Lecture about the protocol of the practical. Instrument handling (colorimeter/ spectrophotometer). Protocol writing in Lab records, Viva voce test, for internal assessment.	1.24 hours active bacterial culture <i>Escherichia coli</i> preparation prior to start the practical and different broth/solid media preparation. 2. carry out the practical ascetically according to the protocols provide.	6 lectures	1 hours X 6= 6 hours

LESSON PLAN SCHEME OF WORK 2021-22 J.K. COLLEGE DEPARTMENT OF MICROBIOLOGY SUBJECT :MICROBIOLOGY THIRD SEMESTER PAPER-BMCBSEHT-305(BIOFERTILIZER &BIO PESTICIDES) PRACTICAL PAPER LECTURER NAME : SWARUP MUKHERJEE					
Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 2 Non Symbiotic Nitrogen Fixers	Helps students develop the knowledge about nonsymbiotic nitrogen fixers	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	Different microbial association. Nitrogen fixers. Symbiotic nitrogen fixers ,and its uses	2 lectures	1hourX2=2 hours

LESSON PLAN SCHEME OF WORK 2021-22

J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FOURTH SEMESTER

PAPER-BMCBCCHT 402 (INDUSTRIAL, FOOD AND DIARY MICROBIOLOGY)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 5 Food borne disease(causative agents, foods involved, symptoms and preventive measures	Helps students develop the knowledge about food intoxication, and food infection.	Lecture method , PPT presentation, PDF notes ,Question answer technique, MCQ discussion, , internal assessment exam	1. Food intoxication by different bacterial species. 2.Food infection by different bacterial species	4 lectures	1hourX4=4 hours

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LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FOURTH SEMESTER

PAPER-BMCBCCHT 402 (INDUSTRIAL, FOOD AND DIARY MICROBIOLOGY)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ METHODOLOGY OF THE PRACTICALS	Allotted lectures	No of hours allotted
1.Determination of viral plaque assay	Students will be able to comprehend about the technique to prepare viral plaque,and thus quantify virus.	Lecture about the protocol of the practical. Different media for virus isolation. Protocol writing in Lab records, Viva voce test for internal assessment.	1.24 hours active bacterial culture <i>Escherichia coli</i> preparation prior to start the practical and different broth/solid media preparation. 2. DSPB PREPARATION. 3. Carry out the practical aseptically according to the protocols provide.	6 lectures	1 hours X 6= 6 hours
2 Examination of milk quality by MBRT TEST	Students will be able to comprehend about the technique to detect the grade of milk	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test	Carry out the practical aseptically		

		for internal assessment.	according to the protocols provide.	6 lectures	1 hours X 6= 6 hours
3.Kirby- Bauer disc diffusion of antibiotic susceptibility test	Students will be able to comprehend about the antibiogram techniques for pathogenic organisms	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test for internal assessment.	Carry out the practical ascetically according to the protocols provide.	6 lectures	1 hours X 6= 6 hours
4.Determination of MIC of antibiotic (penicillin& streptomycin)using gram + and – ve bacteria	Students will be able to comprehend about the Minimum inhibitory concentration and minimum bactericidal concentration of antibiotic.	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test, for internal assessment.	Carry out the practical ascetically according to the protocols provide.	6 lectures	1 hours X 6= 6 hours
5.Assay of antibiotic residue in milk	Helps students develop the knowledge to test antibiotic if present in milk, and its side effects in our body especially for infants.	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test, for internal assessment.	Carry out the practical ascetically according to the protocols provide.	6 lectures	1 hours X 6= 6 hours
6.Detection of Antimicrobial compounds in plant materials	Helps students develop the knowledge about antimicrobial activity of different plant extract,	Lecture about the ethno botany, protocol of the practical. Protocol writing in Lab records, Viva voce test, for internal assessment.	Carry out the practical ascetically according to the protocols provide.	6 lectures	1 hours X 6= 6 hours
7.Production of Bioinsecticides by using Bacillus thuringensis	Students will be able to comprehend about the Bio insecticides, it's safer role to humans and the environment than conventional chemical pesticides.	Lecture about the bio pesticides, its mode of action.in vivo and invitro preparation technique. Protocol of the practical. Protocol writing in Lab records, Viva voce test, for internal assessment.	1.Pure culture preparation of <i>Bacillus thuringensis</i> . 2.media preparation for bt toxin production. 3.isolation of Bt after production. 4.spray the solution of Bt in caterpillar's.	6 lectures	1 hours X 6= 6 hours
8. Cultivation of edible mushroom	Students will be able to comprehend about the edible mushroom, its nutritional value, cultivation techniques.	Lecture about the edible and poisonous mushroom ,cultivation techniques. Protocol writing in Lab records, Viva voce test, for internal assessment.	1. Spawn culture preparation of <i>Agaricus bisporus</i> . 2. Straw bed preparation for the spawn. 3. Aseptic condition maintain.	6 lectures	1 hours X 6= 6 hours

LESSON PLAN

SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FOURTH SEMESTER

PAPER-BMCBSEHT 405 (MICROBIOLOGICAL ANALYSIS OF AIR AND WATER)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 5. Microbiological Analysis of water	Students will be able to comprehend about the analysis technique of water, helps them to gather knowledge about potability and nonpotability criteria of water.	Lecture about the different microbiological analysis of water. Explanation about the different qualitative & Quantitative test for assessment of water. Protocol writing in Lab records, Viva voce test, for internal assessment.	Lectures on microbiological assessment of water and methodology of microbial analysis of water.	5 lectures	1hours X 5= 5 hours

LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FIFTH SEMESTER

PAPER-BMCBSEHT 501 (IMMUNOLOGY AND MEDICAL MICROBIOLOGY)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT :9 PROTOZOAL DISEASE	Helps students develop the knowledge about the different protozoal diseases	Lecture method , ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1.parasitism,intermediate host and definitive host. 2.Malarial protozoa, life cycle in human and mosquito. 3.kala –azar its causative agents,and life cycle. 4. different protozoal diseases .	8 lectures	1hours X 8= 8 hours

LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FIFTH SEMESTER

PAPER-BMCBSEHS 502 (Applied course in clinical and industrial Microbiology)					
LECTURER NAME : SWARUP MUKHERJEE					
Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
3. Identification of Human blood groups (slide agglutination method)	Helps students develop the knowledge about the Human blood group .	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test for internal assessment.	1. Human blood group detection technique. 2.universal donor and acceptor 3. Bombay blood group	3lectures	1hours X 3= 3 hours
4.Perform DOT ELISA	Students will be able to comprehend about the DOT ELISA TEST	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test for internal assessment.	Carry out the practical ascetically according to the protocols provide.	3 lectures	1hours X 3= 3 hours
5..WIDAL TEST (RAPID SLIDE TEST)	Students will be able to comprehend about the WIDAL TEST (RAPID SLIDE TEST)	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test for internal assessment.	Carry out the practical ascetically according to the protocols provide.	3 lectures	1hours X 3= 3 hours
8. STUDY OF DIFFERENTIAL MEDIA	Students will be able to comprehend about the DIFFERENTIAL MEDIA.	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test for internal assessment.	Preparation of different differential media as per syllabus	9 LECTURES	1 hours X 9=9 HOURS
10.paper chromatography and TLC of sugars an amino acids	Students will be able to comprehend about the partition chromatography, and adsorption chromatography	Lecture about the protocol of the practical. Protocol writing in Lab records, Viva voce test for internal assessment.	Carry out the practical according to the protocols provide.	12 LECTURES	1 hours x 12=12 HOURS

LESSON PLAN SCHEME OF WORK 2021-22 J.K. COLLEGE DEPATMENT OF MICROBIOLOGY SUBJECT :MICROBIOLOGY					
FIFTH SEMESTER PAPER-BMCBDSHT 1 (Microbes in sustainable agriculture and development) LECTURER NAME : SWARUP MUKHERJEE					
Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
Unit 5 bio fertilization, phytostimulation,bio insecticides	Helps students develop the knowledge about the bio fertilization, phytostimulation,bio insecticides	Lecture method , ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1. symbiotic nitrogen fixer,its role towards nature. 2. Non symbiotic and associative symbiotic N ₂ fixer 3.PGPR,Phosphate solubilizer	4 LECTURES	1 hours x 4 =4 HOURS

LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPATMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FIFTH SEMESTER

