

ARULMIGU PALANIANDAVAR ARTS COLLEGE
FOR WOMEN

(AUTONOMOUS)

Nationally Re-accredited with A by NAAC in 4th Cycle
(Affiliated to Mother Teresa Women's University, Kodaikanal)

Chinnakalayamputhur, Palani -624 615.



CHOICE BASED CREDIT SYSTEM
ACADEMIC YEAR 2026-2027 ONWARDS
PG DEPARTMENT OF ZOOLOGY

M.Sc., ZOOLOGY
SYLLABUS
BATCH 2026-2028

Dean

S. T. ———
The Head, PG & Research Department of History,
Arulmigu Palaniandavar Arts College For Women,
C.K. Puthur, Palani-624 615.

R. Uma Maheswari
Dr. R. UMA MAHESWARI
M.Sc., M.Phil., Ph.D.
Associate Professor & Head
P.G. Department of Zoology
A.P.A. College for Women
Palani

R. Uma Maheswari
14/7/26
PRINCIPAL.
A.P.A.C for Women
PALANI.

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN
(AUTONOMOUS)

Nationally Re-accredited with A by NAAC in 4th Cycle
(Affiliated to Mother Teresa Women's University, Kodaikanal)
Chinnakalayamputhur, Palani -624 615.



PG DEPARTMENT OF ZOOLOGY
FACULTY MEMBERS

Dr. R. Uma Maheswari M.Sc., M.Phil., Ph. D
Associate Professor & Head

R. Uma Maheswari

Mrs. P. Pavatharini, M.Sc., M.Phil.,
Assistant Professor

P. Pavatharini

Dr. M. Latha Santhi, M.Sc., M.Phil., Ph.D.,
Assistant Professor

M. Latha Santhi

Dr. S. Subhashini M.Sc., M.Phil., Ph.D
Assistant Professor

S. Subhashini

Mrs. J. R. Hemalatha M.Sc., M.Phil., SLET,
Assistant Professor

J. R. Hemalatha

Dr. J. Mekala M.Sc., Ph. D
Assistant Professor

J. Mekala

Dr. Dayana Senthamarai. M, M.Sc., Ph. D
Assistant Professor

Dayana Senthamarai

Ms. V. Sivaranjani M.Sc., M.Phil.,
Assistant Professor

V. Sivaranjani

University Nominee

Dr.R.S.Mohan Raj,M.Sc., M.Phil., Ph.D.,
PG & Research Department of Zoology,
Government Arts College,
Coimbatore.

[Signature]
22-5-2020
Dr. R.S. MOHANRAJ, M.Sc., M.Phil., Ph.D.,
Associate Professor
PG & Research Department of Zoology
Government Arts College (Autonomous)
Coimbatore - 641 018.

Subject Expert

1. Dr. R.V.Kalaimathi, M.Sc., B.Ed., M.A., M.Phil., Ph.D., *[Signature]*
Associate Professor,
PG and Research Department of Zoology,
Arulmigu Palaniandavar College of Arts and Culture,
Palani - 624601.

Dr. R.V. Kalaimathi, M.Sc., M.Phil., M.A., B.Ed., Ph.D.
Associate Professor,
PG and Research Department of Zoology,
Arulmigu Palaniandavar College of Arts & Culture,
Palani - 624601, Dindigul District,
Tamil Nadu, INDIA.

2. Dr.Jeevalatha,M.Sc., M.Phil, Ph.D
Associate Professor & Head,
GTN Arts College,
Dindigul

[Signature]
26
A. A. JEEVALATHA, M.Sc., M.Phil., SET Ph.D
ASSISTANT PROFESSOR
DEPARTMENT OF ZOOLOGY,
G.T.N. ARTS COLLEGE,
DINDIGUL-5

Industrialist

Mr.R.Kathirvel., M.Sc., DMLT.,
Lifecare Bio Line,
SKB Complex,
Subramaniyapuram Road,
Palani

Alumina

Ms.P.Gayathiri,
Assistant Professor,
Department of Microbiology,
Sakthi College of Arts and Science,
Oddanchatram

[Signature]
p. Gayathiri

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN

(AUTONOMOUS)

Nationally Re-accredited with A by NAAC in 4th Cycle

(Affiliated to Mother Teresa Women's University, Kodaikanal)

Chinnakalayamputhur, Palani -624 615.

PREAMBLE

The Department of Zoology are established as undergraduate Department in 1974 and upgraded as postgraduate in 1987. The Department is enriched by altruistic contribution of a galaxy of teachers. The Department is noted for its good academic record and well-established laboratories. The highlight of the Department is the active participation of the faculty members in Research with many International and National papers in reputed Journals, received many awards and Research grants from various funding agencies such as UGC, DST etc., Our Department tirelessly strives to work towards women's education at all level in the State to be a pioneer in the field of Women Empowerment by introducing relevant papers in the Curriculum to fulfill their local needs through the Board of Studies.

COLLEGE VISION

- **Enlightenment and Empowerment of Rural Women.**

COLLEGE MISSION

- **Providing high quality teaching learning environment with practical exposure**
- **Imbibing research culture and collaboration programs with local communities**
- **Imparting strong and supportive education to promote employability**
- **Encouraging questioning spirit and self – reliance**

P.G DEPARTMENT OF ZOOLOGY

VISION

- **To create self confidence among the students through up-to-date curriculum designing.**
- **To develop and maximize the learning competency.**
- **To inculcate the social and moral values that enables the students to become a good citizen.**
- **To develop true research attitude**

MISSION

- **To provide the students with good quality education.**
- **That integrates science, technologies and society and to perform value based real-time research activities and there by leaping to excellence.**

PROGRAMME SPECIFIC OUTCOME

PSO1: Developing deeper understanding of key concepts of biology at biochemical, molecular and cellular level, physiology and ecological impact on animal behavior.

PSO2: Elucidation of animal-animal, animal-plant, animal-microbe interactions and their consequences to animals, humans and the environment.

PSO3: Strengthening of genetics and cytogenetics principle in light of advancements in understanding human genome and genomes of other model organisms.

PSO4: Learning handling DNA sequence data and its analysis which equip students to get employed in R&D in the industry involved in DNA sequencing services, diagnostics, and microbiome analysis.

PSO5: Development of an understanding of zoological science for its application in medical entomology, apiculture, aquaculture, agriculture and modern medicine.

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN

(AUTONOMOUS)

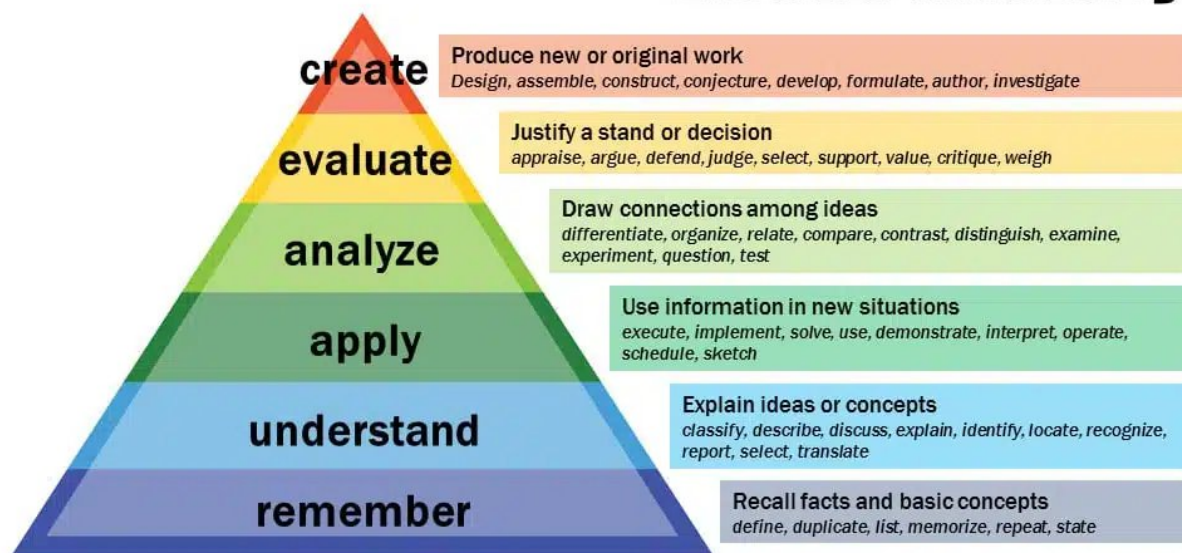
Nationally Re-accredited with A by NAAC in 4th Cycle

(Affiliated to Mother Teresa Women's University, Kodaikanal)

Chinnakalayamputhur, Palani -624 615.

M.Sc., Zoology

Bloom's Taxonomy



K1 Remember

K2 Understanding

K3 Apply

K4 Analyse

K5 Evaluate

K6 Create

LEARNING OUTCOME

PO1: Disciplinary knowledge

PO2: Communication Skills:

PO3: Critical thinking:
PO4: Problem solving:
PO5: Analytical reasoning:
PO6: Research-related skills:
PO7: Cooperation/Teamwork:
PO8: Scientific reasoning:
PO9: Reflective thinking:
PO10: Information/digital literacy:
PO11: Self-directed learning:
PO12: Multicultural competence:
PO13: Moral and ethical awareness / reasoning:
PO14: Leadership readiness/qualities:
PO15: Lifelong learning:

PO1: Disciplinary Knowledge Demonstrate a profound understanding of the animal kingdom, ranging from lower invertebrates to complex vertebrates - Chordata. Students will master concepts in Cell & Molecular Biology, Genetics, Human Physiology, and Embryology, while gaining specialized knowledge in applied fields like Poultry Farming, Sericulture, and Apiculture.

