

Lesson Plan (Sem-I)

Name of the College- Jagannath Kishore College

Subject- Zoology

Course title- Non-Chordates I: Protists to Pseudocoelomates

Course code: BZOOCCHC101

Allotted lectures- Theory- 53 +Tutorial classes required- 7+Remedial classes- 4

Practical- 46

Objectives:

- Classical Zoology is one of the most important pioneer in zoological science. This area mainly explores the animal world to the students, specially the invertebrate world along with their evolutionary significance.
- It also helps them to compare and study the evolution of organisms according to their hierarchy.
- The theoretical knowledge is supported by practical classes in which they get the chance to observe some of the invertebrates which helps them to understand the interrelationship among different group of organisms.

Core T1 – Non-chordates I: Protista to Pseudocoelomates				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of Teaching
1	Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types.	• Definitions of Classification, Systematics and Taxonomy. • Taxonomic Hierarchy. • Types of Taxonomic.	1 1 1	Online
2	Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Six kingdom concept of classification (Carl Woese).	• Codes of Zoological Nomenclature. • Principle of Priority; Synonymy and Homonymy. • Six kingdom concept of classification (Carl Woese).	1 1 1	Online
3	General characteristics and Classification of Protozoa up to phylum (according to Levine <i>et. al.</i> , 1981).	• Characters of Subkingdom Protozoa; Phylum Sarcomastigophora, Epicomplexa, Ciliophora. • Characters of Phylum Labyrinthomorpha, Microspora, Acetospora, Myxozoa.	1 1	Online

4	Locomotion in <i>Euglena</i> , and <i>Paramecium</i> .	- General locomotion type in <i>Euglena</i>, and <i>Paramecium</i>; Structure of cilia and flagella. - Molecular mechanism behind ciliary and flagellar movement.	1 1	Online
5	Locomotion in <i>Amoeba</i> .	- Sol-gel theory of amoeboid movement. - Molecular mechanism of amoeboid movement.	1 1	Online
6	Conjugation in <i>Paramecium</i> .	- Structure of <i>Paramecium</i>. - Mechanism of Conjugation.	1 1	Online
7	Life cycle and pathogenicity of <i>Plasmodium vivax</i> .	- Life cycle of <i>P. vivax</i>. - Pathogenicity of <i>P. vivax</i>.	1 1	Online
8	Life cycle and pathogenicity of <i>Entamoeba histolytica</i> .	- Life cycle of <i>E. histolytica</i>. - Pathogenicity of <i>E. histolytica</i>.	1 1	Online
9	Evolution of symmetry and segmentation of Metazoa.	- Evolution of symmetry in Metazoa. - Evolution of segmentation in Metazoa.	1 1	Online
10	General characteristics and Classification of Porifera up to classes.	- Characteristics of Porifera; Class Calcarea. - Characteristics of Class Hexactinellida, Demospongiae, Sclerospongiae.	1 1	Online
11	Canal system and spicules in sponges.	- Basic internal structure of sponges. - Types of canal system. - Structure and types of spicules in sponges.	1 1 1	Online
12	General characteristics and Classification of Cnidaria up to classes.	- Characteristics of Cnidaria; Class Hydrozoa. - Characteristics of Class Scyphozoa, Cubozoa, Anthozoa.	1 1	Online
13	Metagenesis in <i>Obelia</i> .	- Hydroid phase in <i>Obelia</i>. - Medusoid phase in <i>Obelia</i>. - Life history pattern and similarities between polyp and medusa.	1 1 1	Online
14	Polymorphism in Cnidaria.	- Origin and unit of polymorphism. Polypoid types in Cnidarians. - Medusoid types in Cnidarians, Significance of polymorphism.	1 1	Online
15	Corals and coral reef diversity, function and conservation.	- Coral reef types, distribution of reefs. Threats and conservation of coral reefs. - Formation of coral reefs.	1 1	Online

		Theory of coral reef formation. Ecology of coral reefs.	1	
16	General characteristics of Ctenophora.	Characteristics of Ctenophora.	1	Online
17	General characteristics and Classification of Platyhelminthes up to classes.	- Characteristics of Platyhelminthes, Class Turbellaria - Characteristics of Class Trematoda, Monogenea, Cestoidea.	1 1	Online
18	Life cycle and pathogenicity and control measures of <i>Fasciola hepatica</i> .	- Morphology of <i>F. hepatica</i>. - Life cycle of <i>F. hepatica</i>. - Pathogenicity and control measures of <i>F. hepatica</i>.	1 1 1	Online
19	Life cycle and pathogenicity and control measures of <i>Taenia solium</i> .	- Morphology of <i>T. solium</i>. - Life cycle of <i>T. solium</i>. - Pathogenicity and control measures of <i>T. solium</i>.	1 1 1	Online
20	General characteristics and Classification of Nematoda up to classes.	Characteristics of Nematoda, Class Aphasmda, Secernentea.	1	Online
21	Life cycle, and pathogenicity and control measures of <i>Ascaris lumbricoides</i> .	- Morphology of <i>A. lumbricoides</i>. - Life cycle of <i>A. lumbricoides</i>. - Pathogenicity and control measures of <i>A. lumbricoides</i>.	1 1 1	Online
22	Life cycle, and pathogenicity and control measures of <i>Wuchereria bancrofti</i> .	- Morphology of <i>W. bancrofti</i>. - Life cycle of <i>W. bancrofti</i>. - Pathogenicity and control measures of <i>W. bancrofti</i>.	1 1 1	Online
23	Parasitic adaptations in helminthes.	- Types of parasitism. - Parasitic adaptations in helminthes.	1 1	Online
EVALUATION METHOD- QUIZ,CLASS TEST				
Core P1 – Non-chordates I: Protista to Pseudocoelomates				2 credits
Practical				
	Topic	Subtopic	Periods	Mode of teaching
1	Identification of <i>Amoeba</i> sp., <i>Euglena</i> sp., <i>Entamoeba</i> sp., <i>Opalina</i> sp., <i>Paramecium</i>	Identification and characterization of <i>Amoeba</i> sp., <i>Euglena</i> sp.	4	Online

	sp., <i>Plasmodium vivax</i> and <i>Plasmodium falciparum</i> (from the prepared slides).	• Identification and characterization of <i>Entamoeba</i> sp., <i>Opalina</i> sp. • Identification and characterization of <i>Paramecium</i> sp., <i>Plasmodium vivax</i> and <i>Plasmodium falciparum</i>.	4 4	Online
2	Identification of <i>Sycon</i> sp., Neptune's Cup, <i>Obelia</i> sp., <i>Physalia</i> sp., <i>Millepora</i> sp., <i>Aurelia</i> sp., <i>Tubipora</i> sp., <i>Corallium</i> sp., <i>Alcyonium</i> sp., <i>Gorgonia</i> sp., <i>Metridium</i> sp., <i>Pennatula</i> sp., <i>Fungia</i> sp., <i>Meandrina</i> sp., <i>Madrepora</i> sp.	• Identification and characterization of <i>Sycon</i> sp., Neptune's Cup, <i>Obelia</i> sp. • Identification and characterization of <i>Physalia</i> sp., <i>Millepora</i> sp., <i>Aurelia</i> sp. • Identification and characterization of <i>Tubipora</i> sp., <i>Corallium</i> sp., <i>Alcyonium</i> sp. • Identification and characterization of <i>Gorgonia</i> sp., <i>Metridium</i> sp., <i>Pennatula</i> sp.. • Identification and characterization of <i>Fungia</i> sp., <i>Meandrina</i> sp., <i>Madrepora</i> sp.	4 4 4 4 4	Online
3	Identification and significance of adult <i>Fasciola hepatica</i> , <i>Taenia solium</i> and <i>Ascaris lumbricoides</i> .	• Identification and significance of adult <i>Fasciola hepatica</i>, <i>Taenia solium</i> and <i>Ascaris lumbricoides</i>.	2	Online
4	Staining/mounting of any protozoa / helminth from gut of cockroach.	• Dissection of gut of cockroach. • Isolation, staining and mounting of gut content of cockroach. • Identification of parasitic protozoan and helminth from gut content of cockroach. • Identification and characterization of parasitic protozoan and helminth from gut content of cockroach.	4 4 4 4	Online

Course title: Perspectives of Ecology

Course code: BZOOCCHC102

Allotted lectures- Theory-30 +Tutorial classes required- 8+Remedial classes- 2

Practical- 112

Objectives:

- The basics of ecology is all about to understand the interaction of living and non-living components in respect to their environment.
- This part also includes various branches of ecology which open a vast area of the ecological science that help them broaden their knowledge.
- In this portion they also get the chance to explore the mother nature as they go to the field as a part of their practical study, to expose the theory world in further.

Core T2 – Perspectives in Ecology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.	• History and definition of ecology, Autecology and synecology. • Levels of organization, Laws of limiting factors. • Study of Physical factors. • The Biosphere.	1 1 1	Online
2	Unique and group attributes of population: Demographic factors, life tables, fecundity tables, survivorship curves, dispersal and dispersion.	• Unique and group attributes of population: Demographic and stochastic factors. • Life tables. • Fecundity tables. • Survivorship curves. • Dispersal and dispersion.	1 1 1 1	Online
3	Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors.	• Geometric, and exponential growth, equation derivation and patterns. • Logistic growth, equation derivation and patterns. • r and K strategies. • Density-dependent and independent population regulation.	1 1 1 1	Online

4	Population Interactions, Gause's Principle with laboratory and field examples, Lotka- Volterra equation for competition.	- Population interactions. - Gause's Principle with laboratory and field examples. - Lotka- Volterra equation for competition.	1 1 1	Online
5	Community characteristics: species diversity, abundance, dominance, richness, Vertical stratification.	- Species diversity, evenness, abundance, dominance, richness of a community. - Vertical stratification in a community.	1 1	Online
6	Ecotone and edge effect.	Ecotone types, edge species and edge effect.	1	Online
7	Ecological succession with one example.	- Types of Ecological succession with one example. - Mechanism of Ecological succession.	1 1	Online
8	Types of ecosystem with an example in detail. Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains. Food web.	- Types of ecosystem with an example. - Types of food chain. Food web and its types. - Linear and Y-shaped food chains.	1 1 1	Online
9	Energy flow through the ecosystem. Ecological pyramids and Ecological efficiencies.	- Energy flow through the ecosystem. Different models of energy flow. - Different types of Ecological pyramids and Ecological efficiencies.	1 1	Online
10	Wildlife Conservation (<i>in-situ</i> and <i>ex-situ</i> conservation).	<i>in-situ</i> conservation strategies, concept of surrogate species, flagship species, umbrella species and biodiversity indicator species. <i>ex-situ</i> conservation strategies in zoos and breeding centres.	1 1	Online
11	Management strategies for tiger conservation.	- Causes of decline of tiger population. Threats to tiger population. - Management strategies for tiger conservation.	1 1	Online
12	Wild life protection act (1972).	Wild life protection act (1972).	1	Online

EVALUATION METHOD-

QUIZ, INTERNAL EXAM ,MCQ BASED EXAM

Core P2 – Perspectives in Ecology

2 credits

Practical

	Topic	Subtopic	Periods	Mode
1		Life table.	2	

	Study of life tables and plotting of survivorship curves of different types from the hypothetical / real data provided.	- Plotting of survivorship curves of different types from the hypothetical data provided. - Plotting of survivorship curves of different types from the real data provided. - Calculation of Life table from hypothetical and real data provided.	2 2 2	Online
2	Determination of population density in a natural / hypothetical community by quadrat method and calculation of Shannon-Wiener diversity index for the same community.	- Visit to Ayodhya hills for field survey of natural community of insect in the forest floor by quadrat method. - Identification, quantification and enlistment of the insects from different quadrats. - Diversity indices (Shannon-Weaver), species evenness, species richness and species dominance calculation. Calculation of species abundance, relative density, relative abundance.	2 2 2	
3	Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO ₂ .	- Preliminary idea on phytoplankton, zooplankton, phytoplankton net and zooplankton net. - Preliminary idea and methodology of estimation of dissolved O₂, free CO₂, pH, turbidity, water temperature and COD. - Visit to a nearby water body for procuring water samples in different bottles and plankton using plankton net. Assessment of pH, turbidity, and water temperature in laboratory. - Plankton counting in Sedwick-raptor chamber and assessing plankton density. - Assessment of dissolved O₂ and free CO₂ in laboratory. - Assessment of dissolved COD.	2 2 2 4 4 4	
4	Report on a visit to National Park / Biodiversity Park / Wild life sanctuary / Sea coast.	- Visit to National Park / Biodiversity Park / Wild life sanctuary / Sea coast. - Identification, quantification and enlistment of different non-chordate and chordate fauna from different sampling procedures. - Preparation of field report.	56 10 14	7 days

Lesson Plan (Sem- II)

Name of the College- Jagannath Kishore College

Subject- Zoology

Course title- Non-Chordates II: Coelomate

Course code: BZOOCCHC201

Allotted lectures- **Theory-** 50 +**Tutorial classes required-** 8+**Remedial classes-** 5
Practical- 76

Objectives:

- It is impossible to know the whole invertebrate world in only one semester and as they are very much keen to know them properly, this portion mainly covers the rest along with the practical classes that includes the dissection of various organs of animals.
- It also helps them to compare and study the evolution of organisms according to their hierarchy.

