

DEPARTMENT OF ZOOLOGY

Syllabus for
Undergraduate Programme (Honours)
Under Credit Semester System
(Outcome Based Education with Effect from 2024 Admissions)



St Berchmans College
Founded 1922

AUTONOMOUS | College with Potential for Excellence | A+ in the Fifth Cycle of Reaccreditation by NAAC

Changanassery, Kerala, India 686101 | Affiliated to Mahatma Gandhi University, Kottayam



ACKNOWLEDGEMENT

As the chairman of the Board of Studies in Zoology of St. Berchmans College, Changanassery I extend my sincere gratitude to all those who have contributed to the development of the FYUGP (Four Year Undergraduate Programme) syllabus in Zoology, aligned with the National Education Policy 2020.

Firstly, I would like to thank the experts in the field who provided invaluable insights and guidance throughout the syllabus preparation process. I extend my heartfelt thanks to esteemed external experts: Dr. P M Sureshan, Scientist (Emeritus) at the Zoological Survey of India Western Ghat Regional Centre, Calicut; Dr. Sebastian C D, Professor at the Department of Zoology, University of Calicut; Dr. C A Jayaprakas, Principal Scientist & Head (Rtd) of the Crop Protection Division, ICAR-Central Tuber Crop Research Institute, Thiruvananthapuram; Dr. Sudheer N S, Scientist at Kakdwip Research Centre, ICAR-Central Institute of Brackishwater Aquaculture, Kakdwip, West Bengal; and Dr. Bonsy Scaria, Principal of Amal Jyothi College of Nursing, Kanjirappally. Their contributions have significantly aided in the revision of this syllabus, ensuring its successful restructuring in alignment with the FYUGP framework.

I extend my heartfelt appreciation to my esteemed colleagues at the Department of Zoology, St. Berchmans College for their significant contributions and dedicated involvement in the preparation of this syllabus. Their expertise, commitment, and collaborative spirit have been invaluable throughout this process, ensuring the syllabus's quality and relevance.

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I firmly believe that this syllabus will lay the foundation for a transformative era in undergraduate education, prioritizing the holistic development and academic achievements of our students. With deep gratitude and optimism for what lies ahead, I extend my heartfelt appreciation to all who have contributed to this endeavour.

Dr. Monichan K K

Chairman, BoS in Zoology



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Dr. Joe Prasad Mathew
Dr. Philip Litto Thomas
Dr. Martin J Babu
Dr. Rubin Philip



PROGRAMME OUTCOMES

- PO1:** Develop in-depth conceptual knowledge and skills in the discipline for vertical growth and scholarly pursuits
- PO2:** Integrate and apply interdisciplinary knowledge incorporating historical, theoretical, scientific, technological, economic philosophical, cultural, aesthetic and ethical perspectives to address complex challenges in diverse settings
- PO3:** Demonstrate communication skills promoting adaptability, collaboration and resilience in global and local contexts
- PO4:** Develop problem solving skills to transfer the knowledge of methods and systems of different disciplines for a sustainable and egalitarian world order
- PO5:** Cultivate research skills, and innovative and critical thinking to contribute to societal development through the creation of sustainable solutions and advancements in the respective fields

PROGRAMME SPECIFIC OUTCOMES

- PSO1:** Develop a deep scientific understanding and proficiency to explore the diversity, complexity, and adaptability of the animal world
- PSO2:** Gain comprehensive insights into animal biology at ecological, behavioural, anatomical, physiological, cellular, biochemical and genetic levels
- PSO3:** Recognize the global implications of zoological studies and be equipped to contribute to conservation efforts and sustainable management of natural resources
- PSO4:** Demonstrate proficiency in laboratory and field techniques relevant to zoology and apply them in scientific investigations
- PSO5:** Translate domain knowledge and scientific discoveries into products, services, and technologies that address real-world biological, environmental, and ecological challenges



COURSES IN ZOOLOGY

OUTLINE OF DISCIPLINE SPECIFIC COURSES

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester I (Course Level: 100 - 199)					
SBU24ZO1DSC100	Major/Minor	Science of Life	5	75	4
SBU24ZO1DSC101	Minor	Biological Interactions	5	75	4
Semester II (Course Level: 100 - 199)					
SBU24ZO2DSC100	Major/Minor	Biodiversity and Biosystematics	5	75	4
SBU24ZO2DSC101	Minor	Animal World	5	75	4
Semester III (Course Level: 200 - 299)					
SBU24ZO3DSC200	Major	Evolution of Life	5	75	4
SBU24ZO3DSC201	Major	Environmental Biology	5	75	4
SBU24ZO3DSC202	Minor	Mammalian Physiology	5	75	4
Semester IV (Course Level: 200 - 299)					
SBU24ZO4DSC200	Major	Biology of Non-Chordates	5	75	4
SBU24ZO4DSC201	Major	Animal Physiology	5	75	4
SBU24ZO4DSC202	Minor	Bio-entrepreneurship	5	75	4
SBU24ZO4INT200	Major	Internship	-	-	2
Semester V (Course Level: 300 - 399)					
SBU24ZO5DSC300	Major/Minor	Biology of Chordates	5	75	4
SBU24ZO5DSC301	Major/Minor	Essentials of Biochemistry	5	75	4
SBU24ZO5DSC302	Major/Minor	Endocrinology and Reproductive Biology	4	60	4
Semester VI (Course Level: 300 - 399)					
SBU24ZO6DSC300	Major/Minor	Cell Biology	5	75	4
SBU24ZO6DSC301	Major/Minor	Genetics	5	75	4
SBU24ZO6DSC302	Major/Minor	Developmental Biology	5	75	4
Semester VII (Course Level: 400 - 499)					
SBU24ZO7DSC400	Major/Minor	Microbiology	5	75	4
SBU24ZO7DSC401	Major/Minor	Immunology	4	60	4
SBU24ZO7DSC402	Major/Minor	Molecular Biology	4	60	4
SBU24ZO7DSC403	Major/Minor	Experimental Methods in Biology	4	60	4
SBU24ZO7DSC404	Major/Minor	Research Methodology and Biostatistics	4	60	4
Semester VIII (Course Level: 400 - 499)					
SBU24ZO8DSC400	Major	Behavioural Biology	5	75	4
SBU24ZO8DSC401	Major	Genetic Engineering and Biotechnology	5	75	4
SBU24ZO8PRJ400	Major	Project	-	-	12

OUTLINE OF DISCIPLINE SPECIFIC ELECTIVE COURSES

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester III (Course Level: 200 - 299)					
SBU24ZO3DSE200	Elective	Animal Interactions	4	60	4
SBU24ZO3DSE201	Elective	Disease Biology	4	60	4
Semester IV (Course Level: 200 - 299)					
SBU24ZO4DSE200	Elective	Ecology of Kerala	4	60	4
SBU24ZO4DSE201	Elective	Chronobiology	4	60	4
Semester V (Course Level: 300 - 399)					



SBU24ZO5DSE300	Elective	Natural Resource Management and Eco-tourism	4	60	4
SBU24ZO5DSE301	Elective	Nanobiology and Biomimicry	4	60	4
SBU24ZO5DSE302	Elective	Neurobiology	4	60	4
SBU24ZO5DSE303	Elective	Forensic Biology	4	60	4
SBU24ZO5DSE304	Elective	Wildlife Biology	4	60	4
Semester VI (Course Level: 300 - 399)					
SBU24ZO6DSE300	Elective	Ornithology	4	60	4
SBU24ZO6DSE301	Elective	Restoration Ecology	4	60	4
SBU24ZO6DSE302	Elective	Stem Cell Biology	4	60	4
Semester VII (Course Level: 400 - 499)					
SBU24ZO7DSE400	Elective	Toxicology, Environmental Monitoring and Management	4	60	4
SBU24ZO7DSE401	Elective	Advanced Biochemistry	4	60	4
Semester VIII (Course Level: 400 - 499)					
SBU24ZO8DSE400	Elective	Wildlife Monitoring and Data Collection	4	75	4
SBU24ZO8DSE401	Elective	Genomics, Proteomics and Bioinformatics	4	75	4

OUTLINE OF MULTIDISCIPLINARY COURSES (MDC)

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester I (Course Level: 100 - 199)					
SBU24ZO1MDC100	MDC	Nutrition and Fitness	4	60	3
Semester II (Course Level: 100 - 199)					
SBU24ZO2MDC100	MDC	Sexual Health and Wellness	4	60	3

OUTLINE OF SKILL ENHANCEMENT COURSES (SEC)

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester IV (Course Level: 200 - 299)					
SBU24ZO4SEC200	SEC	Pet Care and Management	3	45	3
Semester V (Course Level: 300 - 399)					
SBU24ZO5SEC300	SEC	Economic Zoology and Entrepreneurship	3	45	3
Semester VI (Course Level: 300 - 399)					
SBU24ZO6SEC300	SEC	Science Communication	3	45	3

OUTLINE OF VALUE ADDITION COURSES (VAC)

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester III (Course Level: 200 - 299)					
SBU24ZO3VAC200	VAC	Disaster Management and Health Support	3	45	3
Semester IV (Course Level: 200 - 299)					
SBU24ZO4VAC200	VAC	Animal Rescue, Translocation and Rehabilitation	3	45	3
Semester VI (Course Level: 300 - 399)					
SBU24ZO6VAC300	VAC	Bioethics and Human Rights	3	45	3



COURSES IN BEHAVIOURAL BIOLOGY

OUTLINE OF DISCIPLINE SPECIFIC COURSES

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
Semester I (Course Level: 100 - 199)					
SBU24BB1DSC100	Minor	Essentials of Human Biology	5	75	4
Semester II (Course Level: 100 - 199)					
SBU24BB2DSC100	Minor	Human Body Systems	5	75	4
Semester III (Course Level: 200 - 299)					
SBU24BB3DSC200	Minor	Neurophysiology and Endocrinology	5	75	4
Semester IV (Course Level: 200 - 299)					
SBU24BB4DSC200	Minor	Neurobiology of Behaviour	5	75	4



SEMESTER I

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO1DSC100	Major/Minor	Science of Life	5	75	4
SBU24ZO1DSC101	Minor	Biological Interactions	5	75	4
SBU24ZO1MDC100	MDC	Nutrition and Fitness	4	60	3



SBU24ZO1DSC100: SCIENCE OF LIFE

Type of Course	Major/Minor		
Course Level	100-199		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the basic principles of biology	U
CO2	Understand the salient features of life and its connections	U
CO3	Analyse the hierarchies of biological organization	An
CO4	Appreciate diverse biological forms and functions	An
CO5	Appreciate the significance of studying biology	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	1	1	2	2	1	1	1
CO2	2	1	1	1	1	2	1	1	1	1
CO3	2	1	1	1	1	2	1	1	1	1
CO4	2	1	1	1	1	2	1	1	1	1
CO5	2	1	1	1	1	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In-class discussions	Viva voce	Oral presentation	Open book test	Case study report	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Observation of practical skills	Practical quizzes	Viva voce	Practical Record	Laboratory report	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Studying Life (15 Hrs)				
Overview of biology Significance of studying biology, Impact of biology on the frontiers of science and technology Methods for studying biology Holistic and reductionist approaches in biology Importance of biological model systems	1.1	1, 5	7	Lecture/Video/ group discussions
Core concepts in biology 1. Evolution accounts for the unity and variety of life 2. The structure of biological entities determines their function 3. Living organisms transform energy and matter 4. Living systems are interdependent and interactive 5. Information transactions are crucial for living systems	1.2	1, 2, 3, 4, 5	8	Lecture/Video/ group discussions
Module 2: Levels of Organisation of Life (8 Hrs)				
Diversity and comparative organization of life forms Multicellular and tissue levels of life forms Variation and diversity of life – bacteria, viruses, protists, plants and animals Patterns of organisation- symmetry, diploblastic and triploblastic organisation Coelomate and acoelomate organisation	2.1	1, 2, 3, 5	8	Lecture/Video/ group discussions
Module 3: Biological Forms and Functions (15 Hrs)				
Concept of ‘form follows function’- examples from molecular levels to ecosystem levels Case studies: Water currents and body forms Nematocysts and their function Metameric life forms Reasons for the success of the arthropod life forms	3.1	1, 4, 5	6	Lecture/Video/ group discussions
Shapes and sizes of life forms: size range, properties and constraints associated with size Case studies: 1. Size regulation at the subcellular levels 2. Size as an indicator of disease Scaling rules in biology, Length and time scales in biology	3.2	1, 4, 5	5	Lecture/Video/ group discussions
Individual variability and plasticity Case studies: 1. Seasonal polyphenism in butterflies 2. Caste polyphenism in social insects 3. Environmental sex determination in reptiles	3.3	1, 4, 5	4	Lecture/Video/ group discussions
Module 4: Molecular Logic of Life (7 Hrs)				
Chemical nature of biological systems Uniformity of life at molecular levels Need for energy in biological systems	4.1	1, 2, 5	4	Lecture/Video/ group discussions



Biology as an information science Biological information molecules DNA: master of biological information	4.2	1, 2, 5	3	Lecture/Video/ group discussions
Module 5: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Practical				
1. Introduction to microscope operation and familiarization. 2. Measurement of microscopic specimens using micrometry. 3. Microscopic observation of model organisms: E. coli, yeast, Drosophila larvae, and C. elegans. 4. Examination of different tissue types (epithelial, muscle, connective, nervous) and specimens (bacterial, protozoan, higher organisms) under the microscope. 5. Study of selected animals through museum specimens, focusing on their general classification, biogeography, and diagnostic features. 6. Comparison of cell sizes (plant cells from onions, animal cells from cheek swabs) under various osmotic stress conditions. 7. Microscopic image analysis using Fiji/ImageJ. 8. Comparison of adaptive features of legs in insects (praying mantis, grasshopper, water beetle, mole cricket, and honey bee). 9. Analysis of glucose utilization by yeast cells. 10. Study of dermatoglyphics of finger and palm. 11. Drosophila culture and maintenance. 12. Identification of different species of Drosophila.	6.1	1, 2, 3, 4, 5	30	Microscopic observations/ Laboratory experiments

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Course designed by: Dr. Martin J Babu and Dr. Philip Litto Thomas



SBU24ZO1DSC101: BIOLOGICAL INTERACTIONS

Type of Course	Minor		
Course Level	100-199		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Appreciate the significance of animal interactions for a sustainable world	An
CO2	Apply ecological knowledge and concepts to issues in conservation of biodiversity	An
CO3	Gain knowledge in concepts, methodologies, and research opportunities in the field of animal interactions.	U
CO4	Develop scientific reading, writing, and information-gathering skills pertaining to animal interactions	U
CO5	Explain and demonstrate ecological and evolutionary concepts in the study of animal interactions.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	1	1	2	2	1	1	1
CO2	2	2	2	1	1	2	1	1	1	1
CO3	1	1	1	2	2	2	1	1	1	1
CO4	1	2	1	2	1	2	1	1	1	1
CO5	2	2	1	2	2	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Case study-analysis	Documentary	Popular science writing	Case study report	Literature survey	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical assignment	Observation of practical skills	Lab notebooks	Lab report	Standardised test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Types of animal interactions (7 Hrs)				
Competition; types and its consequences. Competitive exclusion and coexistence	1.1	3,4	3	Lecture/Video/ group discussions
Predation, Predator-Prey interaction, Role of predation in nature. Cannibalism, Symbiosis, Mutualism Case study of: 1. Corals 2. Gastro intestinal fauna Commensalism and parasitism	1.2	1,2, 3,4, 5	4	Lecture/Video/ group discussions
Module 2: Chemical ecology of interactions (4 Hrs)				
Plant-herbivore interactions – types of herbivory, herbivore feeding patterns, chemical ecology, tri-tropic interactions plant defences; semiochemicals	2.1	1,2, 3,4, 5	4	Lecture/Video/ group discussions
Module 3: Sensory biology of animal interactions (12 Hrs)				
The sensory biology of the interaction between plants, their animal mutualists and parasites	3.1	2,3, 4,5	6	Lecture/Video/ group discussions
Vision, chemoreception, olfaction and multimodal signalling in animal interactions	3.2	1,2, 3,4, 5	6	Lecture/Video/ group discussions
Module 4: Plant-pollinator interactions (16 Hrs)				
1. Pollination biology - pollination modes. floral rewards: pollen and nectar, foraging behaviour of animals and pollination, diurnal and nocturnal pollination. Coevolution of plants and pollinators	4.1	1,2, 3,4, 5	6	Lecture/Video/ group discussions
Plant interactions with Fruit, seed dispersers and seed predators, Frugivory: Frugivores; Major frugivorous animals of India, Seed predation; types of seed predation and dispersal.	4.2	1,2, 3,4, 5	6	Lecture/Video/ group discussions
Shelter & Nesting by animals, Effect of grazing & browsing	4.3	1,5	4	Lecture/Video/ group discussions
Module 5: Climate change and animal interactions (6 Hrs)				
Climate change impacts on Human-wildlife conflict, Impacts on the sensory systems of animals		1,2, 3,4, 5	6	Lecture/Video/ group discussions
Module 6: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				



Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 7: Practical				
Identification of different pollinators	7.1	1,2,3,4,5	30	Field study
Field study of leaf-mining insects	7.2	1,2,3,4,5		Microscopic observations
Identification of the chemosensory sensilla of ants	7.3	1,2,3,4,5		Microscopic observations
Study of the behaviours of insects and other pollinators, generalists and specialist herbivores	7.4	1,2,3,4,5		Field study
Field visits and field reports	7.5	1,2,3,4,5		Field study

Reference

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Course designed by: Dr. Martin J Babu



SBU24ZO1MDC100: NUTRITION AND FITNESS

Type of Course	MDC		
Course Level	100-199		
Credit	3		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	30	30	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand health aspects and nutritional requirements for overall fitness	U
CO2	Identify causes and management strategies for lifestyle diseases	U
CO3	Recognize the effects and control measures for drug and substance abuse	U
CO4	Comprehend the importance of physical fitness and exercise effects	U
CO5	Perform practical health assessments and interpret nutritional data	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	-	1	1	1	1	1	1	1
CO2	1	1	-	1	1	1	2	1	1	1
CO3	1	1	-	1	1	1	1	1	1	1
CO4	1	1	-		-	1	2	2	1	1
CO5	-	-	-	2	1	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Viva voce	Poster presentation	Home assignments	Written test	Individual project report	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5						

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Viva voce	In-lab demonstrations	Lab Notebooks	Laboratory report	Standardized Test	
CO1	-	-	-	-	-	-
CO2	-	-	-	-	-	-
CO3	-	-	-	-	-	-
CO4	-	-	-	-	-	-
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Nutrition & Health (10 hrs)				
Definition of Health Various aspects of health-physical health, mental health, social health Importance of Body Mass Index (BMI)	1.1	1	4	Lecture
Food components- Macro and micronutrients: Carbohydrates, Proteins, Lipids, Minerals, Vitamins, Water Significance of dietary fibre Probiotics and prebiotics Meal pattern, Balanced diet Special nutritional requirements of pregnant and lactating women	1.2	1	4	Lecture/Poster
Malnutrition and nutritional disorders	1.3	1	2	Lecture
Module 2: Life Style Diseases (4 Hrs)				
Life style diseases- causes, preventive measures and management Brief overview of Diabetes, Obesity, Fatty Liver, Liver Cirrhosis, Hypertension, Stroke Food allergies and intolerances	2.1	2	4	Lecture
Module 3: Drug Abuse (4 hrs)				
Meaning of drug and substance abuse Tobacco-related illnesses and tobacco control	3.1	3	2	Lecture
Alcoholism, Abuse related illnesses and their control Addiction; De-addiction	3.2	3	2	Lecture/Activity
Module 4: Physical Fitness (12 Hrs)				
Meaning and importance of physical fitness Exercise-aerobic and anaerobic Sports and games, yoga Effect of exercise on body systems	4.1	4	8	Lecture, Activity
Balanced workout routine: warm-up, workout, and cool-down Connection between exercise, stress reduction, and mental wellness	4.2	4	4	Lecture, Activity
Module 5: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Practical				
Qualitative analysis of carbohydrate, protein and fat	6.1	5		Practical



Determination of blood group	6.2	5	30	
Determination of pulse rate in Resting condition and after exercise (30 beats/10 beats method)	6.3	5		
Determination of BMI and interpretation of the result	6.4	5		

Reference

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Course designed by: Ms. Anju Susan Joy



SEMESTER II

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO2DSC100	Major/Minor	Biodiversity and Biosystematics	5	75	4
SBU24ZO2DSC101	Minor	Animal World	5	75	4
SBU24ZO2MDC100	MDC	Sexual Health and Wellness	4	60	3



SBU24ZO2DSC100: BIODIVERSITY AND BIOSYSTEMATICS

Type of Course	Major/Minor		
Course Level	100-199		
Credits	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the significance of biodiversity as a natural resource	U
CO2	Recognize the distribution patterns of biodiversity across different biomes and understand the factors responsible for the distribution of animals globally	U
CO3	Employ biodiversity indices for ecosystems and devise conservation strategies for locally threatened species	A
CO4	Recognize the need for biodiversity conservation and management, including the conservation of endemic species	U
CO5	Demonstrate skills in the classification and estimation of biodiversity	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1	1	1	1	1	1	1	1
CO2	2	1	1	1	1	1	2	1	2	1
CO3	2	1	1	2	1	1	1	1	1	2
CO4	1	1	1	1	1	2	2	1	1	1
CO5	1	2	1	2	1	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Quiz	Oral presentations	Poster presentations	Written test	Team project report	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Assignment	Lab Notebooks	Viva voce	Laboratory report	Standardized Test	
CO1	-	-	-	-	-	-
CO2	-	-	-	-	-	-
CO3	-	-	-	-	-	-
CO4	-	-	-	-	-	-
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Understanding Biodiversity (15 Hrs)				
Biodiversity and its significance Biodiversity as a natural resource	1.1	1	2	Lecture
Levels of biodiversity - species, domesticated, genetic, alpha, beta, gamma	1.2	2	1	Lecture
Biodiversity distribution - tropical, temperate and polar	1.3	2	2	Lecture, Collage preparation
Biodiversity hot spots- significance Global and Indian biodiversity hot spots	1.4	2	3	Lecture, Video, Poster
Western Ghats - ecological, social, cultural and economic aspects	1.5	2	2	Lecture, Video, Debate/ Discussion
Values of biodiversity	1.6	1	1	Lecture
Threats to biodiversity	1.7	2,4	3	Lecture, Problem-based learning
Role of invasive species	1.8	2,4	1	Lecture, Case study
Module 2: Estimation of Biodiversity (5 Hrs)				
Biodiversity aspects: species richness, abundance, evenness	2.1	3	1	Lecture, Videos, Demonstration
Biodiversity indices: Shannon- Weiner index, Simpson index, Pielou's index	2.2	3	2	Lecture, Videos, Demonstration
Sampling techniques: Quadrature, Transect	2.3	3	1	Lecture, Videos, Demonstration
Remote sensing	2.4	3	1	Lecture, Videos, Lab
Module 3: Conservation and Management of Biodiversity (5 Hrs)				
Need for biodiversity conservation; Global measures; 3Rs in biodiversity	3.1	3,4	1	Lecture, Videos
Endemic species and their conservation	3.2	3,4	2	Lecture
Conservation methods: Ex-situ, In-situ	3.3	3,4	1	Lecture/Visit to botanical garden
Red Data Book and its significance	3.4	3,4	1	Lecture
Module 4: Zoogeography (15 Hrs)				
Zoogeographical realms	4.1	2	4	Lecture, Poster
Biogeography of India	4.2	2	3	Lecture, Videos
Insular fauna: Continental Island- Madagascar	4.3	2	1	Lecture
Oceanic Island- Galapagos	4.4	2	1	Lecture
Kinds of animal distribution	4.5	2	2	Lecture/Activity
Factors and means of animal distribution	4.6	2	2	Lecture
Barriers in animal distribution	4.7	2	2	Lecture
Module 5: Biosystematics (5 Hrs)				
Importance of systematics in various fields	5.1	5	1	Lecture



Animal classification-hierarchy; ICZN code; Nomenclature: Linnaean, Trinomial	5.2	5	2	Lecture, Create a Zoobank account
Morphological, numerical, ecological and phylogenetic systems of classification	5.3	5	1	Lecture
DNA bar-coding	5.4	5	1	Lecture/Videos
Module 6: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 7: Practical				
Sampling - Quadrata study and Transect study	7.1	5	30	Field activity
Species area curve	7.2	5		Lab activity
Identification of Biodiversity hot spots using Google Earth.	7.3	5		Computer lab activity
Identification of Zoogeographical realms.	7.4	5		Lab activity
Identification using keys –insect, fish and snake.	7.5	5		Lab activity
Identification of any 20 local animals representing different taxa with common names and scientific names.	7.6	3,5		Field activity
Visit a biodiversity-rich area and submit a report on the biodiversity and conservation efforts there.	7.7	1,3,4		Field visit

Reference

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Course designed by: Ms. Anju Susan Joy



SBU24ZO2DSC101: ANIMAL WORLD

Type of Course	Minor		
Course Level	100-199		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Gain a comprehensive understanding of animal diversity, encompassing both vertebrates and invertebrates	U
CO2	Explore evolutionary adaptations and physiological specializations unique to each major animal group	U
CO3	Analyse the defining characteristics and adaptations of major animal phyla and classes	R
CO4	Know about extinct organisms of different animal groups and factors that led to extinction	R
CO5	Gain practical knowledge about the animal world	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	1	-	1	-	-	1	1
CO2	2	2	2	1	-	1	1	-	1	1
CO3	2	2	2	1	1	1	1	-	1	1
CO4	2	2	2	1	2	1	1	-	1	1
CO5	1	1	1	2	2	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Quiz	Video/Documentary presentation	One-minute paper	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	-	-	-	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Quizzes	Practical Assignment	In-lab demonstrations	Laboratory report	Standardized Test	
CO1	-	-	-	-	-	-
CO2	-	-	-	-	-	-
CO3	-	-	-	-	-	-
CO4	-	-	-	-	-	-
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Animal World (5 Hrs)				
Introduction to animal diversity	1.1	1,2,3	2	Lectures, video, ppt
Evolutionary relationships among animal group				
Evolution of the Animal body plan, Animal Phylogeny, Basic body plans and adaptations	1.2	1,2,3	1	Lectures, video, ppt
Parazoa and Metazoa, Protostomes and Deuterostomes	1.3	1,2,3	2	Lectures, video, ppt
Module 2: Invertebrates (10 Hrs)				
Introduction to Phylum, Outline Classifications	2.1	1,2,3	1	Lectures, video, ppt
Major characteristics and examples of Protista, Porifera, Cnidaria, Ctenophora and Platyhelminthes	2.2	1,2,3	3	Lectures, video, ppt
Major characteristics and examples of Nematoda, Annelida, and Mollusca	2.3	1,2,3	3	Lectures, video, ppt
Major characteristics and examples of Arthropoda, Echinodermata and Hemichordata	2.4	1,2,3	3	Lectures, video, ppt
Module 3: Amphibia (6 Hrs)				
Salient features of Class Amphibia, Classification up to order	3.1	1,2,3	2	Lectures, video, ppt
Major characteristics and examples of Order Anura, Apoda and Urodela	3.2	1,2,3	2	Lectures, video, ppt
Development and Parental care in Amphibians	3.3	1,2,3	2	Lectures, video, ppt
Module 4: Reptilia (7 Hrs)				
Salient features of Class Reptilia-Classification up to orders	4.1	1,2,3	2	Lectures, video, ppt
Major characteristics and examples of Subclass Anapsida, Parapsida, Synapsida and Diapsida	4.2	1,2,3	2	Lectures, video, ppt
Extinct reptiles (Dinosaurs) Common Poisonous and non-poisonous snakes of Kerala	4.3	1,2,3,4	3	Lectures, video, ppt
Module 5: Aves (7 Hrs)				
Salient features of Class Aves- Outline classification Adaptations and modifications in birds	5.1	1,2,3	3	Lectures, video, ppt
Major characteristics and examples of Subclass Archaeornithes and Neornithes	5.2	1,2,3	4	Lectures, video, ppt
Module 6: Mammalia (10 Hrs)				
Introduction to Class Mammalia with salient features- Outline Classification	6.1	1,2,3	2	Lectures, video, ppt
Major characteristics and examples of Subclass-Protheria, Metatheria and Eutheria	6.2	1,2,3	5	Lectures, video, ppt
Aquatic mammals and Extinct mammals	6.3	1,2,3,4	3	Lectures, video, ppt
Module 7: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				



Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical				
Scientific drawing of local animal species	8.1	5	30	Demonstration, Hands on Training, Experiments
Mounting of nervous system of Prawn	8.2	5		Demonstration, Hands on Training, Experiments
Mounting of digestive system of cockroach	8.3	5		Demonstration, Hands on Training, Experiments
Mounting of mouthparts of Housefly and Honeybee	8.4	5		Demonstration, Hands on Training, Experiments
Mounting of Prawn appendages	8.5	5		Demonstration, Hands on Training, Experiments
Prepare an Insect box by collecting any 10 insects	8.6	5		Demonstration, Hands on Training, Experiments
Identification of fishes and snakes using taxonomic keys (any 5 from each group).	8.7	5		Demonstration, Hands on Training, Experiments
Mounting of placoid scales	8.8	5		Demonstration, Hands on Training, Experiments
Collection of different types of feathers	8.9	5		

Reference

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Course designed by: Mr. Jaison Job



SBU24ZO2MDC100: SEXUAL HEALTH AND WELLNESS

Type of Course	MDC		
Course Level	100 - 199		
Credit	3		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	30	30	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand reproductive health concepts, indicators, and cycles	U
CO2	Explore human sexuality, sexual identity, and rights	An
CO3	Identify and address sexual dysfunctions and abuse	U
CO4	Comprehend STDs: transmission, diagnosis, treatment, and prevention	U
CO5	Promote wellness through mindfulness, safe practices, and education	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1		1	2	1	2	2	2	-	1	2
CO2		2	2	2	1	-	2	-	1	-
CO3	1	1	1	1		1	1	-	-	1
CO4	1	2	2	-	1	-	1	1	-	1
CO5	1	2	1	-	2	-	2	1	-	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In-class discussion	Viva	Home assignment	Written test	Multiple choice	
CO1	x	x		x	x	x
CO2		x	x	x	x	x
CO3	x	x	x	x	x	x
CO4		x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Quizzes	Practical Assignment	In-lab demonstrations	Laboratory report	Standardized Test	
CO1	-	-	-	-	-	-
CO2	-	-	-	-	-	-
CO3	-	-	-	-	-	-
CO4	-	-	-	-	-	-
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Basics of Reproductive Health (6 Hrs)				
Basic concepts of reproductive health, components of reproductive health Reproductive health indicators	1.1	1	3	Lecture/ Presentation
Puberty and other age-related changes in males and females Reproductive cycles –Menstrual cycle	1.2	1	3	Lecture
Module 2: Human Sexuality (4 Hrs)				
Basics of sexuality in humans Physiology, genetics and neuroendocrinology of sexuality Sexual identity and orientation, LGBTQ+ Sexual rights	2.1	1, 2	4	Lecture/Discussion
Module 3: Sexual Dysfunctions and Sexual Abuse (4 Hrs)				
Sexual dysfunctions and psycho-sexual problems Sexual abuse and rape, Paedophilia	3.1	2, 3	2	Lecture/ Presentation
Counselling, Cognitive Behavioral Therapy Role of sex education Legal and safety measures	3.2	2, 3	2	Lecture/Discussion
Module 4: Sexually Transmitted Diseases (4 Hrs)				
Symptoms, mode of transmission, diagnosis, treatment and prophylaxis of AIDS, HPV, Chlamydia, Gonorrhoea, Herpes (genital), Trichomoniasis Socioeconomic dimensions of STD	4.1	4	4	Lecture/ Presentation
Module 5: Safe Sex Practices and Parenting Choices (4 Hrs)				
Importance of safe sex practices Types of contraceptives (condoms, birth control pills, IUDs) Emergency contraception Sperm bank and ovum banks	5.1	1, 2	4	Seminar/ Discussion
Module 6: Wellness (8 Hrs)				
Physical, emotional, and social aspects of wellness The mind-body connection in health Importance of sleep for overall wellness Sleep disorders and their impact Importance of social support and healthy relationships	6.1	5	4	Lecture/Discussion
Strategies for achieving and maintaining work-life balance Setting boundaries and prioritizing self-care Mindfulness-based stress reduction Digital wellbeing	6.2	5	4	Lecture/Discussion
Module 7: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i>				
This content will be evaluated internally				



Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical				
Mindfulness sessions to cultivate present-moment awareness	8.1	5	30	Demonstration/ Practice
Stress management techniques, including relaxation exercises	8.2	5		Demonstration/ Practice
Active listening techniques and mindful communication practice	8.3	5		Demonstration/ Practice
Strategies from cognitive behavioural therapy (CBT) to help students recognize and challenge negative thought patterns	8.4	5		Demonstration/ Practice
Journaling, self-reflection exercises	8.5	5		Demonstration/ Practice
Time management and problem-solving methods	8.6	5		Demonstration/ Practice

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Course designed by: Dr. Monichan K K and Dr. Martin J Babu



SEMESTER III

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO3DSC200	Major	Evolution of Life	5	75	4
SBU24ZO3DSC201	Major	Environmental Biology	5	75	4
SBU24ZO3DSC202	Minor	Mammalian Physiology	5	75	4
SBU24ZO3DSE200	Elective	Animal Interactions	4	60	4
SBU24ZO3DSE201	Elective	Disease Biology	4	60	4
SBU24ZO3VAC200	VAC	Disaster Management and Health Support	3	45	3



SBU24ZO3DSC200: EVOLUTION OF LIFE

Type of Course	Major		
Course Level	200 - 299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Acquire in-depth knowledge of the diversity and relationships in the animal world	An
CO2	Develop a holistic appreciation of the phylogeny and adaptations in animals	An
CO3	Enable the students to understand the evolution of the universe and life.	U
CO4	Understanding of the process and theories in evolutionary biology	U
CO5	Develop an interest in the debates and discussions taking place in the field of evolutionary biology.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	1	1	2	2	1	1	1
CO2	2	1	1	1		2	1	1	1	1
CO3	1	1	1	1	1	2	1	1	-	-
CO4	1	1	1	-	1	2	1	1	1	1
CO5	1	1	1	1	-	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In class discussions	Case study analysis	Quiz	Written test	Open book test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Lab Notebooks	Practical Assignment	Viva voce	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Origin of Life (6 Hrs)				
Life's Beginnings: Chemogeny, RNA World, Biogeny, Origin of photosynthesis, Endo-symbiotic theory and evolution of eukaryotes	1.1	3	6	Lecture/Video/ group discussions
Module 2: Theories of Evolution (3 Hrs)				
Lamarckism, Darwinism, Neo-Darwinism	2.1	4	3	Lecture/Video/ group discussions
Module 3: Evidence of Evolution (6 Hrs)				
1. Paleontological: Fossil records; formation of fossils, types of fossils., Geological time scale 2. Molecular: universality of genetic code and protein synthesising machinery. Neutral theory of molecular evolution, Molecular clock; example of globin gene family. Heritable variations and their role in evolution	3.1	5	6	Lecture/Video/ group discussions
Module 4: Force of Evolution (12 Hrs)				
Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium	4.1	3	6	Lecture/Video/ group discussions
Natural selection, types of selection, density-dependent selection, kin selection, sexual selection. Frequency-dependent selection. Genetic drift (founder's effect, bottleneck phenomenon), migration and mutation (genetic load)	4.2	4	6	Lecture/Video/ group discussions
Module 5: Product of Evolution (10 Hrs)				
Microevolutionary changes (inter-population variations, clines, races. Species concept, modes of speciation—allopatric, sympatric. Isolating mechanisms, Phyletic gradualism and punctuated equilibrium Adaptive radiation/ macroevolution --exemplified by Galapagos finches	5.1	4,5	8	Lecture/Video/ group discussions
Background and Mass extinctions (events, causes and effects, K-T extinction.	5.2	5	2	Lecture/Video/ group discussions
Module 6: Origin and Evolution of Man (8 Hrs)				
Origin and evolution of man, Molecular analysis of human origin	6.1	4,5	8	Lecture/Video/ group discussions
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical				



1. Study of fossils from models	8.1	1,2,3	30	Virtual lab study
2. Inferring evolutionary relationships through skeletal studies	8.2	1,2,3		Virtual Lab study
3. Creating Phylogenetic Trees from DNA Sequences (Virtual lab)	8.3	1,2,3		Virtual lab study
4. Study of variations in a sample human population: (a) Continuous variation: Height/Weight in relation to age and sex (b) Discontinuous variation: Ability/Inability to taste Phenyl thiocarbamide (PTC).	8.4	3		Laboratory analysis
5. Lizard evolution as a case study (Virtual lab)	8.5	2,3		Virtual lab study