PO2: Communication Skills Ability to communicate complex biological concepts clearly through technical reports, practical records, and project presentations. Courses like Women Empowerment and SEC papers help students articulate social and scientific ideas effectively to diverse audiences.

PO3: Critical Thinking Critically evaluate the evolutionary relationships between species -Evolution and the impact of environmental changes on ecosystems -Environmental Biology & Biodiversity. Students will assess the validity of biological theories and the efficiency of various laboratory techniques.

PO4: Problem Solving Develop the capacity to address challenges in livestock management (Poultry Farming) and pest control (Entomology). Students will learn to troubleshoot experimental setups in Microbiology and Biotechnology to achieve desired results.

PO5: Analytical Reasoning Utilize mathematical and logical tools to interpret biological data through Biostatistics & Bioinformatics. Students will analyse trends in wildlife populations and genetic

variations to draw evidence-based conclusions.

PO6: Research-related Skills Acquire the ability to design experiments, execute protocols, and document findings during the Summer Internship and Group Project. Proficiency in Medical Laboratory Techniques and Bioinstrumentation ensures readiness for clinical and academic research.

PO7: Cooperation/Teamwork Foster collaborative skills through the Group Project and shared laboratory sessions, Core Practical's. Students learn to manage roles, resolve conflicts, and work toward a common scientific goal in a team setting.

PO8: Scientific Reasoning Apply the scientific method to observe, hypothesize, and test biological phenomena. Courses like Biophysics and Immunology require students to understand the underlying physical and chemical principles governing life.

PO9: Reflective Thinking Develop the habit of reflecting on personal learning experiences during the Summer Internship. Students will assess their own strengths in practical applications and identify areas for professional growth.

PO10: Information/Digital Literacy Gain proficiency in using bioinformatics tools and databases, Bioinformatics to retrieve and analyse genomic data. Students will use digital platforms for literature reviews and data presentation.

PO11: Self-directed Learning Engage in independent study through elective papers such as Marine Biology or Animal Behaviour, taking responsibility for exploring specialized interests beyond the core curriculum.

PO12: Multicultural Competence Understand the global importance of biodiversity and the socio-economic impact of zoological practices across different cultures, particularly through Ancient Zoological Practices and Wildlife Conservation.

PO13: Moral and Ethical Awareness / Reasoning Demonstrate ethical conduct in animal handling, environmental conservation, and the application of Intellectual Property Rights (IPR). Students will navigate the ethics of Genetic Engineering and Human Reproductive Biology.

PO14: Leadership Readiness/Qualities Develop leadership through the management of the Group Project and by taking initiative during field-based activities in Apiculture and Sericulture etc.,

PO15: Lifelong Learning Cultivate a persistent curiosity about the natural world. The diverse range of vocational skills -Sericulture, Poultry, Med Lab Tech, ensures that graduates are equipped to adapt to evolving career landscapes in life sciences and sustainability.

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN

(AUTONOMOUS)

Nationally Re-accredited with A by NAAC in 4th Cycle

(Affiliated to Mother Teresa Women's University, Kodaikanal)

PG

PG- Internal Question pattern Part III

Knowledge Level	Section	Marks	Total
K1	A (Answer all) Q.No. 1 and 2	2x2	4
K2 and K3	B (Either or Pattern) Q.No. 3 and 4	2x5	10
K4 and K5	C (Open choice) any two out of three questions Q.No. 5 to 7	2x8	16
Total			30

PG-External Question Paper pattern Part III (Theory)

S.No.	Knowledge Level	Part	Type	Marks
1	K1	A(5x2=10)	One question from each Unit	10
2	K2 and K3	B(5x6=30)	Two questions from each Unit with Internal Choice (either / or)	30
3	K4 and K5	C(3x10=30)	One question from each Unit (Open Choice)	30
Total Marks				70

EFFECT FROM THE ACADEMIC YEAR 2026-2027 ONWARDS

ACADEMIC STRUCTURE Zoology

S. NO	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER I								
1		Core I: Structure and Function of Invertebrates	6	3	25	75	100	5
2		Core II: Comparative anatomy of Vertebrates	6	3	25	75	100	5
3		Core III: Organic Evolution	6	3	25	75	100	5
4		Core Practical I: Lab Course in Structure and Function of Invertebrates, Comparative anatomy of Vertebrates, Organic Evolution	6	3	40	60	100	4
5		Elective I Microbiology/ Biostatistics & Bioinstrumentation	6	3	25	75	100	4
TOTAL			30				500	23
SEMESTER II								
1		Core IV: Cellular & Molecular Biology	6	3	25	75	100	5
2		Core V: Developmental biology	6	3	25	75	100	5
3		Core VI : Ethnzoology and Sustainable Animal Sciences	6	3	25	75	100	5
4		CorePractical II: Cell Biology, Developmental Biology & Ethnzoology and Sustainable Animal Sciences.	6	3	40	60	100	3
5		Elective II: Bioinformatics & Computer Application/Animal Behaviour	6	3	25	75	100	4
TOTAL			30				500	22

S . N O	Co urs e co de	COURSE TITLE	Lecture/ Practica l (Hours /week)	Duration of exam (hours)	Max Marks			Cred it point s
					Intern al	External	Total	
SEMESTER III								
1		Core VII: Molecular Genetics	6	3	25	75	100	5
2		Core VIII: Sericulture	6	3	25	75	100	5
3		Core IX: Immunology	6	3	25	75	100	5
4		Core Practical III : Molecular Genetics, Sericulture and Immunology	6	3	40	60	100	3
5		Elective III: Bio composting for Entrepreneurship/ Aquaculture	6	3	25	75	100	4
		INTERNSHIP				100		2
TOTAL			30				600	24
SEMESTER IV								
1		Core X: Environmental Biology	6	3	25	75	100	5
2		Core XI :Animal physiology	6	3	25	75	100	5
3		Core Practical IV: Environmental Biology & Animal Physiology	6	3	40	60	100	3
4.		Elective IV :Cancer Biology/ Animal Culture & Ethics	6	3	25	75	100	4
5		Project	6	---	25	75	100	4
TOTAL			30				500	21

Total Credits: 90

Total Marks: 2100

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	I
CREDITS	5	COURSE TITLE	Core I: Structure and Function of Invertebrates
Course objective ❖ To understand the concept of classification and their characteristic features of major group of invertebrates. ❖ To realize the range of diversification of invertebrate animals. ❖ To enable to find out the ancestors or derivatives of any taxon. ❖ To know the functional morphology of system biology of invertebrates. ❖ Analyze the functional mechanisms of physiological processes, such as feeding, digestion, respiration, excretion, and locomotion.			

Unit	Content	Hrs
I	Classification of Animal Kingdom: International Code of Zoological Nomenclature - Taxonomic Procedures. New trends in Taxonomy, Protozoa: Ultrastructure of locomotory organs, pseudopodia, flagella, cilia and pellicular myonemes. Mechanism of various modes of locomotion. Porifera: Cellular grade of organization in sponges. Coelom: Types of Coeloms.	17
II	Coelenterata: Polymorphism, metagenesis and metamorphosis. Helminthes: Reproductive system, structure and mechanism of reproduction in, <i>Fasciola</i> , <i>Taenia</i> and <i>Ascaris</i> .	14
III	Arthropoda: Respiratory organs, mechanism of gaseous exchange - tracheal respiration in Insecta and gill respiration in Crustacea. Mollusca: Neuroanatomy in Gastropoda (<i>Pila</i>), Bivalvia (<i>Unio</i>) and Cephalopoda (<i>Loligo</i>).	15
IV	Echinodermata: Water vascular system - structure and functions. Echinodermata: Larval forms, Metamorphosis and evolutionary significance.	12
V	Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan;	17

	Filter feeding in Polychaeta, Mollusca and Echinodermata. Excretion: Organs of excretion: Coelom, Coelomoducts, Nephridia and Malpighian tubules; Mechanisms of excretion; Excretion and osmoregulation	
TOTAL CONTACT HOURS		75
REFERENCE BOOK Barnes, R. D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024. Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. 2013. The Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi. Dechenik, J. A. 2015. Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited, pp-624.		
E REFERENCE https://nptel.ac.in/courses/102/106/102106035/ https://biologydictionary.net/invertebrate http://rcastilho.pt/DA/ewExternalFiles/Invertebrates_Cap_33_Cambell.pdf file:///C:/Users/ACER/Downloads/invertebrates_3-4_unit_guide%20(1).pdf		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Outline the foundational principles of animal taxonomy, structural organization, and physiological systems of invertebrates.		PO1,PO3	K3
CO2	Analyze and compare the diverse anatomical structures and reproductive strategies across various invertebrate phyla.		PO1,PO3,PO5	K4
CO3	Explain the functional mechanisms of locomotion, respiration, circulation, and osmoregulation in diverse animal groups.		PO2,PO4,PO8	K3
CO4	Evaluate the evolutionary significance and adaptive complexities of organ systems and life cycles in invertebrates.		PO5,PO7,PO8	K4
CO5	Integrate anatomical, physiological, and taxonomic knowledge to understand the		PO3,PO5	K6

		ecological adaptation and diversity of the animal kingdom.		
--	--	--	--	--

BLOOM’S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	2	3	3	2	2	-	2	1	1	-	-	-	-	-
CO2	2	3	1	2	2	1	-	1	-	-	1	-	-	1	-
CO3	2	2	2	2	3	-	1	-	-	-	-	-	-	-	-
CO4	1	2	1	1	2	-	1	-	-	-	-	-	1	-	-
CO5	3	1	2	2	2	1	2	-	-	-	2	-	-	-	-

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	I
CREDITS	5	COURSE TITLE	Core II: Comparative Anatomy of Vertebrates
Course objective ❖ Exemplifying the vertebrate origin and the intermediary position of Prochordates between invertebrates and vertebrates. ❖ Acquires the knowledge on evolution and adaptive radiation of Agnatha and Pisces. ❖ Understanding knowledge about the first terrestrial vertebrates and the adaptive radiation of land animals ❖ Imparting conceptual knowledge about the animal life in the air and their behaviours. ❖ Understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.			