Title: Core T3: Non-Chordates II: Coelomates				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Evolution of coelom and metamerism.	• Evolution of coelom. • Evolution of metamerism.	1 1	Online
2	General characteristics and Classification of Annelida up to classes Excretion in Annelida through nephridia. Metamerism in Annelida.	• General characteristics and Classification of Annelida up to classes. • Excretion in Annelida through nephridia. • Metamerism in Annelida.	2 3 2	Online
3	General characteristics and Classification of Arthropoda up to classes.	• General characteristics of Arthropoda. • Classification of Arthropoda up to classes.	1 4	Online
4	Vision in Insect.	• Structure of insect eyes. • Working principle of the insect eyes.	2 2	Online
5	Respiration in Arthropoda (Gills in prawn and trachea in cockroach).	• Structure and respiratory mechanism of gill. • Structure and respiratory mechanism of trachea.	2 1	Online
6		• Metamorphosis in Lepidopteran insects.	3	Online

	Metamorphosis in Lepidopteran Insects, Social life in termite.	• Social life in termite.	2	
7	General characteristics and Evolutionary significance.	• General characteristics and evolutionary significance.	1	Online
8	General characteristics and Classification of Mollusca up to classes.	• General characteristics of Mollusca. • Classification of Mollusca up to classes.	1 2	Online
9	Nervous system and torsion in Gastropoda.	• Nervous system of Gastropoda. • Torsion in Gastropoda.	3 2	Online
10	General characteristics and Classification of Echinodermata up to classes.	• General characteristics of Echinodermata. • Classification of Echinodermata up to classes.	1 2	Online
11	Water-vascular system in Asteroidea.	• Generalized organization of water-vascular system. • Mechanism of action of water-vascular system.	2 2	Online
12	Larval forms in Echinodermata.	• Larval forms in Echinodermata.	3	Online
13	Affinities of Echinodermata with Chordates.	• Affinities of Echinodermata with Chordates.	2	Online
14	General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates.	• General characteristics of phylum Hemichordata. • Relationship with non-chordates and chordates.	1 2	Online

EVALUATION METHOD- QUIZ, CLASS TEST, GROUP DISCUSSION

Core P3 - Non-Chordates II: Coelomates

2 credits

Practical

	Topic	Subtopic	Periods	Mode
1	Identification of <i>Aphrodite</i> sp., <i>Nereis</i> sp., <i>Heteronereis</i> sp., <i>Sabella</i> sp., <i>Serpula</i> sp., <i>Chaetopterus</i> sp., <i>Pheretima</i> sp., <i>Hirudinaria</i> sp.	• Identification of <i>Aphrodite</i> sp., <i>Nereis</i> sp., <i>Heteronereis</i> sp., <i>Sabella</i> sp. • Identification of <i>Serpula</i> sp., <i>Chaetopterus</i> sp., <i>Pheretima</i> sp., <i>Hirudinaria</i> sp.	4 4	Online
2	Identification of <i>Limulus</i> sp., <i>Palamnaeus</i> sp., <i>Palaemon</i> sp., <i>Daphnia</i> sp., <i>Balanus</i> sp., <i>Sacculina</i> sp., <i>Cancer</i> sp., <i>Eupagurus</i> sp., <i>Scolopendra</i> sp.,	• Identification of <i>Limulus</i> sp., <i>Palamnaeus</i> sp., <i>Palaemon</i> sp. • Identification of <i>Daphnia</i> sp., <i>Balanus</i> sp., <i>Sacculina</i> sp., <i>Cancer</i> sp.	4 4	Online

	<i>Julus</i> sp., <i>Bombyx</i> sp., <i>Periplaneta</i> sp., Termites and Honey bees, <i>Peripatus</i> sp.	• Identification of <i>Eupagurus</i> sp., <i>Scolopendra</i> sp., <i>Julus</i> sp., <i>Bombyx</i> sp. • Identification of <i>Periplaneta</i> sp., Termites and Honey bees, <i>Peripatus</i> sp.	4 4	Online
3	Identification of <i>Chiton</i> sp., <i>Dentalium</i> sp., <i>Pila</i> sp., <i>Doris</i> sp., <i>Helix</i> sp., <i>Unio</i> sp., <i>Ostrea</i> sp., <i>Pinctada</i> sp., <i>Sepia</i> sp., <i>Octopus</i> sp., <i>Nautilus</i> sp.	• Identification of <i>Chiton</i> sp., <i>Dentalium</i> sp., <i>Pila</i> sp., <i>Doris</i> sp. • Identification of <i>Helix</i> sp., <i>Unio</i> sp., <i>Ostrea</i> sp., <i>Pinctada</i> sp. • Identification of <i>Sepia</i> sp., <i>Octopus</i> sp., <i>Nautilus</i> sp.	4 4 4	Online
4	Identification of <i>Pentaceros</i> sp. / <i>Asterias</i> sp., <i>Ophiura</i> sp., <i>Clypeaster</i> sp., <i>Echinus</i> sp., <i>Cucumaria</i> sp. and <i>Antedon</i> sp.	• Identification of <i>Pentaceros</i> sp. /<i>Asterias</i> sp., <i>Ophiura</i> sp., <i>Clypeaster</i> sp. • Identification of <i>Echinus</i> sp., <i>Cucumaria</i> sp. and <i>Antedon</i> sp.	4 4	Online
5	Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm.	• Study of digestive system of earthworm. • Study of septal nephridia and pharyngeal nephridia of earthworm.	4 4	Online
6	T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm	• T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.	4	Online
7	Mount of mouth parts and dissection of digestive system and nervous system of <i>Periplaneta</i>	• Mount of mouth parts of <i>Periplaneta</i>. • Dissection of digestive system of <i>Periplaneta</i>. • Dissection of nervous system of <i>Periplaneta</i>.	4 4 4	Online
8	To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)	• To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm).	8	Online

Course title: Cell Biology

Course code: BZOCCCHC202

Allotted lectures- Theory-90 +Tutorial classes required- 15+ Remedial classes- 18

Practical- 18

Objectives:

- This portion covers one of the fascinating portion in zoology as it mainly allows the students to know the fundamentals of cell biology along with cell signaling, cell division.
- In practical classes they get the chance of knowing the stages of cell cycle, as well as have the scope of preparations of slides.

Title: Core T4: Cell Biology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Basic structure of Prokaryotic and Eukaryotic cells, Viruses, Viroid, Prion and Mycoplasma.	• Basic structure of prokaryotic and eukaryotic cells. • Basic structure of viruses, viroid. • Basic structure of prion and mycoplasma.	1 1 1	Online
2	Ultra structure and composition of Plasma membrane: Fluid mosaic model.	• Ultra structure and composition of Plasma membrane: Fluid mosaic model.	4	Online
3	Transport across membrane: Active and Passive transport, Facilitated transport.	• Active transport mechanism. • Passive transport mechanism. • Facilitated transport mechanism.	2 2 2	Online
4	Cell junctions: Tight junctions, Gap junctions, Desmosomes.	• Structure of tight junctions, gap junctions and desmosomes. • Functions of tight junctions, gap junctions and desmosomes.	2 2	Online
5	Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes.	• Structure and Functions of Endoplasmic Reticulum. • Structure and Functions of Golgi apparatus. • Structure and Functions of Lysosomes.	3 5 5	Online
6	Protein sorting and mechanisms of vesicular transport.	• Protein sorting mechanisms. • Mechanisms of vesicular transport.	2 4	Online
7		• Structure of mitochondria.	1	

	Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis.	• Semiautonomous nature and endosymbiotic origin of mitochondria. • Mitochondrial Respiratory Chain. • Chemi-osmotic hypothesis.	1 1 1	Online
8	Peroxisomes: Structure and Functions.	• Peroxisomes: Structure and Functions	3	Online
9	Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus.	• Structure of nuclear envelope, nuclear pore complex. • Structure of nucleolus.	2 1	Online
10	Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome).	• Structure of euchromatin and hetrochromatin. • Structure of nucleosome.	1 1	Online
11	Type, structure and functions of cytoskeleton, Centrosome: Structure and Functions, Accessory proteins of microfilament and microtubule.	• Type, structure and functions of cytoskeleton. • Structure and Functions of centrosome. • Accessory proteins of microfilament and microtubule.	1 1 1	Online
12	Cell cycle and its regulation.	• Cell cycle. • Regulation of cell cycle.	4 3	Online
13	Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras and APC.).	• Definition of cancer, types of cancer, causes of cancer. • Concept of oncogenes and tumor suppressor genes. • p53, Retinoblastoma. • Ras and APC.	3 2 2 2	Online
14	Mitosis and Meiosis: Basic process and their significance.	• Basic process and significance of mitosis. • Basic process and significance meiosis.	1 2	Online
15	Cell signalling transduction pathways, Types of signaling molecules and receptors, GPCR and Role of second messenger (cAMP).	• Cell signalling transduction pathways. • Types of signaling molecules and receptors. • GPCR and Role of second messenger (cAMP).	2 2 4	Online
16	Extracellular matrix, Cell interactions.	• Components and function s of extracellular matrix, collagen, elastin. • Proteoglycans. • Laminin and Fibronectin. • Cell adhesion molecules.	1 1 1 1	Online

		Extracellular matrix-Cell interactions – hemidesmosome.	1	Online
17	Apoptosis and Necrosis.	- Extrinsic Pathway of Apoptosis. - Intrinsic Pathway of Apoptosis - Bcl2 Proteins Regulate the Intrinsic Pathway. - Necrosis - Cellular changes, causes. - Types of necrosis. - Distinguish between apoptosis and necrosis.	2 2 1 1 1	Online

EVALUATION METHOD- CLASS TEST, POWER POINT PRESENTATION, GROUP DISCUSSION, QUIZ

Core P4 : Cell Biology

2 credits

Practical

	Topic	Subtopic	Periods	Mode
1	Preparation of temporary stained squash of onion root tip to study various stages of mitosis.	Preparation of temporary stained squash of onion root tip to study various stages of mitosis.	6	Online
2	Study of various stages of meiosis.	Study of various stages of meiosis.	6	Online
3	Preparation of permanent slide to show the presence of Barr body in human female blood cells / cheek cells.	Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.	2	Online
4	Preparation of permanent slide to demonstrate: - DNA by Feulgen reaction/ By Ethidium Bromide. - Cell viability study by Trypan Blue staining.	- DNA by Feulgen reaction / by Ethidium Bromide. - Cell viability study by Trypan Blue staining.	2 2	Online Online

Lesson Plan (Sem-III)

Name of the College- Jagannath Kishore College

Subject- Zoology

Course title- Diversity of Chordata

Course code: BZOOCCHC301

Allotted lectures- Theory-78 +Tutorial classes required- 10 + Remedial classes- 9

Practical- 42

Objectives:

- As this world is made up of not only non-chordates, students will also know about another portion of classification, the chordates.
- They also explore the distribution of animals in the different regions of this globe in light of zoogeographical realms.
- In practical, they identify the species that they go through the theory.