PAPER-BMCBDSHT 2 (INSTRUMENTATION AND BIOTECHNIQUES)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 1. MICROSCOPY	Students will be able to comprehend about microscopy and different types and working principles about e.g light microscopy, and electron microscopy, fluorescent microscopy	Lecture method,ppt,pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	6. different types of microscpe,history,diagram,principle of of optics. 7. bright field and dark field microscope. 8. phase contrast, fluorescent microscope principle and uses. 9. electron microscope principle ,schematic diagram, uses. 10. EM VS light & SEM and tem differences.	4 Lectures	1 hours X 4= 4 hours
UNIT 2. CHROMATOGRAPHY	Students will be able to comprehend about different types of chromatography its working principles,and uses in different areas	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1. Principle and application of different types of chromatography. 2.idea about partition coefficient, different forces apply in chromatography.	12 LECTURES	1 hours x 12=12 HOURS

LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPATMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

FIFTH SEMESTER

PAPER-BMCBDSHT 2 (MICROBIAL BIOTECHNOLOGY)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 4.Microbial products and their recovery	Students will be able to comprehend about the downstream procedure in industry, and product recovery	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1.different types of product purification methods in industry. 2.immobilization methods and their application.	6 LECTURES	1 hours x 6=6 HOURS

LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

SIXTH SEMESTER

PAPER-BMCBCCHT 601 (ENVIRONMENTAL MICROBIOLOGY)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
UNIT 5 .Positive and negative role of microbes in environments	Students will be able to comprehend about the bioremediation ,bio magnification and microbial deterioration. and about microbial leaching	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	1.Different types of bioremediation methods 2. Bioremediation against bio magnification. 3. Biodegradation of recalcitrant products. Idea about Xenobiotic 4.role of microbes in microbial deterioration. and microbial leaching 1.	10 lectures	1 hours x 10=10 HOURS
UNIT 6. Water potability	Students will be able to comprehend about the analysis technique of water, helps them to gather knowledge about potability and nonpotability criteria of water.	Lecture about the different microbiological analysis of water. Explanation about the different qualitative & Quantitative test for assessment of water. Protocol writing in Lab records, Viva voce test, for internal assessment.	Lectures on microbiological assessment of water and methodology of microbial analysis of water.	5 lectures	1hours X 5= 5 hours

LESSON PLAN
SCHEME OF WORK 2021-22
J.K. COLLEGE
DEPARTMENT OF MICROBIOLOGY
SUBJECT :MICROBIOLOGY

SIXTH SEMESTER

PAPER-BMCCHS 602 (Applied course in Environmental microbiology)

LECTURER NAME : SWARUP MUKHERJEE

Learning block	Student learning outcomes (SLOs)	STRATEGY	ASSESSMENT/ TOPICS TO BE COVERED	Allotted lectures	No of hours allotted
1.Isolation of microbes	Students will be able to comprehend about the isolation technique of bacteria and fungi from different areas of soil,water and air.	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	Deferent media and technique employed for isolation of bacteria and fungi	18 lectures	1 hours X 18=18 hours
2.Enrichment culture technique	Students will be able to comprehend about the enrichment technique of different categories bacteria	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	Deferent media and technique employed for enrichment of the cited microorganisms in syllabus.	18 lectures	1 hours X 18=18 hours
3.Assessment of microbiological quality of water	Students will be able to comprehend about the analysis technique of water, helps them to gather knowledge about potability and nonpotability criteria of water and different tests to detect the bacteria in water.	Lecture about the different microbiological analysis of water. Explanation about the different qualitative & Quantitative test for assessment of water. Protocol writing in Lab records, Viva voce test, for internal assessment.	Lectures on microbiological assessment of water and methodology of microbial analysis of water.	18 lectures	1 hours X 18=18 hours
4.filter disc method of water analysis	Students will be able to comprehend about the determination of microbial load in water by filter disc method.	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	Carry out the practical according to the protocols provide.	6 lectures	1 hours X 6=6 hours
5.Determination of BOD of water	Students will be able to comprehend about the BOD AND COD	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	Carry out the practical according to the protocols provide.	6 lectures	1 hours X 6=6 hours
6.ISOLATION OF RHIZOBIUM FROM ROOT NODULES	Helps students develop the knowledge about the Isolation techniques of Rhizobium	Lecture method, ppt, pdf notes ,Question answer technique, MCQ discussion, , internal assessment exam	Carry out the practical according to the protocols provide.	6 lectures	1 hours X 6=6 hours

Lesson Plan**By Miss Halima Zohra****Mode - Online****Session 2020-2021****(November 2020 to 31st August 2021)****CC-01****Course title: Introduction to microbiology and microbial diversity****Course Code- BMCBCCHT101**

Module-1	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Protozoa *Duration of each class is 1hour	10	<i>General characteristics with special reference to Amoeba</i>	2	<i>Lecture (1 class) & feedback Audio-Visual presentation (1 class)</i>
		<i>Paramecium</i>	2	<i>Lecture (1 class) Audio-visual presentation (1 class) and students' feedback.</i>
		<i>Plasmodium</i>	1	<i>Lecture (1 class)</i>
		<i>Leishmania</i>	1	<i>Lecture (1 class)</i>
		<i>Giardia</i>	1	<i>Lecture (1 class)</i>
		<i>Students' seminar</i>	2	<i>2 classes</i>
		<i>Question & answer discussion</i>	1	<i>1 class</i>
		<i>Revision</i>	1	<i>1 class</i>

CC-02**Course title: Bacteriology and virology****Course Code- BMCBCCHT102**

Module-2	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Cell organization	20	<i>Cell size, shape and arrangement, glycocalyx, capsule</i>	2	<i>Lecture (1 class) Audio-visual presentation (1 class) and students' feedback.</i>
		<i>Flagella, Endo flagella, fimbriae And pili.</i>	2	<i>Lecture (1 class) & feed back Audio-Visual presentation (1 class)</i>
		<i>Cell-wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls,</i>	2	<i>Lecture (1 class) & M.C.Q. discussion (1 class).</i>
		<i>Archaeobacterial cell wall,</i>	1	<i>Lecture (1 class)</i>

*Duration of each class is 1 hour		<i>Gram and acid-fast staining mechanisms</i>	2	<i>Lecture (1 class) Surprise test (1 class)</i>
		<i>lipopolysaccharide (LPS), Sphaeroplasts, protoplasts, and L-forms.</i>	1	<i>1 class lecture</i>
		<i>Effect of antibiotics and enzymes on the cell wall</i>	1	<i>Lecture (1 class)</i>
		<i>Cell Membrane: Structure, function and chemical composition of bacterial and archaeal cell membranes.</i>	2	<i>Lecture (1 class) Audio-visual presentation (1 class) and students' feedback.</i>
		<i>Ribosomes, chromosome and plasmids.</i>	2	<i>Lecture (1 class) & question and answer discussion.</i>
		<i>Endospore: Structure, formation, stages of sporulation.</i>	1	<i>Lecture (1 class)</i>
		<i>Cytoplasmic inclusion bodies- (Chlorosome, Magnetosome, Carboxysome, Gas-vesicles),</i>	2	<i>Lecture (1 class) Audio-visual presentation (1 class) and students' feedback</i>
		<i>Question & answer discussion</i>	1	<i>1 class</i>
		<i>Revision</i>	1	<i>1 class</i>

CC-03

Course title: BIOCHEMISTRY

Course Code- BMCBCCHT201

Module-3	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Thermodynamics	10	First and second laws of Thermodynamics.	1	<i>Lecture (1 class)</i>
		Definitions of Gibb's Free Energy, enthalpy.	1	<i>Lecture (1 class)</i>
		Entropy and mathematical relationship among them.	2	<i>Lecture (1 class) (1class) and students' feedback.</i>