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Course designed by: Dr. Martin J Babu



SBU24ZO3DSC201: ENVIRONMENTAL BIOLOGY

Type of Course	Major		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the fundamental principles and concepts of ecology	U
CO2	Comprehend the structure and function of ecosystems	U
CO3	Analyse the diversity and dynamics of various terrestrial and aquatic habitats	An
CO4	Understand population dynamics and regulation	U
CO5	Critically assess environmental issues and conservation strategies	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	-	-	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	-	1	1	1	1	1	1
CO4	1	1	-	1	1	1	1	1	1	1
CO5	-	1	1		1	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Oral presentation	Quiz	Group tutorial work	Written test	Problem-based assignment	
CO1	-	x	-	x	-	x
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Quizzes	Viva voce	Practical Assignment	Standardized Test	Record	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Basic Concepts of Ecology (2 Hrs)				
Definition of ecology, scope of ecological study Approaches to ecology- autecology, synecology	1.1	1	2	Lecture/ppt
Module 2: Ecosystem (4 Hrs)				
Definition and classification of the ecosystem; Components of an ecosystem - Abiotic and Biotic components	2.1	1, 2	1	Lecture/ppt
Functions of ecosystem - Food chains; food web; Energy flow through the ecosystem, Laws of Thermodynamics, Ecological pyramids	2.2	1, 2	1	Lecture/ppt
Biogeochemical cycles	2.3	1, 2	2	Lecture/ppt
Module 3: Habitat Ecology (8 Hrs)				
Freshwater habitat types; Lentic and lotic - Characteristics, stratifications, types of ponds, adaptations	3.1	1, 3	2	Lecture/ppt/field study
Marine habitat: characteristics, zonation and animal adaptations	3.2	1, 3	2	Lecture/ppt/field study
Estuarine ecosystem, Mangrove ecosystem	3.3	1, 3	1	Lecture/ppt/field study
Wetland - characteristics, significance and conservation	3.4	1, 3	1	Lecture/ppt/field study
Terrestrial biomes - Tundra, Coniferous Forest, Deciduous Forest, Tropical Rain Forest, Chapparal, Tropical Savannah, Grassland, Desert	3.5	1, 3	2	Lecture/ppt/field study
Module 4: Population Ecology (10 Hrs)				
Characteristics of population - size and density, dispersion, age structure, natality, mortality, biotic potential, life tables and survivorship curves	4.1	1, 3	3	Lecture/ppt
Population dynamics, growth rates - exponential and logistic, carrying capacity.	4.2	1, 3	1	Lecture/ppt
Concept of limiting factors: Liebig's and Shelford's laws of limiting factors.	4.3	1, 3	1	Lecture/ppt
Population regulation - density-dependent and independent regulation.	4.4	1, 3	1	Lecture/ppt
Life History Strategies - r-selected and k-selected populations; Semelparity vs. Iteroparity	4.5	1, 3	2	Lecture/ppt
Population Distribution and Dispersion - Random, Uniform, and Clumped Distribution; Factors Influencing Distribution; Spatial Patterns in Population Dispersion	4.6	1, 3	2	Lecture/ppt
Module 5: Community Ecology (3 Hrs)				
Characteristics of a community, Ecotone and Edge effect, Keystone and dominant species, Concepts of Ecological Niche and Guild, Resource Partitioning	5.1	1, 4	1	Lecture/ppt



Animal interactions: Commensalism, Mutualism, Proto cooperation, Predation, Parasitism, Competition, Antibiosis	5.2	1, 4	1	Lecture/ppt
Ecological succession	5.3	1, 4	1	Lecture/ppt
Module 6: Climate change and other Environmental issues (18 Hrs)				
Global environmental issues: global warming and climate change, Ozone depletion; greenhouse gases; acid rain; carbon trading, carbon credit; carbon sequestration; IPCC/UNFCCC; Nuclear accidents and nuclear holocaust	6.1	5	5	Lecture/ppt, Case studies, Discussion
Local environmental Issues: Solid waste management; Sand mining; wetland reclamation; deforestation; soil erosion	6.2	5	5	Lecture/ppt, Case studies, Discussion
Pollution: air pollution; water pollution; soil pollution; noise pollution; pesticide pollution	6.3	5	5	Lecture/ppt
Environmental laws	6.4	5	1	Lecture/ppt
National and international agencies for nature conservation.	6.5	5	1	Lecture/ppt
Local, national, and international environmental movements	6.6	5	1	Lecture/ppt
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical				
Estimation of dissolved oxygen	8.1	1	30	Laboratory experiment
Estimation of dissolved carbon dioxide	8.2	1		Laboratory experiment
Collection and identification of freshwater/ marine plankton	8.3	2		Laboratory activity
Plankton count (Freshwater/ marine)	8.4	2		Laboratory activity
Extraction of soil organisms	8.5	3		Demonstration/spotter
Study of soil types	8.6	3		Specimen Identification
Identification of minerals and rocks	8.7	3		Specimen Identification
Transparency measurements using Secchi disc	8.8	4		Demonstration/spotter
Study of pond ecosystem and preparation of food web	8.9	5		Field activity

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Course designed by: Dr. Vincy Mary Varghese



SBU24ZO3DSC202: MAMMALIAN PHYSIOLOGY

Type of Course	Minor		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the principles of nutrition and a balanced diet	U
CO2	Understand the basic organization and function of the organ systems	U
CO3	Understand the common structural and functional disorders	U
CO4	Understand the principles and applications of physiology in relation to environmental parameters like temperature, light, etc.	U
CO5	Evaluate the physiological functions of organ systems.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	2	1	1	2	1
CO2	2	2	2	2	2	2	1	1	2	1
CO3	2	2	2	2	2	2	1	1	2	1
CO4	2	2	2	2	2	2	1	1	2	1
CO5	2	2	2	2	2	2	1	1	2	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Concept mapping	Quiz	One minute paper	Written Test	Open book test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	-	x	x	x	x	x
CO5	-	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical skill	Lab Notebook	Practical Quizzes	Lab report	Standardised Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Nutrition (7 Hrs)				
Types of nutrition; Major and minor nutrients; Importance of fibre in diet	1.1	1	2	Lecture & Discussion
Digestion and absorption of carbohydrates, proteins and lipids; Nervous and hormonal control of digestion	1.2	1	2	Lecture & Discussion
Special modes of digestion: ruminant and symbiotic	1.3	1	1	Lecture & Discussion
Balanced diet; Nutritional disorders: Overnutrition, malnutrition, undernutrition, Defects of modern food habits, Obesity, Anorexia, acidity and ulcers, flatulence.	1.4	1	2	Lecture & Discussion
Module 2: Respiration (9 Hrs)				
Respiration in mammals: Pulmonary. Exchange and transport of respiratory gases, Oxy-haemoglobin curve, Bohr effect, reverse Bohr effect and Haldane effect.	2.1	2	3	Lecture & Discussion
Respiratory pigments: haemoglobin (mention structure) and myoglobin,	2.2	2	2	Lecture & Discussion
Respiratory disturbances and disorders: Dyspnoea, asthma, emphysema, Anoxia, hypoxia, cyanosis, hypocapnia, hypercapnia and asphyxia; Carbon monoxide poisoning	2.3	3	2	Lecture & Discussion
Respiratory adaptations to high altitudes, Physiological adaptations of deep-sea mammals, Physiological problems of deep-sea diving.	2.4	2	2	Lecture & Discussion
Module 3: Circulation (8 Hrs)				
Organs and mechanism of circulation; Cardiac cycle, Control and rhythmicity of the heartbeat- Pacemakers, Pulse, Blood pressure and disorders, Neural and Hormonal control	3.1	2	2	Lecture & Discussion
Human blood and its constituents, Buffer system in blood, Blood clotting mechanism: intrinsic and extrinsic pathways, clotting factors, disorders of blood clotting, anticoagulants, blood groups and transfusion.	3.2	2	2	Lecture & Discussion
Circulatory disorders- Myocardial infarction, angina pectoris, cardiac arrest, thrombus and embolus, arteriosclerosis and atherosclerosis.	3.3	3	2	Lecture & Discussion
Clinical analysis- Electrocardiogram (ECG), Erythrocyte sedimentation rate (ESR), Haematocrit, Total and differential blood cell count.	3.4	3	2	Lecture & Discussion
Module 4: Excretion (7 Hrs)				
Patterns of nitrogen excretion: ammonotelism, ureotelism, uricotelism.	4.1	2	1	Lecture & Discussion
Structure of nephron, formation of urine, counter current mechanism, water and salt balance, acid-base control and homeostasis; Hormonal control of kidney functions.	4.2	2	2	Lecture & Discussion



Composition of urine- normal and abnormal constituents, Diseases of the kidney- kidney stones, Proteinuria, Nephrosis, Pyelonephritis.	4.3	3	2	Lecture & Discussion
Artificial kidney (haemodialysis), Peritoneal dialysis and Kidney transplantation.	4.4	3	2	Lecture & Discussion
Module 5: Muscle Physiology (8 Hrs)				
Types of muscles – Striated, Non-striated and Cardiac	5.1	2	1	Lecture & Discussion
Ultrastructure and function; Mechanism, Biochemistry and Energetics of muscle contraction, Neuromuscular junction.	5.2	2	3	Lecture & Discussion
Electrophysiology of muscle, threshold and spike potentials, simple muscle twitch, whole muscle contraction, latent and refractory periods, isotonic and isometric contraction.	5.3	2	2	Lecture & Discussion
Summation, beneficial effect, tetanus, tonus, staircase phenomenon, fatigue, oxygen debt, rigor mortis.	5.4	2	2	Lecture & Discussion
Module 6: Environmental Physiology (6 Hrs)				
Body Temperature and its regulation	6.1	4	1	Lecture & Discussion
Physiological adaptation to cold; Shivering; Dormancy; Hibernation; Aestivation, Photoperiodism	6.2	4	2	Lecture & Discussion
Stress Physiology- Stress factors (internal & external), Stress adaptations.	6.3	4	3	Lecture & Discussion
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical				
Nutritional composition of Food	8.1	5	30	Lab oriented Training
Nutritional Disorders	8.2	5		Lab oriented Training
Preparation of Human Blood smear and Identification of blood cells	8.3	5		Lab oriented Training
Determination of haemoglobin content of blood	8.3	5		Lab oriented Training
Enumeration of total RBC count using Haemocytometer	8.5	5		Lab oriented Training
Enumeration of total WBC count using Haemocytometer	8.6	5		Lab oriented Training
Estimation of PCV	8.7	5		Lab oriented Training
Instruments: Sphygmomanometer and Stethoscope (principle and use)	8.8	5		Lab oriented Training
Measurement of blood pressure using a Sphygmomanometer	8.9	5		Lab oriented Training
Identification of abnormal constituents of Urine	8.10	5		Lab oriented Training
Identification of types of muscles	8.11	5		Lab oriented Training



Identification of muscle properties- Simple Muscle twitch, Summation, beneficial effect, tetanus, staircase phenomenon, and fatigue from Kymographic images.	8.12	5		Lab oriented Training
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Course designed by: Dr. Joe Prasad Mathew



SBU24ZO3DSE200: ANIMAL INTERACTIONS

Type of Course	DSE		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Appreciate the significance of animal interactions for a sustainable world	An
CO2	Apply ecological knowledge and concepts to issues in conservation of biodiversity	An
CO3	Gain knowledge in concepts, methodologies, and research opportunities in the field of animal interactions.	U
CO4	Develop scientific reading, writing, and information-gathering skills pertaining to animal interactions	U
CO5	Explain and demonstrate ecological and evolutionary concepts in the study of animal interactions.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	1	1	2	2	1	1	1
CO2	2	2	2	1	1	2	1	1	1	1
CO3	1	1	1	2	2	2	1	1	1	1
CO4	1	2	1	2	1	2	1	1	1	1
CO5	2	2	1	2	2	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Case study-analysis	Documentary	Popular science writing	Case study report	Literature survey	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Types of animal interactions (8 Hrs)				
Competition; types and its consequences. Competitive exclusion and coexistence	1.1	3,4	4	Lecture/Video/group discussions



Predation, Predator-Prey interaction, Role of predation in nature. Cannibalism, Symbiosis, Mutualism Case study of: 1. Corals 2. Gastro intestinal fauna Commensalism and parasitism	1.2	1,2, 3,4, 5	4	Lecture/Video/ group discussions
Module 2: Chemical ecology of interactions (8 Hrs)				
Plant-herbivore interactions – types of herbivory, herbivore feeding patterns, chemical ecology, tri-tropic interactions plant defences; semiochemicals	2.1	1,2, 3,4, 5	4	Lecture/Video/ group discussions
Study of leaf-mining insects	2.2	1,2, 3,4, 5	4	Observations/ videos
Module 3: Sensory biology of animal interactions (16 Hrs)				
The sensory biology of the interaction between plants, their animal mutualists and parasites	3.1	2,3, 4,5	6	Lecture/Video/ group discussions
Vision, chemoreception, olfaction and multimodal signalling in animal interactions	3.2	1,2, 3,4, 5	6	Lecture/Video/ group discussions
Identification of the chemosensory sensilla of insects	3.3	1,2, 3,4, 5	4	Microscopic observations/ videos
Module 4: Plant-pollinator interactions (20 Hrs)				
1. Pollination biology - pollination modes. floral rewards: pollen and nectar, foraging behaviour of animals and pollination, diurnal and nocturnal pollination. Coevolution of plants and pollinators	4.1	1,2, 3,4, 5	6	Lecture/Video/ group discussions
Identification of different pollinators	4.2	1,2, 3,4, 5	4	Observations/vid eos
Plant interactions with Fruit, seed dispersers and seed predators, Frugivory: Frugivores; Major frugivorous animals of India, Seed predation; types of seed predation and dispersal.	4.2	1,2, 3,4, 5	6	Lecture/Video/ group discussions
Shelter & Nesting by animals, Effect of grazing & browsing	4.3	1,5	4	Lecture/Video/ group discussions
Module 5: Climate change and animal interactions (8 Hrs)				
Climate change impacts on Human-wildlife conflict, Impacts on the sensory systems of animals	5.1	1,2, 3,4, 5	8	Lecture/Video/ group discussions
Module 6: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

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13. Traveset, A., & Richardson, D. M. *Mutualistic Interactions and Biological Invasions*. Oxford University Press, 2006.

Course designed by: Dr. Martin J Babu



SBU24ZO3DSE201: DISEASE BIOLOGY

Type of Course	DSE		
Course Level	200- 299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recognize the various disease-causing organisms and make strategies to control their population	A
CO2	Understand the need for personal and social hygiene to regulate the spread of disease	A
CO3	List and explain the biological principles required to understand the distribution of infectious and non-infectious diseases	U
CO4	Illustrate the application of biological principles in treating diseases of public health	E
CO5	Highlight areas of public health where recent biological research is likely to be of particular importance	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	-	2	-	1	-	2	-	1	2
CO2	2	2	2	-	1	1	2	-	1	2
CO3	1	1	2	2	1	-	2	1	1	2
CO4	1	2	2	1	-	1	2	-	1	1
CO5	2	2	1	1	2	1	2	-	1	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Oral presentation	Quiz	One minute paper	Written test	Multiple choice	
CO1	x	x	x	x	x	x
CO2	x	x	-	x	x	x
CO3	-	x	x	x	x	x
CO4	x	-	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Disease Biology & Infectious Diseases (12 Hrs)				
Concept of disease, Epidemiological triad, 'Iceberg of disease'	1.1	5	3	Lecture/ Presentation



Dynamics of disease transmission- Sources and reservoir	1.2	4	3	Lecture/ Presentation
Modes of transmission- Direct and indirect transmission	1,3	5	3	Group discussion
Emerging and re-emerging infectious diseases, Nosocomial Infections	1.4	4	3	Lecture
Module 2: Viral Infections - Epidemiology, Pathology and Control (18 Hrs)				
Chickenpox, Hepatitis A, B, C, COVID-19	2.1	1	6	Lecture
Chikungunya, Japanese Encephalitis, Dengue	2.2	1	6	Lecture/ Presentation
Nipah, Kyasanur Forest Disease, H1N1, H5N1, Rabies	2.3	2	6	Lecture
Module 3: Bacterial Infections- Epidemiology, Pathology and Control (8 Hrs)				
Tuberculosis, Leptospirosis, Tetanus	3.1	2	4	Seminar
Typhus, Shigellosis, Salmonellosis	3.2	2	4	Lecture
Module 4: Fungal Infections- Epidemiology, Pathology and Control (7 Hrs)				
Candidiasis, Tinea versicolor	4.1	2	4	Lecture
Ringworm (Dermatophytosis), Onychomycosis	4.2	3	3	Discussion
Module 5: Protistan Infections- Epidemiology, Pathology and Control (6 Hrs)				
Amoebiasis, Giardiasis	5.1	3	3	Lecture
Malaria, Leishmaniasis, Balantidiasis	5.2	4	3	Lecture
Module 6: Helminth Infection- Epidemiology, Pathology and Control (9 Hrs)				
Taeniasis, Schistosomiasis	6.1	3	3	Seminar/video
Fascioliasis, Wuchereriasis (Filariasis)	6.2	2	3	Lecture/ Presentation
Enterobiasis, Ascariasis	6.3	2	3	Group discussion
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

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Course designed by: Dr. Monichan K K



SBU24ZO3VAC200: DISASTER MANAGEMENT AND HEALTH SUPPORT

Type of Course	VAC		
Course Level	200 - 299		
Credit	3		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	-	45
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the principles and practices of health support in disaster management.	U
CO2	Evaluate health needs and provide appropriate first aid, life support, sanitation, and nutritional interventions in disaster situations.	E
CO3	Recognize and address the psychological and mental health needs of disaster-affected populations, including children, elderly, and individuals with specific vulnerabilities.	U
CO4	Apply the skills acquired, for managing infections, wound care, and nutritional support in resource-limited settings.	A
CO5	Evaluate disaster contexts, along with the ability to collaborate efficiently within interdisciplinary teams during both disaster response and recovery phases.	E

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	-	2	2	3	2	3	3	3	3
CO2	2	1	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2
CO4	-	3	3	2	3	2	2	3	3	3
CO5	-	3	3	2	3	2	2	3	3	3

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Poster presentation	Concept mapping	Problem-based assignments	Case study report	Video Documentary	
CO1	x	-	-	-	-	x
CO2	-	x	-	-	-	x
CO3	-	-	x	-	-	x
CO4	-	-	-	x	-	x
CO5	-	-	-	-	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Disaster Management and Health (3 Hrs)				
Definition and types of disasters (natural, manmade, and biological)	1.1	1	1	Presentation
Impact of disasters on health, healthcare systems, and food security	1.2	1	1	Presentation
Introduction to humanitarian principles and ethics	1.3	1	1	Presentation
Module 2: First Aid and Life Support (7 Hrs)				
Principles of First Aid and emergency preparedness	2.1	2	1	Demonstration
Basic life support skills (ABCs, CPR, AED)	2.2	2	2	Demonstration
Management of common injuries and illnesses in disasters (wounds, fractures, burns, heatstroke, hypothermia)	2.3	2	3	Video
Triage and casualty evacuation	2.4	2	1	Presentation
Module 3: Sanitation and Hygiene (7 Hrs)				
Importance of safe water, sanitation, and hygiene (WASH) in disaster response	3.1	2	1	Presentation
Water treatment and purification methods during emergency	3.2	2	2	Presentation
Sanitation options in emergencies (latrines, waste disposal)	3.3	2	2	Presentation
Hygiene promotion and disease prevention strategies	3.4	2	2	Presentation
Module 4: Psychological and Mental Health Support (7 Hrs)				
Impact of disasters on mental health (PTSD, anxiety, depression)	4.1	3	2	Presentation
Psychological First Aid (PFA) principles and techniques	4.2	3	1	Presentation
Supporting children and vulnerable populations in disasters	4.3	3	2	Discussion
Mental health promotion and psychosocial support strategies	4.4	3	2	Presentation
Module 5: Child Support in Disasters (5 Hrs)				
Specific needs and vulnerabilities of children in disasters	5.1	3	2	Discussion
Child protection and safeguarding in emergency settings	5.2	3	1	Presentation
Psychological support and education for children in disaster contexts	5.3	3	1	Presentation
Child-friendly spaces and activities	5.4	3	1	Discussion
Module 6: Care for the Elderly in Disasters (4 Hrs)				
Unique needs and challenges faced by elderly populations in disasters	6.1	3	1	Discussion
Access to healthcare and medications in emergency settings	6.2	3	1	Discussion
Providing social and emotional support for elderly disaster survivors	6.3	3	1	Discussion
Age-friendly evacuation and shelter arrangements	6.4	3	1	Assignments
Module 7: Managing Infections, Wound Care, and Nutritional Support in Disasters (8 Hrs)				
Common infectious diseases in disaster settings	7.1	4	2	Presentation
Principles of infection prevention and control	7.2	4	2	Presentation



Wound management techniques in resource-limited environments	7.3	4	1	Presentation
Nutritional assessment and interventions in disasters (micronutrient deficiencies, malnutrition)	7.4	4	1	Presentation
Role of food aid and supplementary feeding programs	7.5	4	1	Presentation
Food safety and hygiene in emergency settings	7.6	4	1	Presentation
Module 8: Gender-Based Needs and Violence in Disasters (4 Hrs)				
Gender-based violence (GBV) risks and vulnerabilities in emergencies	8.1	5	1	Debate
Identification and reporting of GBV incidents	8.2	5	1	Assignment
Providing safe and culturally sensitive services for survivors	8.3	5	1	Group Activity
Advocating for the protection of women and girls in disasters	8.4	5	1	Group Activity
Module 9: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

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Course designed by: Dr. Rubin Philip



SEMESTER IV

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO4DSC200	Major	Biology of Non-Chordates	5	75	4
SBU24ZO4DSC201	Major	Animal Physiology	5	75	4
SBU24ZO4DSC202	Minor	Bio-entrepreneurship	5	75	4
SBU24ZO4DSE200	Elective	Ecology of Kerala	4	60	4
SBU24ZO4DSE201	Elective	Chronobiology	4	60	4
SBU24ZO4SEC200	SEC	Pet Care and Management	3	45	3
SBU24ZO4VAC200	VAC	Animal Rescue, Translocation and Rehabilitation	3	45	3
SBU24ZO4INT200	Major	Internship	-	-	2



SBU24ZO4DSC200: BIOLOGY OF NON-CHORDATES

Type of Course	Major		
Course Level	200 – 299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the scientific classification of invertebrate fauna	R
CO2	Analyse the evolutionary relationship between different invertebrate fauna and their systematic position	An
CO3	List out the economic importance of invertebrate fauna	U
CO4	Explain various adaptations of parasites and evaluate their role as disease causing agents.	E
CO5	Describe the morphology, anatomy, habit, habitat and systematic position of Paramecium and Penaeus	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	2	-	2		-	-	-	-	1
CO2	2	2	1	2	1		1	-	1	-
CO3	2	1	2	-	1	1	2	-	1	1
CO4	2	1	1	1	-	-	1	-	-	1
CO5	1	2	1	1	2	1	2	1	-	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Home assignment	Poster presentation	One minute paper	Written test	Multiple choice	
CO1	x	-	x	x	x	x
CO2	x	-	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Viva	Practical skill	Lab note book	Lab report	Standardized test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Invertebrates (2 Hrs)				
Outlines of classification	1.1	1	1	Lecture
Phylogeny- cellularity, body symmetry and developmental pattern	1.2	1	1	Lecture
Module 2: Kingdom Protista (6 Hrs)				
General characteristics and outline classification	2.1	1	2	Presentation /Lecture
Type: Paramecium	2.2	5	3	Lecture
Life history of parasitic protozoan –Plasmodium	2.3	4	1	Presentation
Module 3: Kingdom Animalia (2 Hrs)				
Outline classification; Mesozoa and Metazoa	3.1	1	1	Lecture
Phylum Mesozoa – Rhopalura	3.2	1	1	Seminar
Module 4: Subkingdom Metazoa (2 Hrs)				
Levels of animal organization; Body layers; Symmetry; Coelom; Metamerism, Germ layers;	4.1	1	1	Presentation
Protostomes and Deuterostomes Cephalisation Body plan of animals- Cell aggregate, Blind sac and Tube within tube	4.2	1	1	Lecture
Module 5: Phylum Porifera and Placozoa (3 Hrs)				
General Characteristics Outline classification Class Calcarea - Leucosolenia Class Desmospongia - Spongilla Class Hexactinellida – Euplectella	5.1	2	1	Lecture
Canal system in Sponges	5.2	4	1	Seminar
Phylum Placozoa –Trycoplax adherens	5.3	2	1	Lecture
Module 6: Phylum Coelenterata (3 Hrs)				
General characteristics, Outline classification: Class Hydrozoa – Hydra, Obelia Class Scyphozoa - Aurelia Class Anthozoa - Sea Anemone	6.1	1	1	Lecture
Polymorphism in Coelenterates	6.2	4	1	Assignment
Types of Coral reefs with reference to Indian ocean Threats to coral reefs, conservation of coral reefs	6.3	3	1	Discussion
Module 7: Phylum Ctenophora (1 Hr)				
Major characteristics and affinities of Ctenophores; Pleurobrachia	7.1	4	1	Seminar
Module 8: Phylum Platyhelminthes (3 Hrs)				
General characteristics Outline classification Class Turbellaria - Bipalium Class Digenea (Trematoda) Class Aspidogaster - Aspidogaster	8.1	1	2	Lecture



Class Monogenea - Entobdella				
Class Cestoda - Tape worm				
Fasciola and its life cycle	8.2	3	1	Presentation
Module 9: Phylum Aschelminthes (3 Hrs)				
General characteristics Outline classification Class Nematoda - Ascaris Class Nematomorpha - Gordius Class Gastrotrichia - Chaetonotus Class Kinorhyncha – Echinoderes	9.1	1	2	Seminar
Parasitic nematodes -Enterobius, Hook worm, Filarial worm	9.2	4	1	Lecture/ Presentation
Module 10: Phylum Annelida (3 Hrs)				
General characteristics, Outline classification: Class Polychaeta - Nereis Class Archiannelida - Polygordis Class Oligochaeta - Earth worm Class Hirudinea – Hirudinaria, Haemadipsa	10.1	1	2	Discussion
Locomotory organs in annelids	10.2	2	1	
Module 11: Phylum Arthropoda (8 Hrs)				
General characteristics, Type: Penaeus -Morphology, Digestive system, Nervous system, Appendages	11.1		5	Lecture/ Presentation
Outline classification Subphylum Trilobitomorpha Class Trilobita (Extinct) Subphylum Chelicerata Class Merostoma – Limulus Class Arachnida – Spider Class Pycnogonida – Nymphon Subphylum Mandibulata Class Crustacea – Daphnia Class Chilopoda - Centepede Class Symphyla - Scutigera Class Diplopoda - Millipede Class Pauropoda - Pauropus Class Insecta – Butterfly	11.2		3	Lecture
Module 12: Mollusca (4 Hrs)				
General characteristics	12.1	2	1	
Outline classification Class Monoplacophora - Neopilina Class Amphineura - Chiton Class Scaphopoda - Dentalium Class Gastropoda - Pila Class Bivalvia - Lamellidens Class Cephalopoda – Loligo	12.2	1	3	Lecture/ Presentation
Module 13: Phylum Echinodermata (3 Hrs)				
General characteristics	13.1	1	1	



Outline classification Class Asteroidea – Astropecten Class Ophiuroidea - Ophiothrix Class Echinoidea – Echinus Class Holothuroidea – Cucumaria Class Crinoidea – Antedon	13.2	1	1	Lecture/ Presentation
Water vascular system in Echinoderms	13.3	2	1	Presentation
Module 14: Phylum Hemichordata (1 Hr)				
General characteristics –Balanoglossus	14.1	1	1	Lecture
Module 15: Minor Phyla (1 Hr)				
Sipunculida; Chaetognatha; Rotifera; Onychophora, Acantocephala		2	1	Lecture
Module 16: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 17: Practical				
General identification:-	17.1	1	30	Laboratory activities
Identification the following Phylum –wise number of animals by their scientific names. Protista -2, Porifera-1, Coelenterata-2, Platyhelminthes-1, Annelida-2, Arthropoda-3, Mollusca- 2, Echinodermata-2	17.2	1		Study of museum specimens
Identification of any two pests of coconut, plantain, vegetables and stored products Identification of any four species of mosquitoes	17.3	1, 3		Study of specimens
Scientific Drawing-Scientific drawings of 2 invertebrate specimens belonging to different phyla.	17.4	1		Demonstration
Study of sections- 1. Hydra 2. Ascaris (male or female) 3. Fasciola Earthworm (TS through intestine)	17.5	1		Study of slides
Dissection -Nervous system of Prawn, Digestive system in Cockroach	17.6	1, 5		Demonstration
Mounting- Mouth parts – House fly, honey bee Appendages-Prawn	17.7	1, 5		Demonstration

Reference

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Course designed by: Dr. Monichan K K



SBU24ZO4DSC201: ANIMAL PHYSIOLOGY

Type of Course	Major		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the principles of nutrition and a balanced diet	U
CO2	Understand the basic organization and function of the organ systems	U
CO3	Understand the common structural and functional disorders	U
CO4	Understand the principles and applications of Physiology in relation to environmental parameters like temperature, light, etc.	U
CO5	Evaluate the physiological functions of organ systems.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	2	1	1	2	1
CO2	2	2	2	2	2	2	1	1	2	1
CO3	2	2	2	2	2	2	1	1	2	1
CO4	2	2	2	2	2	2	1	1	2	1
CO5	2	2	2	2	2	2	1	1	2	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Concept mapping	Quiz	One minute paper	Written Test	Open book test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	-	x	x	x	x	x
CO5	-	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical skill	Lab Notebook	Practical Quizzes	Lab report	Standardised Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Nutrition (7 Hrs)				
Types of nutrition; Major and minor nutrients; Importance of fibre in diet	1.1	1	2	Lecture & Discussion
Digestion and absorption of carbohydrates, proteins and lipids; Nervous and hormonal control of digestion	1.2	1	2	Lecture & Discussion
Special modes of digestion: ruminant and symbiotic	1.3	1	1	Lecture & Discussion
Balanced diet; Nutritional disorders: Overnutrition, malnutrition, undernutrition, Defects of modern food habits, Obesity, Anorexia, acidity and ulcers, flatulence.	1.4	1	2	Lecture & Discussion
Module 2: Respiration (9 Hrs)				
Respiration in animals: cutaneous, tracheal, branchial, pulmonary. Exchange and transport of respiratory gases, Oxy-hemoglobin curve, Bohr effect, reverse Bohr effect and Haldane effect.	2.1	2	3	Lecture & Discussion
Respiratory pigments in animals: haemoglobin (mention structure), myoglobin, hemocyanin, hemerythrin, chlorocruorin.	2.2	2	2	Lecture & Discussion
Respiratory disturbances and disorders: Dyspnoea, asthma, emphysema, Anoxia, hypoxia, cyanosis, hypocapnia, hypercapnia and asphyxia; Carbon monoxide poisoning	2.3	3	2	Lecture & Discussion
Respiratory adaptations to high altitudes, Physiological adaptations of deep-sea animals, Physiological problems of deep-sea diving.	2.4	2	2	Lecture & Discussion
Module 3: Circulation (8 Hrs)				
Organs and mechanism of circulation; Types of heart Cardiac cycle, Control and rhythmicity of the heart beat- Pacemakers, Pulse, Blood pressure and disorders, Neural and Hormonal control	3.1	2	2	Lecture & Discussion
Human Blood and its constituents, Buffer system in blood, Blood clotting mechanism: intrinsic and extrinsic pathways, clotting factors, disorders of blood clotting, anticoagulants, blood groups and transfusion.	3.2	2	2	Lecture & Discussion
Circulatory disorders- Myocardial infarction, angina pectoris, cardiac arrest, thrombus and embolus, arteriosclerosis and atherosclerosis.	3.3	3	2	Lecture & Discussion
Clinical analysis- Electrocardiogram (ECG), Erythrocyte sedimentation rate (ESR), Haematocrit, Total and differential blood cell count.	3.4	3	2	Lecture & Discussion
Module 4: Excretion 7 Hrs)				
Patterns of nitrogen excretion in animals: ammonotelism, ureotelism, uricotelism.	4.1	2	1	Lecture & Discussion



Structure of nephron, formation of urine, counter current mechanism, water and salt balance, acid-base control and homeostasis; Hormonal control of kidney functions.	4.2	2	2	Lecture & Discussion
Composition of urine- normal and abnormal constituents, Diseases of the kidney-Kidney stones, Proteinuria, Nephrosis, Pyelonephritis.	4.3	3	2	Lecture & Discussion
Artificial kidney (haemodialysis), Peritoneal dialysis and Kidney transplantation.	4.4	3	2	Lecture & Discussion
Module 5: Muscle Physiology (8 Hrs)				
Types of muscles – Striated, Non-striated and Cardiac	5.1	2	1	Lecture & Discussion
Ultrastructure and function; Mechanism, Biochemistry and Energetics of muscle contraction, Neuromuscular junction.	5.2	2	3	Lecture & Discussion
Electrophysiology of muscle, threshold and spike potentials, simple muscle twitch, whole muscle contraction, latent and refractory periods, isotonic and isometric contraction.	5.3	2	2	Lecture & Discussion
Summation, beneficial effect, tetanus, tonus, staircase phenomenon, fatigue, oxygen debt, rigor mortis.	5.4	2	2	Lecture & Discussion
Module 6: Environmental Physiology (6 Hrs)				
Body Temperature and its Regulation, Poikilotherms and Homeotherms	6.1	4	1	Lecture & Discussion
Physiological adaptation to cold; Shivering; Dormancy; Hibernation; Aestivation, Photoperiodism	6.2	4	2	Lecture & Discussion
Stress Physiology- Stress factors (internal & external), Stress adaptations.	6.3	4	3	Lecture & Discussion
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical Physiology				
Nutritional composition of Food	8.1	5	30	Lab oriented Training
Nutritional Disorders	8.2	5		Lab oriented Training
Measurement of insect respiration using respirometer	8.3	5		Lab oriented Training
Comparative study of respiratory organs	8.4	5		Lab oriented Training
Measurement of heartbeat in Cockroach	8.5	5		Lab oriented Training
Preparation of Human Blood smear and Identification of blood cells	8.6	5		Lab oriented Training
Determination of haemoglobin content of blood	8.7	5		Lab oriented Training
Enumeration of total RBC count using Haemocytometer	8.8	5		Lab oriented Training
Enumeration of total WBC count using Haemocytometer	8.9	5		Lab oriented Training
Estimation of PCV	8.10	5		Lab oriented Training



Instruments: Sphygmomanometer and Stethoscope (principle and use)	8.11	5		Lab oriented Training
Measurement of blood pressure using a Sphygmomanometer	8.12	5		Lab oriented Training
Identification of abnormal constituents of Urine	8.13	5		Lab oriented Training
Identification of types of muscles	8.14	5		Lab oriented Training
Identification of muscle properties- Simple Muscle twitch, Summation, beneficial effect, tetanus, staircase phenomenon, and fatigue from Kymographic images.	8.15	5		Lab oriented Training

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Course designed by: Dr. Joe Prasad Mathew