Core T5 - Diversity of Chordata				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	General characteristics and outline classification of Phylum Chordata.	• Introduction to phylum Chordata; characteristics and outline of classification.	1	Online
2	General characteristics and classification of Sub-phylum Urochordata up to Classes.	• General characteristics of sub-phylum Urochordata.	1	Online
		• Classification of class Ascidiacea, Thaliacea, Larvacea.	1	Online
3	General characteristics and classification of Sub-phylum Cephalochordata up to Classes.	• General characteristics of Sub-phylum Cephalochordata up to Classes.	1	Online
4	Retrogressive metamorphosis in <i>Ascidia</i> .	• Advanced chordate characters of larva and characteristics features of retrogressive metamorphosis.	1	Online
		• Changes during metamorphosis; molecular analysis of metamorphosis.	1	Online
5	Chordate features and feeding in <i>Branchiostoma</i> .	• General characteristics of <i>Branchiostoma</i>.	1	Online
		• Affinities with Hemichordata and Urochordata.	1	

		Feeding mechanism in <i>Branchiostoma</i>.	2	Online
6	Dipleurula concept and the Echinoderm theory of origin of chordates.	Dipleural concept and echinoderm ancestry of origin of chordate.	1	Online
7	Advanced features of vertebrates over Protochordata.	Characteristics of vertebrates and protochordates and their differences.	2	Online
8	General characteristics and classification of cyclostomes up to Order.	- Origin and general characters of Cyclostomes. - Classification of cyclostomes up to Order; Petromyzontiformes and Myxiniiformes.	1 1	Online Online
9	General characteristics and classification of Chondrichthyes up to Subclasses.	- General characteristics of Pisces; General characters and classification of Chondrichthyes. - Subclass: Holocephali and Elasmobranchii. Types of scales and caudal fins in fishes.	1 1	Online Online
10	General characteristics and classification of Osteichthyes up to Subclasses.	General characteristics and classification of Osteichthyes up to Subclasses: Actinopterygii and Sarcopterygii.	2	Online
11	Accessory respiratory organ in fishes.	- Introduction, existence and categories of ARO; Types: suprabranchial organ, branchial outgrowths, pharyngeal diverticula, opercular chamber. - Buccopharyngeal epithelium, integument, gut epithelium, modified swim-bladder, oral papillae and functions.	2 2	Online Online
12	Migration in fishes.	- Migration of fish: advantages and types of migration, potamodromous migration, oceanodromous migration. - Diadromous migration, catadromous and anadromous migration; problems of navigation.	1 1	Online Online
13	Parental care in fishes.	- Parental care: definition and needs; types: Deposition of eggs in suitable places, deposition of eggs into self-made nest. - Concealing eggs and young's in or on their body, viviparity, care of independently swimming young's. Cost and benefit of parental care.	2 2	Online Online
14	Swim bladder in fishes.	Swim bladder: Location, types and structure.	1	Online

		• Functions, relationship with lungs and auditory apparatus and disorders.	1	Online
15	General characteristics and classification of Amphibia up to living Orders.	• General characteristics and classification of Amphibia up to living Orders: Apoda, Urodela, Anura.	1	Online
16	Metamorphosis in Amphibia.	• Meaning of metamorphosis, types of amphibian metamorphosis: Progressive and Retrogressive. • Structure, changes and hormonal control of metamorphosis.	1 2	Online Online
17	Parental care in Amphibia	• Different types of Parental care in amphibians: Protection by the parents and direct caring.	2	Online
18	General characteristics and classification of Reptilia up to living Orders.	• General characteristics of Reptilia; Classification: Subclass; Anapsida, Order-Chelonia. • Subclass-Diapsida; Order- Rhynchocephalia, Squamata, Crocodilia.	2 2	Online Online
19	Poison apparatus and biting mechanism in snake.	• Poison apparatus of snake: A pair of poison glands, poison ducts, fangs, muscles. • Different events in biting mechanism of snake.	2 2	Online Online
20	General characteristics and classification of Aves up to Sub-Classes.	• General characteristics of Aves; Subclasses; Archaeornithes, Neornithes.	2	Online
21	Exoskeleton in Birds	• Definition of exoskeleton, types of exoskeleton in birds; feathers, claw, scales, beak and rhamphothecap; structure of typical feathers. • Kinds of feathers, development of down and contour feathers, function of claw and rhamphotheca.	2 1	Online Online
22	Migration in Birds	• Definition of Migration, types of bird migration. • Cause, Guiding mechanism and disadvantages of migration.	2 2	Online Online
23	Principles and aerodynamics of flight in birds.	• Major aerodynamic principle solved by the bird during flight, Mechanism of flight with downstroke upstroke, drags forces.	2	Online

		Chief modes of flying in birds: Gliding, flapping, soaring and hovering.	2	Online
24	General characters and classification of Mammalia up to living Orders.	General characteristics of Mammals; classification; Subclass- Prototheria- order- Monotremata. Subclass-Metatheria, order- Marsupialia.	2	Online
25	Affinities of Prototheria.	Affinities of Prototheria; affinities with Reptilia, Aves, Mammalia and Marsupials.	2	Online
26	Exoskeleton derivatives of mammals.	- Integumentary derivatives: different types of gland- Sweat gland, sebaceous gland, mammary gland and Hair - Claws, nails and hoofs; Horns and Antlers, Epidermal scales.	2 1	Online Online
27	Adaptive radiation in mammals with reference to locomotor appendages.	- Definition, cause and types and general mechanism of adaptive radiation. - Adaptive radiation in mammals based on locomotion: Flying, Climbing, Swimming, walking, Cursorial, Fussorial and others.	2 2	Online Online
28	Echolocation in Chiropterans and Cetaceans.	- Principle of echolocation; mechanism of echolocation in Chiropterans and functions. - Mechanism and functions of echolocation in Cetaceans.	2 1	Online Online
29	Zoogeographical realms, distribution of birds and mammals in different realms.	- Meaning of zoogeographical realms and different types. Distribution of birds and mammals in different division and subdivision of realms - Palaearctic, Nearctic realm. - Neo-tropical Realm, Ethiopian Realm, Oriental Realm, Australian Realm.	2 1	Online Online
30	Plate tectonic and Continental drift theory.	- Plate tectonic theory: Earth's tectonic plates, mechanism of moving plate and plate boundaries. - Theory for continental drift, Evidence of continental drift.	2 1	Online Online
EVALUATION METHOD- QUIZ, CLASS TSET, POWER POINT PRESENTATION				
Core P5 - Diversity of Chordata				2 credits
Practical				
	Topic	Subtopic	Periods	Mode

1	Identification of <i>Balanoglossus</i> sp., <i>Herdmania</i> sp., <i>Branchiostoma</i> sp.	• Identification of <i>Balanoglossus</i> sp., <i>Herdmania</i> sp., <i>Branchiostoma</i> sp.	2	Online
2	Identification of <i>Petromyzon</i> sp., <i>Myxine</i> sp.	• Identification of <i>Petromyzon</i> sp., <i>Myxine</i> sp.	2	Online
3	Identification of <i>Scoliodon</i> sp., <i>Sphyrna</i> sp., <i>Pristis</i> sp., <i>Torpedo</i> sp., <i>Chimaera</i> sp., <i>Mystus</i> sp., <i>Heteropneustes</i> sp., <i>Labeo</i> sp., <i>Exocoetus</i> sp., <i>Echeneis</i> sp., <i>Anguilla</i> sp., <i>Hippocampus</i> sp., <i>Tetrodon</i> sp., <i>Diodon</i> sp., <i>Anabas</i> sp., Flat fish.	• Identification of <i>Scoliodon</i> sp., <i>Sphyrna</i> sp., <i>Pristis</i> sp., <i>Torpedo</i> sp.. • Identification of <i>Chimaera</i> sp., <i>Mystus</i> sp., <i>Heteropneustes</i> sp., <i>Labeo</i> sp. • Identification of <i>Exocoetus</i> sp., <i>Echeneis</i> sp., <i>Anguilla</i> sp., <i>Hippocampus</i> sp • Identification of <i>Tetrodon</i> sp., <i>Diodon</i> sp., <i>Anabas</i> sp., Flat fish	2 2 2 2	Online Online Online Online
4	Identification of <i>Necturus</i> sp., <i>Bufo</i> sp., <i>Hyla</i> sp., <i>Alytes</i> sp., Axolotl larva, <i>Tylototriton</i> sp.	• Identification of <i>Necturus</i> sp., <i>Bufo</i> sp., <i>Hyla</i> sp. • Identification of <i>Alytes</i> sp., Axolotl larva, <i>Tylototriton</i> sp.	2 2	Online Online
5	Identification of <i>Chelone</i> sp., <i>Trionyx</i> sp., <i>Hemidactylus</i> sp., <i>Varanus</i> sp., <i>Uromastix</i> sp., <i>Chamaeleon</i> sp., <i>Ophiosaurus</i> sp., <i>Draco</i> sp., <i>Bungarus</i> sp., <i>Vipera</i> sp., <i>Naja</i> sp., <i>Hydrophis</i> sp., <i>Zamenis</i> sp., <i>Crocodylus</i> sp	• Identification of <i>Chelone</i> sp., <i>Trionyx</i> sp., <i>Hemidactylus</i> sp., <i>Varanus</i> sp. • Identification of <i>Uromastix</i> sp., <i>Chamaeleon</i> sp., <i>Ophiosaurus</i> sp., <i>Draco</i> sp. • Identification of <i>Bungarus</i> sp, <i>Vipera</i> sp., <i>Naja</i> sp. • Identification of <i>Hydrophis</i> sp., <i>Zamenis</i> sp., <i>Crocodylus</i> sp.	2 2 2 2	Online Online Online Online
6	Identification of Bat (Insectivorous and Frugivorous), <i>Funambulus</i> sp	• Identification of Bat (Insectivorous and Frugivorous), <i>Funambulus</i> sp	2	Online
7	Key for Identification of poisonous and nonpoisonous snakes	• Key for Identification of poisonous and nonpoisonous snakes	2	Online
8	Pecten from Fowl head.	• Pecten from Fowl head.	4	Online
9	Dissection of brain and pituitary of Tilapia.	• Dissection of brain and pituitary of Tilapia.	4	Online
10	Power point presentation on study of any two animals from two different classes by students	• Power point presentation on study of any two animals from two different classes by students	6	Online

Course title- Animal Physiology: Controlling and coordinating systems

Course code: BZOOCCHC302

Allotted lectures- Theory- 44+Tutorial classes required- 11+ Remedial classes- 6

Practical- 32

Objectives:

- In this field students will know about the different biological process, how they work, their system of function.
- They also will know about the physiological parameters such as blood pH, homeostasis, organ systems etc in relation to the daily life.
- In practical classes they get the chance of engaging themselves in the preparation of some histological tissues in light of microtomy.