*Duration of each class is 1hour		Standard free energy change and equilibrium constant.	2	<i>Lecture (1 class) & question and answer discussion(1class).</i>
		High energy bond	1	<i>Lecture (1 class)</i>
		Biological applications of thermodynamics.	1	<i>Lecture (1 class)</i>
		Question & answer discussion.	1	<i>1 Class</i>
		Revision	1	<i>1 Class</i>
Lipids *Duration of each class is 1hour	14	Definition and major classes of storage and structural lipids. Storage lipids	1	<i>Lecture (1class)</i>
		Fatty acid's structure and functions.	1	<i>Lecture (1 class)</i>
		Essential fatty acids. Triacylglycerols structure, functions and properties.	2	<i>Lecture (2 classes)</i>
		Saponification Structural lipids. Phosphoglycerides: Building blocks, General Structure functions and properties	2	<i>Lecture (1 class) & question and answer discussion(1class).</i>
		Structure of phosphatidyl ethanol amine and Phosphatidyl choline, Sphingolipids: building blocks, structure of sphingosine, Special. mention of sphingomyelins,	2	<i>Lecture (1 class) (1class) and students' feedback.</i>
		cerebrosides and gangliosides Lipid functions: cell signals, cofactors, prostaglandins,	1	<i>Lecture (1 class)</i>
		Introduction of lipid micelles, monolayers, Bilayers	1	<i>Lecture (1 class)</i>
		Quiz	2	<i>2 Classes</i>
		Remedial Class	1	<i>1 Class</i>
		Revision	1	<i>1 Class</i>

CC-05				
Course title: MICROBIAL PHYSIOLOGY AND METABOLISM				
Course Code- BMCBCCHT301				
Module-4	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Nutrient uptake and Transport *Duration of each class is 1hour	10	Passive and facilitated diffusion.	1	Lecture (1 Class)
		Primary and secondary active transport.	1	Lecture (1 Class)
		Concept of uniport, symport and antiport Group translocation.	2	Lecture (2 Classes)
		Question & answer discussion	2	2 Classes
		Remedial class	1	1 Class
		Tutorial class	1	1 Class
		Revision	1	1 Class
		Internal Assessment examination	1	2 Classes
Nitrogen Metabolism-an over view *Duration of each class is 1hour	7	Introduction to biological nitrogen fixation Ammonia assimilation (3 Lectures),	2	Lecture (1 class) & question and answer discussion(1class)
		Assimilatory nitrate reduction.	1	Lecture (1 class)
		Dissimilatory nitrate reduction, denitrification	2	Lecture (1 class) (1class) and students' feedback.
		Remedial class	1	Lecture (1 class)
		Tutorial class	1	Lecture (1 class)
CC-06				
Course title: CELL BIOLOGY AND MOLECULAR BIOLOGY				
Course Code- BMCBCCHT302				
Module-4	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology

Structure and organization of Cell *Duration of each class is 1hour	12	Cell Organization–Eukaryotic (Plant and animal cells) and prokaryotic Plasma membrane: Structure and transport of small molecules	2	Lecture (1 class) Audio-visual presentation (1 class) and students' feedback
		Cell Wall: Eukaryotic cell wall, Extracellular matrix and cell matrix interactions	1	Lecture (1 class)
		Cell-Cell Interactions-adhesion junctions, tight junctions, gap junctions, and plasmodesmata	2	Lecture (1 Class) & Questions & answers discussion (1 class).
		Mitochondria, chloroplasts and peroxisomes	2	Lecture (2 classes)
		Cytoskeleton: Structure and organization of actin filaments, association of actin filaments with plasma membrane,	2	Lecture (1 Class)
		cell surface protrusions, intermediate filaments, microtubules	1	Lecture (1 class)
		Remedial Class	1	1 class
		Tutorial Class	1	1 class
		Revision	1	1 class
SEC-01 Course title: BIOFERTILIZERS & BIOPESTICIDES Course Code- BMCBSEHT305				
Module-5	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Bioinsecticides	7	General account of microbes used as bioinsecticides and their advantages over synthetic pesticides.	2	Lecture (1 class) & M.C.Q. discussion(1class)
		Bacillus thuringiensis, production, Field applications	2	Lecture (1 class) & M.C.Q. discussion(1class)

*Duration of each class is 1 hour		Viruses–cultivation and field applications.	2	Lecture (1 class) & M.C.Q. discussion(1class)
		Remedial	1	1 class
CC-08 Course title: Microbial Genetics and Recombinant DNA Technology (RDT) Course Code- BMCBCCHT401				
Module-6	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
DNA Amplification, DNA sequencing and construction of genomic and cDNA libraries. *Duration of each class is 1 hour	8	PCR: Basics of PCR, RT-PCR, Real-Time PCR	2	Lecture (1 class) Audio-visual presentation (1 class) and students' feedback
		Sanger's method of DNA Sequencing: Traditional and automated sequencing, ,	1	Lecture (1 class)
		shotgun sequencing, Genomic and cDNA Libraries: Preparation and uses,	2	Lecture (1 class) & question and answer discussion.
		Chromosome walking and chromosome jumping	1	Lecture (1 class)
		Remedial	1	Lecture (1 class)
		Tutorial	1	Lecture (1 class)
Applications of Recombinant DNA Technology *Duration of each class is 1 hour	4	Products of recombinant DNA technology: Products of human therapeutic interest insulin, hGH, antisense molecules.	2	2 classes lecture
		Bt transgenic-cotton, Gene therapy.	1	Lecture (1 class)
		Recombinant vaccines, protein engineering (Only basic idea).	1	Lecture (1 class)

CC-09

Course title: INDUSTRIAL, FOOD AND DAIRY MICROBIOLOGY.

Course Code- BMCBCCHT402

Module-7	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Types of fermentation processes, bio-reactors and measurement of Fermentation parameters. <i>*Duration of each class is 1 hour</i>	10	Types of fermentation processes-Solid-state and liquid-state (stationary and submerged) Fermentations	2	Lecture (1 class) & question and answer discussion.
		batch, fed-batch (e.g. baker's yeast) and continuous fermentations	1	Lecture (1 class)
		Components of a typical bio-reactor	1	Lecture (1 class)
		Types of bioreactors Laboratory	1	Lecture (1 class)
		pilot-scale and Production Fermenters	1	Lecture (1 class)
		constantly stirred tank and air-lift fermenters	1	Lecture (1 class)
		Measurement and Control of fermentation parameters-pH, temperature, dissolved oxygen, foaming and aeration	2	Lecture (1 class) Audio-visual presentation (1 class) and students' feedback
		Remedial class	1	Lecture (1 class)
		Revision	1	Lecture (1 class)
Microbial production of industrial products (micro-organisms involved, media, Fermentation conditions, downstream processing and uses)	18	Antibiotics (Penicillin)	1	Lecture (1 class)
		Antibiotics (Streptomycin)	1	Lecture (1 class)
		Amino acids (lysine)	1	Lecture (1 class)
		Vaccine (BCG vaccine)	1	Lecture (1 class)
		Enzymes (amylase)	1	Lecture (1 class)
		VitB12 production	1	Lecture (1 class)

*Duration of each class is 1 hour		Hormones (insulin production-Humulin)	1	Lecture (1 class)
		Seminar presentation by Student's	3	3 Classes
		Remedial	2	2 Classes
		Tutorial	1	1 Class
		Revision	1	1 Class
		Classes for Entrance Exam i) Topic discussion ii) M.C.Q practices.	4	4 Classes

SEC-02
MICROBIOLOGICAL ANALYSIS OF AIR AND WATER
Course Code- BMCBSEHT405

Module-8	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Control Measures *Duration of each class is 1 hour	4	Precipitation, chemical disinfection,	2	Lecture (1 class) & question and answer discussion.
		filtration, high temperature, UV light.	2	Lecture (1 class) & question and answer discussion.