Unit	Content	Hrs
I	Origin of Chordates: Amphibians, Reptiles, Birds and Mammals. Classification of Vertebrates and specialty of respective classes. Importance of the study of vertebrate morphology	18
II	Vertebrate integument and its derivatives: General structure and functions of Integument. Structure and functions of glands, scales, horns, claws, nails, hoof, feather and hair. Comparative account of Jaw Suspensorium, Vertebral column - Limbs and Girdles.	20
III	Respiration in Vertebrates: Comparative account on Structure and functions of respiratory organs- Fishes, Amphibians & Aves. Circulation in Vertebrates- Amphibians, Reptiles & Mammals.	16
IV	Nervous System – Central, Peripheral and Autonomic. Sense organs.	17

	Comparative account of Sensory Receptors- olfactory & optic. Evolution of Urinogenitalsystem in vertebrates.	
V	Amphibians, Gymnophiona Neoteny, Parental care Reptiles – Extinct reptiles. Birds – Palate in Birds. Mammals. – New world and old world Monkeys	19
TOTAL CONTACT HOURS		90
REFERENCE BOOK Waterman, A.J. 1972. Chordate Structure and Function, MacMillan Co., New York, pp.587. Parker T. J. and W. A. Haswell. 1962. A text book of Zoology, Vol. 2, Vertebrates, 7th Edition, Mac Millan Press, London, pp-750. Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai. Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.		
E REFERENCE Swayam Prabha https://www.swayamprabha.gov.in/index.php/program/archive/9 https://nptel.ac.in/courses/102/106/102106035/ http://assets.vmu.ac.in/MZO06.pd		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and explain the fundamental classification, structural components, and evolutionary origins of vertebrates.	PO1,PO3,PO5	K3
CO2	Analyze and contrast the comparative anatomical structures and physiological systems across various vertebrate classes.	PO2,PO5,PO7	K4
CO3	Apply morphological and anatomical principles to explain the functional adaptations and survival mechanisms of vertebrates.	PO2,PO6,PO9	K3
CO4	Critically evaluate the evolutionary trends, anatomical modifications, and phylogenetic relationships within the vertebrate lineage.	PO3,PO4,PO8	K4
CO5	Synthesize diverse anatomical and evolutionary	PO3	K6

		data to formulate a comprehensive understanding of vertebrate life and diversity.		
--	--	---	--	--

BLOOM’S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	3	2	2	3	1	2	2	2	-	-	-	-	-	-
CO2	3	2	2	3	1	2	1	3	2	-	1	-	-	-	-
CO3	2	2	3	1	2	2	2	1	1	-	-	-	-	-	-
CO4	1	1	2	3	2	1	2	2	2	-	-	-	-	-	-
CO5	2	2	1	2	1	1	2	1	2	1	-	-	-	-	-

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	I
CREDITS	5	COURSE TITLE	Core III: Organic Evolution
Course objective ❖ To critically analyze the concepts of evolution ❖ Understand the factors responsible for origin and generation of diversity among living beings. ❖ To develop strategies for sustenance of life on this planet. ❖ To understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance ❖ To gain in-depth knowledge of relationships within the animal kingdom and how species adapt to changing environments.			

Unit	Content	Hrs
I	Emergence of evolutionary thoughts: Lamarck and Darwin – concepts of variation, adaptation, struggle, fitness and natural selection – Mendelism - Spontaneity of mutations. Isolation-Types, Speciation.	14
II	Origin of cells and unicellular evolution: Origin of basic biological molecules - Abiotic synthesis of organic monomers and polymers - Concept of Oparin and Haldane - Experiment of Miller (1953) - The first cell - Evolution of prokaryotes -Origin of eukaryotic cells - Evolution of unicellular eukaryotes.	15
III	Paleontology and evolutionary history: The evolutionary time scale - Eras, periods and epoch - Major events in the evolutionary time scale	13
IV	Molecular Evolution Evolution of Hemoglobin and Cytochrome, History of Human Evolution- Biological Evolution of Human – the earliest Hominins - Bipedal and Brain size	16

	of the early Human Evolution.	
V	Fossils, Rates of Evolution and Evolution of Human Origin of Higher categories- Simpson's definition. Evidence from Fossil Record- Polyploidy-Modes of origin of higher taxa-Mosaic Mode-Connecting link- Quantum evolution- Simpson's adaptive grid. Cultural Evolution: Osteo - donto - Keratic culture -Pebble tool culture-Paleolithic culture-Neolithic Culture- Language, Self-Awareness and Death Awareness. Sociobiology-Selfish gene -Altruism -Kin selection.	17
TOTAL CONTACT HOURS		75
REFERENCE BOOK Bergstrom, C. T. and L. A. Dugatkin. 2012. Evolution, Second MEDIA Edition. W.W. Norton & Company, International Student Edition, pp-756. Jobling, M., E. Hollox, M. Hurles, T. Kivisild and C. T. Tyler Smith. 2014. Human Evolutionary Genetics. Second Edition. Garland Sciences, London, pp-650. Veer Bala Rostogi, 2018. Organic Evolution (Evolutionary Biology), Thirteenth Edition Vinoth Kumar Jain, Scientific International (Pvt.) Ltd, New Delhi, pp-590.		
E REFERENCE https://www.flipkart.com/books/evolution~contributor/pr?sid=bks http://www.evolution-textbook.org/ https://onlinelibrary.wiley.com/journal/15585646 http://darwin-online.org.uk/		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and explain the core theories of evolution, geological time scales, and the chemical origins of life.	PO1,PO2,PO4	K3
CO2	Analyze the mechanisms of speciation, cellular evolution, and the physical transitions in human phylogeny.	PO5	K4
CO3	Apply experimental evidence and paleontological records to demonstrate the functional progress of biological evolution.	PO8, PO9,	K3
CO4	Critically evaluate molecular, fossil, and	PO3,	K4

		behavioral evidence to understand the complexities of natural and social evolution.		
	CO5	Synthesize biological, molecular, and cultural data to formulate a holistic understanding of the history of life and human civilization.	PO5,PO6	K5

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	2	3	1	2	3	2	-	-	-	-	-	-
CO2	3	2	3	1	2	-	1	2	1	-	-	-	-	-	-
CO3	2	1	2	1	1	2	2	1	1	-	-	-	-	1	-
CO4	2	2	1	1	2	1	-	1	2	-	1	-	-	-	-
CO5	1	-	2	2	1	2	1	2	1	1	-	1	-	-	-

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	I
CREDITS	4	COURSE TITLE	Practical I : Lab Course in Structure and Function of Invertebrates, Comparative anatomy of Vertebrates, Organic Evolution
Course objective ❖ Understanding the different systems in Invertebrates & Vertebrates. ❖ Learning about various animal species, their phylogenetic affinities and their adaptive features. ❖ Imparting conceptual knowledge about the salient features and functional anatomy. ❖ Developing the skill in mounting techniques of the biological samples. ❖ Gaining fundamental knowledge on the skeletal system ❖ To examine the evolutionary history of humans and their ancestors			

Unit	Content	Hrs
I	Mounting & Dissection – Invertebrates Mounting: Earthworm-Body Setae Pineal Setae, Grasshopper -Mouth Parts Dissection: Earthworm-Nervous system. Prawn- Appendages	15
II	Study of the following slides with special reference to their salient features and their modes of life- <i>Amoeba</i> , <i>Entamoeba histolytica</i> , <i>Paramecium</i> , <i>Hydra</i> with bud, Sporocyst – Liver fluke, <i>Cercaria</i> larva, <i>Tape worm (Scolex)</i> , <i>Ascaris</i> T. S. Mysis of prawn. Spotters: <i>Scorpion</i> , <i>Penaeus indicus</i> , <i>Emerita (Hippa)</i> , <i>Perna viridis</i>	20
III	Mounting & Dissection – Vertebrates Mounting: Placoid & Ctenoid Scales. Dissection: Fish – Digestive system,	15

	Reproductive system.	
IV	Study of the following specimens with special reference to their salient features and their modes of life: <i>Amphioxus</i> sp. (Lancelet), <i>Ascidia</i> sp. (sea squirt), <i>Scoliodon laticaudatus</i> (Indian dog shark), <i>Trygon</i> sp. (Sting ray), <i>Torpedo</i> sp. (Electric ray), <i>Arius maculatus</i> (Cat fish), <i>Exocoetus poecilopecterus</i> (Flying fish), <i>Mugil cephalus</i> (Mullet), <i>Tilapia mossambicus</i> (Tilapia), <i>Dendrophis</i> sp. (Tree snake). Study of the frog skeleton system : Hyoid apparatus, Pectoral girdle and sternum, Pelvic girdle, Fore limb, Hind limb	20
V	Organic Evolution Experiments Variation – Fingerprints. Use of Models to study selection in large and small populations and principles of genetic drift. Spotters: Homologous & Analogous organs, Vestigial organs, Fossils, Embryos of various Vertebrates. Examples of Evolutionary importance – Peripatus and Limulus. Animals with adaptive coloration - Leaf insect, Stick insect, Chameleon.	20
TOTAL CONTACT HOURS		90