Core T6 - Animal Physiology: Controlling and Coordinating Systems				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue.	• Epithelial tissue; classification, structure and function.	1	Online
		• Connective tissue: different types and function.	1	Online
		• Nervous and muscular tissue.	1	Online
2	Structure and types of bones and cartilages, Ossification.	• Structure and types of bones and cartilages, Ossification.	1	Online
3	Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and Neuromuscular junction; Reflex action and its types.	• Nervous system; histology of neurons.	1	Online
		• Membrane potential; generation of resting membrane potential.	1	Online
		• Generation of action potential; depolarization, hyperpolarization, repolarization, refractory period, propagation of action potential.	1	Online
		• Synapse types; electrical and chemical. Neurotransmitter.	1	Online
		• Neurotransmission.	1	Online
		• Neuromuscular junction: structure and development.	1	Online
		• Reflex action and reflex arc.	1	Online

4	Structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle fibre.	History of different types of muscle; skeletal, smooth and cardiac muscle. Composition of skeletal muscle.	1	Online
		Ultra structure of skeletal muscle.	2	Online
		Chemical basis of muscle contraction; mechanism of muscle contraction, neuromuscular junction, sliding filament theory. ATP and muscle contraction.	2	Online
		Different characteristics of muscle fibre.	1	Online
5	Histology of testis and ovary (mammalian), Physiology of Reproduction (mammalian).	Histology of testis.	1	Online
		Histology of ovary.	2	Online
		Physiology of Reproduction (mammalian).	3	Online
6	Histology and function of pituitary, thyroid, pancreas and adrenal.	Major hormones producing endocrine glands and organs. Pituitary gland: anterior pituitary and name of hormones and their function.	2	Online
		Hormones. Thyroid glands structure role of hormones.	1	Online
		Histology and function of pancreas.	2	Online
		Structure of Adrenal glands and function of its hormone.	2	Online
7	Classification of hormones.	Classification of hormones according to their chemical nature, mechanism of action, nature of action, their effects, and stimulation of endocrine glands.	1	Online
8	Mechanism of Hormone action.	General mechanism of hormone action: Water and lipid soluble hormones.	2	Online
		Steps of hormone signaling and hormone receptors.	1	Online
9	Signal transduction pathways for Steroidal and Non steroidal hormones.	Signal transduction pathways for Steroidal hormones.	2	Online
		Signal transduction pathways for Non steroidal hormones.	1	Online
10	Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system.	Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary.	2	Online
		Hypothalamus (neuroendocrine gland) - principal nuclei involved in	2	Online

		neuroendocrine control of endocrine system		
11	Placental hormones.	• Role of several placental hormone: Progestins, Estradiol. • Role of several placental hormone: HCG, Relaxin.	1	Online
		2	2	Online
EVALUATION METHOD-		MCQ BASED EXAM, INTERNET EXAM, SLIDESHARE		
Core P6 - Animal Physiology: Controlling and Coordinating Systems				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	Recording of simple muscle twitch with electrical stimulation (or Virtual).	• Recording of simple muscle twitch with electrical stimulation (or Virtual).	2	Online
2	Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex).	• Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex).	2	Online
3	Preparation of temporary mounts: Squamous epithelium.	• Preparation of temporary mounts: Squamous epithelium.	2	Online
4	Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid.	• Study of permanent slides of Mammalian Adrenal, Thyroid and Parathyroid. • Study of permanent slides of Mammalian skin, Cartilage, Bone. • Study of permanent slides of Mammalian Spinal cord, Nerve cell, Pituitary. • Study of permanent slides of Pancreas, Testis, Ovary.	4 4 4 4	Online
5	Microtomy: Preparation of permanent slide of any five mammalian (Goat/Fish) tissues fundamentals of biochemistry.	• Microtomy: Preparation of permanent slide of any five mammalian (Goat/Fish) tissues fundamentals of biochemistry.	10	Online

Course title- Fundamentals of Biochemistry

Course code: BZOOCCHC303

Allotted lectures- Theory- 64+ Tutorial classes required- 18+ Remedial classes- 13

Practical- 38

Objectives:

- It is the study of chemical reaction that takes place inside organisms. It deals with the structures, functions, interactions of biological macromolecules such as carbohydrates, proteins, nucleic acids and lipids that provides the structures of cells and perform many of the function associated with life.
- They will also gather knowledge about the protein estimation by different method, preparation of different experimental solution etc.

Core-T7 - Fundamentals of Biochemistry				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Structure and Biological importance of carbohydrate: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosaccharides.	• Introduction to Biomolecules; Carbohydrates: Importance Nomenclature and Classification.	1	Online
		• General structure of Monosaccharides; types of functional group and other properties; Isomerism and Enantiomers.	1	Online
		• Epimers, derivatives of Monosaccharides.	1	Online
		• Disaccharides; General structure and Glycosidic bond, Occurance and biochemical roles of important disaccharides.	1	Online
		• Naming and synthesis of Disaccharides. Glycoproteins, Reducing and Nonreducing sugar.	1	Online
		• Polysaccharides: General structures; Homopolysaccharides and Heteropolysaccharides.	1	Online
2	Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose	• Concept of metabolism and bioenergetics. General consideration and reaction steps of Glycolysis.	1	Online

	phosphate pathway, Gluconeogenesis.	- Regulation and Stoichiometry of Glycolysis. - Pyruvate oxidation: Oxidative decarboxylation of Pyruvate to AcetylCo A - Reaction steps and enzymes involved in Citric acid cycle. - Stoichiometry and regulation of Citric acid cycle. - Phases of Pentose phosphate pathway: Oxidative and non oxidative. - Function of pentose phosphate pathway and clinical implication(G6PD deficiency and Wernicke Korsakoff syndrome). - Gluconeogenesis: Pathways, Stoichiometry and regulation.	2 1 1 1 1 2 1	Online Online Online Online Online Online Online
3	Structure and Significance of lipids: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpinoids..	- Lipids: definition, biological function and significance; Fatty acids: saturated and unsaturated fatty acids, essential fatty acids. - Classification of Lipids: Simple, Compound and Derived lipids; Triacylglycerols, Phospholipids, Sphingolipid.. - Glycolipids, Steroids, Eicosanoids and terpinoids.	1 1 2	Online Online Online
4	Lipid metabolism: β -oxidation of fatty acids; Fatty acid biosynthesis..	- Mitochondrial β-oxidation of fatty acids: Location and pathways – Activation of fatty acids, transport of fatty-acyl Co A. β-oxidation of even-chain saturated fatty acids and stoichiometry. - Oxidation of odd-chain and unsaturated fatty acids - Alternative pathways and Ketogenesis - Peroxisomal β-oxidation. Regulation and significance of β-oxidation - Fatty acid biosynthesis: sequence of events involved.	1 2 1 1 2 1	Online Online Online Online Online Online

		Biosynthesis of long chain and unsaturated fatty acids.	2	Online
5	Amino acids: Structure, Classification, General and Electro chemical properties of α amino acids; Physiological importance of essential and non-essential amino acids..	- General structure of amino acid and classification; standard and Nonstandard amino acids. - Properties of α-amino acids: general and electrochemical properties. - Physiological importance of essential and non-essential amino acids.	2 1 1	Online Online Online
6	Proteins Bonds stabilizing protein structure; Levels of organization..	- Peptides, peptides bond and polypeptides, Chemical bonds involved in protein structure: Primary and Secondary bond. - Protein structure: Primary Structure, Secondary structure; alpha helix and beta pleated sheet.. - Tertiary and quaternary structure of protein..	1 1 1	Online Online Online
7	Protein metabolism: Transamination, Deamination, Urea cycle, Fate of Cskelton of Glucogenic and Ketogenic amino acids	- Protein metabolism; Amino acid pool, Transamination and oxidative deamination.. - Urea cycle: Reactions, regulation and disorders.. - Catabolism of amino acid's Carbon skeleton; Fate of C-skeleton of Glucogenic and Ketogenic amino acids.	2 1 2	Online Online Online
8	Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids..	- History of discovering nucleic acid, Components of nucleic acid; pentose sugar, sugar phosphate, Purine Pyrimidines and their derivatives. - Nucleosides, Nucleotides: Primary structure of nucleotides and functions..	2 1	Online Online
9	Types of DNA and RNA, Complementarity of DNA, Hpyo-Hyperchromaticity of DNA.	- Salient features of DNA. Types OF DNA with comparison. - RNA: features and types. Difference between DNA and RNA. - Complementarity of DNA, Denaturation and Renaturation of DNA, Hpyo Hyperchromaticity.	1 1 1	Online Online Online
10	Basic concept of nucleotide metabolism..	Nucleotide Synthesis; denovo pathways of Purine.	1	Online

		- denovo pathways of Purine. - Salvage pathways of Nucleotide synthesis: Pyrimidines. - Salvage pathways of Purine. - Nucleotide degradation; Purine and pyrimidines.	1 2 2 1	Online Online Online Online
11	Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Strategy of enzyme actionCatalytic and Regulatory (Basic concept with one example each).	- Nomenclature and classification. - Cofactors; Specificity of enzyme action; Isozymes;. - Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation. - Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions. - Enzyme inhibition; Allosteric enzymes and their kinetics; Strategy of enzyme action - Catalytic and Regulatory (Basic concept with one example each).	1 1 1 1 1 2	Online Online Online Online Online Online
12	Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System.	- Redox systems; Review of mitochondrial respiratory chain. - Inhibitors and un-couplers of Electron Transport System.	1 1	Online Online
EVALUATION METHOD- GROUP DISCUSSION, QUIZ, CLASS TEST ,POWER POINT PRESENTATION				
Core P7 - Fundamentals of Biochemistry				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	Qualitative tests of functional groups in carbohydrates, proteins and lipids.	- Qualitative tests of functional groups in carbohydrates. - Qualitative tests of functional groups in lipids - Qualitative tests of functional groups in proteins	6 6 6	Online Online Online
2	Quantitative estimation of Lowry Method.	Quantitative estimation of Lowry Method.	2	Online

3	Demonstration of proteins separation by SDS-PAGE.	Demonstration of proteins separation by SDS-PAGE.	6	Online
4	To study the enzymatic activity of Trypsin and Amylase.	- To study the enzymatic activity of Trypsin. - To study the enzymatic activity of Amylase.	4 4	Online Online
5	Preparation of Normal. Molar and Standard solutions, Phosphate Buffers, Serial dilutions.	Preparation of Normal. Molar and Standard solutions, Phosphate Buffers, Serial dilutions.	4	Online

Course title- Aquarium fish keeping (SEC-1)

Course code: BZOOSEHT305

Allotted lectures-Theory- 11 +Tutorial classes required- 4+Remedial classes- 0

Objectives:

- This course enable the students to increase their knowledge in some applicable ways by enhancing their skills other than typical theoretical papers.
- In this semester students will deal with the fundamentals of aquarium fish keeping, handling the aquarium as well as the importance of the ornamental fishes in trading and marketing.

SEC-1 - Aquarium Fish Keeping				2 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes.	• History of ornamental fishes, Introduction to aquarium fish keeping and advantages, The potential scope of Aquarium Fish Industry as a Cottage Industry. • Classification: egg layers and live bearers. • Exotic and Endemic species of Aquarium Fishes.	1 1 1	Online Online Online
2	Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.	• Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail. • Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.	1 1	Online Online
3	Use of live fish feed organisms. Preparation and composition of formulated fish feeds, Aquarium fish as larval predator.	• Use of live fish feed organisms. Preparation and composition of formulated fish feeds, Aquarium fish as larval predator.	1	Online
4	Live fish transport - Fish handling, packing and forwarding techniques.	• Fish transport: open and close transport. • Fish handling, packing and forwarding techniques and problems during transport.	1 1	Online Online
5	General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry.	• Types of aquarium and nature. • Maintenance of aquarium - Aeration, lighting, establishment, plants requirements, filtration and selection of fishes. • Budget and economic requirements.	1 1 1	Online Online Online

Lesson Plan- (SEM- IV)

Name of the College- Jagannath Kishore College

Subject- Zoology

Course title- Comparative anatomy of Vertebrates

Course code: BZOOCCHC401

Allotted lectures- Theory- 78 +Tutorial classes required- 10+Remedial classes- 9

Practical- 56

Objectives:

- This is all about the comparison of anatomical structures of vertebrates on the basis of similarities and differences. Students will know about the common descents, different organ systems in light of evolution.
- It builds the concepts of living structures, that are important in determining and establishing classification of organisms.
- In practical they broaden their knowledge by observing different scales, skeleton, skull and also the get the chance of dissection for further studies.