CC-11
Course title: Immunology and Medical Microbiology
Course Code- BMCBCCHT501

Module-9	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Immunological Techniques *Duration of each class is 1 hour	4	Principles of Precipitation, Agglutination, Immuno diffusion, Immuno electrophoresis	2	Lecture (1 class) & question and answer discussion.
		ELISA, ELISPOT, Immuno fluorecence.	2	Lecture (1 class) & question and answer discussion.
Bacterial diseases		List of diseases of various organ systems and their causative agents.	1	Lecture (1 class)

*Duration of each class is 1hour	10	Respiratory Diseases: Haemophilus influenzae, Mycobacterium tuberculosis	2	Lecture (2 classes)
		Gastro intestinal Diseases: Escherichia coli, Salmonella typhi, Vibrio cholerae, Helicobacter pylori.	3	Lecture (2 classes) & question and answer discussion.
		Others: Staphylococcus aureus, Bacillus anthracis, Clostridium tetani	2	Lecture (2 classes)
		Revision	1	1 Class
		Classes for Entrance Exam i) Topic discussion ii) M.C.Q practices.	1	1 Class

DSE-1

Course Title: MICROBES IN SUSTAINABLE AGRICULTURE AND DEVELOPMENT

Course Code- BMCBDSHT1

Module-10	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Secondary Agriculture Biotechnology *Duration of each class is 1hour	11	Biotech feed, Silage, Biomanure.	2	Lecture (2 classes) & question and answer discussion.
		Biomanure, biogas	2	Lecture (2 classes)
		Biofuels–advantages and processing Parameters	2	Lecture (2 classes)
		Internal Examination	2	2 Classes
		Remedial Class	1	1 Class
		Classes for Entrance Exam i) Topic discussion ii) M.C.Q practices.	1	1 Class
		Revision	1	1 Class
GM crops *Duration of each class is 1hour	6	Advantages, social and environmental aspects	1	Lecture (1 class)
		Bt crops, golden rice,	1	Lecture (1 class)
		Transgenic animals	1	Lecture (1 class)
		Classes for Entrance Exam i) Topic discussion ii) M.C.Q practices.	1	1 Class
		Quiz Competition	2	2 Classes

DSE-3

Course Title: MICROBIAL BIOTECHNOLOGY

Course Code- BMCBDSHT3

Module-11	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
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Microbes for bioenergy and environment <i>*Duration of each class is 1 hour</i>	14	Bio-ethanol and bio-diesel production.	2	2 classes lecture
		Biogas production: Methane production using microbial culture.	2	2 classes lecture
		Hydrogen production using microbial culture	2	2 classes lecture
		Microorganisms in bioremediation: Degradation of xenobiotic	2	Lecture (1 class) Surprise test (1 class)
		Mineral recovery, removal of heavy metals from aqueous effluents	2	Lecture (1 class) Audio-visual presentation (1 class) and students' feedback.
		Revision	1	1 Class
		Classes for Entrance Exam i) Topic discussion ii) M.C.Q practices.	1	1 Class
		Remedial Class	1	Lecture (1 class)
		Tutorial Class	1	Lecture (1 class)

CC-13

Course Title: ENVIRONMENTAL MICROBIOLOGY

Course Code- BMCBCCHT601

Module-12	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Microorganisms and their Habitats <i>*Duration of each class is 1 hour</i>	12	Structure and function of ecosystems.	1	Lecture (1 class) & question and answer discussion.
		Terrestrial Environment: Soil profile and soil microflora .	1	Lecture (1 class)
		Aquatic Environment: Microflora of fresh water and marine habitat.	1	Lecture (1 class)
		Atmosphere: Aeromicro flora and dispersal of microbes	1	Lecture (1 Class)
		Animal Environment: Microbes in/on human body (Microbiotics) & animal (ruminants) body.	1	Lecture (1 Class)
		Extreme Habitats: Microbes thriving at high & low temperatures, pH, high Hydrostatic & osmotic pressures, salinity, & low nutrient levels.	2	Lecture (1 class) Audio-visual presentation (1 class) and students' feedback.

		Microbial succession in decomposition of plant organic matter. (1 Lecture)	1	Lecture (1 Class)
		Internal Examination	1	1 Class
		Remedial class	1	1 Class
		Classes for Entrance Exam i) Topic discussion ii) M.C.Q practices.	1	1 Class
		Tutorial class	1	1 class

DSE-5

Course Title: BIOMATHEMATICS AND BIOSTATICS

Course Code: BMCBDSHT5

Module-13	Allotted Lectures	Sub-module	Classes needed	Teaching-learning methodology
Biomathematics Unit: 1 <i>*Duration of each class is 1hour</i>	12	Definition of sample and population	1	Lecture (1 Class)
		concept of variable	1	Lecture (1 Class)
		Frequency distribution & its graphical representation	2	Lecture (1 Class) & Sum practice
		Mean	1	Lecture (1 Class)
		Median	1	Lecture (1 Class)
		Mode	1	Lecture (1 Class)
		Standard deviation & standard error	2	Lecture (1 Class) & Sum practice
		Remedial Class	1	Lecture (1 Class)
		Crash Classes	2	2 Classes
Unit: 2 <i>*Duration of each class is 1hour</i>	12	Tests of statistical significance.	2	Lecture (1 class) & question and answer discussion.
		Simple correlation and regression	2	Lecture (1 class) & sum practice.
		Analysis of variance	2	Lecture (2 classes)
		Remedial Classes	2	2 Class
		Tutorial Class	2	Lecture (2 classes)
		Crash Classes	2	2 Classes
Unit: 3	10	Mathematical modelling of bacterial growth curve.	2	Lecture (1 classes) & question and answer discussion
		Fermentation	2	Lecture (1 classes) & question and answer discussion
		control of microorganism	2	Lecture (1 classes) & question and answer discussion
		Remedial Class	1	1 Class

*Duration of each class is 1hour		Seminar presentation by students	3	3 Classes
Unit: 4 *Duration of each class is 1hour	38	Sets Relations and Functions.	3	Lecture (2 classes) & question and answer discussion
		Matrices and Determinants	3	Lecture (2 classes) & question and answer discussion
		Complex Numbers and Quadratic Equations	3	Lecture (2 classes) & question and answer discussion
		Integral Calculus (only basic)	2	Lecture (1 classes) & question and answer discussion
		Mathematical Induction	3	Lecture (2 classes) & question and answer discussion
		Coordinate Geometry	3	Lecture (2 classes) & question and answer discussion
		Binomial Theorem and its Simple Applications	3	Lecture (2 classes) & question and answer discussion
		Vector geometry	3	Lecture (2 classes) & question and answer discussion
		Mathematical Reasoning	4	Questions & Answers Discussion
		Remedial Class	3	3 Classes
		Tutorial Class	2	2 Classes
		Classes for Entrance Exam i) Topic discussion ii) M.C.Q practices.	3	3 Classes
		Crash Classes	2	2 Classes
		Internal Examination	1	1 Class

LESSON PLAN

SUBJECT-MICROBIOLOGY, SESSION: 2020-21, FACULTY- Miss Tumpa Mahato

SEMESTER- I

COURSE CODE- BMCBCCHT101

COURSE TITLE- INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

COURSE TYPE- CC1,

ALLOTTED LECTURES-12 (1 LECTURE= 1HOUR)

OBJECTIVES- By the end of the topic, students should explain why green and red algae are included in the plant kingdom while other algal groups are not, describe the three features that distinguish green algae from land plants, list the habitats of green algae, describe the economic importance of algae, distinguish the main morphological forms shown by green algae and name one example of each type, explain the terms sporophyte, gametophyte and alternation of generations.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
UNIT 2: Diversity of Microbial world	General characteristics of algae	1	A main aim of the course is to spark the student's interest and curiosity in phycology and to promote their active participation during the lectures: The teaching activities are as follows: i) Lectures Graphic support will be used in the lectures (PowerPoint slides). ii) Seminars iii) Evaluation: A test will be performed at the end of the course that will include short assay questions.
	Occurrence and habitat of algae	1	
	Thallus organization and ultra structure of Algae	2	
	Pigments, flagella, eye spot food reserves	2	
	Vegetative reproduction of Algae	1	
	Asexual reproduction	1	
	Sexual reproduction	2	
	Applications of algae in agriculture	1	
	Applications of algae in industry, environment and food	1	

COURSE CODE- BMCBCCHT102

COURSE TITLE- BACTERIOLOGY AND VIROLOGY

COURSE TYPE- CC2

ALLOTTED LECTURES-21

OBJECTIVES- The discussion on how viruses enter target cells, amplify their genomes and exit from these target cells will give a general view on the intimate relationship of viruses and cells, and will highlight the importance of host factors for virus survival. The discussion on the expansion of viruses within host organisms will emphasize the ongoing struggle between viruses with the immune system, and the students will also be provided with a broad and general knowledge of modern Virology.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING- LEARNING METHODOLOGY
Unit6: History & classification of virus	Viruses: History and development of virology	2	i) Lectures: Graphic support will be used in the lectures (Powerpoint slides). ii) Seminars: Some important topics in Virology will be given within seminars. The students will actively participate. Topics will be chosen from articles published in relevant journals and students will present the data to be discussed.
	Structural organization and chemistry of viruses (TMV, Animal Viruses and Bacteriophages)	1	
	Classification of viruses according to ICTV	1	
	Baltimore scheme of viral classification	1	
	Viral assay (Plaque assay and Pock test)	1	
Unit7: Lytic and lysogeny cycle	Lytic cycle of Bacteriophages with special reference to E. coli and T4	2	iii) Question answer discussion, iv) Evaluation: Continuous evaluation: the participation of students in the practical work and the seminars will be evaluated.
	Lysogeny cycle	1	
	Lysogenic conversion	1	
	Induction and significance	1	
	One step multiplication	1	
	Role of Different repressor in lytic and lysogenic cycle	2	
	Inducer protein in lytic and lysogeny cycle	2	
Unit8: Prions, viroid's, virusoids etc.	A general account on Prions	1	v)Final evaluation: A test will be performed at the end of the course that will include short assay questions
	Viroids and Virusoids	2	
	Satellite virus with special emphasis On its structure and replication.	2	