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Identify and describe the anatomical, microscopic, and evolutionary characteristics of various animal specimens and experimental models.		PO3, PO6,	K3
CO2	Develop hands-on technical skills in dissection, microscopic mounting, and data collection for evolutionary analysis.		PO6, PO7, PO8	K3
CO3	Apply anatomical knowledge to explain the functional adaptations and ecological roles of various invertebrate and vertebrate species.		PO3, PO8	K3

	CO4	Critically evaluate evolutionary evidence, parasitic adaptations, and comparative anatomical transitions across the animal kingdom.	PO5, PO8, PO6	K4
	CO5	Integrate laboratory observations and experimental results to formulate a comprehensive understanding of biological evolution and animal organization.	PO4, PO5	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	1	1	1	1	3	2	2	2	2	1	-	-	-	-	-
CO2	2	1	2	-	2	2	3	2	2	-	-	-	-	-	1
CO3	3	3	2	2	3	1	2	2	1	-	-	-	-	-	-
CO4	1	2	2	1	2	1	2	1	2	-	-	-	-	-	-
CO5	2	1	2	-	2	2	1	1	2	-	-	-	-	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic
council . 08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	I
CREDITS	4	COURSE TITLE	Elective I: Microbiology
Course objective ❖ Understand scope and importance of microbes ❖ Understanding the scope and importance of microbiology. ❖ Learning about various microbial world. ❖ Developing the skill in application of microorganism in industrial aspects. ❖ Gaining fundamental knowledge of microbial industry in crop improvement.			

Unit	Content	Hrs
I	History And Microbial Growth: History and application of Microbiology, Methods in microbiology-Microbial Cultures, methods of culturing anaerobes, methods of isolation and maintenance of pure culture, culture characteristics, microbial growth. Methods of bacterial growth, growth rate, growth curve. Measurement of bacterial growth, factors affecting bacterial growth. Culture medium, sterilization techniques. Staining Techniques - Simple, differential and Gram Staining.	11
II	Fermentors And Fermentative Microbes: History and design of fermenters, basic functions of fermenters, types of fermenter, construction of fermenters, design and operation, use of computer in fermenter, achievement and maintenance of asptic conditions, aseptic operation and contaminent, batch fermentation, fed batch fermentation, continuous fermentation, scale up of fermentations. Industrial	12

	microbiological processes, culture preservation, criteria for selection of microorganisms for fermentation, strain improvement.	
III	Industrial Microbiology: Alcohol production – Ethanol, Production of Acids- Vinegar, Production of Antibiotics – Penicillin and Streptomycin...Production and Application of Microbial Enzymes and Immobilization of Enzymes.	11
IV	Food Microbiology: Dairy Industry; Dairy Products-Yoghurt, Butter Milk, Butter, Cheese. Microbial Spoilage of food: Microbial Contamination and Spoilage of Poultry, Fish and Sea Foods. Preservation of Food: Preservative Methods – Physical and Chemical Methods.	12
V	Medical Microbiology: Bacterial diseases: Air borne diseases- Diphtheria, Streptococcal Pneumonia. Food and Water Borne Diseases- Cholera and Typhoid. Soil Borne Diseases - Tetanus, Anthrax. Sexually Transmitted Diseases - Gonorrhea and Syphilis. Contact Disease – Leprosy. Viral diseases - Influenza, Hepatitis - B, Corona virus.	14
TOTAL CONTACT HOURS		60

REFERENCE BOOK

Dr.R.C.Dubey .Dr.D.K.Maheswari, (2010), A Text book of Microbiology, S.Chand & CO Ramnager, New Delhi.

Ronald , M.Atlas, (1988), Microbiology Macmillan publishing company ,Newyork.

J.Pelczar, D,Reid. (1984), TATA Mc Graw Hill publishing company Ltd. Newyork.

Samuel Baron , Medical Microbiology, II Ed., Wesley publishing company, California Presscott-Microbiology.

N. Sathyanarayana-Biotechnology.

E REFERENCE

1. <https://www.classcentral.com/course/immunologyfundamentalsimmunityb cells-12724>

2. https://swayam.gov.in/nd2_cec20_bt05/preview

3. <https://www.classcentral.com/course/swayam-immunology>

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and explain the fundamental principles	PO1,PO3	K3

	of microbial growth, industrial fermentation, and the role of microbes in food and medicine.		
CO2	Analyse microbial growth dynamics, fermentation strategies, and the pathological mechanisms of various infectious diseases.	PO4,PO5,PO7	K3
CO3	Apply microbiological techniques to industrial production, food processing, and the management of clinical pathogens.	PO6,PO7	K4
CO4	Critically evaluate industrial fermentation efficiency, food safety protocols, and the epidemiological impact of microbial diseases.	PO3,PO5,PO7	K5
CO5	Integrate microbiological, industrial, and clinical data to formulate solutions for biotechnology, food security, and healthcare.	PO6,PO5,	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	2	3	2	1	2	2	-	2	-	1	-	-	-	-
CO2	3	1	2	1	2	2	1	-	2	-	-	-	-	-	-
CO3	3	2	1	2	2	1	2	1	2	-	-	-	-	-	-
CO4	2	2	2	2	2	-	1	1	2	1	-	-	-	-	-
CO5	1	1	1	1	1	2	2	2	1	-	-	-	-	-	-

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	I
CREDITS	4	COURSE TITLE	Elective I: Biostatistics & Bioinstrumentation

Course objective

- ❖ Students should know basic concepts in Biostatistics.
- ❖ Students will conduct basic Statistical analysis of data
- ❖ The students will think critically. Reason analytically and solve problems.
- ❖ To introduce probability theory, sampling methods, and confidence intervals to validate scientific findings.
- ❖ Familiarize students with therapeutic and diagnostic devices like ventilators, pacemakers, and imaging systems.

Unit	Content	Hrs
I	Collection of data: Primary and secondary data-Source and implications; Frequency distribution: Construction of frequency, distribution table for grouped data; Graphic methods: Frequency polygon and ogive curve; Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.	12
II	Measures of central tendency: Mean, median and mode for continuous and discontinuous variables. Measures of dispersion: Range, variation, standard deviation, standard error and coefficient of variation.	11
III	Probability distribution: Properties and application of Normal, Binomial and	

	Poisson distributions. Hypothesis testing: Student 't' test - paired sample and mean difference 't' tests.	11
IV	Good laboratory practice (GLP) - pH, Electrodes and pH meter, Chromatography- Thin layer Chromatography (TLC), Column Chromatography and High-performance liquid chromatography (HPLC).	14
V	Spectrophotometry-UV, Centrifuges- Low, high and Ultracentrifuge, Principles and Applications of tracer techniques in biology, Dosimetry- Geiger- Muller Counter, Scintillation Counter.	12
TOTAL CONTACT HOURS		60

REFERENCE BOOK

Arora, P. N. and P. K. Malhan. 1996. Biostatistics, Himalaya Publishing House, Mumbai, pp-447.

Gurumani, N. 2005. Introduction to Biostatistics, M.J.P. Publishers, Delhi, pp-407.

Das, D. and A. Das. 2004. Academic Statistics in Biology and Psychology, Academic Publisher, Kolkata, pp-363.

Palanichamy, S. and Manoharan, M. 1990. Statistical Methods for Biologists, Palani Paramount Publications, Tamil Nadu, pp-264.

Willard, HH (1986) Instrumental methods of Analysis, 6th Ed., CBS Publication, New Delhi.

E REFERENCE

<http://www.maths.lth.se/matstat/kurser/statgen/book/StatisticsInGenetics-20031125.pdf>

<http://www.bionica.info/biblioteca/AnonimoxxxIntroductionMolecularGenetics.pdf>

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Analyze and represent biological data using various statistical collection and visualization techniques.		PO3,PO4	K3
CO2	Apply measures of central tendency and dispersion to evaluate the variability and reliability of biological datasets.		PO3,PO4,PO5	K4
CO3	Utilize probability distributions and hypothesis testing to make statistical		PO5,PO6,PO8	K5

		inferences in biological research.		
	CO4	Demonstrate proficiency in Good Laboratory Practices and chromatographic techniques for biological separation.	PO5,PO7,	K3
	CO5	Operate and explain the principles of advanced bio-instruments and radioactive tracer techniques in research.	PO2,PO3,PO6	K4

MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	1	3	3	3	2	2	2	1	-	-	-	-	-	-
CO2	1	1	2	2	2	2	2	1	1	-	-	1	-	-	-
CO3	1	1	3	2	1	2	1	2	2	2	-	-	-	-	-
CO4	1	2	1	2	1	1	2	2	2	-	-	-	-	-	-
CO5	1	1	1	2	2	1	2	2	1	-	-	-	-	-	-

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	II
CREDITS	5	COURSE TITLE	Core IV: Cellular & Molecular Biology

Course objective

- ❖ Students will understand how these cellular components are used to generate and utilize energy in cells.
- ❖ Students will understand the cellular components underlying mitotic cell division.
- ❖ Understand the properties of DNA, RNA, and protein synthesis (transcription and translation) to comprehend genetic regulation.
- ❖ Relate cell functions to disease mechanisms and the development of diagnostic tools
- ❖ Develop laboratory skills in molecular biology, including DNA extraction, electrophoresis, and data analysis to solve research questions.