Core T 8 –Comparative Anatomy of Vertebrates				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Structure, function and derivatives of integument in amphibia.	Definition of integument and structure of different types of derivatives.	2	Online
2	Structure, function and derivatives of integument in birds.	- Structure and function of contour feather. - Structure and function of remiges and rectrices. - Structure of exoskeletons like scale, nail etc.	1 1 1	Online Online Online
3	Structure, function and derivatives of integument in mammals.	- Structure of skin (epidermis and dermis). - Structure and function of horn and its modification. - Structure and function of hair and its modification. - Structure and function of different types of gland.	1 2 1 1	Online Online Online Online
4	Overview of axial and appendicular skeleton.	- Definition and brief idea about skeleton. - Structure and function of axial skeleton.	1 1	Online Online

		Structure and function of appendicular skeleton.	1	Online
5	Jaw suspension.	- Definition and different types of jaw suspension. - Significance of jaw suspension.	1 1	Online Online
6	Visceral arches.	Structure and function of visceral arches.	1	Online
7	Comparative anatomy of stomach.	- Structure of different types of stomach and its modification. - Function of stomach. - Structure of ruminating stomach.	2 1 1	Online Online Online
8	Dentition in mammals.	- Definition and structure of teeth. - Teeth modification. - Dental formula.	1 1 1	Online Online Online
9	Respiratory organs in fish, amphibian, birds and mammals.	- Structure and function of gill and its modification. - Structure and function of lung. - Different types of respiratory organ.	1 1 1	Online Online Online
10	General plan of circulation, comparative account of heart and aortic arches.	- Definition, basic structure of heart with function. - Comparative study of vertebrates heart. - Comparative study of aortic arches.	1 2 1	Online Online Online
11	Succession of kidney.	- Basic structure and function of kidney. - Structure and function of different types of succession stages of kidney.	2 2	Online Online
12	Types of mammalian uteri.	- Structure and function of urinogenital ducts. - Evolution of urinogenital ducts.	1 1	Online Online
13	Comparative account of brain.	- Basic structure and function of brain. - Comparative study of vertebrate brain.	2 2	Online Online
14	Cranial nerves in mammals.	Origin and function of cranial nerves in vertebrates.	1	Online
15	Classification of receptors.	Definition of receptors and types of receptors	1	Online
16	Brief account of auditory receptors in vertebrates.	Structure and function of auditory receptor.	1	Online
EVALUATION METHOD- QUIZ,CLASS TEST,PPT PRESENTATION				

Core P8 - Comparative Anatomy of Vertebrates				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	Study of placoid, cycloid and ctenoid scales through permanent slides / photographs.	• Study of placoid scale through permanent slide.	2	Online
		• Study of cycloid scale through permanent slide.	2	Online
		• Study of ctenoid scale through permanent slide.	2	Online
2	Study of disarticulated skeleton of Toad, Pigeon and Guineapig.	• Study of disarticulated skeleton of toad.	6	Online
		• Study of disarticulated skeleton of pigeon.	6	Online
		• Study of disarticulated skeleton of Guinepig.	6	Online
3	Demonstration of Carapace and plastron of turtle.	• Demonstration of carapace of turtle.	2	Online
		• Demonstration of plastron of turtle.	2	Online
4	Identification of mammalian skulls: One herbivorous (Guineapig) and one carnivorous (Dog) animal.	• Identification of Guinepig skull.	2	Online
		• Identification of dog skull.	2	Online
5	Dissection of Tilapia: Digestive system, Brain, pituitary, urinogenital system	• Dissection of Tilapia: Digestive system.	6	Online
		• Dissection of Tilapia: Brain.	6	
		• Dissection of Tilapia: Piyuitary.	6	
		• Dissection of Tilapia: Urinigenital system.	6	

Course title- Animal Physiology : Life sustaining systems

Course code: BZOCCHC402

Allotted lectures-Theory- 57 +Tutorial classes required- 11+Remedial classes- 6

Practical- 16

Objectives:

- This field confers the idea of study of physiology that deals how living organisms function, from cell to system, conferring adaptation to environmental habitat.
- Students will know the different process of hemopoiesis , the renal physiology, biology of heart and its functions, body's role in maintaining the homeostasis.
- They also get the chance of knowing the components of human blood more efficiently as well as the recording of blood pressure.

Core T 9 – Animal Physiology: Life Sustaining System				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Structural organization and functions of gastrointestinal tracts and associated glands.	• Definition and structure of gastrointestinal tracts.	1	Online
		• Function of gastrointestinal tracts.	1	Online
		• Structure and function of different types of glands.	1	Online
2	Mechanical and chemical digestion of food, absorption of carbohydrates, lipids, proteins and nucleic acid; digestive enzymes.	• Definition and molecular mechanism of digestion of food.	1	Online
		• Mechanism of absorption of carbohydrates.	1	Online
		• Mechanism of absorption of proteins.	1	Online
		• Mechanism of absorption of lipids.	1	Online
		• Mechanism of absorption of nucleic acid.	1	Online
		• Different types of digestive enzymes and their function.	1	Online
3	Mechanism of respiration, respiratory volumes and capacities, transport of oxygen and carbon dioxide in blood, Dissociation curves and the factors influencing it, respiratory pigments; Carbon mono oxide poisoning.	• Definition of respiration and its associated organs.	1	Online
		• Mechanism of respiration.	1	Online
		• Details about the terms like respiratory volumes and respiratory capacities.	1	Online
		• Structure and function of haemoglobin.	1	Online
		• Mechanism of oxygen transport.	1	Online

		• Mechanism of carbon dioxide transport. • Structure and significance of oxygen dissociation curve. • Factors affecting the oxygen dissociation curve. • Details about respiratory pigment. • Mechanism of Carbon mono oxide poisoning.	1 1 1 1 1	Online Online Online Online Online
4	Components of blood and their functions; structure and functions of haemoglobin.	• Components function of blood. • Structure and function of haemoglobin.	1 2	Online Online
5	Haemostasis; blood clotting system, Fibrinolytic system.	• Definition and mechanism of haemostasis. • Mechanism of blood clotting system. • Details about fibrinolytic system.	1 1 1	Online Online Online
6	Haemopoiesis; Basic steps and its regulation.	• Definition and different steps of haemopoiesis. • Regulation of haemopoiesis.	2 1	Online Online
7	Blood groups; ABO and Rh factor.	• Mechanism of ABO blood group system. • History of ABO system. • Details about Rh factor. • Details about erythroblastosis foetalis.	1 1 1 1	Online Online Online Online
8	Structure of mammalian heart, Coronary circulation, structure and working of conducting myocardial fibres, origin and conduction of cardiac impulse, cardiac cycle and cardiac output. Blood pressure and its regulation.	• Basic structure of mammalian heart and its function. • Mechanism of coronary circulation. • Working mechanism of myocardial fibres. • Origin and mechanism of conduction of cardiac impulse. • Details about cardiac cycle. • Details about cardiac output. • Details about blood pressure. • Regulation of blood pressure.	2 1 1 1 1 1 1 1	Online Online Online Online Online Online Online Online
9	Physiological classification based on thermal biology.	• Definition of thermoregulation and its mechanism. • Classification of thermoregulatory mechanism. • Significance of thermal biology.	2 1 1	Online Online Online

10	Thermal biology of endotherms.	Mechanism of thermoregulation in endothermic animals.	2	Online
11	Osmoregulation in aquatic vertebrates, External osmoregulatory organs in vertebrates.	- Definition of osmoregulation and its related terms. - Mechanism of osmoregulation in aquatic vertebrates. - Different types of external osmoregulatory organ in vertebrates.	1 2 1	Online Online Online
12	Structure of kidney and its functional unit, Mechanism of urine formation, Regulation of acid base balance.	- Basic structure and function of kidney. - Structure and function of nephron. - Mechanism of Urine formation. - Counter-current mechanism of urine formation. - Regulation of acid- base balance	2 1 1 1 1	Online Online Online Online Online
EVALUATION METHOD- PPT PRESENTATION, SURPRISE TSET				
Core P9 - Animal Physiology: Life Sustaining Systems				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	Enumeration of red blood cells and white blood cells using haemocytometer.	- Enumeration of red blood cells using haemocytometer. - Enumeration of white blood cells using haemocytometer.	2 2	Online Online
2	Estimation of haemoglobin using Sahli's haemoglobinometer.	Estimation of haemoglobin using Sahli's haemoglobinometer.	2	Online
3	Preparation of haemin and haemochromogen crystals.	- Preparation of haemin and haemochromogen crystals. - Preparation of haemin and haemochromogen crystals.	2 2	Online Online
4	Recording of blood pressure using a sphygmomanometer.	Recording of blood pressure using a sphygmomanometer.	6	Online

Course title- Immunology

Course code: BZOOCCHC403

Allotted lectures- Theory-51 +Tutorial classes required- 14+ Remedial classes- 7

Practical- 30

Objectives:

- The topic deals with the study of the immune systems of human, the cells that are related to it, their particular generation, activation process.
- They will also know about the defensive strategies, like the production of antibodies and other processes. Moreover, they come to know how their body protect themselves from different diseases by using vaccines.
- In practical they expose to various immunological tissue and organ experiments.

Core T 10 –Immunology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Basic concept of health and diseases, Historical perspective of Immunology.	• Definition of health and diseases.	1	Online
		• History of immunology (Name of scientists and their contribution).	1	Online
2	Cells and organ of the Immune system.	• Structure and function of immune cells.	1	Online
		• Structure and function of immune organs.	2	Online
3	Anatomical barriers, Inflammation.	• Details about barriers.	1	Online
		• Mechanism of inflammation.	1	Online
4	Cells and molecules involved in innate immunity.	• Structure and function of different types of cells and molecules.	1	Online
		• Mechanism of innate immunity.	2	Online
		• Significance of innate immunity	1	Online
5	Adaptive immunity: cell mediated and humoral.	• Mechanism of adaptive immunity.	2	Online
		• Significance of adaptive immunity.	1	Online
		• Details about cell mediated and humoral immune response.	1	Online
6	Antigenicity and immunogenicity, immunogens, Adjuvants and	• Definition of antigen, types and antigenicity.	1	Online

	Haptens, factors influencing immunogenicity.	• Definition of immunogen and immunogenicity. • Definition of terms like immunogens, haptens, adjuvants and their functional aspects. • Factors influencing immunogenicity.	1	Online
			1	Online
			1	Online
7	B and T cell epitope.	• Definition and basic structure and function of immunoglobulin. • Structure and functions of different classes of immunoglobulins.	2	Online
			1	Online
8	Structure and functions of different classes of immunoglobulins.	• Definition and basic structure and function of immunoglobulin. • Structure and functions of different classes of immunoglobulins.	2	Online
			1	Online
9	Antigen-Antibody interactions, Immunoassays: ELISA and RIA, Hybridoma technology, Monoclonal antibody production.	• Mechanism of antigen-antibody interaction. • Mechanism of Immunoassays: ELISA and RIA and their significance. • Mechanism of hybridoma technology. • Mechanism of monoclonal antibody production.	1	Online
			1	Online
			1	Online
			1	Online
10	Structure and function of different types of MHC molecules.	• Definition and basic structure of MHC molecule. • Details structure and function of different types of MHC molecules. • Antigen presentation through MHC.	1	Online
			1	Online
			2	Online
11	Structure of T cell receptor and its signaling. T cell development and selection.	• Basic structure of receptor. • Structure and function of T cell receptor. • Signaling through T cell receptor. • Mechanism of T cell development pathway. • Selection process of T cells.	1	
			1	
			1	Online
			1	
			1	
12	Types, properties and functions of Cytokines.	• Definition, types and properties of cytokines. • Mechanism of action of cytokines.	1	Online
			1	
13	Components and pathways of Complement activation.	• Definition, components and function of complement proteins. • Different pathways of complement activation.	1	Online
			2	

14	Gell and Coombs classification and brief description of various types of Hypersensitivities.	- Definition and classification of Hypersensitivity reaction - Mechanism of different types of hypersensitivity reactions	1 2	Online
15	Dengue and Tuberculosis, Leprosy.	- Causative agent, symptoms and prevention of dengue. - Causative agent, symptoms and prevention of tuberculosis. - Causative agent, symptoms and prevention of leprosy.	1 1 1	Online
16	Various types of vaccines. Active and passive immunization (Artificial and Natural).	- Definition and types of vaccines. - Details about vaccination process.	1 1	Online
EVALUATION METHOD- STUDENT'S SEMINAR, CLASS TEST, QUIZ				
Core P10 - Immunology				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	Demonstration of lymphoid organs.	Demonstration of lymphoid organs.	6	Online
2	Histological study of spleen, thymus and lymph nodes through slides / photographs.	- Histological study of spleen through slides. - Histological study of thymus through slides. - Histological study of lymph nodes through slides.	2 4 4	Online Online Online
3	Preparation of stained blood film to study various types of blood cells.	Preparation of stained blood film to study various types of blood cells.	6	Online
4	ABO blood group determination.	Preparation of stained blood film for ABO blood group.	4	Online
5	Demonstration of ELISA.	Demonstration of ELISA.	4	Online

Course title- Sericulture (SEC-2)

Course code: BZOOSEHT405

Allotted lectures- Theory- 23 +Tutorial classes required- 4+Remedial classes-1

Objectives:

- In this skill enhancing course students will get the opportunity to know the culture of silk, sericulture which leads them to understand the culture process, different species of silkworm, their predators, diseases.
- Moreover they will acquire the significance of silk marketing in Indian economy.