SEMESTER- II,

COURSE CODE- BMCBCCHT201

COURSE TITLE- BIOCHEMISTRY

COURSE TYPE- CC-3

ALLOTTED LECTURES- 12

OBJECTIVES- Students will be able to describe the structure of enzyme, effect of substrate concentration and product inhibition on the behavior of enzymes and also calculate the kinetic parameters $V_{\max}$ and K_M from enzyme saturation data using Line weaver-Burk methods.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
Unit6. Enzymes	Structure of enzyme: Apoenzyme and cofactors,	1	i) Lectures: Graphic support will be used in the lectures (PowerPoint slides). ii) Seminars: Some important topics in enzymology will be given within seminars. iii) Doubt clearing session iv) Tutorial lectures-2 Remedial lectures-1 v) Evaluation- Class test(10 marks)
	Prosthetic group-TPP, Coenzyme NAD, metal cofactors	1	
	Classification of enzymes	1	
	Mechanism of action of enzymes: active site, transition state complex and activation energy	1	
	Lock and key hypothesis, and Induced Fit hypothesis	1	
	Significance of hyperbolic, double reciprocal plots of enzyme activity, K_m	1	
	Allosteric mechanism Definition soft terms—enzyme unit, specific activity and turnover number	1	
	Multi enzyme complex: pyruvate dehydrogenase	1	
	Isozyme: lactate dehydrogenase	1	
	Effect of pH and temperature on. Enzyme activity	1	
	Enzyme inhibition: competitive	1	
	Non-competitive and mixed inhibition	1	

SEMESTER- III,

COURSE CODE- BMCBCCHT301

COURSE TITLE- MICROBIAL PHYSIOLOGY AND METABOLISM

COURSE TYPE- CC-5

ALLOTTED LECTURES- 16

OBJECTIVES- After this course, students will be able to discuss which components are necessary for the production of energy, identify the key energy molecule of the body, understand which type of cellular respiration produces more energy

and also compare the processes of aerobic and anaerobic respiration in terms of products formed, need for oxygen, and relative amounts of energy transferred.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING- LEARNING METHODOLOGY
Unit3: Chemo heterotrophic Metabolism- Aerobic Respiration	Concept of aerobic respiration	1	i)Lectures with PowerPoint presentation
	Anaerobic respiration	1	
	Fermentation	1	ii) Question answer discussion and doubt clearing session
	Sugar degradation path ways i.e. EMP	1	
	ED Pathway	1	iii) Tutorial lectures-2 Remedial lectures-1
	Pentose phosphate pathway	1	
	TCA cycle	2	
	Electron transport chain: components of respiratory chain	2	iv) Evaluation- Class test(10 marks)
	Comparison of mitochondrial and bacterial ETC	2	
	Electron transport phosphorylation	1	
	Uncouplers	1	
	Inhibitors	2	

COURSE CODE- BMCBCCHT302

COURSE TITLE- CELL BIOLOGY AND MOLECULAR BIOLOGY

COURSE TYPE- CC-6

ALLOTTED LECTURES- 04

OBJECTIVES- The students should be able to understand how bacteria regulate gene expression, examples of important regulatory systems and how current genomic analysis techniques promote understanding of regulation in individual bacterial species.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING- LEARNING METHODOLOGY
Unit 6 Gene Regulation	Positive control and negative control	1	i)Lectures with powerPoint presentation

	Inducible system and repressible system	1	ii) Question answer discussion iii) Tutorial lectures-2 Remedial lectures-1 iv) Evaluation- Class test(10 marks)
	Lac Operon and Catabolite repression	1	
	Try operon,	1	

COURSE CODE- BMCBCCHT305

COURSE TITLE- BIOFERTILIZERS & BIOPESTICIDES

COURSE TYPE- SEC-1

ALLOTTED LECTURES- 10

OBJECTIVES- The students should recognize the different types of fertilizer and advantages of using biofertilizer and understand the conceptual knowledge about biofertilizer and their way of manufacturing and application details.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
Unit1Biofertilizers	General account of the microbes used as biofertilizers for various crop plants	2	i)Lectures with powerPoint presentation
	Advantages of biofertilizer over chemical fertilizers	1	ii) Seminars: Some important topics related to agricultural microbiology will be given within seminars. The students will actively participate. Topics will be chosen from articles published in relevant journals and students will present the data to be discussed.
	SymbioticN ₂ fixers: Rhizobium-Isolation, characteristics, types, inoculum production	1	
	And field application, legume/pulses plants	1	
	Frankia-Isolation, characteristics	1	
	Alder Casurina plants, non-leguminous crop Symbiosis	1	
	· Cyanobacteria	1	ii) Question answer discussion iii) Tutorial lectures-2 Remedial lectures-1 iv) Evaluation- Class test(10 marks)
	Azolla-Isolation, characterization, mass multiplication	1	
	Role in rice cultivation, Crop response, field application	1	

SEMESTER- IV

COURSE CODE- BMCBCCHT401

COURSE TITLE- MICROBIAL GENETICS AND RECOMBINANT DNA TECHNOLOGY (RDT)

OBJECTIVES- Students will be able to understand the types of gene mutations, describe what occurs during each type of mutation, determine a harmful, helpful, and indifferent mutation in living things. Students will also be able to explain how bacterial cells can acquire new genes through conjugation, describe how a population of bacteria can evolve to become antibiotic resistant, use specific, real-world examples to show how quickly bacteria may develop resistance to new antibiotics and understand how rapidly bacteria reproduce, and discuss how this reproduction rate makes it possible for populations of bacteria to quickly adapt to new antibiotics.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
Unit1 Mutations	Mutations and mutagenesis: Definition	1	i) Lectures with PowerPoint presentation ii) Seminar: Important topic will be provided to the students for the seminar presentation
	Types of Mutations	1	
	Physical Mutagens	1	
	Chemical Mutagens	2	
	Molecular basis of mutations	2	
	Ames test	1	
Unit2 Plasmids	Types of plasmids–F plasmid, R Plasmids, Colicinogenic plasmids	1	iii) Question answer discussion iv) Tutorial lectures-2 Remedial lectures-1
	Ti plasmids	1	
	Linear plasmids, Yeast-2 μ plasmid	1	
	Plasmid replication and partitioning	1	
	Host range, Plasmid incompatibility	1	
	Plasmid amplification	1	
	Regulation of copy number	1	
	Curing of plasmids	1	
Unit3Mechanisms of Genetic Exchange	Transformation-Discovery, mechanism of natural competence	2	v) Evaluation- Class test (20 marks)
	Conjugation-Discovery, mechanism, Hfr and F' strains,	2	
	Interrupted mating technique	1	

	Transduction-Generalized transduction	1	
	Specialized transduction,	1	
	LFT & HFT lysates	1	

COURSE CODE- BMCBSEHT405

COURSE TITLE- MICROBIOLOGICAL ANALYSIS OF AIR AND WATER

COURSE TYPE- SEC-2

ALLOTTED LECTURES- 04

OBJECTIVES- After learning about the diseases, students can share these information to their family members so that they will become aware of waterborne diseases and each group students will also make a poster to hang in the classroom about particular disease.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING- LEARNING METHODOLOGY
Unit 4. Water Microbiology	Water borne pathogens	2	i) Lectures with PowerPoint presentation
	Water borne diseases.	2	ii)Evaluation: MCQ Test

SEMESTER- V

COURSE CODE- BMCBCCHT501

COURSE TITLE- IMMUNOLOGY AND MEDICAL MICROBIOLOGY

COURSE TYPE- CC-11

ALLOTTED LECTURES- 12

OBJECTIVES- The students will be able to describe the roles of the immune system or organ in both maintaining health and contributing to disease, identify the cellular and molecular basis of immune responsiveness.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING- LEARNING METHODOLOGY
Unit2 Immune Cells and Organs	Structure, Functions and Properties of: Immune Cells– Stem cell	1	i)Lectures with powerPoint presentation
	T cell	1	ii) Question answer discussion
	B cell	1	