Unit	Content	Hrs
I	Microscopy and Prokaryotes Microscopy: Principles and applications - Electron Microscope (TEM), Phase Contrast Microscope, Confocal and Fluorescent Microscope. Prokaryotic cells- <i>E. coli</i> , Cyanobacteria and Mycoplasma. Bio membrane: Structure, Cell adhesion–Intercellular Junction and function.	12
II	Structure and functions of Cell Organelles	

	Structure and functions of Ribosomes, Mitochondria, Centrioles and Peroxisomes & Glyoxisomes. Nucleus: Structure and function, organization of Nucleosome, Euchromatin and Heterochromatin. Chromosomes - Ultrastructure and functions, Giant Chromosomes- Polytene and Lamp brush.	14
III	Nucleic acids, Cell cycle and Cell division DNA: Replication - Semi-Conservative method - experimental evidence, Enzymology of Replication, Bi-directional Replication, Rolling Circle Replication. DNA damage and repair mechanisms. Types of RNA-mRNA, rRNA, tRNA and ssRNA-Structure and functions. Cell Division and Cell Cycle: Mitosis, Meiosis, Steps in Cell cycle and Control of Cell Cycle.	12
IV	Protein Synthesis Protein synthesis – Transcription in Prokaryotes and Eukaryotes, Mechanism of Transcription - Initiation, Elongation, and Termination. Translation – Initiation of Protein Synthesis - activation of Amino acids, Aminoacylation of tRNA, Elongation and Termination of Polypeptide chain. Enzymes and factors involved in Protein Synthesis.	14
V	Regulation of Gene expression, Cancer and Apoptosis Regulation of Gene expression - Lac operon - Components, Repressor mechanism. Ara Operon- Arabinose metabolism in <i>E. coli</i> . Cancer – Types and Properties, Oncogenes and Tumour Suppressor Gene, Genetics of Cancer, Nanotechnology and Cancer. Biology of Aging-Apoptosis-Definition, Mechanism and Significance.	13
TOTAL CONTACT HOURS		65

REFERENCE BOOK

Karp, G. 2010. Cell Biology (Sixth Edition), John Wiley & Sons, Singapore, pp-765.

Lodish, H., C. A. Kaiser, A. Bretscher, *et al.*, 2013. Molecular Cell Biology (Seventh Edition), Macmillan, England, pp-1154

De Robertis, E.D.P. and E. M. F. De Robertis Jr, 1987. Cell and Molecular Biology. Info-Med, Hong Kong, pp-734

Abbas, A. K., A. H. Lichtman and S. Pillai, 2007, Cell and Molecular Immunology (Sixth Edition), Saunders, Philadelphia, pp-566

E REFERENCE

<https://nptel.ac.in/courses/102/106/102106025/>

<https://nptel.ac.in/courses/102/103/102103012/>

<https://swayam.gov.in/nd2>

<https://nptel.ac.in/courses/102/104/102104059>

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Demonstrate a fundamental understanding of microscopic techniques and the structural diversity of prokaryotic organisms.		PO1,PO3,PO7	K3
CO2	Explain the ultrastructure and specialized functions of eukaryotic organelles and chromosomal variations.		PO1,PO2	K3
CO3	Analyze the molecular mechanisms of DNA replication, repair, and the regulatory checkpoints of the cell cycle.		PO3,PO4,PO5	K4
CO4	Evaluate the complex processes of genetic information flow through transcription and translation in diverse biological systems.		PO5,PO7,PO8,	K5
CO5	Analyze the regulation of gene expression and the molecular basis of cellular pathologies like cancer and programmed cell death.		PO4	K4
CO6	Integrate molecular biology concepts to propose modern biotechnological or nanotechnological solutions for health and disease.		PO10,PO12	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	3	1	2	2	-	2	1	2	-	2	-	-	-
CO2	1	1	2	1	1	1	1	2	-	1	-	-	-	-	-
CO3	2	2	1	-	2	1	1	1	1	1	-	-	-	-	1
CO4	2	3	1	2	1	-	1	2	1	1	-	-	-	-	-

CO5	2	1	2	1	-	2	1	1	-	2	-	-	-	1	-
CO6	2	2	1	2	1	1	-	3	1	-	-	-	-	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council
08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	II
CREDITS	5	COURSE TITLE	Core V: Developmental Biology
Course objective ❖ Understand the process of gametogenesis, cleavage and gastrulation, embryonic development, extra embryonic membrane and placenta in various animals and human. ❖ Learn the principles, methods and applications of cryo-preservation of gametes and embryo. ❖ Students will understand the principles of embryonic development, including fertilization, cleavage, gastrulation, and organogenesis. ❖ Learning to interpret fate maps, the development of body plans, axis formation, and how cells are assigned specific roles.. ❖ Applying knowledge to understand developmental defects cancer, stem cell biology, regeneration and evolutionary changes in development			

Unit	Content	Hrs
I	Gametogenesis: Origin of Primordial germ cells–Spermatogenesis– Formation of Spermatid. Spermiogenesis – Oogenesis – Proliferative phase – Growth phase – Previtellogenesis – Vitellogenesis – Maturation phase. Types of Egg–Hormonal	12

	regulation– Gene expression and control.	
II	Fertilization and Cleavage: Process and mechanism – Activation of Egg and Sperm – Essence of Activation program - Ionic fluxes and Inhibition of Polyspermy – changes in Egg organization after Fertilization–Theories of fertilization– signification of fertilization. Cleavage: Types–Pattern and Molecular changes during Cleavage – maternal cleavage– Maternal gene action and morphogenetic movements– Cells adhesion molecules and pattern formation. Cleavage in Amphioxus, Frog, Chick, and Mammal.	14
III	Gastrulation and Organogenesis Frog, Chick–Fate map, Morphogenetic movement & Gastrulation. Formation of Primary organ Rudiments, Methods of Organ formation, Tubulation in Chick. Development of Eye and heart in frog. Embryonic membranes in Chick. Placenta and formation in Mammals.	13
IV	Induction and Differentiation: Spemann’s Primary Organizer – Analysis of nature of Induction – Emission of inducing substances by Natural Inductions – chemical analysis of inducing substances –Mechanism of action of inducing substances -Theories of Organizer. Differentiation: Types–factors causing Differentiation–dedifferentiation– trans differentiation. Post embryonic events: Metamorphosis in Amphibians and Insects. Regeneration in Planarian and Amphibian.	12
V	Applied Embryology: Human development – Hormonal regulation of Reproductive Cycle – Ovulation – organization of Sperm and Egg–Fertilization–Blastocyst formation–Implantation– Pregnancy changes and Foetal growth – multiple and abnormal Pregnancies – Parturition – Birth defects – Teratogenesis.	14
TOTAL CONTACT HOURS		65

REFERENCE BOOK

Balinsky, B. I. 1981. Introduction to Embryology (5th Edition), CBS College Publishers, New York, pp-782.

Gilbert. S. F. 2006. Developmental Biology, 8th Edition, INC Publishers, USA, pp-785.

Berrill, N.J. 1974. Developmental Biology, Tata Mc-Graw Hill Publications, New Delhi, pp-535.

Tyler, M.S. 2000. Developmental Biology - A Guide for Experimental Study, Sunderland, MA,

pp-208.

Subramoniam, T. 2011. Molecular Developmental Biology (2nd Edition), Narosa Publishers, India, pp-364.

E REFERENCE

<https://nptel.ac.in/courses/102/106/102106084/>

COURSE OUTCOME (CO)			PO	K LEVEL
	CO1	Recall and describe the fundamental processes of gametogenesis and the hormonal control of reproduction	PO1,PO2,PO7	K3
	CO2	Understand the molecular and physiological mechanisms of fertilization, cleavage, and early embryonic activation.	PO1,PO2,PO6	K3
	CO3	Illustrate and compare the morphogenetic movements and organogenesis processes in various animal models.	PO3,PO6,PO8	K4
	CO4	Analyze the principles of embryonic induction, the role of organizers, and the dynamics of cellular differentiation	PO5,PO6	K4
	CO5	Evaluate the biological significance of metamorphosis, regeneration, and the evolution of embryonic membranes	PO5	K5
	CO6	Integrate developmental concepts to address clinical aspects of human pregnancy, birth defects, and applied embryology.	PO10	K6

BLOOM'S MAPPING

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------

CO															
CO1	2	1	3	2	1	2	1	1	1	-	1	-	-	-	-
CO2	2	2	1	2	2	1	1	1	-	-	-	2	-	-	2
CO3	1	2	1	1	2	3	1	1	1	-	-	-	2	-	-
CO4	2	3	2	1	1	1	2	2	1	2	-	-	-	-	-
CO5	1	2	2	1	1	1	1	1	-	-	-	-	-	-	-
CO6	3	2	3	1	2	2	2	2	1	-	-	-	-	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council
08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	II
CREDITS	5	COURSE TITLE	Core: VI: Ethnozoology and Sustainable Animal Sciences

Course objective

- ❖ To introduce students to the fundamental concepts, sources, and scientific contributions of the Indian Knowledge System related to biological sciences.
- ❖ To examine traditional Indian perspectives on animal life, health, biodiversity, ecology, and sustainable resource management.
- ❖ To critically analyse indigenous knowledge using modern zoological principles and promote interdisciplinary research integrating traditional wisdom with contemporary science.
- ❖ To create awareness about ethical practices, conservation values, and intellectual property rights associated with traditional knowledge.
- ❖ Understand the role of animal resources in rural development, cultural ceremonies, and

economic welfare.