SBU24ZO4DSC202: BIO-ENTREPRENEURSHIP

Type of Course	Minor		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the scope of bio-entrepreneurship in various sectors such as aquaculture, poultry farming, apiculture and livestock rearing.	U
CO2	Gain practical skills in setting up and managing aquariums, aquaculture systems, poultry farms, apiaries and livestock operations.	A
CO3	Learn about the nutritional requirements, breeding techniques, disease management, and marketing strategies specific to each sector.	A
CO4	Understand the regulatory and licensing requirements related to bio-entrepreneurship in agriculture and allied industries.	U
CO5	Explore case studies of successful bio-entrepreneurial ventures.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	1	2	1	1	1
CO2	1	2	2	2	2	1	1	1	1	1
CO3	1	1	1	1	2	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Model building	Quiz	Video/Documentary Preparation	Written test	Individual project report	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Assignment	Practical Quizzes	In-lab demonstrations	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to the Bio-entrepreneurship (2 Hrs)				
Defining Entrepreneurship Bio-entrepreneurship-Significance and scope- Selection of the entrepreneurial venture	1.1	1,5	2	Lecture
Module 2: Aquarium Management and Aquaculture (9 Hrs)				
Setting up of aquarium-types of filtrations-Styles in Aquarium Setting-Common species of Aquarium fishes, aquarium plants-Breeding Techniques-Fish Diseases.	2.1	1,2, 3,4	3	Presentation- based lectures, Video, Demonstrations
Advantages and salient features of Aquaculture- Types of aquacultures- Biotic and abiotic factors of water- Importance of algae in aquaculture	2.2	1,2, 3,4	3	Presentation- based Lecture, Video, Demonstrations
Construction and maintenance of culture ponds Morphology and economic importance of cultivable fishes of Kerala Induced breeding in fishes Fish preservation and processing	2.3	1,2, 3,4	3	Presentation- based Lecture, Video
Module 3: Poultry Farming (8 Hrs)				
Importance of poultry farming Different types of poultry breeds and their characteristics (layers, broilers, and dual-purpose breeds)	3.1	1,2, 3,4	3	Presentation- based Lecture, Video
Design and building poultry houses for different needs (Ventilation, lighting, and heating requirements)- Nutritional requirements for different poultry types and life stages-Formulation of balanced diets- Feed management and storage	3.2	1,2, 3,4	3	Presentation- based Lecture, Video
Common poultry diseases: diagnosis, treatment and prevention strategies Vaccines and Vaccination Schedules Biosecurity Measures	3.2	1,2, 3,4	2	Presentation- based Lecture, Video
Module 4: Apiculture (7 Hrs)				
Species of Honey bees- Organization of Honey bee colony- Bee-keeping methods and equipment	4.1	1,2, 3,4	3	Presentation- based Lecture, Video, Demonstrations
Apiary management and maintenance- Stingless beekeeping (Meliponi culture)- Bee pasturage	4.2	1,2, 3,4	2	Presentation- based Lecture, Video, Demonstrations
By-products of Honeybees, their uses, quality control and their marketing- Diseases and pests of honey bees, Control measures	4.3	1,2, 3,4	2	Presentation- based Lecture, Video, Demonstrations



Module 5: Livestock Rearing and Management (9 Hrs)				
Understanding different livestock breeds (Cattle, goat and pig)-Indigenous livestock breeds of India	5.1	1,2,3,4	3	Presentation-based Lecture, Video
Nutritional requirements for different livestock Species Genetic improvement and breeding programs by the government	5.2	1,2,3,4	3	Presentation-based Lecture
Modern Design and construction of livestock Housing Livestock diseases and their management.	5.3	1,2,3,4	3	Presentation-based Lecture, Video
Module 6: Business Strategies (6 Hrs)				
Marketing strategies-Value addition and marketing opportunities-Emerging Trends and technologies-Startups-Innovations.	6.1	4,5	3	Presentation-based Lecture, Video
Intellectual property rights and patents-Case studies of successful bio-entrepreneurial ventures	6.2	4,5	3	Presentation-based Lecture, Video
Module 7: Funding and Ethics (4 Hrs)				
Central and State Government funding schemes	7.1	1,2,3,4	2	Presentation-based Lecture
Ethical considerations in Bio-entrepreneurship-Laws and licensing	7.2	1,2,3,4	2	Presentation-based Lecture
Module 8: Teacher Specific Content				
<i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i>				
This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 9: Practical				
Making of an aquarium, setting up and maintaining an aquarium	9.1	5	30	Demonstration, Hands-on Training
Fish breeding (livebearer and egg layers- one each)	9.2	5		Demonstration, Hands-on Training
Formulation of feed for fish and poultry	9.3	5		Demonstration, Hands-on Training
Vaccination dosage and procedure	9.4	5		Demonstration, Hands-on Training
Apiary setting, Honey extraction and Equipment	9.5	5		Demonstration, Hands-on Training
Formulating the feed for livestock	9.6	5		Demonstration, Hands-on Training
Pests of fish, poultry, honey bee and livestock. Methods for pest control	9.7	5		Demonstration, Hands-on Training



Making Value-added products	9.8	5	Demonstration, Hands-on Training, Experiments
Visit to a modern aqua farm, poultry farm, Livestock farm and Apiary	9.9	5	Field visit

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Course designed by: Mr. Jaison Job



SBU24ZO4DSE200: ECOLOGY OF KERALA

Type of Course	DSE		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Develop a comprehensive understanding of Kerala's ecological landscape	U
CO2	Gain an in-depth understanding of the Western Ghats biodiversity hotspot	U
CO3	Develop an understanding of the dynamics of coastal and wetland ecosystems in Kerala	An
CO4	Acquire knowledge of the urban ecology of Kerala, exploring the interactions between human populations and natural systems	U
CO5	Analyze ecological issues facing Kerala, and evaluate strategies for promoting sustainable development	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	1	1	-	1	1	1	1	-	1
CO2	1	1	-	-	1	1	1	1	-	1
CO3	-	1	1	-	1	1	1	1	-	1
CO4	-	-	-	1	1	1	1	1	1	1
CO5	-	-	-	-	1	-	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Case Study Analysis	In-class discussion	Home assignments	Written test	Case Study report	
CO1	-	-	-	x		x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	-	x	x	x	-	x
CO5	-	x	x	x	-	x

Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Kerala's Ecological Landscape (8 Hrs)				
Overview of Kerala's geography Geographic features and topography Weather patterns and microclimates	1.1	1	4	Lecture/ppt



Historical and Cultural Influences on Kerala's Ecology Traditional agricultural practices Impact of human settlements	1.2	1	4	Lecture/ppt
Module 2: Western Ghats Biodiversity Hotspot (14 Hrs)				
Western Ghats as a World Heritage site	2.1	1, 2	2	Lecture/Video
Flora and Fauna of the Western Ghats Endemic and Threatened species	2.2	1, 2	3	Lecture/ppt
Ecological Functions of the Western Ghats Watershed importance Climate regulation Supporting traditional livelihoods	2.3	1, 2	3	Lecture/ppt
Conservation Challenges and Strategies Habitat fragmentation Invasive species Anthropogenic activities Man- Animal Conflict (Case Studies) Conservation initiatives Gadgil and Kasturirangan reports	2.4	1, 2	6	Lecture / Video / Case study
Module 3: Coastal and Wetland Ecosystems of Kerala (14 Hrs)				
Coastal Biodiversity Mangroves and estuaries Fauna of coastal areas	3.1	1, 3	3	Lecture / Video / Field Visit
Environmental Issues of Kerala Coast Resilience and Adaptation to Natural Disasters Sustainable coastal development Integrated Coastal Zone Management (ICZM)	3.2	1, 3	4	Lecture / Video / Field Visit
Wetlands and Ramsar sites in Kerala Significance of the Kuttanad wetland ecosystem and its challenges	3.3	1, 3	3	Lecture / Video / Field Visit
Human-Environment Interactions Fishing communities and practices Impact of tourism Pollution and conservation measures	3.4	1, 3	4	Lecture / Video / Field Visit
Module 4: Urban Ecology of Kerala (10 Hrs)				
Urbanization Trends Population growth and urban expansion Impacts on natural habitats	4.1	1, 4	3	Lecture / Video
Biodiversity in Urban Areas Urban flora and fauna Green spaces and urban planning	4.2	1, 4	3	Lecture / Video
Sustainable Urban Practices Waste management Green technology in Urban development Community engagement in urban ecology	4.3	1, 4	4	Lecture / Video
Module 5: Ecological Issues and Sustainable Development (14 Hrs)				
Major ecological issues related to mining- quarries, sand mining Land alterations	5.1	1, 5	4	Lecture / Video / Field Visit
Conservation Policies and Initiatives	5.2	1, 5	4	Lecture/ppt



State and national conservation programs Role of local communities in conservation				
Climate change impacts Balancing development and conservation Community-based conservation efforts Conservation efforts and policies	5.3	1, 5	6	Lecture/ppt
Module 6: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

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Course designed by: Dr. Vincy Mary Varghese



SBU24ZO4DSE201: CHRONOBIOLOGY

Type of Course	DSE		
Course Level	200 - 299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand and evaluate information about animal chrono biology and its crucial role in the well-being of humans	U
CO2	Describe alterations in brain, body, and behavior that occur during sleep and how they change across the lifespan	U
CO3	Propose useful approaches to common rhythm issues using the basic principles of chronobiology	An
CO4	Discuss the impacts of rhythms and sleep on societal issues	A
CO5	Analyse the role of chronobiology in the process of ageing	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	1	1	2	2	1	1	1
CO2	2	1	1	1	1	1	2	1	1	1
CO3	1	2	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	1	2	1	1	1
CO5	1	1	1	1	1	1	2	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In-class discussions	Case study analysis	One-minute paper	Written test	Open-book test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Chronobiology (14 Hrs)				
Introduction, milestones and scope of chronobiology. Adaptive significance of biological clocks	1.1	1,3	4	Lecture/Video/ group discussions



Biological rhythms; Characteristics. Short-and Long-term rhythms; ultradian and infradian rhythms. Circadian rhythms; Tidal rhythms, Lunar rhythms, Circannual rhythms. Seasonal migration Photoreception, photo transduction. Factors influencing biological rhythms	1.2	1,2,3	10	Lecture/Video/ group discussions
Module 2: Biological Clocks (14 Hrs)				
Central (SCN) and Peripheral clocks in mammals Melatonin, Role of Melatonin, glucocorticoids in synchronization of timing	2.1	1,2	8	Lecture/Video/ group discussions
Clock Genes, Molecular basis of the biological clock, and its applications	2.2	1,2	6	Lecture/Video/ group discussions
Module 3: Chronobiology and Stress (12 Hrs)				
Hormonal biorhythms and their significance: adrenocortical, pineal and prolactin	3.1	1,3	6	Lecture/Video/ group discussions
Clock misalignment; jet lag, shift work. Lifestyle disorders: Seasonal affective mood disorders, depression and sleep disorders, Social jetlag	3.2	1,4	6	Lecture/Video/ group discussions
Module 4: Applications in Medicine (8 Hrs)				
Chrono pharmacology Chrono medicine Chrono therapy	4.1	1,3	8	Lecture/Video/ group discussions
Module 5: Comparative Chronobiology (6 Hrs)				
Model systems: Cellular and Molecular basis of circadian timekeeping in Drosophila and mammals	5.1	1,2	6	Lecture/Video/ group discussions
Module 6: Chronobiology and Ageing (6 Hrs)				
Ageing impacts on circadian rhythm Change in sleep patterns	6.1	1,2, 5	6	Lecture/Video/ group discussions
Module 7: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

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Course designed by: Dr. Martin J Babu



SBU24ZO4SEC200: PET CARE AND MANAGEMENT

Type of Course	SEC		
Course Level	200 - 299		
Credit	3		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	-	45
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the Diversity and Significance of Canine and Feline Companions	U
CO2	Apply Practical Knowledge in Canine and Feline Care	A
CO3	Evaluate the Unique Characteristics and Requirements of Exotic Birds	E
CO4	Apply Breeding Techniques and Loft Management in Aesthetic Pigeon Companionship	A
CO5	Demonstrate Ethical Practices in Pet Care and Management	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	1	-	2	-	-	1	1
CO2	1	1	1	1	1	2	1	1	1	1
CO3	2	1	-	1	1	1	1	-	1	1
CO4	1	1	-	-	1	2	1	-	1	1
CO5	1	1	-	-	-	2	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Oral presentations	Case study Analysis	Home assignments	Individual project report	Written test	
CO1	x	x	-	-	x	x
CO2	-	-	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	-	x	-	-	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Understanding Canine Companion (15 Hrs)				
Introduction and Significance: Evolution and domestication of dogs Domestic dogs and human health Understand the present significance of dogs in human society	1.1	1	2	lectures, discussions, and case studies



Morphology, Structure, and Breeds: Basic Morphology, anatomy, physiology Overview of dog breeds	1.2	1	2	Visual aids, breed illustrations,
Roles and Abilities of Dogs: Dogs as working companions (e.g., service, therapy) Understand their contributions to various human activities Importance of exercise	1.3	1,2	3	Demonstrations, guest lectures, discussions.
Nutrition, Kennel Design and Responsible Breeding: Dietary needs across life stages Kennel structure and design Breeding techniques and ethical considerations	1.4	1,2,5	2	case studies, Assignment, interactive sessions
Pregnancy, Whelping, and Puppy Care: Recognizing the signs of pregnancy Understand the whelping process, post-partum care Lactation and puppy care Stages of puppy development	1.5	1,2	2	Videos, Lecture, Discussions
Canine Health and Care: Grooming Overview of common diseases and preventive healthcare measures Veterinary care, parasite control, deworming, vaccinations, and handling behavioural issues	1.6	1,2	2	Case studies, role-playing, demonstrations
Clubs, Transportation, and Legal Aspects: Safe transportation methods and legal considerations Clubs- Dog shows	1.7	1,2	2	Videos, Lecture, Discussions
Module 2: Feline Companion Basics (7 Hrs)				
Understanding Feline Behaviour: Communication signals Social hierarchies and bonds Introducing new cats Importance of play and enrichment	2.1	1	1	Lecture, videos
Cat Care Essentials: Dietary needs across life stages Grooming techniques for a healthy coat and skin Identifying common health issues	2.2	1,2	2	interactive session, videos
Indoor Cat Environments: Designing safe and stimulating spaces Cat furniture, scratching posts, and litter box training Addressing behaviour problems and providing mental stimulation	2.3	1,2	2	interactive session, videos
Cat Health and Wellness: Importance of vaccinations and regular check-ups Parasite control and prevention Overview of different cat breeds and selection based on lifestyle	2.4	1,2	2	lectures, case studies, interactive session
Module 3: Avian Habitat Management (10 Hrs)				
Introduction to Aviaries and Avian Species	3.1	3	2	Visual aids, discussions, identification exercises



Aviary Design and Construction	3.2	3	3	Aviary Visit aviary design projects,
Avian Species Selection for Mixed Aviaries Budgerigars, Cockatiels, Lovebirds, Finches, Canaries, parrots, Parakeets	3.3	3	3	Presentation, Aviary Visit
Health and Wellness in Mixed Aviaries. Food and nutrition. Understanding Behavioural and Enrichment Needs Vaccinations, Medicines	3.4	3,5	2	Case studies, Videos, Discussions
Module 4: Fancy Pigeon Keeping (13 Hrs)				
Introduction to Loft Management and Pigeon Breeds	4.1	4	2	Lectures, Videos, discussions
Loft Design and Construction for Pigeons	4.2	4	4	Loft Visit, Assignment
Pigeon Species Selection for Fancy Pigeon Farming	4.3	4	4	Videos, Assignment, Discussions
Health and Wellness in Fancy Pigeons Parasites, Common Health Issues in Fancy Pigeons Preventive Measures and Vaccinations Nutritional Requirements for Fancy Pigeons	4.4	4	2	Expert Lecture, Case study, Discussions
Pigeon Handling, Training, and Ethical Considerations	4.5	4,5	1	Hands on training, discussions, Lecture
Module 5: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

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1. Bonham, M. H., The Ultimate Guide to Puppy Care and Training: Housebreaking, Crate Training, Obedience Training, And More!, 1st Edition, Howell Book House, New York, 2010
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Course designed by: Mr. Joseph Tom



SBU24ZO4VAC200: ANIMAL RESCUE, TRANSLOCATION AND REHABILITATION

Type of Course	VAC		
Course Level	200-299		
Credit	3		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	-	45
Pre-requisite (if any)	Compassion and enthusiasm for animals and nature.		

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall the fundamental principles and concepts of understanding wildlife behaviour, needs, and the necessity for capture and handling.	R
CO2	Remember the definition, significance, and holistic approaches to wildlife rescue and translocation, as well as the principles of humane wildlife handling and equipment techniques.	R
CO3	Understand the root causes of wildlife intrusion into human habitats and the importance of sustainable solutions and long-term planning for mitigating wildlife-human conflicts.	U
CO4	Understand the health and welfare considerations, challenges faced in wildlife rehabilitation in India, and the principles of care and rehabilitation of orphaned wild mammals.	U
CO5	Apply knowledge of wound management in wildlife rehabilitation, establishment, and management of wildlife rescue and rehabilitation centers, and the requirements of wild animals in captivity to design effective rescue and rehabilitation strategies	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	3	1	1	1	1	-	1	1
CO2	1	1	2	2	3	1	2	1	3	3
CO3	2	2	2	2	1	2	2	1	3	3
CO4	1	2	2	2	1	2	2	1	3	3
CO5	1	2	2	2	1	2	2	1	3	3

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Poster Presentation	Concept Mapping	Problem-Based Assignment	Case Study Analysis	Case Study Report	
CO1	-	x	-	-	-	x
CO2	-	-	x	-	-	x
CO3	x	-	-	-	x	x
CO4	-	-	-	x	x	x
CO5	-	-	x	x	-	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Understanding Wildlife, their behaviour and needs (2 Hrs)				
Evaluating the necessity for capture and handling	1.1	1	0.5	Lecture/ Discussion
Identifying the root causes of wildlife intrusion into human habitats	1.2	1	1	Discussion
Critical distance and comfort zone, maintaining wildlife's natural fight/flight distance	1.3	1	0.5	Presentation
Module 2: Principles of Rescue and Translocation (1 Hr)				
Definition and significance of wildlife rescue and translocation	2.1	2	0.5	Presentation
Implementing holistic approaches - Urban Wildlife Task Forces, developing long-term and sustainable solutions – mass education and wildlife population management	2.2	2	0.5	Presentation
Module 3: Humane Approaches to Wildlife Handling (3 Hrs)				
Defining humane treatment based on primary factors	3.1	2	0.5	Presentation / Video
General handling goals for wildlife rescue operations	3.2	2	0.5	Presentation / Video
Addressing stress and pressure to prevent aggressive behaviour	3.3	2	1	Presentation / Video
Low-soft-slow approach: Providing the animal with choices, time for decisions, safe options and rewards	3.4	2	0.5	Presentation / Video
Principle of Minimum: Using the least amount of restraint, equipment and methods when working with wildlife.	3.5	2	0.5	Presentation / Video
Module 4: Equipment and Techniques for Wildlife Handling (8 Hrs)				
Factors to consider - the animals' behaviour and conditions, the weather, and the trapping method.	4.1	2	1	Presentation/Dem onstration
Guidelines on animal handling equipment	4.2	2	1	Presentation/Dem onstration
Equipment and field gear for wildlife rescue and control - grab bags, locating, capturing, handling, and keeping.	4.3	2	0.5	Presentation/Dem onstration
Use of worry toys, distraction techniques, and rewards in wildlife handling	4.4	2	0.5	Presentation/Dem onstration
Using Trail Cameras to better understand the type and number of animals involved, and how to best resolve the conflict.	4.5	2	0.5	Presentation/Dem onstration
Procedures in capturing, handling and releasing wild animals with minimal stress.	4.6	2	0.5	Presentation/Dem onstration
Immobilization of wild animals – use of tranquilizers.	4.7	2	0.5	Presentation/Dem onstration
Volume colony traps, nets, and live traps.	4.8	2	0.5	Presentation/Dem onstration
Translocation of animals, Quarantine measures and Quarantine act	4.9	2	1	Presentation/Dem onstration



Special Considerations for Large Mammals	4.10	2	1	Presentation/Demonstration
Planning for the worst-case scenario: Ensuring necessary resources, services, and manpower if necessary.	4.11	2	1	Presentation/Demonstration
Module 5: Health and Welfare Considerations (6 Hrs)				
Capturing – as last resort. Utilising opportunities and alternate solutions beyond capturing the animal.	5.1	4	1	Lecture/Case Study
Stress and Types of Stress during Capture	5.1	4	1	Presentation
Minimizing stress and injury risks for animals and humans	5.2	4	1	Presentation/Video
Understanding factors contributing to stress and methods to prevent them	5.3	4	1	Presentation/Video
Capture myopathy	5.4	4	1	Presentation/Video
Use of Education and Awareness for effective Rescue operation	5.5	4	1	Presentation/Video
Module 6: The Principles of Care and Rehabilitation of Orphaned Wild Mammals (4 Hrs)				
Four kinds of wildlife ‘orphans’- Rejected, intentionally removed, injured, genuine orphans	6.1	4	1	Lecture
Neonatal characteristics and requirements	6.2	4	1	Lecture
Examples of wildlife rehabilitation in India	6.3	4	1	Lecture
Establishing and Managing a Wildlife Rescue and Rehabilitation Centre	6.4	4	1	Lecture
Module 7: Wound Management in Wildlife Rehabilitation (3 Hrs)				
Wound assessment, Wound management	7.1	5	0.5	Presentation
Wound cleaning, Providing drainage	7.2	5	0.5	Presentation
Preventing further infection, Topical therapeutics	7.3	5	1	Presentation
Bandaging and dressing	7.4	5	1	Presentation
Module 8: Reptile Rescue (6 Hrs)				
Introduction to reptiles and Snake taxonomy	8.1	2	1	Self-Study
Snake identification methods	8.2	2	1	Infographics
Rescue techniques using professional equipment	8.3	2	1	Demonstration
Decision to Rescue or Not to rescue?	8.4	2	1	Discussion
Snake release	8.5	2	0.5	Field Experience
First aid for snake bites	8.6	2	0.5	Presentation
Maintaining Records	8.7	2	1	Lecture
Module 9: Requirements of wild animals in captivity (6 Hrs)				
Animal Rights	9.1	5	1	Presentation
Physical environment, Confinement	9.2	5	1	Presentation
Hygiene, Diet-Quantity, Presentation	9.3	5	1	Presentation
Social grouping and breeding	9.4	5	1	Presentation
Handling, restrain and transportation	9.5	5	1	Presentation
Environmental enrichment	9.6	5	1	Presentation
Module 10: Care and treatment of Injured and diseased animals (6 Hrs)				
Cost/benefit assessment	10.1	4,5	0.5	Lecture/Discussion
Refining procedures to minimise risks to welfare.	10.2	4,5	0.5	Lecture/Discussion



Treatment and rehabilitation of wildlife casualties for welfare.	10.3	4,5	1	Lecture/ Discussion
Treatment and rehabilitation of wildlife casualties for species conservation	10.4	4,5	1	Lecture/ Discussion
Wildlife Health and Common Diseases of wild animals	10.5	4,5	1	Lecture/ Discussion
Zoonoses- Concept-Definition-Types Impacts-Factors of spread-Control.	10.6	4,5	1	Lecture/ Discussion
Prevention and control of important zoonoses of wildlife and public health significance.	10.7	4,5	1	Lecture/ Presentation
Module 11: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

Reference

1. Adams, L.W., J. Hadidian, and V. Flyger. 2004. Movement and mortality of translocated urban-suburban grey squirrels. *Animal Welfare* 13:45-50.
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Course designed by: Dr. Rubin Philip



SEMESTER V

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO5DSC300	Major/Minor	Biology of Chordates	5	75	4
SBU24ZO5DSC301	Major/Minor	Essentials of Biochemistry	5	75	4
SBU24ZO5DSC302	Major/Minor	Endocrinology and Reproductive Biology	4	60	4
SBU24ZO5DSE300	Elective	Natural Resource Management and Eco-tourism	4	60	4
SBU24ZO5DSE301	Elective	Nanobiology and Biomimicry	4	60	4
SBU24ZO5DSE302	Elective	Neurobiology	4	60	4
SBU24ZO5DSE303	Elective	Forensic Biology	4	60	4
SBU24ZO5DSE304	Elective	Wildlife Biology	4	60	4
SBU24ZO5SEC300	SEC	Economic Zoology and Entrepreneurship	3	45	3



SBU24ZO5DSC300: BIOLOGY OF CHORDATES

Type of Course	Major /Minor		
Course Level	300-399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the characteristics and classification of Phylum Chordata	U
CO2	Analyze animal form and function to understand their adaptations to various habits and habitats	An
CO3	Discern the characteristics and affinities of Cephalochordates and Urochordates	U
CO4	Acquire proficiency in vertebrate classification	U
CO5	Develop the capacity to distinguish and identify common animal species	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1	1	1	2	2	1	1	1
CO2	1	1	1	1	1	2	2	1	1	1
CO3	1	1	1	1	1	2	2	1	1	1
CO4	1	1	1	1	1	2	2	1	1	1
CO5	1	1	1	1	1	2	2	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Concept Mapping	Quiz	Oral presentation	Written test	Problem-based assignment	
CO1	x	x	x	x	-	x
CO2	x	x	x	x	-	x
CO3	x	x	x	x	-	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Quizzes	Viva voce	Practical Assignment	Standardized Test	Record	
CO1	-	-	-	x	x	x
CO2	-	-	-	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Phylum Chordata (2 Hrs)				
General characteristics, Outline classification- Subphylum Urochordata, Cephalochordata and Vertebrata	1.2	1	2	Lecture/ppt
Module 2: Sub Phylum Urochordata and Cephalochordata (4 Hrs)				
General characteristics of Urochordata Class I: Larvacea- Oikopleura Class II: Ascidiacea- Ascidia Class III: Thaliacea- Doliolum Retrogressive Metamorphosis	2.1	1,2, 3	2	Lecture/ppt, video
General characteristics of Cephalochordata- Amphioxus Affinities of Cephalochordata	2.2	1, 3	2	Lecture/ppt
Module 3: Sub Phylum Vertebrata (1 Hr)				
General characteristics, Outline classification Division Agnatha and Division Gnathostomata	3.1	4	1	Lecture/ppt
Module 4: Division Agnatha (2 Hrs)				
General characteristics Class I: Ostracodermi- Cephalaspis Class II: Cyclostomata- Petromyzon, Myxine	4.1	4,5	2	Lecture/ppt
Module 5: Superclass Pisces (10 Hrs)				
General characteristics, Outline classification Class I: Chondrichthyes-General characteristics Sub class Elasmobranchi- Narcine Sub class- Holocephali- Chimaera	5.1	4, 5	3	Lecture/ppt
Class II- Osteichthyes- General characteristics and classification	5.2	4, 5	1	Lecture/ppt
Sub class Choanichthyes Order I: Crossopterigii- Latimeria Order II- Dipnoi- Lepidospiren	5.3	4, 5	2	Lecture/ppt, video
Sub class Actinopterygii Superorder I- Chondrostei- Acipenser Superorder II- Holostei- Amia Superorder III- Telostei- Sardine	5.4	4, 5	2	Lecture/ppt
Accessory respiratory organs in fishes, Scales in fishes	5.5	2	2	Lecture/ppt
Module 6: Class Amphibia (4 Hrs)				
General characteristics Order I: Anura- Euphlyctis Order II: Urodela- Ambylostoma Order III: Apoda- Ichthyophis	6.1	4, 5	2	Lecture/ppt
Paedogenesis, Pedogamy, Neoteny, Axolotl larva	6.2	2	1	Lecture/ppt, video
Frogs and toads of Kerala	6.3	4, 5	1	Lecture/ppt
Module 7: Class Reptilia (6 Hrs)				
General characteristics, Classification Subclass I: Anapsida	7.1	4, 5	2	Lecture/ppt



Order Chelonia- Chelone Subclass II: Parapsida Ichthyosaurus				
Subclass III: Diapsida Order I: Rhynchocephalia- Sphenodon Order II: Squamata- Chamaleon Subclass IV: Synapsida Cynognathus	7.2	4, 5	2	Lecture/ppt
Identification of poisonous and non-poisonous snakes	7.3	4, 5	1	Lecture/ppt
Snakes of Kerala	7.4	4, 5	1	Lecture/ppt, video
Module 8: Class Aves (6 Hrs)				
General characteristics, Outline classification	8.1	4, 5	1	Lecture/ppt
Subclass I: Archaeornithes - Archaeopteryx (Affinities)	8.2	4, 5	1	Lecture/ppt
Subclass II: Neornithes Superorder I: Palaeognathae - Struthio Superorder II: Neognathae - Corvus splendens	8.3	4, 5	1	Lecture/ppt
Types of feathers	8.4	2	1	Lecture/ppt
Flight Adaptations in Birds	8.6	2	1	Lecture/ppt
Birds of Kerala	8.7	5	1	Lecture/ppt
Module 9: Class Mammalia (10 Hrs)				
General characteristics Outline classification Subclass I: Prototheria - Echidna (<i>Tachyglossus</i>) Subclass II: Metatheria – <i>Macropus</i>	9.1	4, 5	2	Lecture/ppt
Subclass III: Eutheria Order 1. Insectivora - <i>Talpa</i> Order 2. Dermoptera - <i>Galeopithecus</i> Order 3. Chiroptera - <i>Pteropus</i> Order 4. Primates - <i>Loris</i> Order 5. Carnivora - <i>Panthera</i> Order 6. Edentata - <i>Armadillo</i> Order 7. Pholibota - <i>Manis</i> Order 8. Proboscidea - <i>Elephas</i> Order 9. Hydracoidea - <i>Procavia</i> Order 10. Sirenia - <i>Dugong</i> Order 11. Perissodactyla - <i>Equus</i> Order 12. Artiodactyla - <i>Cameleus</i> Order 13. Lagomorpha - <i>Oryctolagus</i> Order 14. Rodentia - Porcupine Order 15. Tubulidentata - <i>Orycteropus</i> Order 16. Cetacea - <i>Delphinus</i>	9.2	4, 5	6	Lecture/ppt, video
Dentition in mammals	9.3	2	1	Lecture/ppt
Aquatic mammals	9.4	2,5	1	Lecture/ppt, video
Module 10: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				



Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 11: Practical				
Morphology Scientific Drawing: Make a scientific drawing of 5 locally available vertebrate specimens belonging to different classes	11.1	2,5	30	Laboratory activity
Mounting of placoid scales/cycloid/ctenoid scales	11.2	2		Laboratory activity
Dentition in Mammals (Dog, Rabbit, Man)	11.3	2		Spotters/Specimens
Study of feathers	11.4	2		Spotters/Specimens
Identification: - General identification of poisonous snakes (Cobra, Viper, Krait) and nonpoisonous (Rat snake, Natrix, Python) Identify animals by their scientific names: Protochordata - 1, Pisces - 4, Amphibia - 3, Reptilia - 4, Aves - 1, Mammalia - 2.	11.5	5		Spotters/Specimens
Identification of animals using Taxonomic keys: - Identification of fishes up to the level of order. Identification of snakes up to the family.	11.6	4,5		Spotters/Specimens

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Course designed by: Dr. Vincy Mary Varghese



SBU24ZO5DSC301: ESSENTIALS OF BIOCHEMISTRY

Type of Course	Major/Minor		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Comprehend the molecular basis of life	U
CO2	Analyze biomolecular interactions and properties	An
CO3	Describe the structure and function of biomolecules	R
CO4	Understand enzyme function and regulation	U
CO5	Explain metabolic pathways	R

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	1	1	2	1	1	1	1
CO2	2	2	1	2	1	2	1	2	1	2
CO3	2	2	1	1	1	2	2	1	2	2
CO4	1	2	1	2	2	1	2	1	1	2
CO5	2	2	1	2	1	1	2	1	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Poster presentation	Concept mapping	One-minute paper	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Observation of practical skills	Lab Notebook	Viva voce	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Molecular Design of Life (2 Hrs)				
Chemical unity among living organisms Dynamic steady state of life	1.1	1	2	Presentation-based lecture
Module 2: Water & Intermolecular Forces (4 Hrs)				
Structure and properties of water, Behaviour of polar, non-polar and amphipathic molecules in water	2.1	1, 2	2	Presentation-based lecture
Hydrogen bonding, ionic interactions, hydrophobic interactions and van der Waals interactions in macromolecular structures	2.3	2	2	Flipped classroom
Module 3: Carbohydrates (7 Hrs)				
Stereoisomerism: Chiral centre, Enantiomers, Diastereomers, Epimers, anomers	3.1	3	2	Board-based teaching, Peer teaching
Monosaccharides, Aldoses and Ketoses, Pyranose and Furanose structures	3.2	3	1	Board-based teaching, Student seminar
Glycosidic bond; Structure and function of common disaccharides, Reducing and nonreducing ends of sugars	3.3	2, 3	2	Board-based teaching, Student seminar
Polysaccharides: Homopolysaccharides, Heteropolysaccharides: Glycosaminoglycans	3.4	2, 3	2	Presentation-based lecture, Student seminar
Module 4: Proteins (4 Hrs)				
Classification and general structure of amino acids	4.1	3	2	Board-based teaching, Peer teaching
Structure of proteins: outline study of primary, secondary, tertiary and quaternary levels	4.2	3	2	Presentation-based lecture, Roleplay
Module 5: Lipids (7 Hrs)				
Fatty acids: saturated and unsaturated; Naming convention of fatty acids, PUFA, Omega-3 fatty acids	5.1	3	3	Board-based teaching
Triglycerides - Structure and properties	5.2	3	1	Board-based teaching
Lipids in membranes: Glycolipids, sphingolipids, cholesterol	5.3	3	2	Board-based teaching, In-class discussion
VLDL, LDL, and HDL	5.4	2, 3	1	Presentation-based lecture, Gamification
Module 6: Nucleic Acids (7 Hrs)				
Structure of nucleic acids and nucleotides	6.1	1, 3	2	Board-based teaching



Structural organization of DNA – Watson and Crick model	6.2	3	2	Flipped classroom, Model-based teaching
Forms of DNA – A, B and Z	6.3	3	2	Presentation-based lecture, In-silico simulations
Types of RNA	6.4	3	1	Presentation-based lecture, In-class discussion
Module 7: Enzymes (4 Hrs)				
Chemical nature of enzymes, IUBMB classification	7.1	4	2	Presentation-based lecture, Peer teaching
Factors influencing enzyme action (temperature, pH, enzyme concentration, substrate concentration),	7.2	4	2	Presentation-based lecture, In-class discussion
Module 8: An Overview of Metabolism (10 Hrs)				
Carbohydrate metabolism- Glycolysis, citric acid cycle, oxidative phosphorylation	8.1	2, 5	4	Presentation-based lecture, Peer teaching
Lipid metabolism- Biosynthesis and oxidation of fatty acids	8.2	2, 5	3	Presentation-based lecture, Peer teaching
Protein metabolism- Deamination, transamination, transmethylation, decarboxylation	8.3	2, 5	3	Presentation-based lecture, Peer teaching
Module 9: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 10: Practical				
Preparation of percent (w/v and v/v) solutions and molar solutions	10.1	1	30	Lab activity
Qualitative tests for biomolecules - carbohydrates, lipids, amino acids, nucleic acids	10.2	2		Lab experiment
Determination of acid value of oil	10.3	1		Lab experiment
Separation of amino acids by paper chromatography	10.4	1		Lab experiment
Quantitative estimation of glucose	10.5	2		Lab experiment
Effect of pH on enzyme activity	10.6	3		Lab experiment
Study of biomolecular structures using molecular visualization software	10.7	1,2		Virtual lab

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Course designed by: Dr. Philip Litto Thomas



SBU24ZO5DSC302: ENDOCRINOLOGY AND REPRODUCTIVE BIOLOGY

Type of Course	Major/Minor		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the basic structure of reproductive organs and their importance in human body	U
CO2	Describe various causes of infertility and take measures to prevent them.	An
CO3	Explain the basic organization and functions of the human endocrine systems and functional disorders related to them and take precautions to avoid them.	E
CO4	Understand the principles and applications of various birth control methods for family planning	A
CO5	Appreciate the importance of healthy body systems for a healthy life.	R

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	2	2	1	2	1	2	-	1	2
CO2	-	2	2	1	1	-	2	-	1	-
CO3	1	1	1	1	-	1	2	-	-	1
CO4	1	2	2	-	1	-	1	1	-	1
CO5	1	2	2	-	1	-	2	1	-	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In-class discussion	Viva	Case study assessment	Written test	Multiple choice	
CO1	x	x	-	x	x	x
CO2	-	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	-	x	-	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction (3 Hrs)				
Introduction to endocrine system, Chemical nature of hormones, classification of hormones	1.1	3	3	Lecture