	NK cell Macrophage, Neutrophil Eosinophil, Basophil, Mast cell, Dendritic cell	1	
	Immune. Organs–Bone Marrow	1	
	Thymus, Lymph Node, Spleen	1	
	GALT, MALT, CALT	1	
Unit10 Fungal diseases	Brief description of each of the following types of mycoses One representative Disease to be studied with respect to transmission symptoms and prevention Cutaneous mycoses: Tinea pedis (Athlete's foot)	2	iii) Tutorial lectures-2 Remedial lectures-1 iv) Evaluation- Class test(10 marks)
	Systemic mycoses: Histoplasmosis	1	
	Opportunistic mycoses: Candidiasis	2	

COURSE CODE- BMCBCCHT502

COURSE TITLE- APPLIED COURSE IN CLINICAL AND INDUSTRIAL MICROBIOLOGY

COURSE TYPE- CC-12

ALLOTTED CLASSES- 30

OBJECTIVES- The students will be able to identify various bacterial flora associated with skin and urinary tract based on their colony morphology and biochemical test e.g. IMViC, TSI, Nitrate reduction, Oxidase and Catalase test. From demonstrations, student will be able to understand industrial production of amino acid, enzymes and alcohol.

UNITS	TOPICS TO BE COVERED(Practical)	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
1. Microbial fermentations for the production and estimation (qualitative and quantitative) of (in practical exam only demonstration will be asked)	(a) Enzymes: bacterial alpha amylase from <i>Bacillus megaterium</i> and <i>Bacillus subtilis</i>	1	Lectures with PowerPoint presentation showing various images regarding industrial bulk production of various products and also the principle of the particular experiment will be discussed.
	(b) Amino acid: Glutamic acid using <i>Corynebacterium glutamicum</i>	1	
	(c) Organic acid: Citric acid by using <i>Aspergillus niger</i>	1	
	(d) Alcohol: Ethanol by <i>Saccharomyces cerevisiae</i>	1	

11. Study/demonstration of different parts of fermentor.	Different parts of fermentor	1	
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UNITS	LABORATORY WORK	NO. OF PRACTICAL CLASSES	TEACHING-LEARNING METHODOLOGY
6. Examination of Bacteria by using Urine dip slide & study about UTI	Sample collection, Inoculation, Incubation, Next day Observation	3	Discussion about the aim and principle of the experiment and the students will have to perform the experiment in laboratory.
7. Study of bacterial flora of skin by swab method.	Sample collection, Media preparation, inoculation and incubation, next day Observation	3	The experimental results and their applications will be discussed to promote the understanding of the whole experimental set-up.
9. Identify bacteria E. coli and Staphylococcus on the basis of cultural, morphological and Biochemical Characteristics-a. IMViC, TSI, Nitrate reduction, Oxidase and Catalase test	Media preparation, inoculation and next day reagent preparation and observation	5	

COURSE CODE- BMCBDSHT1

COURSE TITLE- MICROBES IN SUSTAINABLE AGRICULTURE AND DEVELOPMENT

COURSE TYPE- DSE-1

ALLOTTED CLASSES- 08

OBJECTIVES- The students will be able to understand the importance of soil, how soil layers are formed and by which process soil can be enriched, about phosphate solubilizing, nitrogen fixing, cellulose and hemicelluloses degrading bacteria.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
Unit2Mineralization of Organic & Inorganic Matter in Soil	Mineralization of cellulose	1	i)Lectures with powerPoint presentation ii) Question answer discussion iii) Evaluation- Class test(10 marks)
	Hemicelluloses	1	
	Lignocelluloses	1	
	Lignin and humus,	1	
	Phosphate	1	
	Nitrate, silica,	2	

	Potassium	1	
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COURSE CODE- BMCBDSHT2

COURSE TITLE- INSTRUMENTATION AND BIOTECHNIQUES

COURSE TYPE- DSE-2

ALLOTTED CLASSES- 10

OBJECTIVES- After this class, students should be able to understand electromagnetic wave and Beer's Lambert law and its derivation, solve the numerical problems related to this topic.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
Unit4. Spectrophotometry	Principle and use of study of absorption spectra of biomolecules	2	i)Lectures with powerPoint presentation
	Beer's Lambert law and its derivation	2	ii) Question answer discussion
	Instrumentation for UV- visible and infrared spectrophotometry	2	iii) Tutorial class-2
	Analysis of Biomolecules using UV and visible range	2	iv) Evaluation- Class test(10 marks)
	Colorimetry and turbidometry	2	

COURSE CODE- BMCBDSHT

COURSE TITLE- MICROBIAL BIOTECHNOLOGY

COURSE TYPE- DSE-3

ALLOTTED CLASSES- 08

OBJECTIVES- The students will be able to explain microbial based transformation of steroids, sterols and production of high fructose syrup, cocoa butter substitutes.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
Unit3. Applications of Microbes in Bio transformations	Microbial based transformation of steroids	2	i)Lectures with PowerPoint presentation
	Microbial based transformation of sterols	2	ii) Question answer discussion

	Bio-catalytic processes and their Industrial applications: Production of high fructose syrup	2	iii) Evaluation- Class test(10 marks)
	Production of cocoa Butter substitute	2	

SEMESTER- VI

COURSE CODE- BMCBCCHT601

COURSE TITLE- ENVIRONMENTAL MICROBIOLOGY

COURSE TYPE- CC-13

ALLOTTED LECTURES- 14

OBJECTIVES- After this course, student will be able to explain about different types of interactions of microbes with microbes, plants and animals.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING- LEARNING METHODOLOGY
Unit2 Microbial Interactions	Microbe interactions: Mutualism	2	i)Lectures with PowerPoint presentation
	Synergism,	1	ii) Question answer discussion and students feedback
	Commensalism	1	
	Competition,	1	iv) Evaluation- Class test(20 marks) assay type question
	Amensalism,	1	
	Parasitism, predation	1	
	Microbe-Plant interaction: Symbiotic	2	
	Nonsymbiotic interactions	1	
	Microbe-animal interaction: Microbes in ruminants	2	
	Nematophagus fungi	1	
	Symbiotic Luminescent bacteria	1	

COURSE CODE- BMCBDSHS4

COURSE TITLE- PROJECTWORK

COURSE TYPE- DSE-3

ALLOTTED LECTURES- 30

OBJECTIVES- Student will be able to apply their practical knowledge that is developed during previous semester practical classes and the students will get immense help from this project work for their higher education and further research works.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
1. Study of algal diversity of a pond 2. Study of microbial diversity of different soil, air condition etc.) 3. Antimicrobial activity of different plant extracts. 4.ANY OTHER PROJECTS ON MICR BIOLOGY	Topic of the project will be selected based on the topics mentioned on the syllabus.	30	Open discussion about the topic, Design of the experiment, Hands on laboratory work

COURSE CODE- BMCBDSHT6

COURSE TITLE- BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS

COURSE TYPE- DSE-4

ALLOTTED LECTURES- 08

OBJECTIVES- The students should be able to understand about bioethics in biological sciences so that they can able to analyze issues using scientific facts, ethical principles, and reasoned judgment.