Unit	Content	Hrs
I	Introduction to Indian Knowledge System and Biological Thought Sources of Indian scientific knowledge: Vedas, Upanishads, Puranas and classical texts, Concepts of life, biodiversity and ecology in ancient Indian literature, Animal classification in traditional Indian texts, Ethical perspectives towards animals: Ahimsa, Dharma and ecological balance, Contribution of ancient Indian scholars to biological sciences.	23
II	Traditional Zoology and Animal Health Systems: Ayurvedic concepts related to animal physiology and behaviour, Panchamahabhuta and Tridosha concepts in understanding animal health, Ethnoveterinary medicine and indigenous animal healthcare practices, Traditional livestock management and breeding methods, Role of medicinal plants in animal disease management.	19
III	Indigenous Ecological Knowledge and Wildlife Conservation: Traditional ecological knowledge (TEK) and biodiversity conservation, Sacred groves and protection of fauna in Indian culture, Indigenous fishing practices and sustainable harvesting, Human–wildlife coexistence in tribal communities, Climate adaptation strategies in traditional ecological systems.	21
IV	Indigenous Technologies Related to Zoology: Sericulture, apiculture and lac culture in Indian tradition, Traditional aquaculture and fish culture systems, Natural pest control and biological regulation methods, Fermentation and microbiological practices in traditional foods, Animal-based products in traditional industries (silk, honey, dairy).	22
V	IKS Integration with Modern Zoological Science: Scientific validation of traditional knowledge in zoology, Traditional Knowledge Digital Library (TKDL) and IPR issues, Bioprospecting and ethical considerations, Role of indigenous knowledge in conservation biology and sustainable development, Case studies linking IKS with modern zoological research	20
TOTAL CONTACT HOURS		105

REFERENCE BOOK

B. Mahadevan, Vinayak Rajat Bhat & Pavana R.N. Nagendra – [*Introduction to Indian Knowledge*](#)

<i>System: Concepts and Applications.</i> N.M. Khandelwal & Pratapsinh Chauhan – <i>Indian Knowledge System (Bhartiya Gyan Parampara)</i> Deepshikha Saxena & Ashok Kumar Upadhyay – <i>Indian Knowledge System</i>
E REFERENCE https://iks.iitgn.ac.in/readings-2022/?utm_source https://iks.uem.edu.in/available-books/?utm_source

<i>System: Concepts and Applications.</i> N.M. Khandelwal & Pratapsinh Chauhan – <i>Indian Knowledge System (Bhartiya Gyan Parampara)</i> Deepshikha Saxena & Ashok Kumar Upadhyay – <i>Indian Knowledge System</i>
E REFERENCE https://iks.iitgn.ac.in/readings-2022/?utm_source https://iks.uem.edu.in/available-books/?utm_source

<i>System: Concepts and Applications.</i> N.M. Khandelwal & Pratapsinh Chauhan – <i>Indian Knowledge System (Bhartiya Gyan Parampara)</i> Deepshikha Saxena & Ashok Kumar Upadhyay – <i>Indian Knowledge System</i>
E REFERENCE https://iks.iitgn.ac.in/readings-2022/?utm_source https://iks.uem.edu.in/available-books/?utm_source

<i>System: Concepts and Applications.</i> N.M. Khandelwal & Pratapsinh Chauhan – <i>Indian Knowledge System (Bhartiya Gyan Parampara)</i> Deepshikha Saxena & Ashok Kumar Upadhyay – <i>Indian Knowledge System</i>
E REFERENCE https://iks.iitgn.ac.in/readings-2022/?utm_source https://iks.uem.edu.in/available-books/?utm_source

<i>System: Concepts and Applications.</i> N.M. Khandelwal & Pratapsinh Chauhan – <i>Indian Knowledge System (Bhartiya Gyan Parampara)</i> Deepshikha Saxena & Ashok Kumar Upadhyay – <i>Indian Knowledge System</i>
E REFERENCE https://iks.iitgn.ac.in/readings-2022/?utm_source https://iks.uem.edu.in/available-books/?utm_source

<i>System: Concepts and Applications.</i> N.M. Khandelwal & Pratapsinh Chauhan – <i>Indian Knowledge System (Bhartiya Gyan Parampara)</i> Deepshikha Saxena & Ashok Kumar Upadhyay – <i>Indian Knowledge System</i>
E REFERENCE https://iks.iitgn.ac.in/readings-2022/?utm_source https://iks.uem.edu.in/available-books/?utm_source

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Relate the historical and philosophical foundations of the Indian Knowledge System (IKS) to modern biological and ecological thought.	PO1,PO2,PO6	K4	
CO2	Interpret traditional animal health systems and ethnoveterinary practices using Ayurvedic and indigenous frameworks.	PO9	K4	
CO3	Apply indigenous ecological knowledge and sustainable harvesting practices to modern wildlife conservation strategies.	PO3,PO7	K3	
CO4	Analyze the scientific principles underlying traditional zoological technologies like sericulture, apiculture, and aquaculture.	PO4, PO5	K3	
CO5	Evaluate the legal, ethical, and intellectual property aspects of integrating traditional knowledge with modern bioprospecting.	PO13	K5	
CO6	Create integrated models that synthesize indigenous wisdom with modern zoological research for sustainable development.	PO11, PO12	K6	

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
----------	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------

CO1	2	1	2	2	3	2	1	1	-	2	-	2	-	-	-
CO2	2	2	1	2	2	1	1	1	-	-	-	1	-	-	-
CO3	1	1	1	1	2	3	1	1	-	-	2	-	-	-	-
CO4	2	1	1	1	1	1	2	2	2	-	2	-	1	-	-
CO5	2	2	2	1	1	1	1	1	-	-	-	-	-	-	-
CO6	3	1	-	1	2	2	2	2	-	-	-	-	-	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council

08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	II
CREDITS	3	COURSE TITLE	Practical II: Cell Biology, Developmental Biology & Ethnozoology and Sustainable Animal Sciences.
Course objective ❖ Acquire knowledge to differentiate the cells of various living organisms and become awareness of physiological processes of cells e.g., cell divisions, various stages of fertilization and embryo development. ❖ Understand and observe as well as correctly identify different cell types, cellular structures using different microscopic techniques. ❖ Develop handling - skills through the wet-lab course.			

- ❖ Learn the method of culturing of *Drosophila* and identification of their wild and mutant strains.
- ❖ Acquire skills to perform human karyotyping and chromosome mapping to identify abnormalities

Unit	Content	Hrs
I	Microscopy: Optical and Phase Contrast Microscope Micrometry - Measurement of cells using Ocular and Stage micrometers - Length and Width. Counting of blood cells in Human blood - R.B.C and W.B.C	12
II	Identification of mitotic stages in Onion root tip. Identification of meiotic stages in <i>Tradescantia</i> Observation of Giant chromosome in Chironomus/Fruit fly larva. (Visual Aid / Virtual Dissection) Observation of osmosis in Onion epidermal cells (Demonstration only)	14
III	Early Embryonic development of Frog – Observation of 2 cell, 4 cell, 8 cell, 16 cell, Blastula, Gastrula and Yolk plug stages. Temporary Mounting of Chick Blastoderm Early Hours of Chick development – Observation of various stages 24, 48, 72 and 96 hrs of chick blastoderm.	15
IV	Types of eggs- , Insect, Chick, Frog, Human Sperms-Amphioxus, Petromyzon, Frog, Human. Amphibian Metamorphosis. Blastema formation.	10
V	Visit Report: Sacred groves and biodiversity conservation. Temple ponds, traditional water management, and aquatic fauna. Indigenous pest control and animal welfare practices. Traditional fish culture systems in India. Indigenous poultry, cattle, and silkworm rearing practices. Ethnoveterinary medicine and natural remedies.	9
TOTAL CONTACT HOURS		60

COURSE OUTCOME (CO)	PO	K LEVEL
---------------------	----	---------

CO1	Operate advanced microscopic tools and perform micrometry to quantify cellular dimensions and blood cell populations.	PO2,PO3	K3
CO2	Prepare and examine cytological slides to identify the various stages of cell division and giant chromosomal structures.	PO6, PO10	K3
CO3	Examine the chronological stages of embryonic development in amphibian and avian models through mounting and observation	PO3,PO11,PO12	K4
CO4	Compare the morphological diversity of gametes and the physiological processes of metamorphosis across vertebrate groups.	PO1,PO8	K4
CO5	Evaluate the scientific validity of traditional ecological knowledge and indigenous animal husbandry through field observations.	PO8,PO12	K5
CO6	Integrate laboratory findings and field data into professional scientific reports and conservation proposals.	PO6,PO7	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	3	2	2	1	2	2	-	1	2	2	2	-	-	-
CO2	1	2	1	3	2	2	2	-	-	1	-	-	-	-	-
CO3	3	2	2	1	2	1	2	-	1	1	-	-	-	-	-
CO4	2	2	3	3	1	1	2	2	2	1	-	-	1	2	-
CO5	1	2	2	1	3	1	1	1	-	2	2	-	-	-	-
CO6	3	1	2	2	2	2	2	2	1	-	-	-	-	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic
council . 08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	II
CREDITS	4	COURSE TITLE	Elective II: Bioinformatics & Computer Application
Course objective ❖ Understand the basic concepts in Bioinformatics and Computer Application. ❖ Learn the Knowledge on the Computational analysis of genes and proteins. ❖ Provide foundational knowledge in genomics, proteomics, and transcriptomics. ❖ Sensitize students to the ethics behind bioinformatics research and data sharing. ❖ Introduce major biological databases (e.g., NCBI, EBI, UniProt) and techniques for querying, storing, and retrieving biological data.			