SEC 2 - Sericulture				2 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Sericulture: Definition, history and present status; silk route, Types of silkworms, Distribution and Races, Exotic and Indigenous races, Mulberry and non mulberry silkworm.	• Definition, history and present status.	1	Online
		• Details about silk route.	1	Online
		• Different types of silkworms and their distribution.	1	Online
		• Details about exotic and indigenous races.	1	Online
		• Life cycle and pathogenicity of mulberry and non mulberry silkworm.	2	Online
2	Life cycle of <i>Bombyx mori</i> , structure of silk gland and secretion of silk.	• Life cycle of <i>Bombyx mori</i> .	1	Online
		• Structure of silk gland.	1	
		• Secretion of silk.	1	
3	Selection of mulberry variety and establishment of mulberry garden. Rearing house and rearing appliances. Disinfectants: Formalin, bleaching powder, RKO. Silkworm rearing technology: Early age and late age rearing. Types of montages. Spinning, harvesting and storage of cocoons.	• Selection of mulberry variety and establishment of mulberry garden.	1	Online
		• Details about rearing house and rearing appliances.	1	Online
		• Description of disinfectants like formalin, bleaching powder, RKO.	1	Online
		• Details about silkworm rearing technology.	1	Online
		• Types of montages.	1	Online
		• Details of spinning, harvesting and storage of cocoons.	1	Online
4	Pests of silkworm: Uzi fly, dermestid beetles and vertebrates. Pathogenesis	• Details about pests of silkworm.	1	Online
		• Pathogenesis of silk worm diseases.	1	

	of silkworm diseases: Protozoan, viral, fungal and bacterial. Control and prevention of pests and diseases.	Control and prevention of pests and diseases.	1	Online
5	Prospectus of sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non mulberry sericulture.	- Prospectus of sericulture in India: sericulture industry in different states. - Prospectus of sericulture in India: employment. - Prospectus of sericulture in India: potential in mulberry and non mulberry silkworm.	1 1 1	Online
6	Visit to various sericulture centers.	Theoretical knowledge about visits to various sericulture centers.	2	Online

Lesson Plan (Sem-V)

Name of the College- Jagannath Kishore College

Subject- Zoology

Course title- Molecular Biology

Course code: BZOOCCHC501

Allotted lectures- Theory-75 +Tutorial classes required- 12+Remedial classes- 7

Practical- 30

Objectives:

- As this field is particularly important to the nucleic acids at the level of molecules which make them up, students will be able to understand living things by examining the components and how they interact with populations.
- As this field is incomplete without any practical, so students will get the observation of chromosomes demonstration, Gel Electrophoresis as well as use of spectrophotometer.

Core T11 - Molecular Biology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Salient features of DNA and RNA Watson and Crick Model of DNA.	• DNA as genetic material. • DNA types and structures. • Watson and Crick model of DNA. • Chemical structure. • RNA type and structure and Function.	1 2 1 2 3	Online
2	Mechanism of DNA Replication in Prokaryotes, Semi-conservative, bidirectional and discontinuous Replication, RNA priming, Replication of telomeres.	• Significance and modes of DNA replication, Semi-conservative, Meselson and Stahl experiment • Bidirectional and discontinuous replication, rolling circle replication. • Enzyme structures and their functions related to DNA replications • Initiation of prokaryotic replication, RNA priming. • Elongation of replication (progression through leading and lagging strand).	2 2 2 1 2	Online

		Replication of telomeres.	1	
3	Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.	- Introduction of transcription, it's significance. - Transcription enzymes, it's structures and function, transcription factors. - Prokaryotic transcription (initiation, elongation, termination). - Eukaryotic transcription (Initiation, elongation, termination). - Comparative study between prokaryotic and eukaryotic transcription.	1 3 4 3 1	Online
4	Mechanism of protein synthesis in prokaryotes. Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain. Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation.	- Ribosome structure and assembly in prokaryotes. - Structure of tRNA, aminoacyl tRNA synthetases and charging of tRNA. - Mechanism of protein synthesis in prokaryotes (Initiation, elongation and termination). fidelity of protein synthesis. - Mechanism of protein synthesis in Eukaryotes (Initiation, elongation and termination). Inhibitors of protein synthesis. - Proteins involved in initiation, elongation. - Comparative study between prokaryotic and eukaryotic translation.	1 2 2 2 1 1	Online
5	Genetic code, Degeneracy of the genetic code and Wobble Hypothesis.	- Characteristics of genetic code. - Degeneracy of the genetic code and Wobble Hypothesis.	1 2	Online
6	Capping and Poly A tail formation in mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA.	- General ideas and significance of post transcriptional modifications. 5' capping and Poly A tail formation in mRNA and their significance. - Split genes: concept of introns and exons, splicing mechanism, alternative splicing. - Exon shuffling and RNA editing. - Processing of tRNA.	1 1 2 1 1	Online
7		General ideas on operon. Structure of <i>lac</i> operon.	2	

	Regulation of Transcription in prokaryotes: <i>lac</i> operon and <i>trp</i> operon.	- Regulation of transcription in <i>lac</i> operon. <i>lac</i> repressor, catabolite activator protein (CAP), effect of glucose level. - Structure of <i>trp</i> operon, attenuation.	2 2 3	Online
8	Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing, Genetic imprinting.	- Regulation of transcription in eukaryotes: activators, enhancers, silencer, repressors. - miRNA mediated gene silencing, genetic imprinting.	3 3	Online
9	Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair.	- Types of DNA repair mechanisms. - RecBCD model in prokaryotes. - Nucleotide and base excision repair, SOS repair.	2 1 2	Online
10	Western and Southern blot, Northern Blot, Sanger DNA sequencing.	- Western blot and it's application. - Southern blot and it's application. - Northern blot and it's application. - Sanger DNA sequencing.	1 1 1 1	Online
11	PCR.	Types, procedures and application of PCR.	2	Online

EVALUATION METHOD-

STUDENT'S SEMINAR, GROUP DISCUSSION,

Core P11 - Molecular Biology

2 credits

Practical

	Topic	Subtopic	Periods	Mode
1	Demonstration of polytene and lampbrush chromosome from photograph.	- Description of polytene and lampbrush chromosome. - Identification of polytene and lampbrush chromosome with photograph.	2 4	Online Online
2	Isolation and quantification of genomic DNA using spectrophotometer (A260 measurement).	- Isolation of genomic DNA. - Quantification of isolated DNA using spectrophotometer (A260 measurement).	4 4	Online Online
3	Agarose gel electrophoresis for DNA Principles of Genetics.	- General introduction of DNA agarose gel electrophoresis. - Isolation of DNA. - Agarose gel electrophoresis of isolated DNA.	4 6 6	Online Online

Course title- Principles of Genetics

Course code: BZOOCCHC502

Allotted lectures- Theory-58 +Tutorial classes required- 10+Remedial classes- 9

Practical- 44

Objectives:

- This area confers the idea about genes along with the concept of heredity, variation in living organisms.
- Students will also know the mutations and its effects, availability of sequence information and genomic analysis together with techniques of gene replacements and their expression patterns.
- In the practical portion they get the chance of solving some mathematical problems based on Chi-square, linkage, mapping, and pedigree analysis etc.

Core T12 - Principles of Genetics				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Principles of inheritance, Incomplete dominance and co-dominance, Epistasis Multiple alleles, Lethal alleles, Pleiotropy.	• Principles of inheritance, test cross, back cross. • Incomplete dominance and co-dominance. • Epistasis Multiple alleles, ABO Blood group. • Lethal alleles, Sickle cell anemia Pleiotropy.	2 1 2 1	Online
2	Sex-linked, sex- influenced and sex-limited inheritance, Polygenic Inheritance	• Sex-linked inheritance, Color blindness, hemophilia. • Sex- influenced and sex-limited inheritance. • Polygenic Inheritance.	2 1 1	Online
3	Linkage and Crossing Over, molecular basis of crossing over, Measuring Recombination frequency and linkage intensity using three factor crosses, Interference and coincidence.	• Linkage, Complete Linkage, incomplete Linkage, linkage group. • General mechanism of Crossing Over. • Molecular basis of crossing over. • Gene mapping / problems. • Interference and coincidence.	1 1 1 3 1	Online

4	Types of gene mutations (Classification), Types of chromosomal aberrations (Classification with one suitable example of each), Non-disjunction and variation in chromosome number; Molecular basis of mutations in relation to UV light and chemical mutagens.	• General ideas of mutation. • Types of mutation (Classification). • Types of chromosomal aberrations (Classification with one suitable example of each). • Non-disjunction and variation in chromosome number. • Molecular basis of mutations in relation to UV light and chemical mutagens.	1 3 2 1 2	Online
5	Mechanisms of sex determination in <i>Drosophila</i> .	• Mechanisms of sex determination in <i>Drosophila</i>. • Genic balance theory, alternative splicing. Regulatory gene.	1 1	Online
6	Sex determination in mammals.	• Mechanisms of sex determination in mammals. • Role of Y chromosome. • Genetic regulation of sex determination.	1 1 2	Online
7	Dosage compensation in <i>Drosophila</i> and Human.	• Dosage compensation in <i>Drosophila</i>. • Dosage compensation in human. • Comparative study.	2 2 2	Online
8	Criteria for extra chromosomal inheritance, Antibiotic resistance in <i>Chlamydomonas</i> , Kappa particle in <i>Paramoecium</i> , Shell spiraling in snail.	• Cytoplasmic inheritance, criteria for extra chromosomal inheritance. • Antibiotic resistance in <i>Chlamydomonas</i>. • Structure of <i>Paramoecium</i> Kappa particle in <i>Paramoecium</i>. • Shell spiraling in snail, maternal effect.	1 1 1 1	Online
9	Conjugation, Transformation, Transduction, Complementation test in bacteriophage.	• Definition of conjugation, mechanism. • Mechanism of Hfr strain, interrupted mating experiment. • Mechanism of transformation. • Mechanism of transduction. • Conjugation map linear and circular. • Problems related transduction. • Mechanism of complementation test.	1 2 1 1 1 2 1	Online
10		• Definition and mechanism of transposons.	1	Online

	Transposons in bacteria, Ac-Ds elements in maize and P elements in <i>Drosophila</i> , LINE, SINE, Alu elements in humans.	• Carnal color experiment. • Mechanism of Ac-Ds elements in maize. • Mechanism of P elements in <i>Drosophila</i>. • Mechanism of LINE, SINE, <i>Alu</i> elements in humans.	1 1 1 3	Online
EVALUATION METHOD-		POWER POINT PRESENTATION, QUIZ, MCQ BASED EXAM		
Core P12 - Principles of Genetics				2 credits
Practical				
	Topic	Subtopic	Periods	Moe
1	Chi-square analyses.	• Details of Chi-square analyses. • Problems and significance.	2 4	Online
2	Linkage maps based on conjugation.	• Conjugation map linear and circular. • Problems and significance.	2 4	Online
3	Identification of chromosomal aberration in <i>Drosophila</i> and man from photograph.	• General ideas on chromosomal aberration in <i>Drosophila</i> and man. • Identification through photograph.	4 4	Online
4	Pedigree analysis of some human inherited traits.	• General ideas on Pedigree analysis. • Problems related to Y link inheritance. • Problems related to X linked dominant inheritance. • Problems related to X linked recessive inheritance. • Problems related to autosomal dominant inheritance. • Problems related to Autosomal recessive inheritance.	4 4 4 4 4 4	Online

Course title- Animal Biotechnology (DSE-1)

Course code: BZOODSHC1

Allotted lectures- Theory-42 +Tutorial classes required- 9+ Remedial classes- 5

Practical- 54

Objectives:

- This field confers the modern idea about applications of various modified techniques in biology related to gene cloning.
- They also know the forensic biology as part of their syllabus as they go through the DNA fingerprinting, ELISA etc.