Module 2: Mechanism of Hormone Action (4 Hrs)				
Plasma membrane hormone receptor, Second messengers of hormonal action	2.1	3	3	Lecture/ Presentation
Intracellular hormone receptors and mode of action	2.3	3	1	Lecture/Video
Module 3: Hypothalamus and Neurohypophysis (6 Hrs)				
Structure of hypothalamus, Releasing and inhibitory hormones of Hypothalamus and their functions	3.1	3	4	Discussion
Structure of Neurohypophysis, Hormones of Neurohypophysis and functions	3.2	3	2	Lecture
Module 4: Thyroid gland (2 Hrs)				
Structure of Thyroid gland, Hormones and their physiological roles, Disorders	4.1	3	2	Lecture
Module 5: Adrenal gland (3 Hrs)				
Structure of adrenal cortex and medulla	5.1	3	1	Seminar
Hormones of adrenal cortex and medulla, their functions, disorders	5.2	3	2	Lecture
Module 6: Pancreas (3 Hrs)				
Structure of pancreas, Hormones of the pancreas, their functions and disorders	6.1	3	3	Discussion
Module 7: Introduction to Reproductive Biology (1 Hr)				
Introduction-Types of reproduction in animals	7.1	1	1	Lecture
Module 8: Male Reproductive Physiology (8 Hrs)				
Structure of male reproductive organs, Anatomy and histology of human testis, Androgens and their functions, Hormonal regulation of testicular functions	8.1	1	3	Seminar/ Presentation
Spermatogenesis, Semen and its components, Structure of human sperm	8.2	1	3	Lecture
Abnormalities of male sexual function- Abnormal spermatogenesis, prostate gland abnormalities, hypogonadism and hypergonadisms, testicular tumours	8.3	5	2	Lecture/ Presentation
Module 9: Female Reproductive Physiology (8 Hrs)				
Structure of female reproductive organs, Anatomy and histology of human ovary, Physiological roles of ovarian steroid hormones.	9.1	1	4	Lecture
Reproductive cycles – oestrous cycle and Menstrual cycle, Regulation of reproductive cycles – hormonal, neural and environmental.	9.2	5	3	Seminar
Oogenesis, Structure of mammalian ovum	9.3	1	1	Lecture
Module 10: Pregnancy (7 Hrs)				
Fertilization and factors affecting fertilization, implantation, Decidualization, Placentation	10.1	1	4	Lecture
Structure and function of the placenta, Placenta as an endocrine organ, Physiological changes in pregnancy	10.2	5	3	Lecture
Module 11: Parturition (3 Hrs)				
Hormonal and mechanical factors of parturition, Mechanism and stages of labour	11.1	1	3	Lecture/Video
Module 12: Lactation (4 Hrs)				
Structure of mammary gland	12.1	1	4	Lecture/ Presentation



Lactation- Physiology of milk secretion, Galactopoiesis, and milk ejection, Role of hormones in lactation, Composition of milk				
Module 13: Infertility and Assisted Reproductive Techniques (4 Hrs)				
Infertility-Definition, Types (primary secondary and unexplained) Causes of infertility in Male and female	13.1	2	2	Group discussion
Assisted reproductive techniques (ART)- Invitro fertilization (IVF), Gamete intrafallopian transfer (GIFT), Zygote intrafallopian transfer (ZIFT), Pronuclear stage tubal transfer (PROST), Frozen embryo transfer (FET), Intracytoplasmic sperm injection (ICSI), Third-party ART and surrogacy	13.2	2	2	Lecture
Module 14: Contraception and Birth Control (4 Hrs)				
Permanent methods-Vasectomy and tubectomy	14.1	4	1	Lecture
Reversible methods -1) Intrauterine devices: LNG IUD, Copper- T 2) Hormonal methods: Implant, Shot (injection), Oral contraception, patch, ring 3) Barrier methods: Diaphragm (Cervical cap), Male condom, Female condom, Use of spermicides	14.2	4	2	Lecture
Fertility Awareness-Based Methods and Lactational Amenorrhea Methods	14.3	4	1	Lecture
Module 15: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

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Course designed by: Dr. Monichan K K



SBU24ZO5DSE300: NATURAL RESOURCE MANAGEMENT AND ECOTOURISM

Type of Course	DSE		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Acquire knowledge on ecotourism as a specialised sector of tourism industry and its advantages to society and economy.	R
CO2	Understand the fundamental principles pertaining to environmentally responsible travel and tourism.	U
CO3	Cultivate the ability to apply sustainable practices in the management and utilization of natural resources, to foster a responsible and proactive stance towards environmental stewardship.	A
CO4	Analyse the economic advantages of ecotourism for local stakeholders and evaluate the consequences of adverse visitor impacts on the site, aiming to develop strategies that maximize benefits while mitigating negative effects.	An
CO5	Evaluate the integration of sustainable utilization principles across various sectors, and their effectiveness and identifying areas for improvement to ensure a holistic approach to environmental conservation.	E

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	3	1	2	1	3	2	3	2
CO2	1	1	2	1	1	1	2	2	2	2
CO3	1	1	1	1	1	1	2	2	2	1
CO4	1	1	2	1	2	1	2	2	2	1
CO5	1	1	2	-	2	2	2	2	3	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Home assignments	Concept mapping	Case study Analysis	Quiz	Case study report	
CO1	x	-	-	-	-	x
CO2	-	x	-	-	-	x
CO3	-	-	x	-	-	x
CO4	-	-	-	x	-	x
CO5	-	-	-	-	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Natural Resource (9 Hrs)				
Definition of natural resources	1.1	1	1	Presentation
Classification of natural resources (renewable vs. non-renewable)	1.2	1	1	Presentation
Importance of natural resources in supporting ecosystems and human societies Plant-land-climate-wildlife interactions	1.3	1	1	Presentation
Soil and land resources, Soil erosion processes and impacts, Soil conservation practices in crop production, range and natural habitats	1.4	1	2	Presentation
Water resources-Surface water pollution and management, Groundwater pollution and management	1.5	1	2	Presentation
Air resources- Air pollution and agriculture, Atmospheric carbon dioxide levels, Impact of climate change on food security	1.6	1	2	Presentation
Module 2: Resource Management Paradigms (3 Hrs)				
Traditional vs. contemporary paradigms of resource management, Evolution of resource management approaches (e.g., from command and control to adaptive management,	2.1	3	1	Library, Discussion
Incorporating sustainability principles into resource management paradigms	2.2	3	1	Library, Discussion
Integrated natural resource management approaches and Ecosystem based management strategies	2.3	3	1	Library, Discussion
Module 3: Biodiversity and Conservation of Natural Resources (4 Hrs)				
Understanding biodiversity and its significance	3.1	3	1	Interactive session
Importance of biodiversity as a natural resource	3.2	3	1	Interactive session
Conservation strategies for protecting biodiversity in ecotourism areas	3.3	3	1	Interactive session
Role of ecotourism in promoting biodiversity conservation	3.4	3	1	Interactive session
Module 4: Community Based Natural Resources Management (6 Hrs)				
Concept of community based natural resource management (CBNRM)	4.1	2,4	1	Case study
Benefits and challenges of CBNRM in ecotourism contexts	4.2	2,4	1	Panel Discussion
Community involvement in decision making processes related to resource management	4.3	2,4	1	Panel Discussion
Participatory approaches to identifying resource management priorities in ecotourism communities	4.4	2,4	1	Lecture
Case studies highlighting successful CBNRM initiatives in ecotourism destinations	4.5	2,4	1	Lecture
Monitoring the success and impacts of community-based tourism	4.6	2,4	1	Lecture



Module 5: Environmental Management Systems (EMS) (6 Hrs)				
Overview of EMS and its components (e.g., environmental policy, planning, implementation, monitoring, and review)	5.1	3,4	2	Presentation
Application of EMS in the context of ecotourism development and management	5.2	3,4	2	Presentation
Integration of EMS principles into sustainable resource management practices in ecotourism areas	5.3	3,4	2	Presentation
Module 6: Ecotourism (4 Hrs)				
Tourism and concept of ecotourism	6.1	2,5	1	Visit
Ecotourism and related sub-sectors of the tourism industry	6.2	2,5	1	Presentation
Ecotourism criteria	6.3	2,5	1	Group activity
Quebec declaration on ecotourism	6.4	2,5	1	Presentation
Module 7: Understanding Ecotourism Resources and Categories (8 Hrs)				
Natural- Geography, Topography, Natural Heritage Ethnic, Built, and Events	7.1	1,2	2	Presentation
Ecotourism in protected areas: Definition, categories and roles	7.2	1,2	2	Presentation
Ecotourism and conservation	7.3	1,2	2	Group Activity
Threats to biodiversity in ecotourism sites (e.g., habitat loss, invasive species, overexploitation)	7.4	1,2	2	Group activity
Module 8: Identifying and Describing Ecotourism Products and Benefits (8 Hrs)				
Ecotourism and economic benefits	8.1	2,5	2	Seminar
Ecotourism and social benefits	8.2	2,5	2	Seminar
Ecotourism and education	8.3	2,5	2	Seminar
Ecotourism and local community	8.4	2,5	2	Seminar
Module 9: Ecotourism Practices (12 Hrs)				
Identifying, listing, and understanding ecotourism resource categories specific to site.	9.1	2,3,4	2	Group Activity
Presume the ecotourists for the site	9.2	2,3,4	1	Group Activity
Plan Facilities, Services types, activities	9.3	2,3,4	2	Group Activity
Code of ethics specific to site	9.4	2,3,4	1	Lecture
Principle of reduce, reuse, recycle, replace	9.5	2,3,4	1	Self-Study
Eco-labelling and Geographical indication	9.6	2,3,4	1	Infographics
Developing an ecotourism product Identifying products, developing partnerships, tapping local knowledge, incorporating research, zoning, developing policies and guidelines,	9.7	2,3,4	2	Presentation
Education & Marketing	9.8	2,3,4	1	Presentation
Ecotourism-based/related employment generation	9.9	2,3,4	1	Discussion
Module 10: Teacher Specific Content				
<i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i>				
This content will be evaluated internally				

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16. Lynch, D.R, Sustainable Natural Resource Management: For Scientists and Engineers, Cambridge University Press, 2009
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Course designed by: Dr. Rubin Philip



SBU24ZO5DSE301: NANOBIOLOGY AND BIOMIMICRY

Type of Course	DSE		
Course Level	300 – 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand examples and potentials of Nanobiology in real life situations	U
CO2	Understand the nature and properties of nano molecules and materials	An
CO3	Apply acquired knowledge in nano biology in their career development in higher education, research and development.	U
CO4	Integrate bio mimicry thinking into learning and create biomimetic outcomes	A
CO5	Interpret observations in nature with a bio mimicry oriented perspective for problem solving and applications	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	1	2	2	1	1	2	1
CO2	2	1	1	1	2	2	2	1	1	1
CO3	2	1	1	1	2	2	1	1	2	1
CO4	1	2	2	1	2	2	2	1	2	2
CO5	2	2	2	1	2	2	2	1	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Case study analysis	In- class discussion	Viva voce	Case study report	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Nanobiology (12 Hrs)				
Introduction to Nanoscience and its Applications Nanoscience in Nature. Various types of nanomaterials - one-dimensional, two dimensional and three-dimensional.	1.1	1.2, 5	5	Lecture/Video/ group discussions



Properties of nano materials: Structural, physical and chemical. Case study of various biopolymers as examples for nano materials -DNA topology and modifications, lipid nanoparticles, micelle; polysaccharides: starch, cellulose, agar, agarose, pectin Types of nanomaterials: nanorods, nanowires, nanoparticles, nano capsules, nano membranes, nano mesh, nano fibres, nano catalysts, carbon nanotubes	1.2	1,2,5	7	Lecture/Video/ group discussions
Module 2. Biological Nanomachines (20 Hrs)				
Biological nanomachines and genetic material: DNA polymerases: DNA pol I, DNA pol II and DNA pol III. Mitotic spindle and chromosome separation. RNA polymerases	2.1	1,2,3	8	Lecture/Video/ group discussions
Mitotic spindle and chromosome separation. Nanomachines in protein metabolism: ribosome structure: 30S, 50S, 40S and 60S sub units – tRNA & mRNA. Antibody structure; monoclonal antibodies.	2.2	1.2, 3,4,5	6	Lecture/Video/ group discussions
Nanomotors: rotary motors: bacterial flagella, ATP synthase. Linear molecular motors: actomyosin responsible for muscle contraction; dynein-microtubule system; Kinesin-microtubule system: transport of vesicles	2.3	1,2,3,4,5	6	Lecture/Video/ group discussions
Module 3: Synthesis and Characterisation of Nanoparticles (8 Hrs)				
Methods of preparation of nanomaterial: top-down and bottom-up approaches-emulsifiers, homogenizers. Nanomaterial characterization: FT-IR, X-ray diffraction, AFM, SEM, HR-TEM, Particle size analyser, Zetasizer.	3.1	1.2,3	8	Lecture/Video/ group discussions
Module 4: Design and application of nanomaterials (8 Hrs)				
Nanomedicine: nanocarriers for drug delivery, nanoparticle-mediated delivery of siRNA. nanoscaffolds and their use in cell culture, organ culture and tissue engineering. Nanobiotechnology: Devices based on bacteriorhodopsin, lipid and starch nanocarriers, nano salt, and nanosensors. Environmental applications: Nano clays, zeolites. Biosensors -nano remediation. Treatment of industrial waste waters using nano-particles.	4.1	1,2,3,4,5	8	Lecture/Video/ group discussions
Module 5: Biomimicry (12 Hrs)				
Defining biomimicry; biomimetic principles, essentials of biomimicry. Patterns and their significance in biology. Structure-function relationship in biological systems. Biomimicry in the design process. Biomimicry thinking. Inventions inspired by nature for biomedical applications.	6.1	4,5	12	Lecture/Video/ group discussions
Module 6: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Reference

1. Arben Merkoci - Biosensing using Nanomaterials. Wiley Publication, New Jersey, 2009
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Course designed by: Dr. Martin J Babu



SBU24ZO5DSE302: NEUROBIOLOGY

Type of Course	DSE		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Identify and explain the structures and functions of the Central Nervous System (CNS) components, including the brain and spinal cord.	U
CO2	Understand neuron structure and function, classify neurons, and explain the role of supporting tissues, including Glial cells in the PNS and CNS.	U
CO3	Explain stimulus and excitability of nerves, understand reflex arcs, describe ion channels and the resting membrane, and analyse methods to record electrical activity of a neuron.	An
CO4	Describe information flow between neurons, differentiate electrical and chemical synapses, and explain synaptic transmission, neurotransmitters, and the formation of neuromuscular junctions.	U
CO5	Explain the structures of the eyeball, the process of vision, and the neural pathways for olfaction and hearing, and understand the senses of taste, touch, and pain, Neurological disorders, Brain imaging techniques	E

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	-	-	-	2	1	1	1	1
CO2	2	2	-	1	-	2	1	-	1	1
CO3	2	2	-	-	-	2	1	-	1	1
CO4	2	2	-	-	-	2	1	-	1	1
CO5	2	2	-	1	1	2	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In-class discussions	Oral presentations	Self and peer assessments	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Organisation of Nervous System (12 Hrs)				
Central Nervous System (CNS)- Overview of Structures and Functions of the Major Components of the Brain Spinal cord & Spinal nerves	1.1	1	5	Lecture, Discussion, Presentation
Peripheral Nervous System (PNS) Afferent Division Efferent Division- Somatic NS, Autonomic NS (Sympathetic & Parasympathetic NS)	1.2	1	6	Lecture, Discussion, Presentation
Enteric Neuron	1.3	1	1	Lecture, Discussion, Presentation
Module 2: Building Blocks of the Nervous System (10 Hrs)				
Neuron- Structure, Function The structural classification of neurons The Functional classes of neuron/neurons form signalling circuits composed of three basic types of nerve cells Common patterns in neural circuits	2.1	2	5	Lecture, Discussion, Presentation
Supporting Tissue- Glial cells: structure and function Types of Glial cells in the PNS Types of Glial cells in the CNS	2.2	2	3	Lecture, Presentation
Neural Stem Cells Form Nerve and Glial Cells in the Central Nervous System	2.3	2	2	
Module 3: Nerve Physiology (13 Hrs)				
Stimulus and Excitability of Nerve. Reflex arc- The knee-jerk reflex.	3.1	3	1	Lecture, Discussion, Demonstration
Non-gated Ion Channels and the Resting Membrane. Overview of membrane transport proteins (ion channels). Operational model of the plasma-membrane Na ⁺ /K ⁺ ATPase- P class pump.	3.2	3	3	Lecture, Discussion, Presentation
Voltage-Gated Ion Channels and the Propagation of Action Potentials Depolarization of the plasma membrane. Operational model of the voltage-gated Na ⁺ channel. Unidirectional conduction of an action potential and inactivation of voltage-gated Na ⁺ channel. Structure of voltage-gated K ⁺ and Na ⁺ channels	3.3	3	4	Lecture, Discussion, Presentation
Conduction of action potentials in myelinated axons.	3.4	3	2	Lecture, Presentation
Methods to record the electrical activity of a neuron.	3.5	3	1	Lecture, Presentations
Peripheral Nerve damage and regeneration.	3.6	3	2	Lecture, Presentation



Module 4: Communication at Synapses (15 Hrs)				
Information Flows Between Neurons via Synapses Electrical Synapses: Gap Junctions Chemical Synapse	4.1	4	2	Lecture, Discussion, Presentation
Synaptic transmission and cellular signalling	4.2	4	1	Lecture, Presentation
Neurotransmitters- Excitatory & Inhibitory	4.3	4	2	Lecture, Presentation
Synaptotagmin-mediated fusion of synaptic vesicles with the plasma membrane	4.4	4	1	Lecture, Presentation
Cycling of neurotransmitters and synaptic vesicles in axon termini.	4.5	4	1	Lecture, Presentation
Neuromuscular junction	4.6	4	1	Lecture, Presentation
Neurotransmitter receptors Ligand Gated ion Channel- Nicotinic Acetylcholine Receptor in muscle contraction. G protein-coupled receptors – -Muscarinic acetylcholine receptor of the heart - The light-activated rhodopsin protein in the eye.	4.7	4	5	Lecture, Discussion, Presentation
Opioid peptide and opioid receptor	4.8	4	1	Lecture, Presentation
Mechanism of drug action	4.9	4	1	Lecture, Presentation
Module 5: Sensing the Environment (5 Hrs)				
The Eyes and Vision- Structures of the Eyeball. The effect of light on the retinal cells. Rod Cells and Cone cells of the Eye	5.1	5	1	Lecture, Discussion, Presentation
The sense of taste: taste cell, signal transduction	5.2	5	1	Lecture, Discussion, Presentation
Touch: Mechano-receptor, Pain: Nociceptors	5.3	5	1	Lecture, Discussion, Presentation
Olfaction: receptor, The neural pathway for olfaction	5.4	5	1	Lecture, Discussion, Presentation
The Ears and Hearing -Neural pathways for hearing.	5.5	5	1	Lecture, Presentation
Module 6: Neurological Disorders (3 Hrs)				
Dementia, Alzheimer's, Epilepsy, Parkinson's Headache disorders, Stroke, Multiple sclerosis, Neurological disorders associated with malnutrition, Traumatic Brain Injuries, Pain associated with neurological disorders	6.1	5	3	Lecture, Discussion, Presentation
Module 7: Brain Imaging (2 Hrs)				
Imaging techniques: CT, MEG, PET, SPECT, EEG, MRI, FMRI	7.1	5	2	Lecture, Discussion, Presentation



Module 8: Teacher Specific Content

(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)

This content will be evaluated internally

Reference

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Course designed by: Mr. Joseph Tom



SBU24ZO5DSE303: FORENSIC BIOLOGY

Type of Course	DSE		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall the fundamental concepts, historical background, and scope of Forensic Biology.	R
CO2	Demonstrate understanding of the procedures involved in examining biological evidence at crime scenes, including protection protocols, search methods, and documentation procedures.	U
CO3	Apply knowledge of basic biological properties of human blood to analyse bloodstain patterns, including spatter stains, types of patterns, and the factors influencing their formation.	A
CO4	Analyse various methods and techniques used in forensic examinations, such as hair and fiber analysis, investigations into asphyxial deaths, sexual offenses, and post-mortem changes, to draw conclusions and make informed decisions in forensic investigations.	AN
CO5	Evaluate the efficacy and reliability of different forensic DNA analysis techniques, including the isolation, extraction, amplification of DNA, and the use of capillary electrophoresis, to make informed decisions regarding their application in forensic investigations.	E

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	3	1	1	1	1	-	1	1
CO2	1	1	2	2	3	1	2	1	3	3
CO3	2	2	2	2	1	2	2	1	3	3
CO4	1	2	2	2	1	2	2	1	3	3
CO5	1	2	2	2	1	2	2	1	3	3

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Home assignments	Concept mapping	Case study Analysis	Quiz	Case study report	
CO1	x	-	-	-	-	x
CO2	-	x	-	-	x	x
CO3	-	-	x	-	x	x
CO4	-	-	-	x	x	x
CO5	-	-	-	-	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Forensic biology (6 Hrs)				
Introduction, history and scope of Forensic Biology	1.1	1	2	Presentation
Examining biological evidence at the crime scene: Protection of Crime Scene, Methods for searching crime scenes, Documentation, Chain of custody, Collection, Packing and Transportation of biological Evidence.	1.2	1,2	4	Lecture, Discussion
Module 2: Crime Scene Bloodstain Pattern Analysis (10 Hrs)				
Basic biological properties of human blood	2.1	1,2	2	Presentation
Formation of bloodstains	2.2	1,2	2	Presentation
Analysing spatter stains - Velocity, Directionality, Angle of Impact, Area of origin.	2.3	1,2	2	Infographics
Types of bloodstain patterns - passive, transfer, projected	2.4	1,2	2	Infographics
ABO blood grouping, Spectroscopic test. Species Identification	2.5	1,2	2	Presentation
Module 3: Forensic Examination of blood, semen and saliva (9 Hrs)				
Composition, formation and function of body fluids	3.1	2,3	2	Handouts, Discussion
Examination for seminal stains: Presumptive Tests- Benzidine test, Phenolphthalein assay, Leucomalachite Green assay, Luminol test, Fluorescein Staining, Factors affecting presumptive assay results. Confirmatory Tests-- Teichmann's test (Hematin Crystal Assay), Takayama Test (Hemochromagen Crystal Assay)	3.2	2,3	4	Handouts, Discussion
Examination for saliva: Presumptive and Confirmatory Tests.	3.3	2,3	3	Handouts, Discussion
Module 4: Forensic examination of hair and fibre (8 Hrs)				
Types of hairs, Morphology of hair, Human and Non-human hair	4.1	2,3	1	Presentation
Forensic hair examinations, Hair Cycle - Anagen, Catagen, Telogen, Anatomy of hair	4.2	2,3	2	Presentation
Medullary Index, Major parameters of hair analysis	4.3	2,3	2	Presentation
Fibers: Definition, types, structure and properties. Forensic Significance of Fibers.	4.4	2,3	2	Presentation
Comparison of natural and synthetic fibres, microscopic examination of fibres	4.5	2,3	1	Presentation
Module 5: Asphyxial Deaths (6 Hrs)				
Hanging, Strangulation, Garroting, Mugging, Suffocation, Smothering, Gagging, Choking, Cafe coronary.	5.1	4	4	Videos, Infographics
Drowning, Diatom test.	5.2	4	2	Infographics
Module 6: Sexual Offences (6 Hrs)				
Types of sexual offences and their respective examination and sampling methods.	6.1	4	4	Lecture
POCSO Act	6.2	4	2	Discussion and Summarisation



Module 7: Post-mortem Changes (6 Hrs)				
Immediate, Early, Late.	7.1	4	2	Lecture
Postmortem Lividity, Cadaveric Spasm, Algor Mortis, Rigor Mortis, Decomposition, Skeletonization, Adipocere, Mummification	7.2	4	4	Lecture
Module 8: Forensic DNA Analysis (9 Hrs)				
Sources of DNA, DNA Collection, preservation and storage of samples for DNA profiling.	8.1	5	3	Presentation
Repetitive DNA, - Satellite DNA, Minisatellites, Microsatellites, STR	8.2	5	3	Presentation
Isolation, Extraction, and Amplification of DNA, Capillary Electrophoresis.	8.3	5	3	Presentation
Module 9: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally.				

Reference

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Course designed by: Dr. Rubin Philip in consultation with Ms. Aswathy Anilkumar, Scientific Officer (Biology) - Forensic Science Laboratory, Kerala



SBU24ZO5DSE304: WILDLIFE BIOLOGY

Type of Course	DSE		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall the fundamental concepts and terminology related to wildlife biology, forest ecology, wildlife conservation and management, distribution, and diversity of Indian wildlife.	R
CO2	Demonstrate understanding of the importance of wildlife, forests, and protected areas, as well as the threats faced by wildlife, including human intervention, habitat destruction, and invasive species.	U
CO3	Apply knowledge of forest ecology to analyse the causes of forest damage and implement preventive and protective measures, including forest fire management strategies	A
CO4	Analyse the distribution and diversity of Indian wildlife and major protected areas with their wild fauna within the context of conservation efforts.	An
CO5	Evaluate the effectiveness of wildlife conservation and management strategies by assessing their impact on biodiversity conservation, habitat preservation, and mitigation of human-wildlife conflicts.	E

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	-	-	-	2	2	2	2	2
CO2	2	2	2	1	1	2	2	3	3	3
CO3	2	2	2	2	2	2	2	2	2	3
CO4	3	2	2	2	2	3	3	3	3	3
CO5	2	2	2	2	1	2	3	3	3	3

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	One-minute paper	Oral presentations	Poster presentation	Case study Analysis	Video Documentary	
CO1	x	-	-	-	-	x
CO2	-	x	-	-	-	x
CO3	-	-	x	-	-	x
CO4	-	-	-	x	-	x
CO5	-	-	-	-	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1 - Introduction to Wildlife Biology (8 Hrs)				
Definition of Wildlife, its scope and importance	1.1	1	1	Presentation
Wildlife wealth of India	1.2	1	1	Presentation
Threats to wildlife - Human intervention, overexploitation, tourism, habitat destruction, degradation and fragmentation.	1.3	1	3	Presentation
Invasive species, Feral animals, Human-wildlife conflicts	1.4	1	3	Presentation
Module 2 - Forest Ecology (10 Hrs)				
Importance of forest, Forest Cover in India. Forest types of India	2.1	1	4	Presentation
Preference of wildlife to forest types	2.2	1	2	Presentation
Nature of damage to forests, cause, preventive and protective measures	2.3	1	2	Presentation
Forest fires: harmful and beneficial effects; management of fires	2.4	1	2	Presentation
Module 3 -Wildlife Conservation and Management (12 Hrs)				
Protected Areas –Concept and Design	3.1	1,2	1	Presentation
Types of Protected Areas- Wildlife Sanctuary, National Park, Conservation Reserve, Community Reserve	3.2	1,2	1	Presentation
Concept of Biosphere reserve, Zonation and management of biosphere reserve: cores, buffers and transition Zones	3.3	1,2	1	Presentation
Critical wildlife habitats (CWH)	3.4	1,2	1	Presentation
Concept of Corridors -Types of Corridors, Animals using Wildlife corridors, Advantages and problems associated with wildlife corridors	3.5	1,2	1	Presentation
Joint Forest Management Programme	3.6	1,2	1	Presentation
Captive breeding and repopulation programme, Role of Zoos, Parks, Oceanarium; Gene banks and germplasm conservation	3.7	1,2	1	Presentation
Laws in wildlife conservation- Wildlife (Protection) Act – 1972	3.8	1,2	1	Presentation
National and international conventions – CITES, TRAFFIC	3.9	1,2	1	Presentation
Brief study of Project Tiger, Project Elephant, Asiatic Lion Conservation Project, and Crocodile Breeding Project.	3.10	1,2	2	Presentation
Governmental and Non-Governmental Organizations in Wildlife conservation, management and research: MoEF, WII, WWF, WCS, BNHS	3.11	1,2	1	Presentation
Module 4 - Distribution and Diversity of Indian Wildlife (15 Hrs)				
Major National Parks: Jim Corbett, Gir, Kaziranga, Sunderbans, Nagerhole, Ranthambhore, Keoladeo Ghana	4.1	3,4	3	Presentation
National Parks and Wildlife Sanctuaries in Kerala (including lesser-known sanctuaries and national parks)	4.2	3,4	4	Presentation



Important Indian wild fauna: Vultures, Indian Tiger, Asiatic Lion, Indian one horned Rhinoceros, Indian Elephant, Gaur, Lion-tailed Macaque, Dhole, Sloth Bear, Nilgiri Tahr, Malabar Giant Squirrel, Great Indian Hornbill, Gangetic Dolphin	4.3	3,4	8	Presentation
Module 6: Field Activity (15 Hrs)				
Visit to Zoological Garden- (Report on Morphology, general characters, behaviour and conservation implications of any 10 wild animals)	6.1	1,2, 3,4, 5	6	Visit and Documentation
Visit to any protected area – A video documentary of a minimum of 10 minutes duration including, photos, videos and narrative highlighting the biology, habitat characteristics and threats of the flagship species of the protected area visited.	6.2	1,2, 3,4, 5	9	Visit, Evidence based content writing, Presentation

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16. Saravanan G. and Ponmurugan P., Animal Studies: Experimental Procedures, Narosa Publications, New Delhi, 2015
17. Vivek Menon, Indian Mammals: A Field Guide, HachetteBook Publishing India, Gurgaon, 2014

Course designed by: Dr. Rubin Philip



SBU24ZO5SEC300: ECONOMIC ZOOLOGY AND ENTREPRENEURSHIP

Type of Course	SEC		
Course Level	300-399		
Credit	3		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	-	45
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the scope of bio-entrepreneurship in various sectors such as aquaculture, poultry farming, apiculture and livestock rearing.	U
CO2	Gain practical skills in setting up and managing aquariums, aquaculture systems, poultry farms, apiaries and livestock operations.	A
CO3	Learn about the nutritional requirements, breeding techniques, disease management, and marketing strategies specific to each sector.	A
CO4	Understand the regulatory and licensing requirements related to bio-entrepreneurship in agriculture and allied industries.	U
CO5	Explore case studies of successful bio-entrepreneurial ventures.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	1	2	1	1	1
CO2	1	2	2	2	2	1	1	1	1	1
CO3	1	1	1	1	2	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Model building	Quiz	Video/Documentary Preparation	Written test	Individual project report	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to the Bio-entrepreneurship (2 Hrs)				
Defining Entrepreneurship Bio-entrepreneurship-Significance and scope- Selection of the entrepreneurial venture	1.1	1,5	2	Lecture



Module 2: Aquarium Management and Aquaculture (9 Hrs)				
Setting up of aquarium-types of filtrations-Styles in Aquarium Setting-Common species of Aquarium fishes, aquarium plants-Breeding Techniques-Fish Diseases.	2.1	1,2,3,4	3	Presentation-based lectures, Video, Demonstrations
Advantages and salient features of Aquaculture-Types of aquacultures- Biotic and abiotic factors of water-Importance of algae in aquaculture	2.2	1,2,3,4	3	Presentation-based Lecture, Video, Demonstrations
Construction and maintenance of culture ponds Morphology and economic importance of cultivable fishes of Kerala Induced breeding in fishes Fish preservation and processing	2.3	1,2,3,4	3	Presentation-based Lecture, Video
Module 3: Poultry Farming (8 Hrs)				
Importance of poultry farming Different types of poultry breeds and their characteristics (layers, broilers, and dual-purpose breeds)	3.1	1,2,3,4	3	Presentation-based Lecture, Video
Design and building poultry houses for different needs (Ventilation, lighting, and heating requirements)- Nutritional requirements for different poultry types and life stages-Formulation of balanced diets- Feed management and storage	3.2	1,2,3,4	2	Presentation-based Lecture, Video
Common poultry diseases: diagnosis, treatment and prevention strategies Vaccines and Vaccination Schedules Biosecurity Measures	3.2	1,2,3,4	3	Presentation-based Lecture, Video
Module 4: Apiculture (7 Hrs)				
Species of Honey bees- Organization of Honey bee colony- Bee-keeping methods and equipment	4.1	1,2,3,4	3	Presentation-based Lecture, Video, Demonstrations
Apiary management and maintenance- Stingless beekeeping (Meliponi culture)- Bee pasturage	4.2	1,2,3,4	2	Presentation-based Lecture, Video, Demonstrations
By-products of Honeybees, their uses, quality control and their marketing- Diseases and pests of honey bees, Control measures	4.3	1,2,3,4	2	Presentation-based Lecture, Video, Demonstrations
Module 5: Livestock Rearing and Management (9 Hrs)				
Understanding different livestock breeds (Cattle, goat and pig)-Indigenous livestock breeds of India	5.1	1,2,3,4	3	Presentation-based Lecture, Video
Nutritional requirements for different livestock Species Genetic improvement and breeding programs by the government	5.2	1,2,3,4	3	Presentation-based Lecture



Modern Design and construction of livestock Housing Livestock diseases and their management.	5.3	1,2, 3,4	3	Presentation- based Lecture, Video
Module 6: Business Strategies (6 Hrs)				
Marketing strategies-Value addition and marketing opportunities-Emerging Trends and technologies- Startups-Innovations.	6.1	4,5	3	Presentation- based Lecture, Video
Intellectual property rights and patents-Case studies of successful bio-entrepreneurial ventures	6.2	4,5	3	Presentation- based Lecture, Video
Module 7: Funding And Ethics (4 Hrs)				
Central and State Government funding schemes	7.1	1,2, 3,4	2	Presentation- based Lecture
Ethical considerations in Bio-entrepreneurship- Laws and licensing	7.2	1,2, 3,4	2	Presentation- based Lecture
Module 4: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

Reference

1. Amita Saxena, Aquarium Management, Daya Publishing House, New Delhi, 2009
2. Banerjee G.C., Poultry, 4th Ed., Oxford & IBH Publishing Co Pvt. Ltd., New Delhi, 2018
3. Charantimath Poornima M., Entrepreneurship Development and Small Business Enterprises, Pearson Education, New Delhi, 2018
4. Himadri Panda, Complete Technology Book on Beekeeping and Honey Products, EIRI, New Delhi, 2017
5. Holt, Entrepreneurship: New Venture Creation, Pearson Education, New Delhi, 2016
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Course designed by: Mr. Jaison Job



SEMESTER VI

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO6DSC300	Major/Minor	Cell Biology	5	75	4
SBU24ZO6DSC301	Major/Minor	Genetics	5	75	4
SBU24ZO6DSC302	Major/Minor	Developmental Biology	5	75	4
SBU24ZO6DSE300	Elective	Ornithology	4	60	4
SBU24ZO6DSE301	Elective	Restoration Ecology	4	60	4
SBU24ZO6DSE302	Elective	Stem Cell Biology	4	60	4
SBU24ZO6SEC300	SEC	Science Communication	3	45	3
SBU24ZO6VAC300	VAC	Bioethics and Human Rights	3	45	3



SBU24ZO6DSC300: CELL BIOLOGY

Type of Course	Major/Minor		
Course Level	300-399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the principles of cell theory and differentiate between eukaryotes, prokaryotes.	U
CO2	Interpret and explain the structural organization of cell membranes and the mechanisms of cell permeability, adhesion, cell communication including extracellular signalling, signalling molecules, cell-surface receptors, and the central dogma of molecular biology.	U
CO3	Analyse the subcellular organization of eukaryotic cells, including the structural and functional aspects of the nucleus, mitochondria, endoplasmic reticulum, Golgi bodies, lysosomes, and peroxisomes.	An
CO4	Evaluate the processes of cell division, including the cell cycle, mitosis, meiosis, and amitosis, and understand the implications for aging and cancer.	E
CO5	Apply knowledge gained in theoretical modules to practical scenarios, demonstrating skills in cell biology techniques.	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	2	-	2	1	2	1	-	1	2
CO2	2	2	-	1	1	2	1	-	-	2
CO3	1	2	1	1	1	2	1	-	-	1
CO4	1	2	-	1	1	1	1	-	-	2
CO5	1	1	1	2	2	2	1	-	1	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In-class discussions	Video/Documentary Preparation	Group Tutorial work	Open book test	Problem-based assignments	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	-	x



Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	In-lab demonstrations	Observation of practical skills	Lab Notebooks	Laboratory report	Standardized Test	
CO1	x	x	x	x	-	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction (2 Hrs)				
Cell theory	1.1	1	1	Lecture, Presentation
Eukaryotic cell, Prokaryotic cell	1.2	1	1	Lecture, Presentation, Discussion
Module 2: Cell membrane & Structural Organisation (8 Hrs)				
Molecular models of cell membrane: Sandwich model, Fluid mosaic model	2.1	2,3	2	Lecture, Presentation, Discussion
Cell permeability – Diffusion, Osmosis, Passive transport, Active transport	2.2	2,3	2	Lecture, Presentation, Discussion
Modifications of plasma membrane/Cell Junctions: Microvilli, Tight junction, Gap junction, Desmosomes	2.3	3	2	Lecture, Presentation, Discussion
Cell Adhesion –Extra Cellular Matrix (ECM)	2.4	3	2	Lecture, Presentation, Discussion
Module 3: Subcellular Organization of Eukaryotic Cells (5 Hrs)				
Nucleus, Nuclear membrane; Pore complex, Structure of DNA, Chromatin, Chromosome structure, Heterochromatin, Euchromatin, Nucleolus	3.1	3	2	Lecture, Presentation, Discussion
Mitochondria, Endoplasmic reticulum, Ribosomes Golgi bodies, Lysosomes, Peroxisome	3.2	3	2	Lecture, Presentation
Cytoskeleton: Microtubules; Microfilaments, Intermediate Filaments	3.3	3	1	Lecture, Presentation,
Module 4: Cell Division (5 Hrs)				
Cell cycle - G1, S(Replication), G2 and M phases	4.1	4	2	Lecture, Presentation
Mitosis, Meiosis	4.2	4	3	Lecture, Presentation