Unit	Content	Hrs
I	Basics Of Bioinformatics: Introduction to Bioinformatics, important contributions, sequence development, aims and tasks, Fields related to Bioinformatics, Applications of Bioinformatics in various fields.	12
II	Databases: Importance of Databases, Nucleic acid Sequence Databases- EMBL, GenBank. Protein Sequence Databases- SWISSPROT, TrEMBL and PIR. Structure of Databases, Uses of Databases. Objectives of Biological Databases.	11
III	Sequence Alignment: Algorithm, goals and types of Alignment, Study of seminaries, Scoring mutation, Deletion and Substitutions, Sequence Alignment methods. Pairwise sequence alignment – Dot matrix, Dynamic Programming & word or K tuple, FASTA, BLAST. Multiple Sequence Alignment- Dynamic programming, progressive and Iterative method CLUSTAL W.	15
IV	Proteomics-Proteomics: Protein structures – Primary, Secondary & Tertiary – Protein Structure Predictions: a). Ab initio modeling and Identification of conserved and variable regions. b) Comparative modeling – homology modeling and protein threading. Protein. Structure prediction software available on the web.	12
V	Computer Application: Introduction to computers, Architecture of computers, milestones and early development, types of modern computers, Number system – Binary, Decimal and Octal number system. Hardware and software. Symbols of databases, importance of databases-types, classification, entries, sequence formats, record, database management system, RDBMS, SQL, data mining Computers and programs, Internet, world wide web, browsers and search engines, statistical software available on web.	10
TOTAL CONTACT HOURS		60
REFERENCE BOOK		
S.Ignacimuthu ., (2005), Basic Bioinformatics, III Ed., Narosa Publishing House Pvt. Ltd.		
Prakash S Lohar., (2009), Bioinformatics, I Ed., MJP Publishers.		
BG Curran., (2010), Bioinformatics, I Ed., CBS Publishers & Distributors. M.Rajadurai (2010) – Bioinformatics A Practical Manual – I Ed., PBS Book Enterprises.		
T K Attwood & D J Parry Smith., (2008), Introduction to Bioinformatics, I Ed., Himalaya Publishing House.		

E REFERENCE

<https://en.wikipedia.org/wiki/Bioinformatics>
<https://www.irma-international.org/viewtitle/17848/?isxn=9781591409892#:~:text=A%20bioinformatics%20Web%20portal%20is,databases%20through%20a%20Web%20browser.>

international.org/viewtitle/17848/?isxn=9781591409892#:~:text=A%20bioinformatics%20Web%20portal%20is,databases%20through%20a%20Web%20browser.

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Recall and describe the fundamental concepts of bioinformatics, computer hardware, and software architectures.	PO1,PO5	K3	
CO2	Summarize the organization, structure, and utility of various biological databases for genomic and proteomic data.	PO1,PO2	K3	
CO3	Execute sequence alignment algorithms and computational tools to identify similarities and evolutionary relationships.	PO5,PO6	K4	
CO4	Analyze protein structures and predictive models to understand the functional implications of molecular sequences.	PO8,PO10	K4	
CO5	Evaluate the efficiency of different biological algorithms and data mining techniques in solving complex biological problems.	PO4,PO7	K5	
CO6	Integrate computer applications, statistical software, and bioinformatics workflows to propose solutions for biological research.	PO6,PO13	K6	

BLOOM'S MAPPING

BLOOM'S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15

CO1	2	2	2	2	1	2	1	1	1	2	-	-	2	-	-
CO2	2	2	1	2	2	1	1	1	-	1	-	-	-	-	-
CO3	1	1	1	1	2	3	1	1	1	1	-	-	-	-	-
CO4	2	1	1	1	1	1	2	2	1	2	1	-	-	1	-
CO5	1	-	2	2	1	1	1	1	-	-	-	-	-	-	-
CO6	1	1	-	1	2	3	2	2	1	-	-	-	-	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council
08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	II
CREDITS	4	COURSE TITLE	Elective II: Animal Behaviour
Course objective ❖ To produce animals with high yielding quality. ❖ To produce animals with high feed conversion rate. ❖ To produce animals that are resistant to disease and parasites. ❖ Apply knowledge of animal behaviour to solve problems in animal welfare, husbandry, and wildlife conservation. ❖ Understand the ethical implications of animal research and management.			

Unit	Content	Hrs
I	Genetic material, Genes and chromosomes, Genetic variation, Single and Polygenic inheritance of behaviour, Heritability of behaviour, Natural selection and behaviour, Frequency distribution of phenotypes, Darwinian fitness, Evolution of adaptive strategies.	15
II	Sexual selection, Altruism, Sexual strategy and social organisation, Animal perception, Neural control of behaviour, Sensory processes and perception, Visual adaptations to unfavourable environments.	12
III	Coordination and Orientation, Homeostasis and Behaviour, Physiology and Behaviour in changing environments, Animal Learning, Conditioning and Learning, Biological aspects of learning, Cognitive aspects of learning.	10
IV	Instinct and learning, Displacement activities, Ritualization and Communication, Decision making behaviour in Animals, Complex behaviour of honeybees, Evolutionary optimality, Mechanism of Decision making. The mentality of Animals: Languages and mental representation, non-verbal communication in human, mental images, Intelligence, tool use and culture, Animal awareness and Emotion.	12
V	Organization of circadian system in multicellular animals; Concept of central and peripheral clock system; Circadian pacemaker system in invertebrates with particular reference to Drosophila; Photoreception and photo- transduction; Molecular bases of seasonality; The relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chrono pharmacology, Chrono medicine, Chronotherapy.	11
TOTAL CONTACT HOURS		60

REFERENCE BOOK

David McFarland, 1985. Animal Behaviour, Longman Scientific & Technical, UK. 576pp.

Harjindra Singh, 1990. A Text Book of Animal Behaviour, Anomol Publication, 293pp.

Hoshang S. Gundevia and Hare Govind Singh, 1996. Animal Behaviour, S. Chand & Co, 280pp.

Shukla, J. P 2010, Fundamentals of Animal Behaviour, Atlantic, 587pp.

Vinod Kumar, 2002. Biological Rhythms. Narosa Publishing House, Delhi.

E REFERENCE

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Relate the principles of genetics and natural selection to the evolution and heritability of animal behaviors.	PO1,PO3,PO5	K3
CO2	Interpret the neural and sensory mechanisms that govern animal perception and sexual strategies within social structures.	PO1,PO2,PO6	K3
CO3	Analyze the physiological and cognitive aspects of animal learning, orientation, and homeostatic behavioral responses.	PO2,PO3,PO10	K4
CO4	Evaluate complex behaviors such as communication, ritualization, and decision-making through the lens of evolutionary optimality.	PO5,PO6,PO9	K5
CO5	Appraise the mentality of animals, including tool use, intelligence, and the ethical implications of animal awareness and emotion.	PO4,PO13	K5
CO6	Synthesize chronobiological concepts to understand human health, disease, and the application of chronotherapy in clinical settings.	PO13	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	1	2	2	1	2	1	1	1	2	-	-	-	-	-

CO2	3	3	2	2	2	1	-	2	-	1	-	-	-	-	-
CO3	2	2	1	1	2	3	1	1	1	2	-	-	-	-	-
CO4	2	1	3	2	3	1	2	2	1	2	-	-	-	-	2
CO5	3	2	2	1	1	2	1	1	-	2	2	-	2	-	-
CO6	2	2	-	2	2	2	2	2	1	-	1	-	2	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council

08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	III
CREDITS	5	COURSE TITLE	Core VII: Molecular Genetics
Course objective ❖ Learn the structure and function of chromosome and chromosomal basis of genetic disorders. ❖ To acquire knowledge about microbial genetics. ❖ To provide information about rDNA technology and its application. ❖ Master the mechanisms of transcription, translation, and their regulation. ❖ Relate genetic variants to human disease, understand Mendelian/non-Mendelian			

inheritance, and develop skills in pedigree analysis and genetic counseling.

Unit	Content	Hrs
I	Structure, properties and functions of genetic materials: DNA as the genetic Materials - alternate and unusual forms of DNA - Physical and Chemical properties of nucleic acid, base properties, denaturation and renaturation.	16
II	Polygenic Inheritance - Skin colour in Man. Multiple Alleles ABO, Rh and MN blood group inheritance. Role of Genes in Metabolism – Disorders of Phenyl alanine Metabolism only. Genetic code - Characteristics of Genetic code - Deciphering of Genetic Code - invitro and invivo codon Assignment - Wobble hypothesis.	18
III	Pedigree Chart. Human Karyotype Analysis. Sex determination - Sex Determination in Man, Drosophila, Fowl, Butterfly, Grasshopper and Honeybee: Sex Linked Inheritance in Man. Chromosomal Syndromes-Klinefelter, Down's, Turner, Extrachromosomal inheritance- Paramecium and Snail.	17
IV	Recombinant DNA technology: Recombinant DNA technology - Overview - Tools for Recombinant DNA Technology – Vectors P ^{BR} 322, Techniques used in recombinant DNA technology - generation of DNA fragments - Restriction endonucleases, DNA modifying enzymes, Ligases.	20
V	Introduction of rDNA into host cell - calcium chloride mediated gene transfer - <i>Agrobacterium</i> mediated DNA transfer, electroporation, microinjection, liposome fusion, particle gun bombardment - Selection and screening of transformed cells - Expression of cloned gene; Application of rDNA technology in human welfare - Environment, Medicine and Agriculture.	19
TOTAL CONTACT HOURS		90

REFERENCE BOOK

Griffiths, A. J. F., H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart. 2012. An Introduction to Genetic Analysis. 11th Edition, W. H. Greeman. New York.