DSE T1 - Animal Biotechnology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Concept and scope of Biotechnology: Organization of prokaryotic and eukaryotic genome, Concept of genomics.	• Meaning, concept and scope of Biotechnology. • Organization of prokaryotic genome. • Organization of eukaryotic genome. • Concept of genomics.	1 1 1 1	Online Online Online Online
2	Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics). Restriction enzymes: Nomenclature, detailed study of Type II. Transformation techniques: Calcium chloride method and electroporation. Construction of genomic and cDNA libraries and screening by colony and plaque hybridization.	• Definition and concept of cloning vectors. • Structure and application of Plasmids, Cosmids. • Structure and application of Phagemids, Lambda bacteriophage. • Structure and application of M13, BAC. • Structure and application of YAC and MAC. • Structure and application of Expression vectors. • Restriction enzymes: Nomenclature, detailed study of Type II. • Calcium chloride method and its application. • Electroporation method and its application. • Construction of genomic library.	1 1 1 1 1 2 1 1 1	Online Online Online Online Online Online Online Online Online

		• Construction of cDNA library. • Screening by colony hybridization technique. • Screening by plaque hybridization technique.	1 1 1	Online Online
3	Southern, Northern and Western blotting.	• Definition and concept of blotting. • Procedure and application of Southern blotting. • Procedure and application of Northern blotting. • Procedure and application of Western blotting.	1 1 1 1	Online
4	DNA sequencing: Sanger method.	• Definition and concept of sequencing. • Procedure of Sanger method and its application.	1 2	Online
5	Polymerase Chain Reaction, DNA Finger Printing and DNA micro array.	• Brief idea about cloning. • Procedure and application of Polymerase chain reaction. • Procedure and application of DNA Fingerprinting. • Procedure and application of DNA micro array.	1 1 1 1	Online
6	Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection.	• Definition and concept of cloned and transgenic animals. • Concept of production of cloned animals. • Concept of production of transgenic animals.	1 1 1	Online
		• Procedure and application of nuclear transplantation technique. • Procedure and application of Retroviral Method. • Procedure and application of DNA microinjection technique.	1 1 1	Online
7	Applications of transgenic animals: Production of pharmaceuticals,	• Procedure of Production of pharmaceuticals and its application. • Procedure of Production of donor organs.	1 1	Online

	production of donor organs, knock-out mice.	• Procedure of Production of Knock-out mice	1	
8	Animal cell culture, Expressing cloned genes in mammalian cells.	• Definition and concept of animal cell culture and its application. • Procedure of Expressing cloned genes in mammalian cells.	2 1	Online
9	Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia).	• Mechanism of Molecular diagnosis of genetic disease - Cystic fibrosis. • Mechanism of Molecular diagnosis of genetic diseases-Sickle cell anemia.	1 1	Online
EVALUATION MRTHOD- SLIDESHARE,SURPRISE TEST,QUIZ,GROUP DISCUSSION				
DSE P1 - Animal Biotechnology				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	Genomic DNA isolation from <i>E. coli</i> / Blood genomic.	• General ideas on DNA isolation. • Genomic DNA isolation from <i>E. coli</i>. • Genomic DNA isolation from Blood	2 4 4	Online
2	Plasmid DNA isolation (pUC 18 / 19) from <i>E. coli</i> .	• General ideas on plasmid DNA. • Plasmid DNA isolation (pUC 18 / 19) from <i>E. coli</i>.	2 4	Online
3	Restriction digestion of plasmid DNA.	• General ideas on Restriction digestion. • Restriction digestion of plasmid DNA.	2 4	Online
4	Construction of circular and linear restriction map from the data provided.	• General ideas on linear and circular restriction map. • Construction of map from the data provided.	2 4	Online
5	Calculation of transformation efficiency from the data provided	• Description of transformation efficiency. • Calculation of transformation efficiency from the data provided	2 4	Online
6	To study following techniques through photographs a) Southern Blotting b) Northern Blotting c) Western Blotting d) DNA Sequencing (Sanger's Method) e) PCR DNA fingerprinting	• Description of southern blotting through photograph • Description of Northern blotting through photograph. • Demonstration of Western blotting through photograph. • Actual demonstration of Western blotting.	2 2 2 4	Online

		• Description of DNA Sequencing (Sanger's Method) through photograph. • Demonstration of PCR through photograph. • Demonstration of DNA fingerprinting through photograph.	2 2 2	Online
7	Project report on animal cell culture.	• Project report on animal cell culture.	4	Online

DSE T3 - Wild Life Conservation and Management				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.	- Values of wild life - positive and negative; Conservation ethics; Importance of conservation. - Causes of depletion; World conservation strategies.	1 1	Online
2	Habitat analysis, Physical parameters: Topography, Geology, Soil and water Biological Parameters: food, cover, forage, browses and cover estimation Standard evaluation procedures: remote sensing and GIS.	- Habitat analysis. - Physical parameters: Topography, Geology, Soil and water. - Biological Parameters: food, cover, forage, browses and cover estimation - Standard evaluation procedures: remote sensing and GIS	1 1 1 2	Online
3	Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity. Restoration of degraded habitats.	- Setting back succession. - Grazing logging, Mechanical treatment. - Advancing the successional process. - Cover construction. - Preservation of general genetic diversity. - Restoration of degraded habitats.	1 1 1 1 1 1	Online
4	Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of	- Population density, natality, birth rate, mortality. - Fertility schedules and sex ratio computation.	2 3	Online

	ungulates and carnivores; Pug marks and census method.	- Faecal analysis of ungulates and carnivores. - Pug marks and census method.	1 2	Online
5	Wildlife conservation in India – through ages; different approaches of wildlife conservation; modes of conservation; <i>in-situ</i> conservation and <i>ex-situ</i> conservation: necessity for wildlife conservation.	- Wildlife conservation in India through ages. - Different approaches of wildlife conservation. - Modes of conservation. <i>in-situ</i> conservation and <i>ex-situ</i> conservation: necessity for wildlife conservation	2 2 1 2	Online
6	Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbation.	- Estimation of carrying capacity. - Eco tourism / wild life tourism in forests. - Concept of climax persistence. - Ecology of perturbation.	2 1 1 1	Online
7	Causes and consequences of human-wildlife conflicts; mitigation of conflict – an overview; Management of excess population.	- Causes and consequences of human-wildlife conflicts. - Mitigation of conflict – an overview. - Management of excess population.	2 1 1	Online
8	National parks and sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.	- National parks and sanctuaries, Community reserve. - Important features of protected areas in India. - Tiger conservation - Tiger reserves in India - Management challenges in Tiger reserve	2 2 2 1	Online

Evaluation method-

QUIZ,SURPRISE TEST

DSE P3 - Wild Life Conservation and Management

2 credits

Practical

	Topic	Subtopic	Periods	Mode
1	Identification of flora, mammalian fauna, avian fauna, herpeto-fauna.	- Identification of flora. - Identification of mammalian fauna. - Identification of avian fauna. - Identification of herpeto-fauna.	2 2 2 2	Online
2	Demonstration of basic equipment needed in wildlife studies use, care	Compass, Binoculars, Spotting scope, Range Finders.	2	Online

	and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses).	• Global Positioning System. • Various types of Cameras and lenses.	4 4	Online
3	Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc.	• Familiarization and study of animal evidences in the field. • Identification of animals through pug marks, hoof marks. • Identification of animals through scats, pellet etc. • Identification of animals through nest, antlers, etc.	4 2 2 2	Online
4	Demonstration of different field techniques for flora and fauna.	• Demonstration of different field techniques for flora and fauna.	6	Online
5	PCQ, ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.	• PCQ, ten tree method. • Circular, square and rectangular plots. • Parker's 2 step and other methods for ground cover assessment. • Tree canopy cover assessment. • Shrub-cover assessment.	2 2 4 4 2	Online
6	Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences).	• Trail / transect monitoring for abundance and diversity estimation of mammals (direct and indirect evidences). • Trail / transect monitoring for abundance and diversity estimation of bird (direct and indirect evidences)	4 4	Online Online

Lesson Plan (Sem-VI)

Name of the College- Jagannath Kishore College

Subject- Zoology

Course title- Developmental Biology

Course code: BZOOCCHC601

Allotted lectures- Theory-46 +Tutorial classes required- 14+Remedial classes- 5

Practical- 34

Objectives:

- This have the basic outline of the events that do happen in daily life like gametogenesis, the development phases, Fertilization, the late and post embryonic development and some implications of teratogenic agents in human life.
- It also delivers the ideas of different types of placenta, stem cells and brief idea about IVF & ET.
- In practical classes they get they concern about the different developmental stages of chick and Drosophila etc.

Core T13 - Developmental Biology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Basic concepts: Phases of Development, Cell-cell interaction, Differentiation and growth, Differential gene expression.	• Phases of development, cell-cell interaction.	1	Online
		• Differentiation and growth.	1	
		• Differential gene expression.	2	
2	Gametogenesis, Spermatogenesis, Oogenesis.	• Process of spermatogenesis.	2	Online
		• Process of oogenesis.	3	Online
3	Types of eggs, Egg membranes.	• Types of eggs.	1	Online
		• Types and functions of egg membranes.	1	Online
4	Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy.	• External fertilization in sea urchin.	2	Online
		• Internal fertilization in mammals.	3	Online
5	Planes and patterns of cleavage.	• Cleavage and its types.	1	Online
		• Mechanism of cleavage.	1	Online
6		• Blastulation and types of blastula.	1	Online

	Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation.	- Blastulation of frog. - Blastulation of chick.	1 1	Online Online
7	Embryonic induction and organizers.	- Gastrulation in frog. - Gastrulation in chick.	3 2	Online Online
8	Fate of Germ Layers; Extra-embryonic membranes in birds.	Extra-embryonic membranes in chick.	2	Online
9	Implantation of embryo in humans.	Implantation of embryo in humans.	1	Online
10	Placenta (Structure, types and functions of placenta).	- Placenta definition and structure. - Placenta types and functions.	1 1	Online Online
11	Development of Eye in Vertebrate.	- Induction and reciprocal induction concept. - Development of eye.	1 2	Online Online
12	Development of brain in Vertebrate.	Development of brain in vertebrate.	3	Online
13	Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each).	- Definition of regeneration and modes of regeneration. - Epimorphosis and morphallaxis. - Mechanism of regeneration.	1 1 1	Online Online Online
14	Teratogenesis: Teratogenic agents and their effects on embryonic development; <i>In vitro</i> fertilization, Stem cell (ESC), Amniocentesis.	- Definition and agents of teratogenesis. - Effect of teratogenesis on embryonic development. <i>In vitro</i> fertilization. - Stem cell (ESC), and amniocentesis.	1 1 2 2	Online Online Online Online

EVALUATION METHOD-

POWER POINT

PRESENTATION,SLIDESHARE,CLASS TEST

Core P13 - Developmental Biology

2 credits

Practical

	Topic	Subtopic	Periods	Mode
1	Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages).	- Identification and characterization of chick embryo at 13 h and 18 h of incubation. - Identification and characterization of chick embryo at 21 h and 24 h of incubation. - Identification and characterization of chick embryo at 28 h and 33 h of incubation. - Identification and characterization of chick embryo at 72 h and 96 h of incubation.	2 2 2 2	Online Online Online Online

		• Identification and characterization of chick embryo at 13 h and 18 h of incubation.	2	Online
2	Study of the developmental stages and life cycle of <i>Drosophila</i> from stock culture.	• Preparation of culture media for <i>Drosophila</i> culture. • Trapping of <i>Drosophila</i> in the culture. • Identification and characterization of developmental stages of <i>Drosophila</i> sp.	2 2 4	Online
3	Study of different sections of placenta (photomicrograph / slides).	• Identification and characterization of different types of placenta from photomicrograph.	4	Online
4	Project report on <i>Drosophila</i> culture/chick embryo development.	• Project report on <i>Drosophila</i> culture and its development. • Project report on chick embryo development.	4 8	Online Online

Course title- Evolutionary Biology

Course code: BZOOCCHC602

Allotted lectures-Theory- 41 +Tutorial classes required- 8+Remedial classes- 0

Practical- 28

Objectives:

- This part gives the idea of life, how it starts, its evolution in this earth.
- Students will know about the Species diversity starting from single common ancestor, and how the organisms transform from simple to complex by several processes.
- In practical they will know about different ancient fossils, homology and analogy in addition with Hardy-Weinberg law.