UNITS	TOPICS TO BE COVERED	NO. OF LECTURES	TEACHING-LEARNING METHODOLOGY
UNIT6. Bioethics	Introduction to ethics and bioethics, framework for ethical decision making.	2	i) Lectures with PowerPoint presentation ii) Seminar: Important topic will be provided to the students for the seminar presentation iii) Question answer discussion iv) Evaluation: Class test(20 marks)
	Ethical Conflicts in biological sciences-interference with nature, bioethics in health.	1	
	Artificial Reproductive technologies, prenatal diagnosis	1	
	Ethics in transplantation and stem cell research, Human and animal experimentation	1	
	Agricultural biotechnology-Genetically engineered food, environmental risk, labeling and public opinion	1	
	Sharing benefits and protecting future generations-Protection of environment and biodiversity	1	
	Biopiracy	1	

LESSON PLAN
SUBJECT- MICROBIOLOGY
SESSION- 2020-21
BY- Miss Yanki Lama

SEMESTER-I
Course Code-BMCBCCHT101
Course Title- INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY
Course Type- CC-1

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING- LEARNING METHODOLOGY
Module-2 Diversity of Microbial World	By the end of the lesson, students will gain understanding about fungi and will be able to discuss its characteristics, reproductive nature and economic importance.	15 lectures (15 hours)	General characteristics of fungi	1	Lectures, ppt, mcq, discussion, class test, assignment, doubt clearing session
			Habitat, distribution	1	
			Nutritional Requirements	1	
			Fungal cell ultra-structure, thallus organization and aggregation	2	
			Fungal wall structure and synthesis	1	
			Asexual reproduction	1	
			Sexual reproduction, heterokaryosis, heterothallism	2	
			Parasexual Mechanism	1	
			Economic importance of fungi with examples in agriculture, environment	2	
			Industry, medicine, food	1	
			Biodeterioration and mycotoxins	1	
Module-3 An overview of Scope of Microbiology	Students will know the overall scope of the microbiology.	5 lectures (5 hours)	Introduction of the subject and members of microbial world and their distribution in nature	2	Lectures, ppt, open discussion
			Different branches of microbiology	1	
			Importance and scope of microbiology	1	
			Scope of microbiology as a modern science and applied areas of microbiology	1	

Course Code-BMCBCCHT102

Course Title- BACTERIOLOGY & VIROLOGY

Course Type- CC-2

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING- LEARNING METHODOLOGY
Module-4 Growth and nutrition	Students will be able to understand the nutritional requirements of bacteria and types of bacteria based on nutrition, effect of oxygen on microbial growth and different types of culture media.	8 lectures (8 hours)	Nutritional requirement	1	Lectures, ppt, mcq discussion, class test, assignment
			Nutritional types (Definition&Examples)– Photoautotroph; Photo-organotrophs; Chemo-lithotrophs (Ammonia,Nitrate,Sulphur, Hydrogen, Iron Oxidizing bacteria); Chemo-organotrophs	2	
			Effects of oxygen on growth; Classification on the basis of oxygen requirement & tolerance	2	
			Culture media: components of media- natural and synthetic media, chemically defined media, complex media	1	
			Selective & differential media	1	
			Transport media, enriched and enrichment media	1	
Module-5 Bacterial reproduction and Growth Characteristics	Students will be able to understand the microbial growth pattern, kinetics and characteristics.	10 lectures (10 hours)	Growth curve	2	Lectures, ppt, open discussion, mcq discussion, class test, doubt clearing session
			Generation time; Growth Kinetics	1	
			Asynchronous & synchronous growth	2	
			Batch & Continuous culture	1	
			Measurement of growth	2	
			Factors affecting growth	2	

SEMESTER-II**Course Code-BMCBCCHT201****Course Title- BIOCHEMISTRY****Course Type- CC-3**

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING- LEARNING METHODOLOGY
Module-3 Structures of DNA and RNA/Genetic Material	Students will know about basic understanding of structure and properties of nucleic acids.	8 lectures (8 hours)	DNA Structure: Miescher to Watson and Crick-historic perspective	2	Lectures, ppt, mcq discussion, class test, assignment
			DNA structure, Salient features of double helix, Types of DNA	2	
			Types of genetic material, denaturation and renaturation, cot curves	2	
			DNA topology–linking number, topoisomerases	1	
			Organelle DNA-mitochondria and chloroplast DNA	1	
Module-7 Vitamins	Students will understand the importance of vitamins in biological systems.	4 lectures (4 hours)	Classification and characteristics with suitable examples	2	Lectures, ppt, open discussion, mcq discussion, class test
			Sources and importance	2	

SEMESTER-II**Course Code-BMCBCCHS202****Course Title- LABORATORY TECHNIQUES IN MICROBIAL DIVERSITY AND BIOCHEMISTRY****Course Type- CC-4**

EXPT NO.	EXPERIMENT NAME	OBJECTIVE (After attending the experiments the students will be able to)	WORK OUT PLANNING
1	Microbiology Good Laboratory Practices and Biosafety	Specify laboratory rules and safety practices	Lectures-2, ppt
2	To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory	Describe the basic requirements in a microbiology laboratory and operate and explain the functions of various equipments used in microbiological lab	Day I- Lectures-3, ppt Day II- Lectures-3, ppt
3	Preparation of culture media for bacterial cultivation	Prepare different culture media for growth and maintenance of microorganisms	Work out time-day I- 3 hrs Work out time-day II- 3 hrs
4	Sterilization of medium using Autoclave and assessment for sterility	Assess the sterilization of medium using autoclave	Work out time-day I- 3 hrs Work out time-day II- 3 hrs
5	Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air	Identification of general bacteria present in air	Work out time-day I- 3 hrs Work out time-day II- 3 hrs
6	Staining Techniques: Gram Staining, Endospore Staining, Simple Staining, Negative Staining	Perform different staining techniques to study bacteria	Work out time- 3 hrs for each staining
7	Demonstration of motility of bacteria by Hanging Drop Technique	Visualize unstained living cells and its motility	Work out time- 3 hours
8	Isolation of pure cultures of bacteria by streaking method	Prepare and maintain pure cultures	Work out time-day I- 3 hrs Work out time-day II- 3 hrs
9	Estimation of CFU count by spread plate method/pour plate method.	To estimate the number of viable bacterial cells in a sample	Work out time-day I- 3 hrs Work out time-day II- 3 hrs for each experiment.
10	Study of <i>Rhizopus</i> , <i>Penicillium</i> , <i>Aspergillus</i> using permanent mounts	Describe the structure, morphology and identify different fungi	Total- 3 hrs for visualization, identification and writing in notebook
11	Study of <i>Spirogyra</i> and <i>Chlamydomonas</i> , <i>Volvox</i> using permanent Mounts	Describe the structure, morphology and identify different algae	Total time- 3 hrs for visualization, identification and writing in notebook
12	Study of the following protozoans using permanent mounts/photographs: <i>Amoeba</i> , <i>Paramecium</i> and <i>Euglena</i>	Describe the structure, morphology and identify different protozoans	Total time- 3 hrs for visualization, identification and writing in notebook
13	Biochemical Estimation: DNA (DPA Method), RNA (Orcinol Method), Sugar (DNSA Method), Amino Acid (Ninhydrin Method) and Protein (Lowry's Method)	Estimate different biomolecules	Work out time- 3 hrs for each estimation

SEMESTER-III**Course Code-BMCBCCHT301****Course Title-MICROBIAL PHYSIOLOGY AND METABOLISM****Course Type- CC-5**

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-4 Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation	By the end of the lecture, the students will understand the concept of anaerobic respiration and fermentation.	6 lectures (6 hours)	Anaerobic respiration with special reference to dissimilatory nitrate reduction(Denitrification; nitrate/nitrite and nitrate/ ammonia respiration; fermentative nitrate reduction)	2	Lectures, ppt, mcq discussion, class test, doubt clearing session
			Fermentation-Alcohol fermentation and Pasteur effect	2	
			Lactate fermentation-homofermentative and heterofermentative pathways	2	

Course Code-BMCBCCHT302**Course Title- CELL BIOLOGY AND MOLECULAR BIOLOGY****Course Type- CC-5**

MODULE	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-2 Cell Signaling	By the end of the lecture, the students will gain concept of cell signaling pathways.	8 lectures (8 hours)	Signaling molecules and their receptors	1	Lectures, ppt, mcq discussion, class test, doubt clearing session
			Function of cell surface receptors	1	
			Pathways of intra-cellular receptors–Cyclic AMP pathway	2	
			Cyclic GMP	2	
			MAP kinase pathway	2	

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-6 Translation in Prokaryotes	Students will understand the translation process detail.	5 lectures (5 hours)	Genetic code and its characteristics	1	Lectures, ppt, mcq discussion, class test, open discussion, doubt clearing session
			Charging of tRNA, aminoacyl RNA synthetases Mechanisms of initiation, elongation and termination of polypeptides in prokaryotes	2	
			Comparative study of translation of prokaryotes with that of eukaryotes	1	
			Inhibitors of protein synthesis in prokaryotes and eukaryote, post translational modifications (Only Basic Idea)	1	