Module 5: Cell Communication & Signalling (10 Hrs)				
Types of extracellular signalling	5.1	2	2	Lecture, Presentation
Signalling Molecules/Paracrine Factors & Second Messenger (cAMP, Ca ²⁺)	5.2	2	2	Lecture, Presentation
Steroid Hormones and Peptide hormone action	5.3	2	2	Lecture, Presentation, Discussion
Common types of Cell-surface receptors	5.4	2	2	Lecture, Presentation
Cell Signalling- GPCR, JAK-STAT	5.5	2	2	Lecture, Presentation
Module 6: Cancer and Apoptosis (8 Hrs)				
Types of tumours -benign and malignant	6.1	2,4	1	Lecture, Presentation, Discussion
Types of cancers-Carcinoma, Sarcoma, Lymphoma, Leukaemia	6.2	4	1	Lecture, Presentation, Discussion
Properties of cancer cells	6.3	4	1	Lecture, Presentation, Discussion
Causes of cancer	6.4	2,4	1	Lecture, Presentation, Discussion
Apoptosis- Intrinsic and Extrinsic Pathway	6.5	2,4	4	Lecture, Presentation
Module 7: Central Dogma of Molecular Biology (7 Hrs)				
Transcription	7.1	2	3	Lecture, Presentation
Translation	7.2	2	4	Lecture, Presentation
Module 8: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 9: Practical				
Comparative study of prokaryotic and eukaryotic cells.	9.1	5	30	Lecture, Presentation, Discussion
Identification of cell organelles.	9.2	5		Microscopic Observation, Discussion
Models of DNA and RNAs	9.3	5		Observation, Discussion
DNA isolation	9.4	5		Hands on training



Study of tissues using permanent slides- Epithelial tissues (Squamous, Cuboidal, Columnar), striated muscle, smooth muscle, neuron, cartilage and bone.	9.5	5		Microscopic Observation, Discussion
Squash preparation of onion root tip and identification of mitotic stages.	9.6	5		Hands on training, Discussion
Mounting of polytene chromosome (Drosophila/Chironomus).	9.7	5		Microscopic Observation, Discussion
Identification of meiotic stages using permanent slides.	9.8	5		Microscopic Observation, Discussion
Preparation of human blood smear and identification of blood cells.	9.9	5		Hands on training, Microscopic Observation, Discussion
Study of tonicity using RBC	9.10	5		Hands on training, Microscopic Observation, Discussion

Reference

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P., Molecular Biology of the Cell, 6th Edition, Garland Science, 2014.
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Course designed by: Mr. Joseph Tom



SBU24ZO6DSC301: GENETICS

Type of Course	Major/Minor		
Course Level	300-399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Apply Mendelian principles to predict genetic outcomes and analyse, interpret, and articulate various genetic interactions	A
CO2	Understand Chromosomal Morphology and the Genetic basis of Inheritance	U
CO3	Understand the bacterial genome organization and genetic processes in bacteria	U
CO4	Analyse various genetic disorders and outline the applications of genetics in human welfare	An
CO5	Demonstrate laboratory skill and interpret results	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1		2		1	1	1	1		
CO2	1	1				1	1			1
CO3	1	1				1				
CO4	1	2				1	1		1	1
CO5	1	1	1	3	1	2	1	1	2	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Model building	Home assignment	Quiz	Problem-based assignment	Written test	
CO1	-	-	x	x	x	x
CO2	-	-	x	x	x	x
CO3	x	-	x	-	x	x
CO4	-	x	x	-	x	x
CO5	-	-	x	-	-	-

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Skill	Work Book	Lab involvement	Lab Report	Lab Test	
CO1	-	-	-	-	-	-
CO2	-	-	-	-	-	-
CO3	-	-	-	-	-	-
CO4	-	-	-	-	-	-
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Mendelian Genetics (7 Hrs)				
Basic Terminologies and concepts- Gene and alleles, genotype and phenotype, homozygous and heterozygous, wild type and mutant alleles, Chromosome theory of heredity	1.1	1	2	Lecture, AV aids
Mendel's laws, Dominant and recessive traits, test cross and back cross, reciprocal cross, Mendelian traits in man	1.2	1	5	Lecture, AV aids, discussion
Module 2: Interaction of Genes (8 Hrs)				
Allelic interactions: Incomplete dominance, Co-dominance Non-allelic interactions: Complementary, supplementary	2.1	1	2	Lecture, Visual presentation
Epistasis: Dominant, Recessive	2.2	1	1	Lecture, Visual presentation
Polygenes (Skin colour inheritance in man)	2.3	1	1	Lecture, Visual presentation,
Pleiotropism; Modifying genes; Lethal genes (Brief account with one example each)	2.4	1	1	Lecture
Multiple alleles (coat colour in rabbits, ABO blood group, Rh factor and its inheritance)	2.5	1	3	Lecture, Visual presentation, Hands on activity
Module 3: Chromosome, Genes, DNA and Heredity (15 Hrs)				
Structure of DNA, Organization of Chromosomes; Chromosome morphology, classification of chromosomes-based on shape. Sex chromosomes and autosomes; Special kinds of chromosomes-polytene, Lampbrush and B chromosomes	3.1	2	3	Lecture, Visual presentation, Hands on activity
Sex determination- Chromosomal mechanism sex determination (XX-XO, XX-XY, ZW-ZZ). Sex determination in man: Barr bodies and Lyon hypotheses (Dosage compensation); Role of Y chromosome Sex determination in honey bees; Sex determination in Drosophila; Intersex; Gynandromorphs	3.2	2	3	Lecture, Visual presentation
Sex-linked inheritance – Definition, Characteristics of sex-linked inheritance (criss-cross inheritance); Haemophilia and colour blindness. Pseudoautosomal genes (incompletely sex-linked genes), Holandric genes; Sex limited and sex-influenced traits in man	3.3	2	3	Lecture, Visual presentation
Chromosomal aberrations - structural and numerical changes.	3.4	2	2	Lecture, Visual presentation
Gene mutation (point mutation), Molecular basis of gene mutations: Transversions, Transitions, Frame shift. Mutagens: Physical, Chemical, Biological	3.5	2	2	Lecture, Visual presentation



Extra nuclear inheritance- Characteristics Kappa particles in Paramecium Maternal effect genes in snail	3.6	2	2	Lecture, Visual presentation, Hands on activity
Module 4: Bacterial Genetics (4 Hrs)				
Bacterial genome	4.1	3	1	Lecture, AV aids
Recombination in Bacteria	4.2	3	1	Lecture, AV aids
Bacterial transformation; Transduction; Conjugation; F mediated sexduction	4.3	3	2	Lecture, AV aids
Module 5: Human Genetics (6 Hrs)				
Pedigree Analysis; Karyotyping- Normal human chromosome complement	5.1	4	2	Lecture, hands on activities
Genetic disorders in Man: Autosomal anomalies-: Down syndrome; Edward's syndrome; Cri-du-chat syndrome	5.2	4	1	Lecture, hands on activities, seminars
Sex chromosomal anomalies - Klinefelter's syndrome; Turners syndrome	5.3	4	1	Lecture, hands on activities, seminars
Single gene disorders (Brief mention): Sickle cell anaemia and Brachydactyly	5.4	4	1	Lecture, hands on activities, seminars
Multifactorial disorders: Polygenic traits - Cleft lip and cleft palate	5.5	4	1	Lecture, seminar
Module 6 – Biotechnology (5 Hrs)				
Tools: Enzymes- Restriction enzymes and DNA ligases; Vectors: Plasmids and Phage vectors Gene transfer methods	6.1	4	2	Lecture, AV aids
Applications of biotechnology Medicine- Therapeutic cloning, Gene therapy, Monoclonal antibodies, Humulin, DNA Vaccines; Agriculture- Microbial insecticides, GMO	6.2	4	2	Lecture, seminars/ group discussions
Issues in Biotechnology: Hazards of genetic engineering; Ethical issues	6.3	4	1	Group discussions
Module 7: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical				
Genetics problems –(a) Mono and Dihybrid cross (b) Multiple alleles (c)Back cross.	8.1	1,5	30	Laboratory activities
Study of Barr body in human buccal epithelium.	8.2	2,5		Laboratory activities
Analyse the Karyotype and identification of phenotypic manifestations- Turner's Syndrome, Klinefelter's and Down's Syndrome.	8.3	2,5		Laboratory activities



Sex-linked inheritance (colour blindness, hypertrichosis, ichthyosis, haemophilia)	8.4	2,5	Laboratory activities
Autosomal disorders (sickle cell anaemia, brachydactyly)	8.5	2,5	Laboratory activities
Sexing of <i>Drosophila melanogaster</i> and study of mutants	8.6	2,5	Laboratory activities
Isolation of genomic DNA	8.7	3,5	Laboratory activities

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5. Freeman, Scott. Biological Science. Pearson, Boston, 2021
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15. Vir Bala Rastogi. Genetics. Chand and Company Ltd, New Delhi, 2019
16. Weaver, Robert F. Molecular Biology. McGraw-Hill Education, New York, 2020

Course designed by: Dr. Jomon K V



SBU24ZO6DSC302: DEVELOPMENTAL BIOLOGY

Type of Course	Major/Minor		
Course Level	300-399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the fundamental concepts and principles of developmental biology	U
CO2	Describe the molecular mechanisms involved in embryonic development and cell differentiation	U
CO3	Analyze the processes of morphogenesis and organogenesis in various organisms	An
CO4	Explore ethical and societal implications of developmental biology research, including issues related to stem cell research and reproductive technologies	U
CO5	Critical Analysis in Experimental Embryology	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	1	1	2	2	1	1	1
CO2	1	2	1	1	1	1	2	1	1	1
CO3	1	1	2	1	1	1	2	1	1	1
CO4	2	1	1	1	1	2	1	1	1	1
CO5	1	1	1	2	1	1	1	2	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Quiz	Oral presentations	Viva voce	Written test	Literature Survey & Comprehensive Reviews	
CO1	x	-	x	x	-	x
CO2	x	-	x	x	-	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	-	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical Quizzes	Viva voce	Practical Assignment	Standardized Test	Record	
CO1	x	x	-	x	x	x
CO2	x	x	-	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	x	x	x	x
CO5	-	-	-	-	-	-



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Classification of Eggs (3 Hrs)				
Classification of eggs based on the amount, and distribution pattern of yolk	1.1	1	1	Lecture/ppt
Mosaic and regulative egg, Cleidoic and non-cleidoic egg	1.2	1	1	Lecture/ppt
Influence of yolk on development, Egg polarity; Egg symmetry	1.3	1	1	Lecture/ppt
Module 2: Fertilization (2 Hrs)				
Attraction of sperm and egg, Binding of spermatozoa-fertilization tube formation, Cortical reactions	2.1		2	Lecture/ppt
Module 3: Cleavage (5 Hrs)				
Definition – rules of cleavage; factors affecting cleavage, Influence of yolk on cleavage	3.1	1	1	Lecture/ppt
Planes of cleavage - meridional, vertical, equatorial, and latitudinal	3.2	1	1	Lecture/ppt
Types - Holoblastic and Meroblastic; Patterns - radial, bilateral and spiral Determinate and indeterminate cleavage	3.3	1	2	Lecture/ppt
Cell lineage and its significance	3.4	1	1	Lecture/ppt
Module 4: Morulation and Blastulation (2 Hrs)				
Formation of morula and blastula; Types of blastula	4.1	1	1	Lecture/ppt
Factors affecting blastulation	4.2	1	1	Lecture/ppt
Module 5: Fate maps (3 Hrs)				
Fate map and its significance, Natural and artificial fate maps	5.1	1, 2	1	Lecture/ppt
Construction of fate maps- Vital staining, Carbon particle, Radioactive, Histochemical and Cytological labelling	5.2	1, 2	2	Lecture/ppt
Module 6: Gastrulation (4 Hrs)				
Morphogenetic cell movements: Epiboly and Emboly (invagination, involution, delamination, infiltration convergence, divergence, ingression, constriction, extension and concrescence)	6.1	1	4	Lecture/video
Module 7: Germ Layers and Stem Cells (2 Hrs)				
Concept of germ layers and their derivatives	7.1	1, 3	1	Lecture/ppt
Properties stem cells; Type – Totipotency and Pluripotency of embryonic cells	7.2	1, 3	1	Lecture/ppt
Module 8: Early Embryology of Frog (8 Hrs)				
Fertilization, cleavage, blastulation, fate map, gastrulation, notogenesis, neurulation	8.1	1, 4	6	Lecture/ppt
Hormonal control of metamorphosis in frog	8.2	1, 4	2	Lecture/ppt
Module 9: Embryology of Chick (5 Hrs)				
Primitive streak development, Brief account of 18-hour chick embryo and 24-hour chick embryo	9.1	1, 4	3	Lecture/ppt
Extra embryonic membranes in chick	9.2	1, 4	2	Lecture/ppt



Module 10: Mammalian Development (7 Hrs)				
Blastocyst; Implantation	10.1	2,3	1	Lecture/ppt
Foetal membranes and placenta; Functions of placenta Classification of placenta based on nature of contact, mode of implantation and histological intimacy of foetal and maternal tissue	10.2	2,3	2	Lecture/ppt
Contraception & birth control; MTP	10.3	2,3,4	1	Lecture/ppt
Infertility- Causes of infertility-male and female; IVF, test tube babies, GIFT & ZIFT; Embryo transfer technology	10.4	2,3,4	3	Lecture/ppt
Module 11: Parthenogenesis (2 Hrs)				
Natural parthenogenesis; Arrhenotoky; Thelytoky; Obligatory and Facultative; Artificial Parthenogenesis	11.1	2	2	Lecture/ppt
Module 12: Experimental Embryology (2 Hrs)				
Spemann's constriction and transplantation experiments	12.1	1, 5	1	Lecture/ppt
Organizer and embryonic induction	12.2	1,5	1	Lecture/ppt
Module 13: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 14: Practical				
Study of egg types	14.1	1	30	Demonstration/s potter
Candling of eggs	14.2	2		Demonstration/s potter
Embryological studies – Blastula, Gastrula, Neurula (frog)	14.3	4		Demonstration/s potter
Study of 18-hour & 24-hour chick embryo slides	14.3	5		Demonstration/s potter
Mounting of chick embryo (36 - 48 hr)	14.5	5		Laboratory activity
Shell-less culture of chick embryos	14.6	5		Laboratory experiment

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Course designed by: Dr. Vincy Mary Varghese



SBU24ZO6DSE300: ORNITHOLOGY

Type of Course	DSE		
Course Level	300 – 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall and identify major bird orders and families.	U
CO2	Grasp bird songs, calls, and communication modes.	An
CO3	Apply bird watching, identification, and survey methods in the field.	A
CO4	Analyse advantages, disadvantages, cues, and significance of bird migration.	An
CO5	Evaluate effectiveness of conservation strategies and citizen science contributions.	E

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	2	1	2	-	-	-	1
CO2	2	2	1	2	1	2	-	-	-	2
CO3	2	2	1	2	1	2	1	-	1	2
CO4	1	1	1	1	1	1	-	-	-	1
CO5	1	1	2	1	1	2	1	1	2	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Quiz	Group Tutorial work	Home assignments	Individual project report	Written test	
CO1	x	x	x	x	-	x
CO2	x	x	x	x	-	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Ornithology (10 Hrs)				
Overview of Ornithology as a Discipline	1.1	1	2	Lecture, presentation, discussion
Importance of Birds in Ecosystems	1.2	1	2	Lecture, presentation, discussion



Basics of Bird Morphology and Anatomy	1.3	1	2	Lecture, presentation, discussion
Outline classification Major Bird Orders and Families Species Concepts and Identification techniques	1.4	1	4	Interactive sessions, Identification exercises Group discussions
Module 2: Ecology and Behaviour of Birds (15 Hrs)				
Adaptations for Specialized Lifestyles Habitat Selection and Niche Partitioning in Birds Foraging and Roosting Behaviour Flight adaptations, Beak and Feet modifications	2.1	1,2	5	Field visits, bird- watching excursions, guest lectures
Avian Senses and Communication: Vision and Auditory	2.2	2	4	Lecture, presentation, discussion
The Intricate World of Bird Songs and Calls Social Behaviour in Birds: Mating Displays, Aggression, and Cooperation	2.3	2	6	Lecture, presentation, discussion
Module 3: Field Techniques in Ornithology (15 Hrs)				
Bird Watching and Identification in the Field	3.1	3	3	Field visits, bird- watching excursions
Bird Banding and Mark-Recapture Techniques	3.2	3	3	Demonstration
Avian Survey Methods (Point Counts, Transects, etc.)	3.3	3	3	Field visit
Use of Technology in Ornithological Fieldwork (GPS, Drones, etc.)	3.4	3	2	Demonstration
Data Collection and Analysis in Ornithology	3.5	3	2	Lecture, discussion
Gadgets used for monitoring- Binoculars, Camera	3.6	3	2	Demonstration
Module 4: Migration in Birds 5 Hrs)				
Modes of flight in Migration	4.1	4	1	lectures, documentary, discussions.
Migration- Advantages and disadvantages	4.2	4	1	lectures, documentary, discussions.
Cues for Migration	4.3	4	2	lectures, documentary, discussions.
Significance of Migration.	4.4	4	1	lectures, documentary, discussions.
Module 5: Conservation Biology of Birds (8 Hrs)				
Threats to Avian Populations: Habitat Loss, Pollution, Climate Change	5.1	5	2	Case study, presentation, discussion
Conservation Status and Red List Categories	5.2	5	2	presentation, discussion
Conservation Strategies: Protected Areas, Habitat Restoration, Captive Breeding	5.3	5	2	Case study, presentation, discussion
Citizen Science Contributions to Bird Conservation	5.4	5	2	presentation, discussion
Module 6: Human-Bird Interactions (7 Hrs)				
Birds in Human Culture and Mythology	6.1	5	1	Presentation, lecture
Domestication of Birds	6.2	5	1	presentation, case study, lecture
Urban Ecology: Birds in Urban Environments	6.3	5	2	presentation, lecture
Economic Importance of Birds: Agriculture, Pest Control, and Tourism	6.4	5	3	presentation, case study, lecture



Module 7: Teacher Specific Content

(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)

This content will be evaluated internally

Reference

1. Anderson, Patricia K. "Human–bird interactions." *The welfare of domestic fowl and other captive birds* (2010): 17-51.
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Course designed by: Mr. Joseph Tom



SBU24ZO6DSE301: RESTORATION ECOLOGY

Type of Course	DSE		
Course Level	300 – 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall the fundamental principles and historical development of restoration ecology, including its importance in environmental conservation and management.	R
CO2	Remember the key ecological principles and concepts relevant to restoration ecology, such as ecological succession, biodiversity, ecosystem services, landscape structure, and key ecological processes in degraded ecosystems.	R
CO3	Understand the methods for assessing ecosystem degradation, selecting restoration sites, setting restoration goals, and developing restoration plans and strategies.	U
CO4	Understand the various restoration techniques and approaches, including passive vs. active restoration, habitat and soil restoration methods, and species reintroduction techniques.	U
CO5	Apply knowledge of monitoring and evaluation techniques to select appropriate indicators, monitor ecological changes, and evaluate the success of restoration projects, while considering socioeconomic factors and ethical considerations.	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1	1	1	1	1	1	1	1
CO2	1	1	2	2	2	1	1	1	1	1
CO3	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2
CO5	3	3	3	3	3	3	3	3	3	3

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Home assignments	Concept mapping	Case study Analysis	Quiz	Case study report	
CO1	x	-	-	-	x	x
CO2	-	x	-	-	x	x
CO3	-	-	x	-	x	x
CO4	-	-	-	x	x	x
CO5	-	-	-	-	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Restoration Ecology (4 Hrs)				
Overview of restoration ecology principles and concepts	1.1	1	1	Presentation
Historical background and development of restoration ecology	1.2	1	1	Presentation
Importance of restoration ecology in environmental conservation and management	1.3	1	2	Presentation
Module 2: Importance of restoration ecology in environmental conservation and management (10 Hrs)				
Ecological succession and its relevance in restoration	2.1	1	3	Presentation
Biodiversity and its significance in restoration projects	2.2	1	2	Presentation
Ecosystem services and their role in ecosystem restoration	2.3	1	2	Presentation
Understanding Landscape structure and function	2.4	1	2	Presentation
Understanding key ecological processes in degraded ecosystems	2.5	1	1	Presentation
Module 3: Degradation Assessment and Planning (8 Hrs)				
Reference conditions	3.1	1,2	1	Field Exposure
Methods for assessing ecosystem degradation	3.2	1,2	2	Field Exposure
Site selection criteria for restoration projects	3.3	1,2	2	Field Exposure
Setting restoration goals and objectives	3.4	1,2	2	Field Exposure
Development of restoration plans and strategies	3.5	1,2	1	Field Exposure
Module 4: Restoration Techniques (11 Hrs)				
Understanding Limitations -Biological Limitations, Physical Limitations, Chemical Limitations	4.1	2,3	2	Presentation
Passive vs. active restoration approaches	4.2	2,3	2	Presentation
Habitat restoration techniques- Revegetation	4.3	2,3	2	Presentation
Soil restoration methods - Mulching, Phytoremediation, soil amendments, erosion control,	4.4	2,3	3	Presentation
Species reintroduction and propagation techniques	4.5	2,3	2	Presentation
Module 5: Monitoring and Evaluation (8 Hrs)				
Importance of monitoring in restoration projects	5.1	4	2	Discussion
Selection of monitoring indicators and parameters	5.2	4	2	Discussion
Techniques for monitoring ecological changes	5.3	4	2	Discussion
Evaluation of restoration success and adaptive management	5.4	4	2	Discussion
Module 6: Socioeconomic and Ethical Considerations (9 Hrs)				
Socioeconomic benefits and challenges of restoration	6.1	3,4	2	Lecture/Discussion
Indigenous knowledge and practices in ecological restoration	6.2	3,4	2	Lecture/Discussion
Involvement of local communities in restoration projects- Collaborative Restoration	6.3	3,4	3	Lecture/Discussion
Ethical considerations in restoration ecology	6.4	3,4	2	Lecture/Discussion
Module 7: Case Studies and Analysis of Restoration Efforts (10 Hrs)				
Case study-1- Restoration of the Thol Lake Ecosystem, Gujarat, India.	7.1	4,5	2	Group Activity



Case study-2-Wild Food Nurseries and the Kheria Sabar Community in West Bengal	7.2	4,5	2	Group Activity
Case study-3-Ecorestoration of Chika Lake	7.3	4,5	2	Group Activity
Case study- 4- Restoration of phosphate mines in Doon Valley	7.4	4,5	2	Group Activity
Group projects: Designing a restoration plan for a local degraded ecosystem	7.5	4,5	2	Group Activity
Module 8: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Reference

- Bell, S. S., Fonesca, M. S., & et al., Restoration Ecology, 5th Edition, Publisher: Restoration Ecology, 1997.
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- Holl, K. D., Loik, M. E., & et al., Restoration Ecology, 1st Edition, Publisher: Restoration Ecology, 2000.
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Course designed by: Dr. Rubin Philip



SBU24ZO6DSE302: STEM CELL BIOLOGY

Type of Course	DSE		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the fundamental principles of stem cell biology	U
CO2	Understand the techniques used for derivation, culture, and differentiation of embryonic stem cells	U
CO3	Evaluate the regenerative potential and characteristics of various types of adult stem cells	U
CO4	Assess the mechanisms of cellular reprogramming and their role in disease modelling and therapy	An
CO5	Appraise the ethical considerations and controversies surrounding the use of stem cells in tissue repair, cell replacement therapies, and experimental models of diseases	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	1	2	2	1	1	1	1
CO2	2	2	1	2	2	2	1	2	1	2
CO3	1	1	1	1	1	2	2	1	2	2
CO4	1	2	1	2	2	1	2	1	1	2
CO5	1	1	2	2	1	1	2	1	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Case study analysis	Poster presentation	One-minute paper	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Basic Biology of Stem Cells (7 Hrs)				
Definition of stem cells; Potency levels of stem cells: totipotent, pluripotent, multipotent, unipotent	1.1	1	2	Presentation-based lecture
Stem cell markers, Concept of stem cell niche	1.2	1	2	Presentation-based lecture



Division of stem cells; Progenitor cells	1.3	1	3	Presentation-based lecture
Module 2: Stem Cells of the Embryo & Foetus (17 Hrs)				
Totipotency to pluripotency in the embryo; potency of inner cell mass (ICM); Gurdon's reprogramming experiment	2.1	1,2	4	Presentation-based lecture
Derivation of embryonic stem cells from ICM – mouse ES cells and human ES cells	2.2	1,2	4	Presentation-based lecture
Characteristics of ES cells, In vitro culture, maintenance and expansion of ES cells	2.3	1,2	4	Presentation-based lecture
Directed differentiation of ES cells	2.4	1,2	3	Presentation-based lecture
Cord blood stem cells; Stem cell banking	2.5	1,2	2	Presentation-based lecture
Module 3: Adult Stem Cells & Regeneration (14 Hrs)				
Hematopoietic stem cells, mesenchymal stem cells, neural stem cells, epidermal stem cells, intestinal stem cells	3.1	1,3	6	Presentation-based lecture
Regenerative potential of stem cells Regeneration in Planaria, Zebra fish and Mammals	3.2	1,3	6	Presentation-based lecture
Decline in stem cell function and tissue ageing	3.3	1,3	2	Presentation-based lecture
Module 4: Cellular Reprogramming (12 Hrs)				
Somatic Cell Nuclear Transfer	4.1	1,4	3	Presentation-based lecture, Flipped classroom
Stem cell plasticity; Epigenetic memory	4.2	1,4	2	Presentation-based lecture
Induced Pluripotent Stem Cells- Yamanaka's reprogramming factors; Reprogramming cocktails; ESCs vs iPSCs	4.3	1,4	4	Presentation-based lecture
Dedifferentiation and transdifferentiation of cells	4.4	1,4	3	Presentation-based lecture
Module 5: Applications of Stem Cells (10 Hrs)				
Stem cells in tissue repair	5.1	5	2	Presentation-based lecture
Cell replacement therapies	5.2	5	3	Presentation-based lecture
Stem cells as an experimental model Stem cells in disease modelling and drug screening	5.3	5	3	Presentation-based lecture, In-class discussion
Stem cell controversies and ethical guidelines	5.4	5	2	Presentation-based lecture, In-class discussion
Module 6: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

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Course designed by: Dr. Philip Litto Thomas



SBU24ZO6SEC300: SCIENCE COMMUNICATION

Type of Course	SEC		
Course Level	300 - 399		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	-	45
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Utilize visual media science communication for creating scripts and documentaries about animal world	A
CO2	Identify the need and role of science communication in zoological sciences	An
CO3	Contribute in science popularization through internet communication and public Sensitization.	A
CO4	Recognize the importance of the media for public understanding of science	An
CO5	Use science to explain everyday phenomena	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	-	1	1	1	1	1	2
CO2	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	2
CO4	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Oral presentations	Video preparation	Popular science writing	Written test	Case study report	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction (2 Hrs)				
Importance and goals of communicating with the public, knowing the audience and their interests, using different genres for different purposes, science in the media	1.1	1,3,4,5	2	Lecture/Video/group discussions



Module 2. The role of language in science communication (12 Hrs)				
Identifying and avoiding jargon, importance for communication through regional languages	2.1	2.4.5	4	Lecture/Video
Public speaking training, the principles of public speaking	2.2	2,3,4,5	4	
Writing a news item; Choosing a topic and newsworthiness, the title, the lead, the inverted pyramid	2.3	1.3.4,5	4	Modelling the process by an expert, small group work and class discussion
Module 3: Models of science communication (4Hrs)				
Deficit, contextual, lay expertise and dialogic models of science communication: from dissemination to participation	3.1	4,5	4	Lecture and class discussion
Module 4: Interviews and Framing (12 Hrs)				
The concept of framing and its importance to science communication. Elements of style: analogies, humour and narrative.	4.1	1.2.3,4,5	6	Lecture, analysis of televised interviews, modelling the interview process by an expert
Conducting an interview and media training for on-camera interviews	4.2	1,3,4,5	6	Practicum
Module 5: Science communication in the new media (15 Hrs)				
Blogs- Science communication in the new media, the role of Web 2.0 in enabling public deliberation and participation	5.1	1,3,4,5	4	
Science communication through Podcasts	5.2	1,2,3,4,5	6	Practicum
Filming science; The role of visualization in science communication; Creating science documentaries, creating the outline and expanding, scripts, citing authentic sources, case study: Famous documentaries of Carl Sagan, David Attenborough and Prof. Yashpal	5.3	1,2,3,4,5	5	Practicum
Module 6: Teacher Specific Content				
<i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i>				
This content will be evaluated internally				

Reference

1. Baron, N. Escape from the ivory tower: A guide to making your science matter. Washington, DC: Island Press. 2010
2. Bucchi, Massimiano. Science and the Media: Alternative Routes in Scientific Communication. Routledge, London, UK, 2008
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Course designed by: Dr. Martin J Babu



SBU24ZO6VAC300: BIOETHICS AND HUMAN RIGHTS

Type of Course	VAC		
Course Level	300-399		
Credit	3		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	-	45
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Comprehend the essence of bioethics and its contemporary relevance	U
CO2	Analyze the ethical dimensions inherent in animal research AND wildlife conservation endeavors	An
CO3	Evaluate the ethics of environmental stewardship, sustainability, and animal rights in conservation efforts	E
CO4	Examine the ethical implications of emerging technologies, biosecurity concerns, and global bioethics	An
CO5	Understand the foundational principles of human rights, delineating international norms and constitutional provisions within the Indian context	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	-	-	-	1	1	2	-	-	-
CO2	-	-	-	-	-	-	2	-	-	-
CO3	-	-	1	-	-	-	2	1	-	-
CO4	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	1	-	-	-	-	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Case study analysis	Ethical Decision-making exercises	Debate	Written test	Open book test	
CO1	-	-	x	x	x	x
CO2	x	x	x	x	x	x
CO3	-	-	x	x	x	x
CO4	-	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Bioethics (3 Hrs)				
Define bioethics and its significance in contemporary society.	1.1	1	1	Lecture/ppt



Introduce ethical theories and principles (utilitarianism, deontology, virtue ethics).	1.2	1	1	Lecture/ppt
Explore the history and development of bioethics as a field of study.	1.3	1	1	Lecture/ppt
Module 2: Ethical Issues in Animal Research (12 Hrs)				
Introduction to ethical considerations in animal studies, wildlife research, and conservation efforts.	2.1	2	1	Lecture/ppt
Ethical treatment of animals in research, including field studies and captive settings.	2.2	2	1	Lecture/ppt
Animal Ethical Committee for research on animals.	2.3	2	1	Lecture/ppt
Ethical dilemmas in wildlife conservation, such as invasive species management and habitat restoration.	2.4	2	1	Lecture/ppt
Animal welfare concerns in zoological research, including the use of non-invasive and minimally invasive techniques.	2.5	2	2	Lecture/ppt
Indigenous perspectives on the ethical treatment of animals and the integration of traditional ecological knowledge in zoological research.	2.6	2	2	Lecture/ppt
Genetic research in animals and the ethical implications of studying wild populations, including concerns related to genetic diversity and population management.	2.7	2	2	Lecture/ppt
Case studies examining ethical issues arising from zoological research, conservation initiatives, and the intersection of human and animal interests.	2.8	2	2	Case study discussion
Module 3: Environmental Ethics and Conservation (6 Hrs)				
Ethics of environmental stewardship and sustainability.	3.1	3	2	Lecture/ppt
Animal rights and welfare in conservation efforts	3.2	3	2	Lecture/ppt
Indigenous perspectives on biodiversity conservation and environmental justice.	3.3	3	2	Lecture/ppt
Module 4: Emerging Issues in Bioethics (6 Hrs)				
Ethical implications of emerging technologies (e.g., artificial intelligence, nanotechnology).	4.1	4	2	Lecture/ppt
Biosecurity and dual-use research concerns.	4.2	4	2	Lecture/ppt
Global bioethics and cross-cultural perspectives on ethical dilemmas.	4.3	4	2	Lecture/ppt
Module 5: Human Rights (18 Hrs)				
Understanding Human Rights: Define human rights and their relevance in India, covering social, economic, and political aspects. Explore international norms, including the Universal Declaration of Human Rights (UDHR), focusing on civil and political rights, economic, social, and cultural rights, and rights against torture, discrimination, and forced labor.	5.1	5	5	Lecture/ppt
Human Rights and Duties in India: Examine human rights and duties as outlined in the Indian Constitution, particularly in the Preamble and other constitutional provisions.	5.2	5	4	Lecture/ppt
Deprivation of Human Rights: Analyze core issues leading to the deprivation of human rights, such as poverty, overpopulation, illiteracy, unsustainable development, and	5.3	5	5	Lecture/ppt



the challenges faced by disadvantaged groups, including women, children, SC/ST, homeless and slum dwellers, physically and mentally handicapped individuals, refugees, and internally displaced persons.				
Redressal Mechanisms: Explore mechanisms for addressing human rights violations, including the judiciary, government systems, statutory commissions like the National Human Rights Commission (NHRC), media advocacy, and initiatives aimed at creating human rights literacy and awareness.	5.4	5	4	Lecture/ppt

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15. Zwitter, Andrej. Human Rights in the Age of Platforms. MIT Press, 2019.