Core T14 - Evolutionary Biology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Life's Beginnings: Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes.	• Basic concept of evolution. RNA world hypothesis. • Biogeny. Origin of photosynthesis. • Evolution of eukaryotes.	1 1 1	Online Online Online
2	Historical review of Evolutionary concepts, Lamarkism, Darwinism and Neo Darwinism.	• Concept of Lamarkism. • Concept of Darwinism. • Concept of Neo Darwinism.	1 1 1	Online Online Online
3	Geological time scale, Fossil records of Hominids (from <i>Australopithecus</i> to <i>Homo sapiens</i>), evolution of horse.	• Geological time scale. • Fossil records from <i>Australopithecus</i> to <i>Homo sapiens</i>. • Evolution of horse.	1 2 2	Online Online Online
4	Neutral theory of molecular evolution, Molecular clock.	• Neutral theory of molecular evolution. • Molecular clock.	2 2	Online Online
5	Sources of variations: Heritable variations and their role in evolution.	• Heritable variations and their role in evolution.	1	Online
6	Population genetics: Hardy-Weinberg Law (statement and derivation of equation, application of law to biallelic Population); Evolutionary forces upsetting H-W equilibrium;	• Statement and derivation of equation of Hardy-Weinberg Law. • Effect of evolutionary forces like mutation, genetic drift, natural selection, etc on H-W equilibrium.	2 2	 Online

	Natural selection (concept of fitness, types of selection, selection coefficient, mode of selection heterozygous superiority).	Natural selection (concept of fitness, types of selection, selection coefficient, mode of selection heterozygous superiority).	2	Online
7	Genetic Drift mechanism (founder's effect, bottleneck phenomenon).	- Mechanism of genetic drift and its effects. - Founder effect and bottleneck phenomenon.	1 1	Online Online
8	Role of Migration and Mutation in changing allele frequencies.	- Role of Migration in changing allele frequencies. - Role of Mutation in changing allele frequencies.	1 1	Online Online
9	Species concept, Isolating mechanisms, modes of speciation.	- Isolating mechanisms. - Different types of Species concept. - Speciation and its types.	1 1 1	Online Online Online
10	Adaptive radiation/macroevolution (exemplified by Galapagos finches).	Adaptive radiation in Galapagos finches.	2	Online
11	Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction.	- Causes and effects of mass extinction. - Causes of K-T extinction and its effects.	1 1	Online Online
12	Origin and Evolution of Man, Unique Hominid characteristics contrasted with primate characteristic.	Evolution of man in light of evolution of hominid characters.	3	Online
13	Molecular analysis of human origin.	Molecular analysis of human origin.	2	Online
14	Phylogenetic trees, Construction and interpretation of Phylogenetic tree using parsimony, Convergent and Divergent evolution.	- Construction and interpretation of Phylogenetic tree using parsimony. - Convergent and Divergent evolution.	2 1	Online Online

EVALUATION METHOD- QUIZ, CLASS TEST

Core P14 - Evolutionary Biology

2 credits

Practical

	Topic	Subtopic	Periods	Mode
1	Study of fossils from models / pictures.	Study of fossils from pictures.	6	Online
2	Study of homology and analogy from suitable specimens.	- Study of homology from suitable specimens. - Study of analogy from suitable specimens.	4 4	Online
3	Study and verification of Hardy-Weinberg Law by chi square analysis.	Study and verification of Hardy-Weinberg Law by chi square analysis.	6	Online

4	Graphical representation and interpretation of data of height / weight of a sample of 100 humans in relation to their age and sex.	- Collection and compilation of data. - Calculation of the data and construction of graphical representation.	4 4	Online

Course title- Animal Behaviour and Chronobiology (DSE-3)

Course code: BZOODSHC5

Allotted lectures- Theory- 51 +Tutorial classes required- 6+Remedial classes- 1

Practical- 108

Objectives:

- This field of biology mainly deals with the behaviour of animals in respect to their environment as this will link them not only to their nervous system but also with their environmental aspect to their own world as well as to humans.
- Students will also know about the process of parental care specially in fish, in addition with the investment, their effect and cost.

DSE T5 - Animal Behaviour and Chronobiology				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Origin and history of Ethology, Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.	• Origin and history of Ethology. • Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.	1 1	Online
2	Proximate and ultimate causes of behaviour, Methods and recording of a behavior.	• Proximate and ultimate causes of behaviour. • Methods and recording of a behavior.	1 2	Online
3	Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.	• Stereotyped behaviours (orientation, reflexes). • Individual behavioural patterns. • Instinct behaviour. • Learning behaviour, associative learning. • Classical and operant conditioning. • Habituation and imprinting.	1 1 1 1 1 1	Online Online Online Online Online
4	Social Behaviour: Concept of Society; Communication and the senses.	• Concept of social behaviour. • Concept of communication and senses.	2 3	Online
5	Altruism; Insects' society with Honey bee as example.	• Concept of altruism and reciprocal altruism. • Altruism in insect society and honey bee.	2 2	Online
6	Foraging in honey bee and advantages of the waggle dance.	• Communication in honey bee.	3	Online

7	Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice).	- Asymmetry of sex, sexual dimorphism in sexual behaviour. - Mate choice, intra-sexual selection (male rivalry), inter-sexual selection (female choice).	3 3	Online
8	Parental care in fish and amphibian.	- Parental care in fish. - Parental care in amphibian.	2 2	Online Online
9	Parent-offspring conflict.	Parent-offspring conflict.	3	Online
10	Historical developments in chronobiology; Biological oscillation: the concept of Average, amplitude, phase and period.	- Developments in chronobiology. - Concept of average, amplitude, phase and period in biological oscillation.	1 2	Online
11	Adaptive significance of biological clocks.	- Biological clock definition and significance. - Molecular mechanism of biological clock.	1 2	Online Online
12	Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of synchronization and masking; Photic and non-photic zeitgebers; Circannual rhythms; Photoperiod and regulation of seasonal reproduction of vertebrates; Role of melatonin.	- Short- and long- term biological rhythms. - Circadian rhythms. - Tidal rhythms and lunar rhythms. - Concept of synchronization and masking; Photic and non-photic zeitgebers. - Circannual rhythms; Photoperiod and regulation of seasonal reproduction of vertebrates. - Role of melatonin in biological rhythm.	1 2 1 1 2 2	Online Online Online Online Online Online
EVALUATION METHOD-		CLASS TEST, FIELD REPORT		
DSE P5 - Animal Behaviour and Chronobiology				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	To study nests and nesting habits of the birds and social insects.	- Study of nests of the birds. - Study of nests of social insects. - Study of nesting habits of the birds. - Study of nesting habits of social insects.	2 2 2 2	Online Online Online Online
2	To study the behavioural responses of wood lice to dry and humid conditions.	Study of behavioural responses of wood lice to dry and humid conditions.	4	Online
3	To study geotaxis behaviour in earthworm.	Study of geotaxis behaviour in earthworm.	4	Online

4	To study the phototaxis behaviour in insect larvae.	Study of phototaxis behaviour in insect larvae.	4	Online
5	Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.	- Visit to National Park / Biodiversity Park / Wild life sanctuary / Sea coast. - Documentation of behavioral activities of animals observed during the field trip. - Preparation of field report.	56 10 14	7 days Online Online
6	Study and actogram construction of locomotor activity of suitable animal models.	Study and actogram construction of locomotor activity of suitable animal models.	4	Online
7	Study of circadian functions in humans (daily eating, sleep and temperature patterns).	Study of circadian functions in humans (daily eating, sleep and temperature patterns).	4	Online

Course title- Biostatistics and Bioinformatics (DSE-4)

Course code: BZOODSHC6

Allotted lectures- Theory- 27 +Tutorial classes required- 4+ Remedial classes- 4

Practical- 28

Objectives:

- Students may deal with different statistical methods and analysis of data collection, Biometry.

DSE T6 - Biostatistics and Bioinformatics				4 credits
Theory				
	Topic	Subtopic	Periods	Mode of teaching
1	Definition of data. Concept of qualitative, quantitative, discrete, continuous, nominal, ordinal, interval and ratio data.	• Definition of data. Concept of qualitative, quantitative, discrete, continuous, nominal, ordinal, interval and ratio data.	2	Online
2	Types of distribution: Normal, skewed, uniform, symmetric bimodal, non-symmetric bimodal, spread, spread with outlier.	• Types of distribution: Normal, skewed, uniform, symmetric bimodal, non-symmetric bimodal, spread, spread with outlier.	3	Online
3	Basic concept and types of Kurtosis.	• Basic concept and types of Kurtosis.	1	Online
4	General concept of probability. The sum rule and the product rule. Usage of probability in Biological Sciences (Genetics mainly).	• General concept of probability. The sum rule and the product rule. • Usage of probability in biological sciences (genetics mainly).	2 4	Online Online
5	Correlation and Regression.	• Correlation. • Regression.	3 2	Online Online
6	t Test.	• t Test paired and 2 tailed t-test.	3	Online
7	Basic concept of Bioinformatics: Goals, scope, application and limitations.	• Goals and scope of bioinformatics. • Application and limitations of bioinformatics.	1 1	Online
8	Biological databases: Primary, secondary, and specialized databases.	• Primary, secondary, and specialized databases. • Role of mutation in changing allele frequencies.	3 1	Online
9	Pitfalls of biological databases.	• Pitfalls of biological databases.	1	Online

EVALUATION METHOD-		CLASS TEST, MATHEMATICAL PROBLEM SOLVING		
DSE P6 - Biostatistics and Bioinformatics				2 credits
Practical				
	Topic	Subtopic	Periods	Mode
1	Calculation of mean, median, mode, standard deviation, and standard error.	- Calculation of mean. - Calculation of median. - Calculation of mode. - Calculation of standard deviation. - Calculation of standard error.	2 2 2 2 2	Online Online Online Online Online
2	Construction of bar diagrams and pie diagrams using computer.	- Construction of bar diagrams using computer. - Construction of pie diagrams using computer.	4 4	Online Online
3	Submission of a project report on field generated data with application of at least one statistical tool (i.e. correlation, regression, t Test, mean, median, mode, standard deviation, and standard error).	Submission of a project report on field generated data with application of at least one statistical tool (i.e. correlation, regression, t-test, mean, median, mode, standard deviation, and standard error).	10	Online