Course Code-BMCBSEHT305

Course Title- BIOFERTILIZERS AND BIOPESTICIDES

Course Type- SEC-1

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-4 Mycorrhizal Biofertilizers	Students will understand the importance of mycorrhizal biofertilizers.	5 lectures (5 hours)	Importance of mycorrhizal inoculum	1	Lectures, ppt, mcq discussion, class test
			Types of mycorrhizae and associated plants	2	
			Mass inoculum production of VAM	1	
			Field applications of Ectomycorrhizae and VAM	1	

SEMESTER-IV**Course Code-BMCBCCHT401****Course Title- Microbial Genetics and Recombinant DNA Technology (RDT)****Course Type- CC-8**

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-5 Methods in Molecular Cloning	Students will learn about the transformation methods and their use in genetic engineering and analysis techniques of DNA, RNA and protein.	12 lectures (12 hours)	Transformation of DNA: Chemical method, Electroporation	1	Lectures, ppt, mcq discussion, class test, assignment
			Gene delivery: Microinjection, electroporation, biolistic method (gene gun)	2	
			Liposome and Viral mediated delivery	2	
			<i>Agrobacterium</i> - mediated delivery	1	
			DNA, RNA and Protein analysis: Agarose gel electrophoresis	1	
			Southern-and Northern-blotting techniques, dot blot	2	
			DNA microarray analysis	1	
			SDS-PAGE	1	
			Western blotting	1	

Course Code-BMCBCCHT402**Course Title- Industrial, food and dairy microbiology****Course Type- CC-9**

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-1 Foods as a substrate for microorganisms	By the end of lesson, the students will be able to understand about the factors that determine the presence, growth and survival of microorganisms in food.	4 lectures (4 hours)	Intrinsic factors that affect growth and survival of microbes in foods	1	Lectures, ppt, mcq discussion, class test, assignment
			Extrinsic factors that affect growth and survival of microbes in foods	1	
			Natural flora of food	1	
			Source of contamination of foods in general	1	

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-2 Microbial Contamination & Spoilage of various foods	Students will get the understanding of microorganisms associated with food, their role in spoilage and characterization.	10 lectures (10 hours)	Principles, Spoilage of vegetables, fruits,	2	Lectures, ppt, mcq discussion, class test, assignment doubt clearing session
			meat, eggs, fish,	2	
			milk and milk products,	2	
			bread, canned foods	1	
			Detection of spoilage and characterization	3	
Module-3 Principles and methods of food preservation	Students will learn about different food preservation techniques.	10 lectures (10 hours)	Principles, physical methods of food preservation: temperature-low, high	3	Lectures, ppt, mcq discussion, class test, open discussion, doubt clearing session
			Canning, drying	1	
			Irradiation, hydrostatic pressure,	1	
			high voltage pulse, microwave processing	1	
			Aseptic packaging,	1	
			Chemical methods of food preservation: salt, sugar, organic acids,	1	
			SO ₂ , nitrite and nitrates, ethylene oxide	1	
			antibiotics and bacteriocins	1	

Course Code-BMCBSEHT405

Course Title-Microbiological analysis of air and water

Course Type- SEC-2

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-1 Aeromicrobiology	Students will understand the significance of air borne pathogens.	4 lectures (4 hours)	Bioaerosols, Airborne microorganisms (bacteria, Viruses, fungi)	1	Lectures, ppt, mcq discussion
			Their impact on human health and environment	1	
			Significance in food and pharma industries	1	
			Operation theatres, allergens	1	
Module-4 Control measures	Students will learn the control measures- bioaerosols.	4 lectures (4 hours)	Fate of bioaerosols	2	Lectures, ppt, mcq discussion
			Inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration	2	

SEMESTER-V
Course Code-BMCBCCHT501
Course Title- Immunology and Medical Microbiology
Course Type- CC-11

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-4 Generation of Immune Response and Tumour Immunology	By the end of the lesson, students will understand the immune responses, humoral, cell mediated and tumor immunology.	7 lectures (7 hours)	Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells)	2	Lectures, ppt, class test, doubt clearing session
			Generation of Cell Mediated Immune Response (Self MHC restriction,T cell activation, Costimulatory signals)	2	
			Killing Mechanisms by CTL and NK cells	1	
			Types of tumors, tumor Antigens, causes and therapy for cancers	2	
Module-8 Viral diseases	Students will become aware about different viral diseases.	8 lectures (8 hours)	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	1	Lectures, ppt, class test, assignment
			Herpes	1	
			Hepatitis	1	
			Dengue	1	
			AIDS	1	
			Influenza with brief description of swine flu	1	
			Ebola	1	
			Chikungunya, Japanese Encephalitis	1	

Course Code- BMCBDSHT2
Course Title- INSTRUMENTATION AND BIOTECHNIQUES
Course Type- DSE-2

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-5 Centrifugation	By the end of the lesson, the students will learn about the different types of centrifugation techniques.	12 lectures (12 hours)	Centrifugation (Preparative and analytical centrifugation)	2	Lectures, ppt, class test
			fixed angle and swinging bucket rotors	2	
			RCF And Sedimentation coefficient	2	
			Differential centrifugation,	2	
			Density gradient Centrifugation and	3	
			Ultracentrifugation	1	

Course Code- BMCBDSHT3
Course Title- MICROBIAL BIOTECHNOLOGY
Course Type- DSE-3

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-1 Microbial Biotechnology and its Applications	Students will understand about the importance of microbial technology and its applications.	10 lectures (10 hours)	Microbial biotechnology: Scope and its applications in human therapeutics	2	Lectures, ppt, class test, assignment
			agriculture (Biofertilizers, PGPR, Mycorrhizae),	2	
			Environmental	1	
			Food technology	1	
			Use of prokaryotic and eukaryotic microorganisms in biotechnological applications	2	
			Genetically engineered microbes for industrial application	2	

SEMESTER-VI
Course Code-BMCBCCHT601
Course Title- ENVIRONMENTAL MICROBIOLOGY
Course Type- CC-13

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-4 Waste Management	Students will gain understanding about the solid and liquid waste management.	14 lectures (14 hours)	Solid Waste management: Sources and types of solid waste	2	Lectures, ppt, mcq discussion, class test, doubt clearing session
			Methods of solid waste disposal(composting and sanitary landfill)	3	
			Liquid waste management: Composition and strength of sewage (BOD and COD)	2	
			Primary, secondary oxidation ponds, ,	2	
			trickling filter	1	
			Activated sludge process and septic tank	2	
			tertiary sewage treatment	2	

Course Code- BMCBDSHT6
Course Title- BIOSAFETY AND INTELLECTUAL PROPERTY RIGHTS
Course Type- DSE-6

MODULE NAME	OBJECTIVE	ALLOTTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-1 Introduction to biosafety	Students will gain understanding about biosafety and its risk assessment.	4 lectures (4 hours)	Overview of biosafety	1	Lectures, ppt, mcq discussion, class test
			Risk assessment, Cartagena protocol on Biosafety	1	
			GMOs: Concerns and challenges transgenic technology	1	
			Future opportunities and challenges	1	

MODULE NAME	OBJECTIVE	ALLOTED LECTURES	SUB- MODULE	NO.OF LECTURES/ SUB-MODULE	TEACHING-LEARNING METHODOLOGY
Module-2 International Regulatory bodies	Students will understand about the biosafety of GM products.	7 lectures (7 hours)	National regulatory bodies, Biosafety of Genetically engineered Products	1	Lectures, ppt, mcq discussion, class test, assignment, doubt clearing session
			Genetically engineered products and recombinant DNA technology	2	
			Risk assessment of RDT products, Regulating recombinant DNA technology	2	
			Permit for movement and import of GMOs	1	
			Good Laboratory biosafety practices	1	
Module-3 Introduction to Intellectual Property Rights	Students will understand the concept of different IPR.	4 lectures (4 hours)	Concept of IPR, Designs	1	Lectures, ppt, mcq discussion, class test, assignment, doubt clearing session
			Trademarks TM, Trade Secret(TS), Domain Names	1	
			Geographical Indications,	1	
			Copyright	1	
Module-4 History and Evolution of Patent Law	Students will learn about the history of IPR.	4 lectures (4 hours)	History of Indian Patent System	2	Lectures, ppt
			Patent Laws in other countries.	2	
Module-5 Classification of Patents	Students will gain understanding about the different types of patent.	10 lectures (10 hours)	Classification of patents in India, Classification of patents by WIPO	3	Lectures, ppt, mcq discussion, class test, open discussion, doubt clearing session
			Categories of Patent, Special Patents	2	
			Patenting Biological products	2	
			Classification of patents	1	