Course designed by: Dr. Vincy Mary Varghese



SEMESTER VII

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO7DSC400	Major/Minor	Microbiology	5	75	4
SBU24ZO7DSC401	Major/Minor	Immunology	4	60	4
SBU24ZO7DSC402	Major/Minor	Molecular Biology	4	60	4
SBU24ZO7DSC403	Major/Minor	Experimental Methods in Biology	4	60	4
SBU24ZO7DSC404	Major/Minor	Research Methodology and Biostatistics	4	60	4
SBU24ZO7DSE400	Elective	Toxicology, Environmental Monitoring and Management	4	60	4
SBU24ZO7DSE401	Elective	Advanced Biochemistry	4	60	4



SBU24ZO7DSC400: MICROBIOLOGY

Type of Course	Major/Minor		
Course Level	400-499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Comprehend the diversity of microorganisms	U
CO2	Understand the concepts of microbial classification and identification procedures	U
CO3	Attain proficiency in microbial culture and preservation techniques	U
CO4	Understand microbial structure, growth phases, growth factors and mode of multiplication.	U
CO5	Develop an understanding of viral architecture and comprehend the replication processes characteristic of viruses	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	2	1	1	2	2
CO2	2	2	2	2	2	2	1	1	2	2
CO3	2	2	2	2	2	2	1	1	2	2
CO4	2	2	2	2	2	2	1	1	2	2
CO5	2	2	2	2	2	2	1	1	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Concept mapping	Quiz	One minute paper	Written Test	Open book test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Practical skill	Lab Notebook	Practical Quizzes	Lab report	Standardised Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Microbiology (7 Hrs)				
Scope of Microbiology and Microbial groups	1.1	1	1	Lecture & Discussion
Outline classification of bacteria	1.2	1	2	Lecture & Discussion
Outline classification of fungi	1.3	1	2	Lecture & Discussion
Outline classification of viruses	1.4	1	2	Lecture & Discussion
Module 2: Methods in Microbiology (15 Hrs)				
Methods of sterilization and disinfection: Physical and Chemical methods	2.1	2	4	Lecture & Discussion
Preparation of culture media: Selective media; Enrichment media; Enriched media; Differential media	2.2	3	4	Lecture & Discussion
Plating techniques and isolation of pure colonies; Aerobic and anaerobic cultivation	2.3	3	3	Lecture & Discussion
Culture preservation techniques: Refrigeration, Deep freezing, Freezing under liquid nitrogen; Lyophilization	2.4	3	4	Lecture & Discussion
Module 3: Basic Bacteriology (8 Hrs)				
Morphology and fine structure of bacteria-Flagella, Pili, Capsule	3.1	4	2	Lecture & Discussion
Structure of Cell wall and its composition	3.2	4	2	Lecture & Discussion
Cytoplasmic membrane and its composition	3.3	4	1	Lecture & Discussion
Protoplast; Spheroplast; Nuclear material, plasmid and other cell inclusions	3.4	4	2	Lecture & Discussion
Bacterial spores	3.5	4	1	Lecture & Discussion
Module 4: Bacterial Growth (6 Hrs)				
Factors affecting bacterial growth	4.1	4	3	Lecture & Discussion
Bacterial growth phases and Growth curve	4.2	4	3	Lecture & Discussion
Module 5: Basic Virology (9 Hrs)				
Viruses -Structure of Viruses	5.1	4	2	Lecture & Discussion
Human, Animal, Plant and Bacterial Viruses	5.2	4	5	Lecture & Discussion
Replication of viruses – Lytic and lysogenic cycle	5.3	4	2	Lecture & Discussion
Module 6: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 7: Practical Microbiology				
Instruments –Autoclave, Hot air oven, Laminar Air Flow, Bacteriological incubator- Principle, Working and use in Microbiology lab.	7.1	5		Lab oriented training



Cleaning and sterilization of glassware, Sterilization of culture media	7.2	5	30	Lab oriented training
Preparation of solid and liquid media for microbial cultures. (Ingredients, pH and method of preparation) (Demonstration) (a) Solid media (1) Nutrient agar (2) Mac Conkey's agar (b) Liquid Media (1) Nutrient broth (2) Peptone water. (c) Semi solid agar (d) Firm agar	7.3	5		Lab oriented training
Culture methods - Streak plate technique Pour plate culture Liquid culture	7.4	5		Lab oriented training
Examination of microbes in living conditions - Hanging drop method for demonstrating motility of bacteria.	7.5	5		Lab oriented training
Gram staining – preparation, procedure and identification of Gram + ve and Gram –ve bacteria.	7.6	5		Lab oriented training

References

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Course designed by: Dr. Joe Prasad Mathew



SBU24ZO7DSC401: IMMUNOLOGY

Type of Course	Major/Minor		
Course Level	400- 499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the Fundamental components of the immunity	U
CO2	Describe the structural and functional aspects of antigens and antibodies.	U
CO3	Understand the essential genetic make-up and the various mechanisms behind immune response	U
CO4	Analyse the causes of various immune disorders.	An
CO5	Examine and validate the significance of applications of immunology in preserving quality of human life, and analyse & interpret immunological test results.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	-	1	1	1	-	-	-
CO2	1	2	2	-	1	2	1	-	-	-
CO3	1	-	2	-	-	2	1	-	-	-
CO4	-	-	1	1	1	1	1	-	2	1
CO5	1	-	1	2	3	2	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Assignment	Poster	Quiz	Written Test	Written Test	
CO1	-	-	x	x	-	x
CO2	x	-	x	x	-	x
CO3	-	-	x	-	x	x
CO4	-	x	x	-	x	x
CO5	-	-	x	-	x	x

Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Fundamentals of Immunity (8 Hrs)				
Overview of the immune system, Classification of immunity	1.1	1	1	Lecture, Discussion



Innate immunity and defence mechanisms (barriers); Pathogen associated molecular patterns and Pattern recognition receptors; Adaptive Immunity- definition, attributes	1.2	1	3	AV aids
Immune cells and their functions	1.3	1	2	Lecture, Discussion
Organs of immunity- Anatomy of primary and secondary lymphoid organs and their and functions	1.4	1	2	AV aids
Module 2: Antigens and Antibodies (7 Hrs)				
Definition and classification of antigens, Epitope, Haptens, Adjuvants	2.1	2	3	Lecture,
Basic structure of Immunoglobulin, Immunoglobulin classes and subclasses, specific functions. Antibody effector functions	2.2	2	4	AV aids, Quiz
Module 3: Immunoglobulin genes and MHC genes (15 Hrs)				
Multigene organization of immunoglobulin genes	3.1	3	3	Lecture, AV aids
Gene rearrangement and expression	3.2	3	3	Lecture, AV aids
Mechanism of generation of antibody diversity	3.3	3	3	Lecture, AV aids
Organization of MHC genes and MHC molecule	3.4	3	3	Lecture, AV aids
Antigen processing and presentation	3.5	3	3	Lecture, AV aids
Module 4: Immune Response system (15 Hrs)				
Humoral Immune Response- B cell development, activation and differentiation, Clonal selection, Memory B cells and plasma cells, Immunological Memory; Primary and secondary immune response.	4.1	3	4	Lecture, Discussion
Cellular immune response- T cell development, maturation and activation. Th cells and Tc Cells; Effector T cell subsets, Cytotoxic T lymphocytes (CTLs)	4.2	3	5	AV aids
Inflammation- cells, process, type and mediators	4.3	3	3	Lecture, Discussion
Complement system- pathways of complement activation, regulation, Functions of complements.	4.4	3	3	AV aids
Module 5: Immune Disorders (7 Hrs)				
Hypersensitivity - types of hypersensitivity reactions	5.1	4	2	Lecture, Group Discussion
Autoimmunity - causes; classification. Examples- Graves' disease; Hashimoto thyroiditis; Goodpasture's syndrome, Autoimmune anaemia, Pernicious anaemia, SLE. Mechanism of self-tolerance	5.2	4	2	AV aids, case studies, Poster presentations
Immunodeficiency- primary and secondary. 4 examples	5.3	4	3	Lecture, Group Discussion
Module 6: Applications of Immunology (8 Hrs)				
Immunological test for clinical diagnosis- Widal test; ELISA test	6.1	5	1	Lecture, Discussion AV aids, Hands on activity



Vaccines and vaccination- principle, types, merits and demerits, examples	6.2	5	2	Lecture, Discussion AV aids, case studies, Debate, Hands on activity
Monoclonal antibodies – Hybridoma technology, applications MABs	6.3	5	1	Lecture, Discussion
Transplantation immunology and Mechanisms of Graft rejection; Blood grouping and Immunology of blood transfusion; Rh factor incompatibility and Erythroblastosis foetalis	6.4	5	3	Lecture, Discussion AV aids, Hands on activity
Tumour Immunology- Tumour antigens, immune response to tumour	6.4	5	1	Lecture, AV aids.
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

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Course designed by: Dr Jomon K V



SBU24ZO7DSC402: MOLECULAR BIOLOGY

Type of Course	Major/Minor		
Course Level	400-499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall the basic concepts of molecular biology	R
CO2	Elucidate DNA replication mechanisms in both prokaryotic and eukaryotic organisms	U
CO3	Understand transcription and post-transcriptional modifications	U
CO4	Comprehend, genetic code, and the mechanism of gene expression	U
CO5	Analyze different gene regulatory mechanisms	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	2	-	2	1	2	1	-	-	1
CO2	2	1	-	1	-	2	2	-	1	-
CO3	1	2	-	1	1	2	1	-	1	1
CO4	2	2	-	1	1	1	-	-	-	1
CO5	2	1	-	1	1	2	1	-	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	In-class discussions	Video/Documentary Preparation	Group Tutorial work	Open book test	Literature Survey & Comprehensive Reviews	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction (5 Hrs)				
Discovery of DNA as genetic material – Griffith's transformation experiments; Hershey Chase experiment of Bacteriophage infection	1.1	1	3	Lectures, Presentation
Structure of Prokaryotic and Eukaryotic genome	1.2	1	2	Presentation, Discussion



Module 2: DNA Replication (10 Hrs)				
The Michelson-Stahl experiment	2.1	2	1	Presentation, Discussion, Demonstration
Semi-conservative replication of DNA	2.2	2	2	Lectures, Discussion,
Prokaryotic replication, DNA Polymerase- Theta Model, Rolling-Circle Model	2.3	2	3	Discussion, Demonstration
Eukaryotic replication, DNA Polymerase Telomere replication and replication	2.4	2	4	Lectures, Presentation, Discussions
Module 3: Transcription (10 Hrs)				
Substrate for the Transcription - rNTPs	3.1	3	1	Lecture, Presentation
The Transcription Apparatus-RNA polymerases	3.2	3	2	Lecture, Presentation
Prokaryotic Transcription	3.3	3	3	Lecture, Presentation
Eukaryotic Transcription	3.4	3	4	Lecture, Presentation
Module 4: RNA Molecules and Processing (13 Hrs)				
Coding sequences of many eukaryotic genes (exons)are disrupted by noncoding introns	4.1	4	2	Lecture, Presentation
mRNA Structure	4.2	4	2	Presentation
Posttranscriptional modifications to eukaryotic pre-mRNA Capping Splicing and Introns, Alternate Splicing Tailing RNA editing by guide RNA mRNA transport and degradation	4.3	4	3	Lecture, Presentation, Discussion
RNA interference- siRNA, miRNA, and piRNA	4.4	4	2	Lecture, Presentation
Structure of tRNA and its Processing	4.5	4	2	Lecture, Presentation
Structure of Ribosome, Prokaryotic and Eukaryotic rRNA and processing	4.6	4	2	Lecture, Presentation
Module 5 The Genetic code and Translation (12 Hrs)				
Genetic code Characteristics of the Genetic Code Codons Degeneracy and wobble hypothesis	5.1	5	4	Lecture, Presentation
Translation in Prokaryotes and Eukaryotes Initiation, Elongation, Termination	5.2	5	6	Lecture, Presentation
mRNA surveillance	5.3	5	1	Lecture, Presentation
Posttranslational Modifications of Proteins	5.4	5	1	Lecture, Presentation
Module 6: Gene Regulation (10 Hrs)				
Prokaryotic Gene Regulation: Operons Control Transcription in Bacterial Cells Lactose operon, Catabolite repression Galactose Operon Tryptophan Operon Arabinose Operon Lambda Bacteriophage Riboswitches.	6.1	4,5	6	Lecture, Presentation, Discussion



Eukaryotic Gene regulation: Histone modification Chromatin remodelling DNA Methylation, Acetylation Epigenetic Effects	6.2	5	4	Lecture, Presentation, Discussion
Module 7: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

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1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P., Molecular Biology of the Cell, 6th Edition, Garland Science, 2014.
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Course designed by: Mr Joseph Tom



SBU24ZO7DSC403: EXPERIMENTAL METHODS IN BIOLOGY

Type of Course	Major/Minor		
Course Level	400-499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Demonstrate adherence to laboratory safety protocols and ethical principles in biological research	U
CO2	Demonstrate proficiency in performing various molecular biology techniques	A
CO3	Develop skills in cell biology techniques	A
CO4	Acquire competence in physiology and biochemistry techniques	A
CO5	Employ appropriate statistical methods to analyse experimental data and draw meaningful conclusions.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	2	1	1	2	1
CO2	2	2	2	2	2	2	1	1	2	1
CO3	2	2	2	2	2	2	1	1	2	1
CO4	2	2	2	2	2	2	1	1	2	1
CO5	2	2	2	2	2	2	1	1	2	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Quiz	Viva Voce	One minute paper	Written Test	Open book test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	-	x	-	x	-	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Laboratory Safety and Ethics (3 Hrs)				
Basic laboratory safety protocols	1.1	1	2	Lecture, Discussion
Ethical considerations in biological research	1.2	1	1	Lecture, Discussion
Module 2: Molecular Biology Techniques (10 Hrs)				
DNA extraction and purification	2.1	2	2	Lecture & Lab oriented training



Polymerase Chain Reaction (PCR)	2.2	2	3	Lecture & Lab oriented training
Gel electrophoresis methods	2.3	2	3	Lecture & Lab oriented training
Analyse and interpret molecular biology data	2.4	2	2	Lecture & Lab oriented training
Module 3: Cell Biology Techniques (27 Hrs)				
Cultivation and maintaining cell cultures	3.1	3	6	Lecture & Lab oriented training
Microscopy to observe cellular structures and processes	3.2	3	4	Lecture & Lab oriented training
Fluorescence microscopy	3.3	3	3	Lecture & Lab oriented training
Micrometry	3.4	3	2	Lecture & Lab oriented training
Immunocytochemistry and Histochemistry	3.5	3	6	Lecture & Lab oriented training
Centrifugation	3.6	3	2	Lecture & Lab oriented training
Chromatography	3.7	3	4	Lecture & Lab oriented training
Module 4: Physiology and Biochemistry Techniques (10 Hrs)				
Physiological experiments on model organisms	4.1	4	3	Lecture & Lab oriented training
Spectrophotometry and Colorimetry	4.2	4	4	Lecture & Lab oriented training
ELISA	4.3	4	3	Lecture & Lab oriented training
Module 5: Statistical Analysis of Biological Data (10 Hrs)				
Biological data analysis using Excel, PH stat, and SPSS	5.1	5	10	Lecture & Lab oriented training
Module 6: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

References

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Course designed by: Dr. Joe Prasad Mathew



SBU24ZO7DSC404: RESEARCH METHODOLOGY AND BIostatISTICS

Type of Course	Major/Minor		
Course Level	400 - 499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall the fundamental concepts of research, including the scientific method, types of research, and basic principles of research design	R
CO2	Remember the steps involved in statistical investigation, including data collection, organization, and types of sampling methods.	R
CO3	Understand the process of research formulation, including problem selection, literature review, hypothesis formulation, and the importance of research design.	U
CO4	Understand the basics of biostatistics, including descriptive statistics, correlation, regression analysis, mathematical modelling, probability, and hypothesis testing.	U
CO5	Apply knowledge of research methods and biostatistics to design and conduct research studies effectively, formulate research questions, analyse data, and interpret statistical results accurately.	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	3	1	1	1	1	-	1	1
CO2	1	1	2	2	3	1	2	1	3	3
CO3	2	2	2	2	1	2	2	1	3	3
CO4	1	2	2	2	1	2	2	1	3	3
CO5	1	2	2	2	1	2	2	1	3	3

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Home assignments	Concept mapping	Poster presentation	Problem-based assignments	Lab Evaluation	
CO1	x	-	-	-	-	x
CO2	-	x	-	-	-	x
CO3	-	-	x	-	-	x
CO4	-	-	-	x	-	x
CO5	-	-	-	-	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
PART I- RESEARCH METHODOLOGY				
Module 1: Concept of Research (5 Hrs)				
Research- Its Meaning, Objectives and Motivation	1.1	1	1	Lecture/ Presentation
Scientific method and Research Process	1.2	1	1	Lecture/ Presentation
Research methods versus Methodology	1.3	1	1	Lecture/ Presentation
Inductive and Deductive approach	1.4	1	1	Lecture/ Presentation
Types of Research (Descriptive/Analytical, Applied/ Fundamental, Quantitative/Qualitative, Conceptual/ Empirical)	1.5	1	1	Lecture/ Presentation
Module 2: Research Formulation (3 Hrs)				
Selecting the problem and defining the problem	2.1	1,3	1	Presentation/ Activity
Literature review- Identifying gap area from literature review	2.2	1,3	1	Presentation/ Activity
Formulation of hypothesis	2.3	1,3	1	Presentation/ Activity
Module 3: Research Design (4 Hrs)				
Research Design - Meaning, Basic principles, Need and features of good design	3.1	1,3	1	Presentation
Types of research design- Explorative, Descriptive, Diagnostic	3.2	1,3	2	Presentation
Experimental design and principles	3.3	1,3	1	Presentation
Module 4: Scientific Documentation and Communication (7 Hrs)				
Research Paper, Oral presentation, Poster Presentations, Thesis and dissertations	4.1	3	1	Presentation
Research Paper formats and Bibliography styles.	4.2	3	2	Presentation
Reference management software: Mendeley	4.3	3	1	Presentation
Writing Project proposal		3	1	Presentation
Presentation techniques: Assignment, Seminar, Debate, Workshop, Colloquium, Conference	4.4	3	1	Presentation
Research metrics- journal level, article level and author level metrics	4.5	3	1	Presentation
Module 5: Research Considerations and Ethics (4 Hrs)				
Lab protocols, ISO standards for lab safety	5.1	1,3	1	Seminar
Animal rights and animal laws in India; Animal use in research and education	5.2	1,3	1	Seminar
Animal Ethical Committees and Constitution	5.3	1,3	1	Seminar
Experimentation on man and animals, Consent,	5.4	1,3	1	Seminar
PART II – BIOSTATISTICS				
Module 6 - Basics of Biostatistics (7 Hrs)				
Steps in Statistical Investigation	6.1	2,4	1	Presentation
Data and Variable (Collection, Types, Sources)	6.2	2,4	1	Presentation
Population, Sample, Sampling Methods (Random, Cluster, Stratified and Geographical) and Sampling Errors; Bias in sampling	6.3	2,4	1	Presentation



Organization of Data - Editing, Classification, Tabulation, Frequency distribution and its types	6.4	2,4	1	Presentation
Presentation and visualisation of statistical data using software	6.5	2,4	1	Presentation
Types of statistical data and analysis- Parametric and Non-Parametric; Bivariate and Multivariate Analysis. Interpretation and Forecasting	6.6	2,4	2	Presentation
Module7: Descriptive Statistics (4 Hrs)				
Types of descriptive statistics and their use	7.1	2,4	2	Presentation/Lab
Calculation of descriptive statistics	7.2	2,4	2	Presentation/Lab
Module 8: Correlation and Regression Analysis (7 Hrs)				
Correlation - types and methods of correlation analysis	8.1	2,4	2	Practicum
Karl Pearson's correlation coefficient and Spearman's rank correlation	8.2	2,4	2	Practicum
Regression and Line of Best Fit, Types and methods of regression analysis. Graphic Methods (Scatter method, Curve fitting). Regression equation.	8.3	2,4	2	Practicum
Probit analysis	8.4	2,4	1	Practicum
Module 9 - Mathematical Modelling in Biology (3 Hrs)				
Introduction to Mathematical modelling	9.1	2,4	1	Practicum
Length – Weight Relationship in Fishes	9.2	2,4	2	Practicum
Module 10: Probability (4 Hrs)				
Measures of Probability	10.1	2,4	2	Practicum
Theorems in Probability	10.2	2,4	1	Practicum
Probability distributions – Binomial, Poisson and Normal	10.3	2,4	1	Practicum
Module 11: Testing of Hypothesis (12 Hrs)				
Hypothesis and types, Confidence Interval. Level of significance	11.1	5	2	Practicum
Tests of significance (For large and small samples – Critical Ratio and P value)	11.2	5	2	Practicum
Z Test (Problem for small samples), Student 't' test (Problem for small samples comparing mean of two variable)	11.3	5	3	Practicum
Chi- Square Test (Problem for 2×2 table only)	11.4	5	2	Practicum
F-test and Analysis of Variance (ANOVA - One way)	11.5	5	3	Practicum
Module 12: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

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1. Anderson, J, Durston, B.H. and Poole, M., Thesis and Assignment Writing, Wiley Eastern Ltd, 1992.
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Course designed by: Dr Rubin Philip



SBU24ZO7DSE400: TOXICOLOGY, ENVIRONMENTAL MONITORING AND MANAGEMENT

Type of Course	DSE		
Course Level	400-499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Students should be able to demonstrate an understanding of basic toxicological concepts and identify common environmental pollutants.	U
CO2	Students should be able to identify source and types of common environmental pollutants and their effects on ecosystem.	U
CO3	Students should be proficient in selecting and applying appropriate environmental monitoring techniques for different types of pollutants.	A
CO4	Students will be able to conduct human health risk assessments and interpret regulatory frameworks related to environmental pollutants	An
CO5	Students should be able to develop and implement effective environmental management strategies, informed about emerging trends and issues in environmental toxicology and propose solutions to real-world environmental challenges.	E

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	2	1	1	2	1
CO2	2	2	2	2	2	2	1	1	2	1
CO3	2	2	2	2	2	2	1	1	2	1
CO4	2	2	2	2	2	2	1	1	2	1
CO5	2	2	2	2	2	2	1	1	2	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Concept mapping	Quiz	One minute paper	Written Test	Open book test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Environmental Toxicology (4 Hrs)				
Definition and scope of environmental toxicology	1.1	1	1	Lecture, Discussion
Historical perspectives and key milestones	1.2	1	1	Lecture, Discussion
Principles of toxicology and risk assessment	1.3	1	2	Lecture, Discussion
Module 2: Ecotoxicology (18 Hrs)				
Sources and types of pollutants – Air, water and soil pollutants.	2.1	1	2	Lecture, Discussion
Transport mechanism of pollutants in Air, water and soil	2.2	1	2	Lecture, Discussion
Toxicology of Pesticides, Herbicides, Heavy metals and Industrial pollutants	2.3	1	4	Lecture, Discussion
Effects of pollutants on ecosystems: individual, population and community level impact.	2.4	2	4	Lecture, Discussion
Environmental persistence and degradation; Biomagnification and bioaccumulation	2.5	2	3	Lecture, Discussion
Case studies on environmental disasters	2.6	2	3	Review&Discussion
Module 3: Environmental Monitoring Techniques (10 Hrs)				
Air, water and soil monitoring methods	3.1	3	3	Lecture, Discussion
Sampling techniques and analysis	3.2	3	2	Lecture, Discussion
Remote sensing and GIS applications in monitoring	3.3	3	3	Lecture, Discussion
Early warning systems	3.4	3	2	Lecture, Discussion
Module 4: Human Health and Risk Assessment (8 Hrs)				
Assessing human exposure to pollutants	4.1	4	2	Lecture, Discussion
Health risk assessment methodologies	4.2	4	3	Lecture, Discussion
Regulatory frameworks and standards	4.3	4	3	Lecture, Discussion
Module 5: Environmental Management and Policy (12 Hrs)				
Strategies for pollution prevention and control	5.1	5	3	Lecture, Discussion
Environmental impact assessment	5.2	5	3	
Environmental laws and policies - International and national environmental regulations	5.3	5	3	Lecture, Discussion
Case studies on successful environment management programmes.	5.4	5	3	Review & Discussion
Module 6: Emerging Trends in Environmental Toxicology (8 Hrs)				
Nanotoxicology	6.1	6	3	Lecture, Discussion
Endocrine disruptors	6.2	6	3	Lecture, Discussion
Climate change and toxicology	6.3	6	2	Lecture, Discussion
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

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Course designed by: Dr. Joe Prasad Mathew



SBU24ZO7DSE401: ADVANCED BIOCHEMISTRY

Type of Course	DSE		
Course Level	400 - 499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	60	-	60
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the principles of protein architecture	U
CO2	Analyze the mechanism of enzyme action and kinetics	An
CO3	Apply thermodynamic concepts to biochemical systems	A
CO4	Remember and recall metabolic pathways and regulation	R
CO5	Understand the interconnections of metabolic pathways	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	1	1	2	1	1	1	1
CO2	1	2	1	2	1	2	1	2	1	2
CO3	1	1	1	1	1	2	2	1	2	2
CO4	1	2	1	2	2	1	2	1	1	2
CO5	1	1	1	2	1	1	2	1	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Model Building	Concept mapping	One-minute paper	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Protein Architecture (20 Hrs)				
Structure and properties of proteinogenic amino acids, Chirality and optical isomerism in amino acids, pKa and pI of amino acids	1.1	1	3	Board-based teaching
Structure of proteins: Primary structure- Peptide bond and its planar nature, <i>cis</i> and <i>trans</i> conformations, Phi and Psi angles, Ramachandran plot	1.2	1	3	Presentation-based lecture, Concept mapping



Secondary structure- Helical structures: Alpha helix, 310 helix, π helix, Pitch and handedness of helix, Parallel and antiparallel beta sheets, Loops and turns, Random coil	1.3	1	3	Presentation-based lecture, Model-based teaching
Super secondary structures/Motifs: Helix-Turn-Helix, Coiled coil, β -hairpin, Greek key	1.4	1	2	Presentation-based lecture, Gamification
Tertiary structure: Forces stabilizing tertiary structure, Protein Domains: structure and function	1.5	1	2	Presentation-based lecture, Roleplay
Fibrous proteins – Keratin and Collagen	1.6	1	2	Presentation-based lecture
Globular proteins –Molecular structure of Myoglobin, Forces stabilizing quaternary structure Quaternary structure of Haemoglobin	1.7	1	3	Presentation-based lecture, In silico simulations
Protein folding, Molecular Chaperons, GroEL/GroES Chaperonin, Protein denaturation	1.8	1	2	Presentation-based lecture, Narrative-based teaching
Module 2: Enzyme Mechanisms (15 Hrs)				
Mechanism of enzymic action - Lowering of activation energy, concept of binding energy, Lock and key model, induced fit model, Transition state hypothesis, Proximity and orientation effects, substrate strain	2.1	2, 3	3	Presentation-based lecture
Specificity of enzymes, concept of active site, Occurrence of lysine/ cysteine/ serine/histidine residues in the active sit	2.2	1, 2	3	Presentation-based lecture
Catalytic mechanisms- general acid-base catalysis, covalent catalysis, role of metal ion in enzyme catalysis, Mechanism of action of serine proteases - chymotrypsin	2.3	2	3	Presentation-based lecture
Enzyme kinetics- Rate equations for uni-substrate reactions, progress curve for enzyme reactions, Michaelis Menten hyperbolic curve for enzymes, V_o vs $[S]$, V_{max} , derivation of Michaelis -Menten equation applying steady state hypothesis, K_{cat} (turnover number) and K_m and their significance	2.4	2	3	Board-based teaching, Presentation-based lecture
Regulation of enzyme activity- allosteric enzymes, reversible covalent modification, Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate)	2.5	2	3	Presentation-based lecture
Module 3: Bioenergetics (7 Hrs)				
System and surroundings – isolated, closed and open systems, First law of thermodynamics, second law of thermodynamics	3.1	3	3	Presentation-based lecture
Gibbs free energy, endergonic & exergonic reactions, Standard state free energy change- ΔG ,	3.2	3	4	Presentation-based lecture



Relationship between equilibrium constant and ΔG , Feasibility of reactions				
Module 4: Carbohydrate Metabolism & its Regulation (12 Hrs)				
Aerobic and anaerobic pathways, Regulation of glycolysis, fates of pyruvate, Gluconeogenesis, Reciprocal regulation of glycolysis and gluconeogenesis, Glycogen metabolism and its regulation	4.2	4,5	6	Presentation-based lecture, Board-based teaching
Amphibolic & anaplerotic reactions, Regulation of TCA cycle, Malate- Aspartate shuttle	4.3	4,5	4	Presentation-based lecture, Board-based teaching
Pentose phosphate pathway (HMP shunt) and its regulation	4.4	4,5	2	Presentation-based lecture, Board-based teaching
Module 5: Lipid Metabolism & its Regulation (6 Hrs)				
Alpha oxidation, Omega oxidation, Regulation of fatty acid oxidation	5.1	4,5	3	Presentation-based lecture, Board-based teaching
Cholesterol biosynthesis and its regulation	5.2	4,5	2	Presentation-based lecture, Board-based teaching
Production of bile pigments	5.3	4,5	1	Presentation-based lecture
Module 6: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

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2. Bob B. Buchanan, Wilhelm Gruissem, Russell L. Jones, 2015, Biochemistry and Molecular Biology of Plants, Wiley-Blackwell, NJ, USA
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Course designed by: Dr. Philip Litto Thomas



SEMESTER VIII

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24ZO8DSC400	Major	Behavioural Biology	5	75	4
SBU24ZO8DSC401	Major	Genetic Engineering and Biotechnology	5	75	4
SBU24ZO8DSE400	Elective	Wildlife Monitoring and Data Collection	5	75	4
SBU24ZO8DSE401	Elective	Genomics, Proteomics and Bioinformatics	5	75	4
SBU24ZO8PRJ400	Major	Project	-	-	12



SBU24ZO8DSC400: BEHAVIOURAL BIOLOGY

Type of Course	Major		
Course Level	400 - 499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the concepts of behavioural biology and analyse the need for ethological studies	U
CO2	Understand and evaluate the types of animal migrations and its significance	E
CO3	Evaluate various genes and hormones involved in animal behaviour.	An
CO4	Describe the basic of behavioural aspects, instincts and learning in animals, communication and navigation among animals	A
CO5	Recognize the concept of social life, territoriality, dominance hierarchy etc.	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	2	-	-	1	1	1	-	-	1
CO2	2	2	1	1	2	2	2	-	1	1
CO3	1	2	2	2	1	2	2	-	-	2
CO4	2	1	2	1	2	1	2	2	1	2
CO5	2	2	2	2	1	-	2	-	-	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Video/ Documentary	Oral presentation	Viva	Written test	Multiple choice	
CO1	-	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	-	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Viva	Practical skill	Lab note book	Lab report	Standardized test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Behavioural Biology (2 Hrs)				
Historical background and scope of Ethology	1.1	1	1	Lecture
Branches of Ethology, Ethograms	1.2	1	1	Lecture
Module 2: Behavioural Genetics (3 Hrs)				
Genetic basis of behaviour	2.1	3	1	Lecture
Behavioural genetics: Hygienic behaviour of honey bee, Nest building material transport in love birds	2.2	3	2	Group discussion
Module 3: Motivation (3 Hrs)				
Goal oriented drive, Homeostatic and Non-homeostatic drives	3.1	3	2	Lecture
Psycho-hydrologic model of motivation	3.2	3	1	Demonstration
Module 4: Learning and Memory (6 Hrs)				
Types of Learning: Instinct, Imprinting, Habituation Classical conditioning - Pavlov's contribution, Instrumental conditioning, Latent learning, Trial and error learning	4.1	4	4	Lecture
Memory: nature of memory, Types of memory- short- and long-term memory	4.2	4	2	Lecture
Module 5: Communication (4 Hrs)				
Types of Communications: Electrical, Chemical, Olfactory, Auditory, Visual, Tactile	5.1	4	2	Lecture
Dance language of honeybees	5.2	4	1	Lecture,
Pheromonal communication in insects and mammals	5.3	5	1	Field visit
Module 6: Social Behaviour (9 Hrs)				
Socio-biology (Brief account only), Costs and benefits of group living, Evolutionary advantages and disadvantages of group living,	6.1	5	2	Lecture
Dominance hierarchy, Territoriality- territory marking in animals, Aggressive behaviour	6.2	5	2	Lecture
Aggregations – Schooling in fishes, Herding in mammals	6.3	5	2	Discussion
Altruism and reciprocal altruism- Alarm calls-in birds and ground squirrel	6.4	5	1	Lecture
Foraging behaviour -social organization in insects and primates	6.5	5	2	Field study
Module 7: Reproduction and Behaviour (10 Hrs)				
Sexual selection, Mating systems, Reproductive strategies	7.1	5	2	Lecture
Courtship and ritual behaviour - Courtship behaviour in invertebrates, Courtship behaviour in vertebrates- Stickle back behaviour and Peacock dance	7.2	4	4	Lecture
Role of hormones in reproductive behaviour	7.3	4	2	Discussion
Parental care and investment, Nesting behaviour, Care of eggs, larvae and juveniles and young	7.4	4	2	Seminar



Module 8: Complex Behaviour (8 Hrs)				
Orientation, Navigation	8.1	2	1	Lecture
Migration in fishes and birds	8.2	2	3	Group discussion
Navigation cues	8.3	2	1	Seminar
Biological rhythms – Circadian, Circannual, Lunar, Tidal. Genetics of biological rhythms	8.4	4	3	Lecture
Module 9: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 10: Practical				
Study of nesting behaviour of the birds and social insects	10.1	1,4	30	Field observation
Behavioural studies on Siamese fighting fish	10.2	1,4		Laboratory experiment
Study of geotaxis in earthworm	10.2	1,4		Laboratory experiment
Study of phototaxis in Drosophila	10.3	1,4		Laboratory experiment
Study different types of animal behaviour such as habituation, social life, courtship behaviour in insects and birds, and parental care from short videos/movies. At least two videos for each behaviour	10.4	1.4.5		Demonstration/ Video
Study of ethogram -grooming behaviour of cockroach	10.5	1,4		Laboratory experiment
Visit to Forest/Wildlife Sanctuary/Biodiversity Park/Zoological Park to study and record the behavioural activities of animals and prepare a short report.	10.6	1,4,5		Field visit

References

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Course designed by: Dr. Monichan K K



SBU24ZO8DSC401: GENETIC ENGINEERING AND BIOTECHNOLOGY

Type of Course	Major		
Course Level	400 - 499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understanding of the fundamental molecular tools and their applications in DNA modification and cloning	U
CO2	Establish a solid foundation in biotechnology and related disciplines to advance their career prospects in higher education and research	A
CO3	Utilize acquired knowledge to devise strategies for addressing challenges and exploring potential applications in the fields of biotechnology	A
CO4	Understand the ethical and social issues regarding Genetic engineering	An
CO5	Use or demonstrate the basic techniques of biotechnology	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E – Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1	2	2	2	1	1		1
CO2	1	1	1	2	1	1	1	1	1	1
CO3	1	1	1	2	2	1	1		1	1
CO4		1		1	1	1	1	1	1	1
CO5	1	1	1	1	2	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	One minute paper	In-class discussions	Concept mapping	Written test	Problem-based assignment	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Observation of practical skills	Lab notebook	Viva voce	Laboratory report	Standardize d test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Molecular Tools in Biotechnology (12 Hrs)				
Introduction to Genetic Engineering and Biotechnology Enzymes as tools for Genetic Engineering: Restriction Enzymes, DNA-modifying enzymes, T4 and E. coli DNA Polymerase (Klenow), DNA-methylase, Polynucleotide Kinase, DNA-ligase, Taq DNA polymerase, Reverse Transcriptase, T7 and T3 RNA polymerases. Vehicles for DNA cloning: Plasmid DNA vectors, bacteriophage lambda-derived vectors	1.1	1,2,3,5	12	Lecture/Video/ group discussions
Module 2: Recombination and Cloning (12 Hrs)				
DNA (Gene) cloning, Creating recombinant DNA, cDNA library, genomic library. Isolation of gene from gene library. Screening and identification of recombinant DNA clone from gene library. Expression of recombinant protein from a DNA clone in bacteria and purification of the protein. Examples of useful recombinant proteins: Insulin, enzymes, antibodies, vaccines etc.	2.1	1,2,3,5	12	Lecture/Video/ group discussions
Module 3: Recent Advances in Gene Technology (10 Hrs)				
Polymerase Chain Reaction (PCR). Transgenic animals, Ligation, Cloning, Transformation, Gene Targeting: Knock-ins and Knock-outs. Targeted Genome Editing: CRISPRs.	3.1	1,2,3,4,5	10	Lecture/Video/ group discussions
Module 4: Applications of Genetic Engineering and Biotechnology (6 Hrs)				
Somatic gene therapy and germ line gene therapy; DNA vaccines, Therapeutic and reproductive cloning.	4.1	1,2,3,4,5	6	Lecture/Video/ group discussions
Module 5: Ethical Issues in Biotechnology (5 Hrs)				
Potential hazards of biotechnology; Bio war. Bio-ethics - problems and solutions.	5.1	1,2,3,4,5	5	Lecture/Video/ group discussions
Module 6: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 7: Practical				
RNA isolation	7.1	1,2,5		Lab experiment
cDNA preparation	7.2	1,2,5		Lab experiment
PCR Primer designing	7.3	1,2,5		In silico tools
Polymerase Chain Reaction	7.4	1,2,5		Lab experiment



Agarose Gel Electrophoresis	7.5	1,2,5	30	Lab experiment
DNA elution	7.6	1,2,5		Lab experiment
Plasmid DNA isolation	7.8	1,2,5		Lab experiment
Qualitative and quantitative analysis of DNA using spectrophotometer	7.9	1,2,5		Lab experiment
Restriction digestion and Ligation of DNA	7.10	1,2,5		Lab experiment
Transformation of Competent cells	7.11	1,2,5		Lab experiment
Selection of recombinant clones	7.12	1,2,5		Lab experiment

Reference

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Course designed by: Dr. Martin J Babu



SBU24ZO8DSE400: WILDLIFE MONITORING AND DATA COLLECTION

Type of Course	DSE		
Course Level	400- 499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Recall key terms and definitions in wildlife monitoring and data collection.	R
CO2	Understand essential equipment, tools, and ethical guidelines for field data collection.	U
CO3	Apply direct monitoring methods to design wildlife programs.	A
CO4	Apply knowledge of indirect population monitoring methods to assess wildlife populations and habitat conditions accurately.	A
CO5	Analyze wildlife monitoring techniques to assess their suitability and impact in conservation and management practices.	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	1	1	3	1	1	1	1	-	1	1
CO2	1	1	2	2	3	1	2	1	3	3
CO3	2	2	2	2	1	2	2	1	3	3
CO4	1	2	2	2	1	2	2	1	3	3
CO5	1	2	2	2	1	2	2	1	3	3

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Concept mapping	One-minute paper	Oral presentations	Problem-based assignments	Team project report	
CO1	-	x	-	-	-	x
CO2	-	-	x	-	-	x
CO3	x	-	-	-	x	x
CO4	-	-	-	x	x	x
CO5	-	-	x	x	-	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Mapping Basics	Advanced mapping	Use of GIS tools	Case study report	Video Documentary	
CO1	x	-	-	x	x	x
CO2	x	x	-	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction to Wildlife Monitoring (4 Hrs)				
Definition, importance and objectives of wildlife monitoring	1.1	1	1	Presentation
Absolute Abundance, Relative Abundance: Census and Sampling, direct and indirect methods.	1.2	1	2	Presentation
Ethical considerations in wildlife monitoring	1.3	1	1	Presentation
Module 2: Preparation for Field study (2 Hrs)				
Equipment for data collection, Miscellaneous tools for the field. Study specific Inventories for data collection.	2.1	2	1	Heuristic method
Field clothing-use of hides, Do's and Don'ts wild habitats.	2.2	2	1	Heuristic method
Module 3: Population Monitoring - Direct Methods (10 Hrs)				
Direct count - Total Counts and Sample counts	3.1	2,1	2	Demonstration
Sampling Methods-Transect Method-Line and Belt transects, Quadrant sampling	3.2	2,1	1	Demonstration
Relative abundance: Drive counts, Road side Count, Point count Method, Waterhole Census Method.	3.3	2,1	2	Demonstration
Tagging and banding.	3.4	2,1	1	Video
Population estimation methods - Capture-mark-recapture estimate, distance sampling.	3.5	2,1	1	Video
Camera trapping: principles, setup, application, types, and data analysis	3.6	2,1	1	Demonstration
Acoustic monitoring-Call Recording, Bat sound recording.	3.7	2,1	1	Video
Sonogram and Acoustic analysis- Applications in studying vocalizations and behaviour,	3.8	2,1	1	Demonstration
Module 4: Population Monitoring - Indirect Methods (10 Hrs)				
Indirect counts (Sign Survey) – Pellet/Scat/Dung counts, Call counts, and Track counts, Foot Prints, Nest Counts, Den Survey, Day Beds, Diggings	4.1	2,3	3	Field Study, Presentation
Tiger Census, Pug mark - Tiger Pug mark- Design and Measurement. Pugmark Impression Pads Plaster Casts, Tiger Tracer, Digital Pugmark, Criticism of Pugmark census method, Modern Methods in Tiger Monitoring.	4.2	2,3	4	Field Study, Presentation
Introduction to statistical analysis in population monitoring	4.3	2,3	3	Dry Lab
Module 5: Advanced Techniques in Wildlife Monitoring (6 Hrs)				
Radio telemetry: tracking animal movements and behaviour- (VHF Radio Tracking) Satellite Telemetry- (UHF Radio Tracking)	6.1	4,5	2	Video
GPS tracking: applications in migration studies, home range analysis	6.2	4,5	1	Video
Drones in wildlife monitoring: aerial surveys, habitat assessment	6.3	4,5	1	Video
Genetic monitoring - Use of environmental DNA (eDNA) in wildlife assessment, DNA sampling, non-invasive techniques.	6.4	4,5	2	Video



Module 6: Scat Analysis (4 Hrs)				
Scat Identification, Collection and Preservation	7.1	3	2	Demonstration
Quantitative and qualitative analysis of scat samples (microscopic analysis, DNA analysis, frequency of occurrence, volume etc.)	7.2	3	2	Presentation
Module 7: Wildlife Photography (5 Hrs)				
Nature of wildlife photography	8.1	3,4	1	Lecture
Considering Critical Distance	8.2	3,4	1	Presentation
Types of wildlife images and Compositional elements	8.3	3,4	1	Presentation
Photography Basics	8.4	3,4	2	Demonstration
Module 8: Data Analysis and Interpretation (4 Hrs)				
Inventories and Tools, Tabulation	9.1	2	2	Hands on experience
Interpretation of monitoring data: trends, patterns, and implications for management	9.3	2	1	Lecture
Reporting and communication of monitoring data	9.4	2	1	Group Activity
Module 9: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 10: Habitat Monitoring and Assessment using GIS and other tools (30 Hrs)				
Georeferencing and Digitization	10.1	4,5	3	Dry Lab
Layout and study area map	10.2	4,5	3	Dry Lab
Data downloading from USGS & BHUVAN	10.3	4,5	3	Dry Lab
Mapping-DEM, LULC	10.4	4,5	3	Dry Lab
Interpolation- IDW, Kriging	10.5	4,5	3	Dry Lab
Geoprocessing	10.6	4,5	3	Dry Lab
Introduction to statistical software for data analysis	10.7	4,5	3	Dry Lab
Sonogram and Acoustic Study	10.8	4,5	3	Dry Lab
Feather and Hair Studies	10.9	4,5	2	Wet Lab
Scat Analysis	10.10	4,5	2	Wet Lab
Foot Print Identification	10.11	4,5	2	Wet Lab

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Course designed by: Dr. Rubin Philip



SBU24ZO8DSE401: GENOMICS, PROTEOMICS AND BIOINFORMATICS

Type of Course	DSE		
Course Level	400 - 499		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understand the fundamental principles of genomics, proteomics, and bioinformatics	U
CO2	Understand advanced techniques used to obtain genomic and proteomic data	U
CO3	Understand the modes of data storage in biological databases	U
CO4	Analyze genomic and proteomic data using various analytical tools	An
CO5	Apply genomic and proteomic data to predict and simulate biomolecular interactions	A

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	1	1	1	1	2	1	1	1	1
CO2	1	2	1	2	1	2	1	2	1	2
CO3	1	1	1	1	1	2	2	1	2	2
CO4	1	2	1	2	2	1	2	1	1	2
CO5	1	1	1	2	1	1	2	1	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Popular science writing	Concept mapping	One-minute paper	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Observation of practical skills	Lab Notebook	Viva voce	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Introduction (3 Hrs)				
DNA, RNA and proteins as information molecules; Sequence – structure-function relationship	1.1	1	2	Presentation-based lecture, In-class discussion
Concept of genome and proteome	1.2	1	1	Presentation-based lecture
Module 2: Genome Sequencing (9 Hrs)				
Genome sequencing projects	2.1	1,2	2	Presentation-based lecture
DNA sequencing: Sanger method, Maxam-Gilbert method	2.2	1,2	3	Presentation-based lecture
Next Generation Sequencing (NGS): Pyrosequencing	2.3	1,2	2	Presentation-based lecture
Gene expression profiling: DNA microarray	2.4	1,2	2	Presentation-based lecture, Virtual lab
Module 3: Proteomics (5 Hrs)				
Isoelectric focusing, 2-D electrophoresis	3.1	1, 2	2	Presentation-based lecture, Virtual lab
MALDI-ToF mass spectrometry, Peptide mass fingerprinting	3.2	1, 2	3	Presentation-based lecture
Module 4: Biological Databases (6 Hrs)				
Nucleotide sequence database: GenBank Protein sequence database: UniProt-KB Structure database: PDB	4.1	1,3	6	Demonstration, Flipped classroom
Module 5: Sequence Analysis (8 Hrs)				
Methods of sequence alignment: Pair-wise alignment-BLAST; Multiple sequence alignment- CLUSTAL W Local and Global alignments, Gaps and gap penalties	5.1	1.4	6	Presentation-based lecture, Board-based teaching
Scoring schemes: basic concept of a scoring matrix, PAM and BLOSUM matrices	5.2	1,4	2	Presentation-based lecture
Module 6: Comparative Genomics (4 Hrs)				
Concepts of Similarity, Identity, Homology, Paralogy and Orthology	6.1	1	2	Presentation-based lecture
Inferring phylogenetic relationship from sequence comparison, Gene tree versus Species tree	6.2	1,4	2	Presentation-based lecture
Module 7: In silico Predictions & Simulations (6 Hrs)				
Gene prediction using ORF, Codon bias, Intron-Exon junctions, CpG islands, Regulatory elements	7.1	1,5	2	Presentation-based lecture
Biomolecular structure visualization tools	7.2	1,5	1	Demonstration
Structure-based drug design, Molecular docking	7.3	1,5	3	Presentation-based lecture



Module 8: New Approaches in Bioinformatics (4 Hrs)				
Metabolomics	8.1	1,4	1	Presentation-based lecture
Gene Interaction Networks, Systems Biology	8.2	1,5	2	Presentation-based lecture
Synthetic Biology	8.3	1,4	1	Presentation-based lecture, In-class discussion
Module 9: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 10: Practical				
Database file formats - FASTA, GenBank	10.1	3	30	Web-based lab
Biological database search and data retrieval using NCBI, SWISS-PROT, PDB	10.2	3,4		Web-based lab
Pairwise sequence alignment using BLAST	10.3	3,4		Web-based lab, In silico data analysis
Multiple sequence alignment using CLUSTALW	10.4	4		Web-based lab, In silico data analysis
Phylogenetic tree building using MEGA	10.5	4		In silico data analysis
Promoter prediction using Promoter 2.0 Prediction Server	10.6	4		Web-based lab, In silico prediction
Gene prediction using GENSCAN	10.7	4		Web-based lab, In silico prediction
Identify Conserved Domains within Proteins using CD-Search	10.8	4		Web-based lab, In silico data analysis
Protein function analysis using PANTHER	10.9	4		Web-based lab, In silico data analysis
Gene interaction network analysis using STRING	10.10	4		Web-based lab, In silico data analysis
Protein structure analysis using RASMOL	10.11	5		In silico simulation

Reference

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Course designed by: Dr. Philip Litto Thomas



SBU24ZO8PRJ400: PROJECT

Type of Course	Major (Honours with Research)		
Course Level	400-499		
Credit	12		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	-	-	-
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Demonstrate advanced research skills	A
CO2	Conduct independent inquiry and scholarship	An
CO3	Develop problem-solving and critical thinking skills	E
CO4	Demonstrate proficiency in data analysis and interpretation	An
CO5	Communicate research findings effectively	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2	1	1	1	1	2
CO2	2	2	2	2	2	1	2	1	2	2
CO3	2	2	2	2	2	1	1	1	1	2
CO4	2	2	2	2	2	1	1	2	2	2
CO5	2	2	2	2	2	1	1	2	1	2



COURSES IN BEHAVIOURAL BIOLOGY



SEMESTER I

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BB1DSC100	Minor	Essentials of Human Biology	5	75	4



SBU24BB1DSC100: ESSENTIALS OF HUMAN BIOLOGY

Type of Course	Minor		
Course Level	100-199		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Understanding of the characteristics of life, levels of biological organization, and the concept of homeostasis	U
CO2	Describe the structure and function of cells and tissues and comprehend the organization of the human body	U
CO3	Understand the basics of human heredity and the genetic evidence supporting human evolution and variation	U
CO4	Explore the mechanisms of biological evolution and the influence of biocultural factors on human populations	U
CO5	Explain the basic functions of the immune system and appreciate the principles of active and passive immunity	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	1	1	1	1	1
CO2	-	-	-	-	-	1	1	1	1	1
CO3	-	-	-	-	-	1	1	1	1	1
CO4	-	-	-	-	-	1	1	1	1	1
CO5	-	-	-	-	-	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Poster presentation	Concept mapping	One-minute paper	MCQ	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Observation of practical skills	Lab Notebook	Viva voce	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Organization of Life (8 Hrs)				
Characteristics of life	1.1	1	2	Lecture/Video
Levels of biological organization	1.2	1	2	Lecture/Video
Basic chemicals of life, Energy requirement of life	1.3	1	2	Presentation-based lecture
Significance of Metabolism	1.4	1	2	Presentation-based lecture
Module 2: Cell-The Basic Unit of Life (10 Hrs)				
Overview of cell structure	2.1	2	1	Presentation-based lecture
Structure and function of the plasma membrane	2.2	2	2	Lecture/Video
Cellular compartmentalization: Organelles	2.4	2	4	Presentation-based lecture
Nucleus, Chromosomes and Karyotype	2.5	2	3	Presentation-based lecture
Module 3: Human Heredity (10 Hrs)				
Genes and DNA	3.1	3	4	Presentation-based lecture
Determination of sex	3.2	3	2	Presentation-based lecture
Mutation, Chromosomal abnormalities	3.3	3	4	Lecture/Video
Module 4: Human Evolution (9 Hrs)				
Mechanism of biological evolution	4.1	4	3	Presentation-based lecture
Evolution of modern humans	4.2	4	2	Lecture/Video
Human variation	4.5	4	2	Presentation-based lecture
Biocultural evolution	4.6	4	2	Lecture/Video
Module 5: Immunity (8 Hrs)				
The first and second lines of defence	5.1	5	2	Lecture/Video
Antigens and Antibodies	5.2	5	2	Presentation-based lecture
Active and Passive Immunity	5.3	5	2	Presentation-based lecture
Vaccination	5.4	5	2	Presentation-based lecture
Module 6: Teacher Specific Content <i>(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)</i> This content will be evaluated internally				



Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 7: Practical				
Good Laboratory Practices	7.1	1	30	Lab orientation
Familiarising with the Microscope	7.2	2		Lab activity
Examination of cheek cells under the microscope	7.3	2		Lab activity
Use of Punnett Square and coloured beads to understand Mendelian inheritance	7.4	3		Lab activity
Identification of chromosomal abnormalities using karyotyping images	7.5	3		Lab activity
Simulation of permeability of the cell membrane using dialysis tubing.	7.6	2		Lab activity
Study of evolutionary processes and their effects on populations over time using simulation software (Avida-ED / BREVE).	7.7	4		Computer-based activity

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Course designed by: Dr. Philip Litto Thomas



SEMESTER II

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BB2DSC100	Minor	Human Body Systems	5	75	4



SBU24BB2DSC100: HUMAN BODY SYSTEMS

Type of Course	Minor		
Course Level	100-199		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Describe the concept of homeostasis and its importance in maintaining the internal environment	U
CO2	Outline the process of digestion and its key components	U
CO3	Explain the functions of the circulatory and respiratory systems	U
CO4	Understand the basic organization of the reproductive system	U
CO5	Describe the process of human development through different stages	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	1	1	1	1	1
CO2	-	-	-	-	-	1	1	1	1	1
CO3	-	-	-	-	-	1	1	1	1	1
CO4	-	-	-	-	-	1	1	1	1	1
CO5	-	-	-	-	-	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Poster presentation	Concept mapping	Case study Analysis	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Observation of practical skills	Lab Notebook	Viva voce	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Organization of the Body (5 Hrs)				
Tissues	1.1	1	2	Presentation-based lecture
Overview of Organs and Organ Systems	1.2	1	1	Lecture/Video
The Internal Environment and Homeostasis	1.3	1	1	Presentation-based lecture
Biological Rhythms	1.4	1	1	Presentation-based lecture, Discussion
Module 2: Digestive System and Nutrition (10 Hrs)				
Parts of the Digestive System	2.1	2	2	Presentation-based lecture
Overview of Digestion	2.2	2	2	Presentation-based lecture
The Gut-Brain axis	2.3	2	1	Presentation-based lecture
Classes of nutrients	2.4	2	2	Presentation-based lecture
Eating disorders; Obesity and Weight control; BMI	2.5	2	3	Presentation-based lecture
Module 3: Cardio-Vascular System (12 Hrs)				
Arteries, Veins and Capillaries Heart as a double pump Pulmonary circuit; Systemic circuit	3.1	3	6	Presentation-based lecture, Video
Composition of blood; Functions of blood; Human blood types	3.2	3	4	Presentation-based lecture
Pulse rate, ECG	3.3	3	2	Lecture/Video
Module 4: Respiratory System (6 Hrs)				
The upper respiratory tract The lower respiratory tract	4.1	3	3	Presentation-based lecture
Inspiration and Expiration	4.2	3	2	Lecture/Video
Control of breathing	4.3	3	1	Presentation-based lecture
Module 5: Reproductive System (6 Hrs)				
Male reproductive system	5.1	4	2	Presentation-based lecture
Female reproductive system	5.2	4	2	Presentation-based lecture
Ovarian cycle	5.3	4	2	Presentation-based lecture
Module 6: Human Development and Ageing (6 Hrs)				
Fertilization and Implantation	6.4	5	2	Presentation-based lecture



Childbirth and Lactation	6.2	5	2	Presentation-based lecture
Ageing and Death	6.4	5	2	Presentation-based lecture
Module 7: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 8: Practical				
Examination of prepared slides of different tissue types	8.1	1	30	Lab activity
Blood typing	8.2	3		Lab experiment
Measure pulse rates under different conditions (resting, after exercise, after meditation) using a Stethoscope	8.3	3		Lab activity
Monitor blood pressure using a Sphygmomanometer	8.4	3		Lab activity
Study of models of human organs and organ systems	8.5	3		Lab activity
Activity of salivary amylase on starch	8.6	2		Lab experiment
Calculation of BMI	8.7	2		Lab activity
Microscopic observation of gametes and embryos	8.8	4,5		Lab activity

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Course designed by: Dr. Philip Litto Thomas



SEMESTER III

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BB3DSC200	Minor	Neurophysiology and Endocrinology	5	75	4



SBU24BB3DSC200: NEUROPHYSIOLOGY AND ENDOCRINOLOGY

Type of Course	Minor		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Demonstrate a comprehensive understanding of the organization and function of the nervous system	U
CO2	Articulate the underlying mechanisms governing neural conduction and synaptic transmission	U
CO3	Analyze various classes of neurotransmitters, and their interactions with receptors, and comprehend the mechanism of drug action	An
CO4	Describe the anatomical structures and physiological functions of the endocrine system	U
CO5	Interpret the complex interplay between the nervous and endocrine systems in orchestrating vital physiological processes	An

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	1	1	2
CO2	-	-	-	-	-	2	2	1	2	2
CO3	-	-	-	-	-	2	2	1	2	2
CO4	-	-	-	-	-	2	1	1	1	1
CO5	-	-	-	-	-	2	2	2	2	2

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Poster presentation	Concept mapping	One-minute paper	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Lab involvement	Viva-voce	In-class Discussion	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Course Content & Transaction Mechanism

Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: The Nervous System (10 Hrs)				
General layout of the Nervous System	1.1	1	1	Lecture/Video
Structure of a typical neuron; Types of neurons	1.2	1	2	Lecture/Video
Glial cells; Myelin sheath	1.3	1	1	Presentation-based lecture
The Central Nervous System; Five Major Divisions of the Brain	1.4	1	3	Presentation-based lecture
The Limbic System and Basal Ganglia	1.5	1	2	Presentation-based lecture
The Peripheral Nervous System	1.6	1	1	Presentation-based lecture
Module 2: Neural Conduction (10 Hrs)				
Membrane Potential; Resting Membrane Potential	2.1	2	2	Presentation-based lecture
Generation of Action Potential; Conduction of Action Potential; Saltatory conduction	2.2	2	4	Lecture/Video
Structure of Synapse; Synaptic Transmission	2.3	2	2	Lecture/Video
Neuromuscular Junction	2.5	2	1	Presentation-based lecture
Module 3: Neurotransmitters (10 Hrs)				
Overview of the Neurotransmitter Classes	3.1	3	4	Presentation-based lecture
Activation of Receptors by Neurotransmitter Molecules	3.2	3	1	Presentation-based lecture
Reuptake, Enzymatic Degradation, and Recycling of Neurotransmitters	3.3	3	3	Presentation-based lecture
Effect of Drugs on Synaptic Transmission	3.4	3	2	Lecture/Video
Module 4: Endocrinology (15 Hours)				
Hypothalamus and Pituitary Gland	4.1	4,5	4	Presentation-based lecture
Thyroid Gland	4.2	4	2	Presentation-based lecture
Adrenal Gland	4.3	4,5	2	Presentation-based lecture
Pineal Gland	4.4	4,5	1	Presentation-based lecture
Testes and Ovaries	4.5	4	4	Presentation-based lecture
Endocrine Disrupting Chemicals	4.6	4	2	Presentation-based lecture



Module 5: Teacher Specific Content

(This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned)

This content will be evaluated internally

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 6: Practical				
Microscopic study of prepared slides of neurons and glial cells	6.1	2	30	Lab activity
Study of the human brain sections	6.2	2		Lab activity
Simulation of action potential using PhysioEx	6.3	3		Computer simulation
Case studies of endocrine disorders	6.4	3		Case study
Microscopic study of endocrine gland sections	6.5	2		Lab activity

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Course designed by: Dr. Philip Litto Thomas



SEMESTER IV

Course Code	Type of Course	Course Title	Hours /Week	Total Hours	Credit
SBU24BB4DSC200	Minor	Neurobiology of Behaviour	5	75	4



SBU24BB4DSC200: NEUROBIOLOGY OF BEHAVIOUR

Type of Course	Minor		
Course Level	200-299		
Credit	4		
Course Delivery Duration	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
	45	30	75
Pre-requisite (if any)			

Course Outcomes

No.	Description	Cognitive Level
CO1	Analyse the multifactorial influences on hunger and eating behaviours, integrating physiological, psychological, and environmental factors to develop strategies for promoting healthy eating habits.	An
CO2	Evaluate the impact of circadian rhythms and sleep-wake cycles on cognitive function, emotional regulation, and overall health, and formulate strategies for optimizing sleep hygiene and managing sleep disruptions.	E
CO3	Assess the synaptic mechanisms underlying learning and memory processes, including Long-Term Potentiation (LTP) and hippocampal function, to understand the neural basis of memory formation and retention.	U
CO4	Examine the interplay between neural circuits regulating emotions, stress response systems, and immune function, and develop strategies for enhancing emotional resilience and coping with stressors	A
CO5	Investigate the neurobiological basis of sexual differentiation, mating behaviours and sexual orientation.	U

Cognitive Levels: R – Remember; U – Understand; A – Apply; An – Analyse; E - Evaluate

Course Mapping Table

CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	-	-	-	-	-	2	2	1	2	2
CO2	-	-	-	-	-	2	2	1	2	2
CO3	-	-	-	-	-	2	2	1	2	2
CO4	-	-	-	-	-	2	2	1	1	2
CO5	-	-	-	-	-	1	1	1	1	1

Mapping of CO to Assessment Tools (Theory)

CO	Formative Assessment			Summative Assessment		ESE
	Poster presentation	Concept mapping	One-minute paper	Open book test	Written test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x



Mapping of CO to Assessment Tools (Practical)

CO	Formative Assessment			Summative Assessment		ESE
	Case study Analysis	Lab Notebook	Viva voce	Laboratory report	Standardized Test	
CO1	x	x	x	x	x	x
CO2	x	x	x	x	x	x
CO3	x	x	x	x	x	x
CO4	x	x	x	x	x	x
CO5	x	x	x	x	x	x

Course Content & Transaction Mechanism Theory

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 1: Hunger and Eating (8 Hrs)				
Theories of hunger and eating: Set points assumption and Positive incentive perspective	1.1	1	2	Lecture/Video
Factors that influence what, when and how much we eat	1.2	1	3	Presentation-based lecture
Role of blood glucose levels in hunger and satiety	1.3	1	1	Lecture/Video
Satiety peptides of the gut; Role of serotonin in satiety	1.4	1	2	Presentation-based lecture
Module 2: Sleep and Wakefulness (12 Hrs)				
Circadian Rhythms; Sleep-Wake cycle Changes in circadian rhythms: shift work and jet lag	2.1	2	2	Presentation-based lecture
Circadian clock in the Suprachiasmatic nuclei (SCN); Regulation of sleep-wake cycles by SCN	2.2	2	2	Lecture/Video
Stages of sleep; Brain activity during sleep; Measuring brain activity- EEG	2.3	2	3	Lecture/Video
Effects of sleep deprivation on cognition, mood, and health	2.4	2	1	Presentation-based lecture
Biological perspectives on dreaming	2.5	2	2	Presentation-based lecture
Brain mechanisms of wakefulness	2.6	2	2	Presentation-based lecture
Module 3: Learning and Memory (10 Hrs)				
Types of learning: Stimulus-Response learning, Motor learning, Perceptual learning, Relational learning	3.1	3	4	Presentation-based lecture
Types of memory: sensory, short-term and long-term memory	3.2	3	3	Presentation-based lecture
Synaptic mechanism of learning and memory: Long-Term Potentiation (LTP)	3.3	3	2	Presentation-based lecture
Role of the Hippocampus in learning and memory	3.4	3	1	Presentation-based lecture
Module 4: Emotions and Stress (7 Hrs)				
Fear and Anxiety; Role of the amygdala in fear	4.1	4	2	Presentation-based lecture



Stress and the Hypothalamus-Pituitary-Adrenal Cortex (HPA) axis	4.2	4	2	Presentation-based lecture
Effects of stress on the immune system	4.3	4	2	Presentation-based lecture
Aggression and Testosterone	4.4	4	1	Lecture/Video
Module 5: Sexual Behaviour (8 Hrs)				
Sex differences in the brain	5.1	5	1	Presentation-based lecture
Role of sex hormones (testosterone, estrogen) in sexual motivation	5.2	5	2	Presentation-based lecture
Mating behaviour	5.3	5	2	Lecture/Video
Parental behaviour	5.4	5	2	Lecture/Video
Role of pre-natal environment in sexual orientation	5.5	5	1	Presentation-based lecture
Module 6: Teacher Specific Content (This can be either classroom teaching, practical session, field visit etc. as specified by the teacher concerned) This content will be evaluated internally				

Practical

Course Content	Unit	CO	Hours	Transaction Mechanism
Module 7: Practical				
Study learning and memory capabilities of Drosophila using olfactory conditioning.	7.1	3	30	Lab experiment
Analysis of blood glucose levels during i) fasting ii) before a meal iii) after a meal Correlate glucose levels with hunger and satiety.	7.2	1		Lab activity
Study sleep-wake cycles by analysing sleep diaries over several nights.	7.3	2		Lab activity
Measurement of physiological markers of stress, (heart rate and blood pressure) under standardized stressor (cold pressor test).	7.4	4		Lab experiment

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Rubrics for Assessment Tools

Each course contains specific assessment tools. However, the faculty teaching the course has the freedom to alter these tools according to the course requirements, with prior permission from the respective Board of Studies.

1. Rubrics for Case-study Analysis

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Data Interpretation and Analysis	<p>- Thorough Analysis: Extracts relevant information from data.</p> <p>- Patterns and Trends: Identifies key patterns and trends. - Statistical Competence: Applies appropriate statistical methods.</p>	<p>- Solid Interpretation: Understands data implications.</p> <p>- Recognizes Patterns: Identifies trends. - Basic Statistics: Uses simple statistical tools.</p>	<p>- Basic Analysis: Describes data without depth.</p> <p>- Limited Pattern Recognition: Misses nuances.</p> <p>- Minimal Statistics: Lacks statistical rigor.</p>	<p>- Superficial Interpretation: Fails to analyze data. - No Pattern Recognition: Ignores trends. - No Statistics: No quantitative analysis.</p>
Critical Thinking and Problem-Solving	<p>- Analytical Skills: Evaluates case components critically. - Problem Identification: Identifies key issues. - Innovative Solutions: Proposes creative approaches.</p>	<p>- Reasoned Analysis: Assesses case elements logically. - Problem Recognition: Identifies challenges. - Some Creativity: Suggests practical solutions.</p>	<p>- Basic Problem-Solving: Recognizes straightforward issues. - Limited Analysis: May miss nuances. - Minimal Creativity: Lacks novel ideas.</p>	<p>- Lacks Critical Thinking: Fails to evaluate case. - No Problem Recognition: Ignores challenges. - No Creativity: No innovative solutions.</p>
Evidence-Based Reasoning	<p>- Scientific Literature: Draws from peer-reviewed research. - Cites Sources: References relevant studies or articles. - Critical Evaluation: Assesses the quality of evidence.</p>	<p>- Uses Literature: Incorporates scientific sources. - Some Citations: Refers to relevant studies. - Basic Evaluation: Considers evidence quality.</p>	<p>- Limited Use of Literature: May lack citations. - Minimal Evaluation: Accepts evidence at face value. - No Critical Assessment: Ignores evidence quality.</p>	<p>- No Evidence Base: Fails to support arguments. - No Citations: Lacks references. - No Evaluation: Ignores evidence quality.</p>
Communication and Presentation	<p>- Effective Expression: Communicates findings clearly.</p> <p>- Logical Structure: Presents information coherently.</p> <p>- Conciseness: Avoids unnecessary verbosity.</p>	<p>- Clear Communication: Conveys thoughts understandably.</p> <p>- Basic Structure: Sections are discernible. - Some Conciseness: Minimizes unnecessary details.</p>	<p>- Basic Clarity: Some ambiguity in communication.</p> <p>- Limited Structure: May lack clear organization.</p> <p>- Verbose: Includes extraneous information.</p>	<p>- Unclear Communication: Fails to express ideas. - No Structure: Lacks organization. - Verbose and Confusing: Overly wordy and unclear.</p>



2. Rubrics for Concept Maps

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Accuracy of Concepts	All concepts accurately represented; demonstrates deep understanding.	Most concepts accurately represented; some minor inaccuracies.	Some concepts inaccurately represented; significant gaps in understanding.	Many concepts inaccurately represented; lacks understanding.
Clarity of Structure	Clear and logical organization; easy to follow relationships.	Generally clear organization; some areas could be improved.	Structure lacks clarity; relationships are unclear.	Poorly organized; difficult to follow.
Use of Visual Elements	Effective use of visual elements (color, size, icons, etc.) enhances understanding.	Visual elements used appropriately; some missed opportunities.	Limited use of visual elements; not fully integrated.	Minimal or no use of visual elements.
Effective Communication	Precise labels and linking phrases; communicates complex ideas effectively.	Labels and linking phrases are clear; occasional ambiguity.	Labels and linking phrases lack precision; communication is basic.	Unclear labels; ineffective communication.

3. Rubrics for Group Discussion/In-class Discussion

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Knowledge and Understanding	<ul style="list-style-type: none"> - Comprehensive Knowledge: Demonstrates deep understanding of biological concepts. - Integration: Connects ideas across topics. - In-Depth Responses: Provides detailed answers. 	<ul style="list-style-type: none"> - Solid Understanding: Grasps essential biological principles. - Some Integration: Relates concepts within topics. - Reasonable Depth: Provides relevant information. 	<ul style="list-style-type: none"> - Basic Knowledge: Covers basic biological principles. - Limited Integration: Concepts remain isolated. - Surface-Level Responses: Brief answers. 	<ul style="list-style-type: none"> - Superficial Understanding: Lacks depth. - No Integration: Concepts are disjointed. - Minimal Knowledge: Provides minimal information.
Critical Thinking and Analysis	<ul style="list-style-type: none"> - Analytical Skills: Evaluates information critically. - Evidence-Based: Supports arguments with relevant data. - Synthesis: Combines multiple viewpoints. 	<ul style="list-style-type: none"> - Reasoned Analysis: Assesses information logically. - Some Evidence: Uses data to support claims. - Basic Synthesis: Combines limited perspectives. 	<ul style="list-style-type: none"> - Basic Analysis: Identifies key points. - Limited Evidence: May lack data-based support. - Minimal Synthesis: Presents isolated viewpoints. 	<ul style="list-style-type: none"> - Lacks Analysis: Fails to evaluate information. - No Evidence: Claims lack support. - No Synthesis: Presents disjointed perspectives.



Evidence-Based Reasoning	- Scientific Literature: Draws from peer-reviewed research. - Cites Sources: References relevant studies or articles. - Critical Evaluation: Assesses the quality of evidence.	- Uses Literature: Incorporates scientific sources. - Some Citations: Refers to relevant studies. - Basic Evaluation: Considers evidence quality.	- Limited Use of Literature: May lack citations. - Minimal Evaluation: Accepts evidence at face value. - No Critical Assessment: Ignores evidence quality.	- No Evidence Base: Fails to support arguments. - No Citations: Lacks references. - No Evaluation: Ignores evidence quality.
Active Participation and Engagement	- Contributor: Actively participates in discussions. - Quality Contributions: Adds value to the conversation. - Engages Peers: Responds to others' ideas.	- Engaged Participant: Contributes to discussions. - Reasonable Quality: Provides relevant input. - Acknowledges Peers: Responds to classmates.	- Basic Participation: Minimal involvement. - Limited Quality: Offers basic comments. - Minimal Engagement: Rarely responds to peers.	- Passive: Rarely participates. - No Quality Contributions: Adds little value. - No Peer Interaction: Ignores classmates.

4. Rubrics for Lab Involvement

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Attendance and Punctuality	Consistently attends all lab sessions on time. Demonstrates exceptional punctuality.	Attends most lab sessions on time. Rare instances of lateness.	Irregular attendance; occasional lateness.	Frequent absences; consistently late.
Initiative and Engagement	Actively participates in lab activities. Takes initiative to explore beyond the assigned tasks.	Engages in lab activities; occasionally demonstrates initiative.	Minimal engagement; follows instructions without additional effort.	Passive participation; lacks initiative.
Data Collection and Interpretation	Accurately collects data during experiments. Demonstrates thorough understanding of data interpretation.	Collects data with minor errors. Adequate interpretation of results.	Incomplete data collection; limited interpretation.	Inaccurate data collection; misinterprets results.



5. Rubrics for One-minute Test

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Content Knowledge	<ul style="list-style-type: none"> - Comprehensive Knowledge: Demonstrates deep understanding of biological concepts. - Precision: Accurate and relevant answers. - Integration: Connects ideas across topics. 	<ul style="list-style-type: none"> - Solid Understanding: Grasps essential biological principles. - Reasonable Precision: Mostly accurate responses. - Some Integration: Relates concepts within topics. 	<ul style="list-style-type: none"> - Basic Knowledge: Covers basic biological principles. - Limited Precision: May contain minor inaccuracies. - Isolated Concepts: Concepts remain separate. 	<ul style="list-style-type: none"> - Superficial Understanding: Lacks depth. - Inaccurate Content: Significant factual errors. - No Integration: Concepts are disjointed.
Prioritization of Information	<ul style="list-style-type: none"> - Effective Prioritization: Focuses on key points. - Relevance: Addresses the most critical aspects. - Avoids Irrelevant Details: Omits non-essential information. 	<ul style="list-style-type: none"> - Reasonable Prioritization: Highlights important points. - Mostly Relevant: Covers essential aspects. - Some Conciseness: Minimizes unnecessary details. 	<ul style="list-style-type: none"> - Basic Prioritization: Some key points included. - Partial Relevance: May stray from critical aspects. - Verbose: Includes extraneous information. 	<ul style="list-style-type: none"> - Poor Prioritization: Fails to emphasize critical points. - Irrelevant Details: Includes non-essential information. - No Conciseness: Overly wordy.
Conciseness and Clarity	<ul style="list-style-type: none"> - Clear Expression: Communicates ideas succinctly. - No Ambiguity: Avoids vague language. - Effective Language: Uses precise terms. 	<ul style="list-style-type: none"> - Concise Communication: Conveys thoughts clearly. - Basic Clarity: Understandable language. - Some Precision: Uses relevant terminology. 	<ul style="list-style-type: none"> - Limited Conciseness: Some unnecessary wording. - Ambiguity: May lack clarity. - Minimal Precision: General language. 	<ul style="list-style-type: none"> - Verbose: Overly wordy responses. - Unclear: Fails to express ideas succinctly. - No Precision: Lacks relevant terms.
Time Management and Efficiency	<ul style="list-style-type: none"> - Effective Time Use: Maximizes content within the time limit. - Prioritization: Focuses on high-value questions. - Avoids Delays: No time wasted. 	<ul style="list-style-type: none"> - Reasonable Time Management: Addresses key questions. - Basic Prioritization: Allocates time to critical aspects. - Some Efficiency: Minimizes delays. 	<ul style="list-style-type: none"> - Limited Time Use: May miss some questions. - Partial Prioritization: Uneven time allocation. - Minimal Efficiency: Some delays. 	<ul style="list-style-type: none"> - Poor Time Management: Fails to cover essential questions. - No Prioritization: Ignores critical aspects. - Inefficient: Significant delays.



6. Rubrics for Open-book Test

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Understanding of Core Concepts	<p>- In-Depth Knowledge: Demonstrates a deep understanding of fundamental biological principles.</p> <p>- Conceptual Connections: Integrates concepts across topics.</p> <p>- Application: Applies core concepts to novel scenarios.</p>	<p>- Solid Understanding: Grasps essential biological concepts.</p> <p>- Some Integration: Relates concepts within topics.</p> <p>- Basic Application: Applies known concepts.</p>	<p>- Basic Knowledge: Covers basic biological principles.</p> <p>- Limited Integration: Concepts remain isolated.</p> <p>- Minimal Application: Struggles with novel situations.</p>	<p>- Superficial Understanding: Lacks depth. - No Integration: Concepts are disjointed. - No Application: Fails to apply knowledge.</p>
Critical Analysis and Evaluation	<p>- Analytical Thinking: Evaluates information critically.</p> <p>- Evidence-Based: Supports arguments with relevant data.</p> <p>- Synthesis: Combines multiple sources to form conclusions.</p>	<p>- Reasoned Analysis: Assesses information logically. - Some Evidence: Uses data to support claims.</p> <p>- Basic Synthesis: Combines limited sources.</p>	<p>- Basic Analysis: Identifies key points. - Limited Evidence: May lack data-based support. - Minimal Synthesis: Presents isolated information.</p>	<p>- Lacks Analysis: Fails to evaluate information. - No Evidence: Claims lack support. - No Synthesis: Presents disjointed points.</p>
Application of Knowledge	<p>- Practical Application: Translates theoretical knowledge into practical solutions.</p> <p>- Problem-Solving: Applies biological concepts to real-world scenarios.</p> <p>- Innovative Solutions: Proposes creative applications.</p>	<p>- Applied Knowledge: Uses concepts in practical contexts. - Basic Problem-Solving: Addresses straightforward problems. - Limited Creativity: Solutions follow standard approaches.</p>	<p>- Limited Application: Struggles with practical scenarios. - Basic Problem Recognition: Identifies issues but lacks solutions. - Minimal Creativity: No novel applications.</p>	<p>- No Application: Fails to apply knowledge practically. - No Problem-Solving: Ignores real-world contexts. - No Creativity: Lacks innovative ideas.</p>
Communication and Clarity	<p>- Effective Expression: Communicates ideas clearly. - Logical Structure: Presents information in a well-organized manner.</p> <p>- Conciseness: Avoids unnecessary verbosity.</p>	<p>- Clear Communication: Conveys thoughts understandably. - Basic Structure: Sections are discernible. - Some Conciseness: Minimizes unnecessary details.</p>	<p>- Basic Clarity: Some ambiguity in communication. - Limited Structure: May lack clear organization. - Verbose: Includes extraneous information.</p>	<p>- Unclear Communication: Fails to express ideas. - No Structure: Lacks organization. - Verbose and Confusing: Overly wordy and unclear.</p>



7. Rubrics for Poster Presentation

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Content and Scientific Rigor	<ul style="list-style-type: none"> - Comprehensive Content: Addresses all relevant aspects. - Depth of Information: Provides detailed insights. - Cites Sources: References scientific literature. 	<ul style="list-style-type: none"> - Solid Content: Covers essential points. - Reasonable Depth: Offers relevant information. - Basic Citations: Includes references. 	<ul style="list-style-type: none"> - Basic Coverage: May lack depth. - Limited Sources: Few or no citations. - Surface-Level Information: Provides minimal insights. 	<ul style="list-style-type: none"> - Superficial Content: Lacks substance. - No Citations: Ignores scientific literature. - No Insights: Provides no meaningful information.
Organization and Layout	<ul style="list-style-type: none"> - Logical Flow: Presents information coherently. - Section Clarity: Clearly demarcates sections. - Visual Hierarchy: Prioritizes key content. 	<ul style="list-style-type: none"> - Structured Layout: Sections are discernible. - Basic Flow: Follows a logical sequence. - Some Visual Hierarchy: Highlights important elements. 	<ul style="list-style-type: none"> - Limited Organization: May lack clear structure. - Minimal Section Clarity: Sections blend together. - Sparse Visual Hierarchy: Minimal emphasis. 	<ul style="list-style-type: none"> - Disorganized: Fails to follow a clear structure. - No Section Clarity: Lacks discernible sections. - No Visual Hierarchy: No prioritization.
Clarity and Readability	<ul style="list-style-type: none"> - Clear Language: Uses simple terms. - Conciseness: Avoids verbosity. - Readable Fonts: Ensures legibility. 	<ul style="list-style-type: none"> - Understandable: Communicates ideas clearly. - Moderate Conciseness: Minimizes unnecessary wording. - Basic Font Legibility: Font size and style are readable. 	<ul style="list-style-type: none"> - Limited Clarity: May be ambiguous. - Verbose: Includes unnecessary details. - Minimal Font Consideration: Font choices may hinder readability. 	<ul style="list-style-type: none"> - Unclear: Difficult to understand. - No Conciseness: Overly wordy. - No Font Legibility: Unreadable fonts.
Visual Appeal	<ul style="list-style-type: none"> - Aesthetically Pleasing: Engages viewers. - Balanced Design: Distributes elements evenly. - Appropriate Imagery: Uses relevant visuals. 	<ul style="list-style-type: none"> - Reasonably Attractive: Holds attention. - Basic Balance: Arranges elements suitably. - Some Imagery: Includes relevant images. 	<ul style="list-style-type: none"> - Limited Appeal: May lack visual interest. - Uneven Design: Some clutter. - Minimal Imagery: Few visuals. 	<ul style="list-style-type: none"> - Unappealing: Fails to engage viewers. - No Balance: Chaotic layout. - No Imagery: Lacks visuals.



8. Rubrics for Practical Skills

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Scientific Inquiry and Curiosity	<ul style="list-style-type: none"> - Inquisitive Mindset: Demonstrates curiosity about biological phenomena. - Hypothesis Generation: Formulates testable hypotheses. - Exploration: Actively seeks answers through research and experimentation. 	<ul style="list-style-type: none"> - Curious Attitude: Shows interest in biological questions. - Reasonable Hypotheses: Proposes hypotheses based on existing knowledge. - Some Exploration: Seeks answers through research. 	<ul style="list-style-type: none"> - Basic Curiosity: Limited exploration of biological concepts. - Hypotheses Lacking Depth: Formulates simple hypotheses. - Minimal Research: Limited effort to seek answers. 	<ul style="list-style-type: none"> - Lack of Curiosity: Disinterested in biological questions. - No Hypotheses: Fails to propose testable ideas. - No Exploration: Ignores research opportunities.
Laboratory Safety and Compliance	<ul style="list-style-type: none"> - Strict Adherence: Follows safety protocols meticulously. - Risk Assessment: Identifies potential hazards. - Emergency Preparedness: Knows emergency procedures. 	<ul style="list-style-type: none"> - Safety-Conscious: Generally adheres to safety guidelines. - Basic Risk Awareness: Recognizes common hazards. - Emergency Knowledge: Aware of emergency procedures. 	<ul style="list-style-type: none"> - Occasional Lapses: Some safety oversights. - Limited Hazard Recognition: May miss certain risks. - Emergency Ignorance: Unfamiliar with emergency protocols. 	<ul style="list-style-type: none"> - Unsafe Practices: Disregards safety rules. - No Hazard Awareness: Fails to recognize risks. - Emergency Unpreparedness: Lacks knowledge of emergency procedures.
Experimental Troubleshooting	<ul style="list-style-type: none"> - Analytical Skills: Diagnoses experimental issues systematically. - Resourceful Solutions: Finds creative ways to address problems. - Adaptable: Adjusts protocols when faced with challenges. 	<ul style="list-style-type: none"> - Effective Troubleshooting: Identifies common issues. - Resourcefulness: Seeks solutions within existing knowledge. - Some Adaptability: Makes minor protocol adjustments. 	<ul style="list-style-type: none"> - Basic Problem-Solving: Recognizes straightforward issues. - Limited Resourcefulness: May struggle to find solutions. - Minimal Adaptation: Relies on standard protocols. 	<ul style="list-style-type: none"> - Ineffective Troubleshooting: Fails to diagnose problems. - No Resourcefulness: Lacks problem-solving skills. - Rigid Approach: Does not adapt to challenges.
Collaboration and Teamwork	<ul style="list-style-type: none"> - Effective Communication: Listens actively and articulates ideas clearly. - Contributor: Actively 	<ul style="list-style-type: none"> - Good Communicator: Conveys thoughts effectively. - Team Player: Collaborates with peers. - Basic 	<ul style="list-style-type: none"> - Limited Communication: May struggle to express ideas. - Passive Contributor: Participates but 	<ul style="list-style-type: none"> - Poor Communication: Fails to convey thoughts. - Isolation: Does not engage with the team.



	participates in group work. - Conflict Resolution: Handles disagreements constructively.	Conflict Management: Addresses minor disagreements.	lacks enthusiasm. - Conflict Avoidance: Ignores disagreements.	- Conflict Escalation: Aggravates disagreements.
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9. Rubrics for Practical Workbook/Lab Notebook

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Documentation and Presentation	- Professional Appearance: Well-organized, neat, and visually appealing. - Clear Structure: Sections (e.g., introduction, methods, results) are distinct. - Visual Aids: Effective use of tables, graphs, and images.	- Presentable: Generally organized and visually clear. - Adequate Structure: Sections are discernible. - Basic Visuals: Some use of tables or graphs.	- Basic Documentation: Lacks polish or consistency. - Limited Structure: Sections may blend together. - Sparse Visuals: Minimal use of graphics.	- Unprofessional: Messy or disorganized. - No Clear Structure: Sections lack differentiation. - No Visuals: Lacks any graphical representation.
Completeness of Entries	- Comprehensive: All relevant information is recorded. - Detailed Descriptions: Elaborates on procedures, observations, and results. - No Omissions: Nothing essential is missing.	- Mostly Complete: Most relevant details are included. - Sufficient Descriptions: Provides necessary context. - Minor Omissions: Some non-essential information missing.	- Partial Completion: Some gaps in information. - Brief Descriptions: Lacks depth. - Significant Omissions: Key details are absent.	- Incomplete: Major gaps in entries. - Minimal Descriptions: Barely explains procedures or results. - Critical Omissions: Essential information is missing.
Accuracy and Precision of Data	- Precise Measurements: Data entries are accurate and well-documented. - Units and Uncertainty: Includes units and measurement uncertainties. - Consistency: Data aligns with expected values.	- Reasonably Accurate: Minor deviations from expected values. - Some Units: Includes units but may miss uncertainties. - Moderate Consistency: Some discrepancies.	- Acceptable Accuracy: Noticeable deviations. - Basic Units: May lack consistency in units. - Limited Consistency: Inconsistencies in data.	- Inaccurate Data: Significant discrepancies. - No Units: Fails to provide units. - No Consistency: Data lacks alignment.



10. Rubrics for Viva-voce

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Knowledge Base	<ul style="list-style-type: none"> - Comprehensive Knowledge: Demonstrates deep understanding of biological concepts. - Integration: Connects ideas across topics. - In-Depth Responses: Provides detailed answers. 	<ul style="list-style-type: none"> - Solid Understanding: Grasps essential biological principles. - Reasonable Integration: Relates concepts within topics. - Relevant Information: Provides relevant details. 	<ul style="list-style-type: none"> - Basic Knowledge: Covers basic biological principles. - Limited Integration: Concepts remain isolated. - Surface-Level Responses: Brief answers. 	<ul style="list-style-type: none"> - Superficial Understanding: Lacks depth. - Inaccurate Content: Significant factual errors. - No Integration: Concepts are disjointed.
Conceptual Clarity and Explanation	<ul style="list-style-type: none"> - Clear Explanation: Communicates ideas succinctly. - No Ambiguity: Avoids vague language. - Effective Language: Uses precise terms. 	<ul style="list-style-type: none"> - Concise Communication: Conveys thoughts clearly. - Basic Clarity: Understandable language. - Some Precision: Uses relevant terminology. 	<ul style="list-style-type: none"> - Limited Clarity: Some ambiguity in communication. - Basic Structure: May lack clear organization. - Verbose: Includes extraneous information. 	<ul style="list-style-type: none"> - Unclear Communication: Fails to express ideas succinctly. - No Structure: Lacks organization. - Verbose and Confusing: Overly wordy and unclear.
Critical Thinking Skills	<ul style="list-style-type: none"> - Analytical Thinking: Evaluates information critically. - Depth of Analysis: Goes beyond surface observations. 	<ul style="list-style-type: none"> - Reasoned Analysis: Assesses information logically. - Some Depth: Provides relevant insights. 	<ul style="list-style-type: none"> - Basic Analysis: Identifies key points. - Limited Depth: Covers the basics. 	<ul style="list-style-type: none"> - Lacks Critical Thinking: Fails to evaluate information. - No Depth: Superficial observations.
Communication Skills	<ul style="list-style-type: none"> - Effective Expression: Communicates ideas clearly. - Active Listening: Engages with the examiner's questions. - Politeness and Respect: Maintains a professional tone. 	<ul style="list-style-type: none"> - Clear Communication: Conveys thoughts understandably. - Responsive: Addresses examiner's queries. - Basic Etiquette: Remains courteous. 	<ul style="list-style-type: none"> - Limited Communication: May struggle to express ideas. - Passive Listening: Responds minimally. - Minimal Politeness: May lack professional tone. 	<ul style="list-style-type: none"> - Poor Communication: Fails to express ideas coherently. - No Responsiveness: Ignores examiner's questions. - No Etiquette: Lacks courtesy.



Critical Thinking and Analysis	<ul style="list-style-type: none"> - Depth of Analysis: Goes beyond surface observations. - Interpretation: Analyzes trends, patterns, and outliers. - Insightful Conclusions: Draws meaningful insights. 	<ul style="list-style-type: none"> - Analytical Approach: Considers implications of data. - Basic Interpretation: Describes trends. - Reasonable Conclusions: Draws straightforward insights. 	<ul style="list-style-type: none"> - Superficial Analysis: Limited exploration of data. - Surface-Level Interpretation: Misses nuances. - Minimal Conclusions: Provides basic observations. 	<ul style="list-style-type: none"> - Lack of Analysis: No critical examination. - No Interpretation: Fails to analyze trends. - No Conclusions: Lacks insights.
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11. Rubrics for Assignment

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Content Knowledge	<ul style="list-style-type: none"> - Comprehensive Knowledge: Demonstrates deep understanding of biological concepts. - Integration: Connects ideas across topics. - In-Depth Responses: Provides detailed answers. 	<ul style="list-style-type: none"> - Solid Understanding: Grasps essential biological principles. - Reasonable Integration: Relates concepts within topics. - Relevant Information: Provides relevant details. 	<ul style="list-style-type: none"> - Basic Knowledge: Covers basic biological principles. - Limited Integration: Concepts remain isolated. - Surface-Level Responses: Brief answers. 	<ul style="list-style-type: none"> - Superficial Understanding: Lacks depth. - Inaccurate Content: Significant factual errors. - No Integration: Concepts are disjointed.
Critical Thinking and Analysis	<ul style="list-style-type: none"> - Analytical Skills: Evaluates information critically. - Depth of Analysis: Goes beyond surface observations. - Insightful Conclusions: Draws meaningful insights. 	<ul style="list-style-type: none"> - Reasoned Analysis: Assesses information logically. - Some Depth: Provides relevant insights. - Basic Conclusions: Draws straightforward insights. 	<ul style="list-style-type: none"> - Superficial Analysis: Limited exploration of data. - Surface-Level Interpretation: Misses nuances. - Minimal Conclusions: Provides basic observations. 	<ul style="list-style-type: none"> - Lack of Analysis: No critical examination. - No Interpretation: Fails to analyze trends. - No Conclusions: Lacks insights.
Creativity and Originality	<ul style="list-style-type: none"> - Fresh Perspective: Offers novel insights. - Creative Analogies: Uses imaginative comparisons. - Unique Voice: Stands out from generic writing. 	<ul style="list-style-type: none"> - Some Creativity: Presents ideas in an interesting way. - Basic Analogies: Uses straightforward comparisons. - Distinctive Style: Shows individuality. 	<ul style="list-style-type: none"> - Limited Originality: May lack fresh perspectives. - Minimal Analogies: Lacks creative comparisons. - Generic Voice: Blends with common writing. 	<ul style="list-style-type: none"> - Lacks Creativity: Fails to offer unique insights. - No Analogies: Misses imaginative comparisons. - No Distinctiveness: Generic tone.



Written Communication	<ul style="list-style-type: none"> - Effective Expression: Communicates ideas clearly. - Logical Structure: Presents information in a well-organized manner. - Conciseness: Avoids unnecessary verbosity. 	<ul style="list-style-type: none"> - Clear Communication: Conveys thoughts understandably. - Basic Structure: Sections are discernible. - Some Conciseness: Minimizes unnecessary details. 	<ul style="list-style-type: none"> - Basic Clarity: Some ambiguity in communication. - Limited Structure: May lack clear organization. - Verbose: Includes extraneous information. 	<ul style="list-style-type: none"> - Unclear Communication: Fails to express ideas succinctly. - No Structure: Lacks organization. - Verbose and Confusing: Overly wordy and unclear.
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12. Rubrics for Case-study Analysis

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Data Interpretation and Analysis	<ul style="list-style-type: none"> - Thorough Analysis: Extracts relevant information from data. - Patterns and Trends: Identifies key patterns and trends. - Statistical Competence: Applies appropriate statistical methods. 	<ul style="list-style-type: none"> - Solid Interpretation: Understands data implications. - Recognizes Patterns: Identifies trends. - Basic Statistics: Uses simple statistical tools. 	<ul style="list-style-type: none"> - Basic Analysis: Describes data without depth. - Limited Pattern Recognition: Misses nuances. - Minimal Statistics: Lacks statistical rigor. 	<ul style="list-style-type: none"> - Superficial Interpretation: Fails to analyze data. - No Pattern Recognition: Ignores trends. - No Statistics: No quantitative analysis.
Critical Thinking and Problem-Solving	<ul style="list-style-type: none"> - Analytical Skills: Evaluates case components critically. - Problem Identification: Identifies key issues. - Innovative Solutions: Proposes creative approaches. 	<ul style="list-style-type: none"> - Reasoned Analysis: Assesses case elements logically. - Problem Recognition: Identifies challenges. - Some Creativity: Suggests practical solutions. 	<ul style="list-style-type: none"> - Basic Problem-Solving: Recognizes straightforward issues. - Limited Analysis: May miss nuances. - Minimal Creativity: Lacks novel ideas. 	<ul style="list-style-type: none"> - Lacks Critical Thinking: Fails to evaluate case. - No Problem Recognition: Ignores challenges. - No Creativity: No innovative solutions.
Evidence-Based Reasoning	<ul style="list-style-type: none"> - Scientific Literature: Draws from peer-reviewed research. - Cites Sources: References relevant studies or articles. - Critical Evaluation: Assesses the quality of evidence. 	<ul style="list-style-type: none"> - Uses Literature: Incorporates scientific sources. - Some Citations: Refers to relevant studies. - Basic Evaluation: Considers evidence quality. 	<ul style="list-style-type: none"> - Limited Use of Literature: May lack citations. - Minimal Evaluation: Accepts evidence at face value. - No Critical Assessment: Ignores evidence quality. 	<ul style="list-style-type: none"> - No Evidence Base: Fails to support arguments. - No Citations: Lacks references. - No Evaluation: Ignores evidence quality.



Communication and Presentation	<ul style="list-style-type: none"> - Effective Expression: Communicates findings clearly. - Logical Structure: Presents information coherently. - Conciseness: Avoids unnecessary verbosity. 	<ul style="list-style-type: none"> - Clear Communication: Conveys thoughts understandably. - Basic Structure: Sections are discernible. - Some Conciseness: Minimizes unnecessary details. 	<ul style="list-style-type: none"> - Basic Clarity: Some ambiguity in communication. - Limited Structure: May lack clear organization. - Verbose: Includes extraneous information. 	<ul style="list-style-type: none"> - Unclear Communication: Fails to express ideas. - No Structure: Lacks organization. - Verbose and Confusing: Overly wordy and unclear.
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13. Rubrics for Concept Maps

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Accuracy of Concepts	All concepts accurately represented; demonstrates deep understanding.	Most concepts accurately represented; some minor inaccuracies.	Some concepts inaccurately represented; significant gaps in understanding.	Many concepts inaccurately represented; lacks understanding.
Clarity of Structure	Clear and logical organization; easy to follow relationships.	Generally clear organization; some areas could be improved.	Structure lacks clarity; relationships are unclear.	Poorly organized; difficult to follow.
Use of Visual Elements	Effective use of visual elements (color, size, icons, etc.) enhances understanding.	Visual elements used appropriately; some missed opportunities.	Limited use of visual elements; not fully integrated.	Minimal or no use of visual elements.
Effective Communication	Precise labels and linking phrases; communicates complex ideas effectively.	Labels and linking phrases are clear; occasional ambiguity.	Labels and linking phrases lack precision; communication is basic.	Unclear labels; ineffective communication.

14. Rubrics for Group Discussion/In-class Discussion

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Knowledge and understanding	<ul style="list-style-type: none"> - Comprehensive Knowledge: Demonstrates deep understanding of biological concepts. - Integration: Connects ideas across topics. - In-Depth Responses: Provides detailed answers. 	<ul style="list-style-type: none"> - Solid Understanding: Grasps essential biological principles. - Some Integration: Relates concepts within topics. - Reasonable Depth: Provides relevant information. 	<ul style="list-style-type: none"> - Basic Knowledge: Covers basic biological principles. - Limited Integration: Concepts remain isolated. - Surface-Level Responses: Brief answers. 	<ul style="list-style-type: none"> - Superficial Understanding: Lacks depth. - No Integration: Concepts are disjointed. - Minimal Knowledge: Provides minimal information.



Critical Thinking and Analysis	<ul style="list-style-type: none"> - Analytical Skills: Evaluates information critically. - Evidence-Based: Supports arguments with relevant data. - Synthesis: Combines multiple viewpoints. 	<ul style="list-style-type: none"> - Reasoned Analysis: Assesses information logically. - Some Evidence: Uses data to support claims. - Basic Synthesis: Combines limited perspectives. 	<ul style="list-style-type: none"> - Basic Analysis: Identifies key points. - Limited Evidence: May lack data-based support. - Minimal Synthesis: Presents isolated viewpoints. 	<ul style="list-style-type: none"> - Lacks Analysis: Fails to evaluate information. - No Evidence: Claims lack support. - No Synthesis: Presents disjointed perspectives.
Evidence-Based Reasoning	<ul style="list-style-type: none"> - Scientific Literature: Draws from peer-reviewed research. - Cites Sources: References relevant studies or articles. - Critical Evaluation: Assesses the quality of evidence. 	<ul style="list-style-type: none"> - Uses Literature: Incorporates scientific sources. - Some Citations: Refers to relevant studies. - Basic Evaluation: Considers evidence quality. 	<ul style="list-style-type: none"> - Limited Use of Literature: May lack citations. - Minimal Evaluation: Accepts evidence at face value. - No Critical Assessment: Ignores evidence quality. 	<ul style="list-style-type: none"> - No Evidence Base: Fails to support arguments. - No Citations: Lacks references. - No Evaluation: Ignores evidence quality.
Active Participation and Engagement	<ul style="list-style-type: none"> - Contributor: Actively participates in discussions. - Quality Contributions: Adds value to the conversation. - Engages Peers: Responds to others' ideas. 	<ul style="list-style-type: none"> - Engaged Participant: Contributes to discussions. - Reasonable Quality: Provides relevant input. - Acknowledges Peers: Responds to classmates. 	<ul style="list-style-type: none"> - Basic Participation: Minimal involvement. - Limited Quality: Offers basic comments. - Minimal Engagement: Rarely responds to peers. 	<ul style="list-style-type: none"> - Passive: Rarely participates. - No Quality Contributions: Adds little value. - No Peer Interaction: Ignores classmates.

15. Rubrics for Lab Involvement

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Attendance and Punctuality	Consistently attends all lab sessions on time. Demonstrates exceptional punctuality.	Attends most lab sessions on time. Rare instances of lateness.	Irregular attendance; occasional lateness.	Frequent absences; consistently late.
Initiative and Engagement	Actively participates in lab activities. Takes initiative to explore beyond the assigned tasks.	Engages in lab activities; occasionally demonstrates initiative.	Minimal engagement; follows instructions without additional effort.	Passive participation; lacks initiative.
Data Collection and Interpretation	Accurately collects data during experiments. Demonstrates thorough understanding of data interpretation.	Collects data with minor errors. Adequate interpretation of results.	Incomplete data collection; limited interpretation.	Inaccurate data collection; misinterprets results.



16. Rubrics for Literature Survey & Comprehensive Reviews

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Organization and Structure	Clear, logical, and effective organization; seamless flow of information.	Well organized; mostly clear flow of information.	Basic organization; some areas lack clear structure.	Poor or no clear organization; disjointed flow of information.
Coverage of Key Concepts	Comprehensive coverage; insightful analysis and synthesis.	Good coverage; adequate analysis and synthesis.	Basic coverage; limited analysis or synthesis.	Inadequate or incorrect coverage; no analysis or synthesis.
Engagement with Primary Literature	Extensive engagement with a wide range of relevant literature.	Good engagement with a range of relevant literature.	Limited engagement with relevant literature.	Little to no engagement with relevant literature.
Writing Style and Clarity	Exceptional writing style, clarity, grammar, and spelling.	Good writing style, clarity, grammar, and spelling with minor errors.	Writing lacks style or clarity in places; several errors in grammar/spelling.	Poor writing style/clarity/grammar/spelling.

17. Rubrics for Model building

Criteria	Expert (4 points)	Proficient (3 points)	Apprentice (2 points)	Novice (1 point)
Scientific Accuracy	<ul style="list-style-type: none"> - Precise Models: Demonstrates a deep understanding of biological principles. - Valid Assumptions: Models are built on accurate biological data and assumptions. - Robustness: Models withstand scrutiny and align with existing knowledge. 	<ul style="list-style-type: none"> - Accurate Models: Generally reliable, with minor deviations. - Reasonable Assumptions: Some aspects may need further validation. - Moderate Robustness: Holds under scrutiny. 	<ul style="list-style-type: none"> - Acceptable Accuracy: Some inaccuracies or oversimplifications. - Basic Assumptions: May lack full validation. - Limited Robustness: Some inconsistencies. 	<ul style="list-style-type: none"> - Inaccurate Models: Significant deviations from biological reality. - Unsubstantiated Assumptions: Lack of validation. - Poor Robustness: Fails under scrutiny.
Relevance and Applicability	<ul style="list-style-type: none"> - Problem-Specific: Models address relevant biological questions. - Practical Utility: Applicable to real-world scenarios. - Translational Potential: Can inform experimental design or clinical decisions. 	<ul style="list-style-type: none"> - Contextual Relevance: Models relate to biological contexts. - Some Practical Utility: Applicable within specific contexts. - Limited Translational Potential: May not directly impact practice. 	<ul style="list-style-type: none"> - Basic Relevance: Models somewhat related to biology. - Limited Practical Utility: Applicable in narrow contexts. - Minimal Translational Potential: Limited impact. 	<ul style="list-style-type: none"> - Irrelevant: Models lack relevance to biology. - No Practical Utility: Not applicable beyond theoretical exercises. - No Translational Potential: No impact on practice.



<p>Model Complexity and Simplicity</p>	<p>- Optimal Complexity: Models strike a balance between capturing essential details and avoiding unnecessary complexity. - Justified Complexity: Complexity aligns with research goals. - Scalability: Models can be extended or adapted.</p>	<p>- Reasonable Complexity: Some simplifications but still informative. - Context-Driven Complexity: Complexity suits the problem context. - Limited Scalability: May not generalize to other scenarios.</p>	<p>- Overly Complex or Oversimplified: Models lack balance. - Arbitrary Complexity: Complexity does not align with research goals. - No Scalability: Limited adaptability.</p>	<p>- Excessive Complexity or Extreme Simplicity: Hinders understanding. - No Justification: Complexity lacks rationale. - No Scalability: Cannot be extended.</p>
<p>Creativity</p>	<p>- Innovative Approach: Demonstrates originality in model design or application. - Creative Features: Includes unique elements. - Problem-Specific Solutions: Tailored to the biological context.</p>	<p>- Incorporates Ideas: Adapts existing methods creatively. - Some Unique Aspects: Adds novel features. - Problem Relevance: Addresses the biological problem effectively.</p>	<p>- Conventional Approach: Uses standard techniques. - Limited Creativity: Few unique elements. - Generic Solutions: May not fully address the biological problem.</p>	<p>- Derivative: Replicates existing methods. - Lacks Creativity: No unique features. - Problem Ignored: Fails to address the biological context.</p>



SHORT TERM COURSES

The main objective of the short term courses offered by the college is to supplement the students with various skills and technical know-how outside the structured academic curriculum, to produce quality citizens who are academically proficient, self-reliant and socially committed. The courses have compulsory components and optional components that equip the students to attain various programme objectives envisaged by the Vision and Mission statements of the college.

All Short-Term Courses (STCs) are coordinated by the Department of Short Term Courses, headed by a Director and is supervised by a Vice Principal nominated by the Principal. Each component of the STC is coordinated and managed by a Faculty Convener. The Advisory Board of the Department consists of the Vice-Principals, Director of the Short Term Courses and the various Conveners.

In case of any grievances, students can approach the Grievance Redressal Cell of the STC which consists of the Vice-Principal in Charge, Director and the concerned Convener. If the student feels that the issue was not adequately addressed, he/she can approach the Grievance Redressal Cell of the college. The grading pattern for all courses will be the same as in the UG regulations 2024. The courses offered by the department are given in the following table.

	Name	Semesters	Type	Credit
1	Value Education	I to VI	Compulsory	3
2	Basic Life Support System and Disaster Management (BLS & DM)	I	Compulsory	1
3	Social Awareness Course (SAC)	I and II	Compulsory	2
4	Skill Development Courses (SDC)	II and III	Optional	2
5	Finishing School	III and IV	Compulsory	1
6	Virtual Lab Experiments	V	Optional	1



REGULATIONS FOR SHORT TERM COURSES

VALUE EDUCATION

Value Education is a compulsory extra credit course with three (3) credits for all the students admitted to the undergraduate programmes.

Duration

The duration of the course shall be three academic years (six semesters). There shall be minimum 60 hours spread over three years with 20 hours every academic year.

Evaluation

The evaluation of each course shall contain two parts.

- i. Continuous evaluation (every year)
- ii. Final evaluation (every year)

There shall be a maximum of 50 marks comprising of forty (40) marks for final evaluation and ten (10) marks for continuous evaluation.

Continuous Evaluation

Component	Marks
Assignment	5
Attendance	5
Total	10

1. Assignment

The students shall submit at least one assignment in every year. The marks for assignment is five (5).

2. Attendance

The minimum requirement of aggregate attendance during a year for appearing the final examination shall be 75%.

Marks for attendance

Maximum of five (5) marks will be given for attendance as follows.

% of Attendance	Marks
90 and above	5
85-89	4
80-84	3
76-79	2
75	1

(Decimals shall be rounded off to the next higher whole number)

Final evaluation

Final evaluation shall be conducted by the course coordinator at the end of every year.

There shall be an annual written examination of one and a half hours (1½) duration with a maximum forty marks (40), every year.

The question paper shall be strictly on the basis of model question paper set by the Expert Committee.

A question paper consists of short answer type, short essay type and long essay type questions.

The total marks of the course (three years combined) shall be one hundred and fifty (150).

Award of certificate

A separate minimum 30% marks each for continuous evaluation and final evaluation and an aggregate minimum of 35% are required for a pass in the course.

If a student does not acquire minimum marks in first and second years, he/she can continue the course.



The student shall be eligible to get certificate only after completing the course with D Grade. On successful completion of the course, the grade awarded will be indicated in the Mark cum Grade Card.

The grading pattern will be the same as in UG Regulations 2024.

The course shall be completed during the tenure of the programme.

BASIC LIFE SUPPORT SYSTEM AND DISASTER MANAGEMENT (BLS & DM)

- The main objective of this course is to provide intensive training on Basic Life Support System and Disaster Management with the help of professional trainers and adequate numbers of mannequins and kits for imparting the training to students.
- This course is compulsory for all the undergraduate students of this college and has one (1) credit.
- The course on BLS & DM shall be conducted by a nodal centre created in the College.
- Each student shall undergo five (5) hours of hands-on training in BLS & DM organised by the Centre for BLS & DM.
- After the completion of the training, the skills acquired shall be evaluated using an offline/online test and grades shall be awarded.
- Nodal Centre for BLS & DM shall conduct an online test and publish the results.
- Students who could not complete the requirements of the BLS & DM training shall appear for the same along with the next batch.
- The grading of the course is as per the grading pattern in UG Regulations 2024.



SOCIAL AWARENESS COURSE (SAC)

- The aim of SAC is to make students aware of the problems that different societies and communities face on a day-to-day basis and to be conscious of the difficulties and hardships of society.
- This is a compulsory course with two (2) credits.
- Social Awareness Course shall be conducted by a nodal centre consisting of the convenor, other faculty members nominated by the Principal.
- The centre shall identify the areas where the students can serve the society through the course.
- During the first semester itself, the centre shall organise activities to sensitize the students about the significance and relevance of Social Awareness and publish a list of different areas where they can work as volunteers.
- The centre shall allot students to various areas based on their preference.
- Students shall carry out the voluntary work allotted to them after the regular class hours/weekends/holidays falling in the first and second semesters and the summer vacation following the second semester.
- Evaluation of the SAC activity shall be based on the hours of work put in by a student. A minimum of 50 hours of social work (corresponding to 50 marks) is required for the successful completion of the course. Every additional work beyond the minimum 50 hours shall fetch five (5) marks per hour. Maximum marks shall be 100.
- Students who donate blood during the first year shall be given 10 marks on production of the certificate from the medical officer. However, marks earned through blood donation shall not be counted for a pass in the course. Mark for blood donation shall be awarded only once during the SAC.
- Two credits shall be awarded to students who complete the requirements of SAC.
- The grading will be as per the grading pattern in the UG Regulations 2024.
- Students who could not complete the requirements of the SAC shall appear for the same with the next batch.
- The Director of Short-Term Courses and Convenor of SAC has the right to exclude students who are physically challenged from SAC, if requested.



SKILL DEVELOPMENT COURSES (SDC)

- This is a compulsory component of STC with two (2) credits.
- SDC's shall be completed within the first four semesters of the programme.
- Depending on the nature of the course, there will be a theory component and a skill development component.
- The credit will be awarded only if the student gets a D grade (35% marks) and above.
- A student can do a maximum of three skill Development Courses according to his/her choice, but pass in at least one course is compulsory.
- The Convenor of SDC will coordinate the course.
- The Head of the Department concerned in consultation with the faculty members may prepare a syllabus for the SDC, which will be approved by the Board of Studies concerned.

Evaluation of SDC

The evaluation the course shall be done internally and contain two parts.

- Continuous evaluation
- Final evaluation

Both continuous evaluation and final evaluation shall be carried out using indirect grading. The marks for continuous evaluation is twenty (20) and that of the final evaluation is eighty (80).

Continuous evaluation

The components of the continuous evaluation and their marks are as below.

For all courses, without practical

There are two components for continuous evaluation, which include attendance and assignment. All the components of the continuous evaluation are mandatory.

Component	Marks
Attendance	5
Assignments	15
Total	20

Marks for attendance

Minimum 75% attendance is compulsory for attending the final examination.

% of Attendance	Marks
90 and above	5
85 - 89	4
80 – 84	3
76 – 79	2
75	1

(Decimals shall be rounded mathematically to the nearest whole number)

For all courses with practical

The components for continuous evaluation of courses with practical are given below.

Component	Marks
Attendance	5
Lab/skill work involvement	15
Total	20



Assignments

At least one assignment shall be submitted for the course.

Final evaluation

The final evaluation of theory and practical courses shall be conducted by the office of the Controller of Examinations. It can be in the form of 80 marks written examination or 80 marks project/practical examination or 80 marks written and project/practical examination combined, as decided by the Board of Studies concerned.

FINISHING SCHOOL

- It is a compulsory course with one (1) credit.
- The course provides compulsory training for all under graduate students of this college.
- The training is to help students develop their soft skills and interview skills.
- The training shall impart soft skills comprising of language skills, personal presentation and grooming, table manners, resume preparation, group discussion techniques, and interview skills among the undergraduate students.
- This course shall be conducted during the third and fourth semesters for all the undergraduate students.
- There will be a total of 20 contact hours which shall be handled by a team of professional members/faculty. In addition, a one-day outbound training session by a team of professional trainers that touches on the aspects of creativity, problem solving and team building shall also be organized.
- The students shall be assessed on the basis of the components given below.

Component	Marks
Attendance	5
Aptitude Test	10
Assignments	10
Group discussion	10
Interview	15
Total	50

Marks for attendance

Maximum of five (5) marks will be given for attendance as follows.

% of Attendance	Marks
90 and above	5
85-89	4
80-84	3
76-79	2
75	1

(Decimals shall be rounded off to the next higher whole number)

Grades will be awarded as per grading pattern in UG Regulations 2024.



VIRTUAL LAB EXPERIMENTS

- This is an optional course with one (1) credit.
- The main aim of the Virtual Lab Experiments is to provide remote-access to simulation-based Labs in various disciplines of Sciences which enthuse students to conduct experiments by arousing their curiosity.
- The Convenor will coordinate the Virtual Lab component and he may use the services available in different virtual lab platforms after the approval of the advisory body.
- Students have to do at least 36 hours of experiments and they get a maximum of one credit for this.
- Convenor and the mentor of the student shall oversee the progress and assign grades as per the grading pattern in UG Regulations 2024 after the completion of the programme.