Snustad, D.P., Simmons, M.J. 2015. Principles of Genetics, John Wiley Publications, pp-784.

Watson, J. D., T. A. Baker, S. P. Bell, Alexander Gann, Michael Levine, Richard Losick. 2003. Molecular Biology of the Gene, (5th Edition). Cold Spring Harbor Laboratory Press, pp-912.

Klug, W. S. and M. R. Cummings, C. A. Spencer. 2005. Concepts of Genetics, Benjamin - Cummings Publishing Company.

Harti, D. L. 2002. Essential Genetics, A Genomic Perspective, Jones & Bartlet.

Krebs, J. E., E.S. Goldstein, S.T. Kilpatrick. 2018. Lewin's Genes XII, Jones & Bartlet Publisher, pp-613.

Watson, J. D., T. A. Baker S. P. Bell, A. Cann, M. Levine and R. Losick, 2014. Molecular Biology of Gene 7th Edition, Pearson Education RH Ltd. India.

E REFERENCE

https://onlinecourses.swayam2.ac.in/cec21_bt02/preview

<https://www.khanacademy.org/science/high-school-biology/hs-molecular-genetics/hs-rna-and-protein-synthesis/a/the-genetic-code>

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Describe the fundamental principles of genetic material, inheritance patterns, and the basic framework of recombinant DNA technology.		PO1,PO2	K3
CO2	Explain the molecular mechanisms of gene expression, chromosomal behavior, and the enzymatic basis of DNA manipulation.		PO2,PO6	K4
CO3	Apply genetic principles and biotechnological tools to solve problems related to inheritance, blood grouping, and molecular cloning.		PO5,PO8	K3
CO4	Analyze complex genetic data, metabolic pathways, and the comparative efficiency of various molecular biology techniques.		PO6,PO8,PO9	K4
CO5	Evaluate the ethical and functional implications of genetic modifications and the role of genetics in advancing human welfare.		PO12	K5
CO6	Design experimental protocols and genetic diagnostic strategies by integrating molecular biology techniques and inheritance theories.		PO13	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	2	1	1	1	1	2	2	1	3	-	-

CO2	2	2	1	1	1	2	1	1	-	2	1	1	-	1	1
CO3	2	1	2	1	2	1	1	3	1	-	1	-	-	-	-
CO4	2	2	1	2	2	3	2	2	2	-	2	2	-	2	-
CO5	1	2	2	1	2	2	1	2	2	1	-	2	-	1	-
CO6	2	2	1	2	2	2	2	2	2	2	-	2	-	2	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council
08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	III
CREDITS	5	COURSE TITLE	Core VIII: Sericulture
Course objective ❖ Students should know basic concepts and techniques in Sericulture. ❖ Impart practical training in mulberry cultivation, silkworm rearing techniques, and silk reeling to maximize quality cocoon production. ❖ Introduce new technologies, high-yielding mulberry varieties, and improved, disease-free			

silkworm seeds to enhance productivity.

- ❖ Understand the biology of various silkworm species, their food plants, and silkworm pathology.
- ❖ Provide an understanding of the economic importance of sericulture, the, and market aspects of cocoons and raw silk.

Unit		Content	Hrs
I		Introduction to textile fibers; types- natural and synthetic fibers; sources of silk fiber- Eri,Tasar, Muga; properties and importance of silk fiber. History, development, status, characteristics, and advantages of sericulture in India.	12
II		Host plants; Moriculture- distribution, morphology, propagation- seedling, cutting, grafting, layering and micropropagation methods, maintenance- irrigation, manuring and pruning, pests and diseases of mulberry.	17
III		Bombyx mori- morphology, anatomy-Silk gland, digestive, reproductive system, life cycle, geographical locations, larval moults, voltinism, indigenous and commercial races. Diapause. Egg-storage and transportation.	16
IV		Rearing and Reeling: <i>Bombyx mori</i> - Voltinism, Diapause, Egg-storage and transportation. Rearing houses and equipment. Rearing operations- disinfection, brushing, feeding and spacing. Moulting, spinning, and harvesting. Rearing methods- Chawki, Late age worm rearing-s shelf-rearing, floor-rearing and shoot rearing. Diseases of <i>Bombyx mori</i> - protozoan, bacterial, viral and fungal. Pests of silkworm- Uzi fly, dermestids, mites, ants, nematodes.	14
V		Reeling: Physical and commercial characteristics of cocoons. Cocoon harvesting and marketing. Cocoon sorting, stifling, deflossing, riddling, cooking, brushing, reeling, and re-reeling. Weaving. By-products of sericulture industry.	16
		TOTAL CONTACT HOURS	75

	REFERENCE BOOK • G. Ganga and J. Sulochana Chetty. 2019. An introduction to sericulture, 2nd edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. • M. Johnson and M. Kesary. 2019. Sericulture, Saras publication, Tamilnadu. • Singh, Amardev & Ravinder Kumar. 2013. Sericulture handbook Vol 1, Biotech. • M. Madan Mohan Rao. An Introduction to Sericulture, 2nd edition, BS Publications.
--	---

	E REFERENCE https://agritech.tnau.ac.in/sericulture/ https://csb.gov.in/
--	---

COURSE OUTCOME (CO)			PO	K LEVEL
CO 1	Recall and identify the fundamental components of sericulture, including fiber types, host plants, silkworm biology, and industry terminology.		PO2,PO3,PO7	K2
CO 2	Explain the biological processes of silkworms, agricultural requirements of host plants, and the socio-economic scope of sericulture.		PO6,PO9	K3
CO 3	Apply technical skills in mulberry cultivation, silkworm rearing, and cocoon processing to ensure productive sericulture practice.		PO6,PO7	K3
CO 4	Analyze the factors affecting silkworm health, plant productivity, and the comparative efficiency of different rearing and reeling techniques.		PO5,PO8	K4
CO 5	Evaluate the quality of sericulture products and the efficacy of management protocols in controlling diseases		PO5,PO8	K5

		and pests.		
	CO 6	Design comprehensive management strategies and innovative protocols for the improvement of the silk production value chain.	PO12,PO14	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	3	3	1	2	1	3	1	1	2	2	1	1	-	-
CO2	2	2	1	1	1	3	1	1	2	2	1	1	-	1	1
CO3	2	1	2	1	2	2	2	1	1	1	1	3	1	-	1
CO4	2	2	1	2	3	2	2	3	2	2	3	2	2	2	-
CO5	1	2	2	1	3	2	1	3	2	1	2	2	2	-	-
CO6	2	2	1	2	2	2	2	2	2	2	2	2	3	-	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council

08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	III
CREDITS	5	COURSE TITLE	Core IX: Immunology
Course objective			

- ❖ To impart conceptual understanding of functional organization of immune system and its responsiveness in health and disease.
- ❖ Analyze the role of the immune system in disease, including autoimmunity, hypersensitivity, allergy, and chronic inflammation.
- ❖ Gain knowledge of lymphocyte generation, B- and T-cell receptor gene rearrangements, and antigen recognition.
- ❖ Apply knowledge to analyze clinical data, interpret experimental results, and understand modern diagnostic/therapeutic techniques
- ❖ To enable a successful performance in Immunology component of CSIR-UGC NET.

Unit	Content	Hrs
I	Introduction to Immunology: An overview; Scope of immunology, recognition of self and non-self as a basic functional feature of immune system; Concepts of external and internal defense systems; External (first line / innate) defense system: components, distribution, salient functions; Internal (second line / acquired) immune system: cellular and humoral immune components- distribution, salient functions- primary and secondary immune responses; Immune tissues / organs: types, anatomical location, structure and development; lymphocyte traffic during development; Types of immunity: innate and acquired - types, functional features; concept of adaptive immunity	14
II	Antigens: Definition, characteristic features and classification; Antigenicity versus immunogenicity; Adjuvants: definition, types and applications	12
III	Major effector components of cellular immune system: Lymphocytes - types, morphology, clones; sub-populations, distribution, B and T cell receptors, B and T cell epitopes, Toll-like receptors; Antigen presenting cells: antigen processing and presentation, MHC molecules and their immunologic significance. Major effector components of humoral immune system: Antibodies – Primary structure, classification, variants and antigen-antibody interactions; Structural and functional characteristics of various antibody classes; Generation of diversity.	15
IV	Monoclonal antibodies: definition, production and applications; Antibody engineering and its applications. Complement system - Components, three major activation pathways, and immune functions including anaphylaxis and	

	inflammation. Cytokines -Definition and salient functional features; Interleukins: definition, types (lymphokines and monokines), and functions. Interferons - Origin, types and functions	16
V	Diseases and immune responses: Hypersensitivity: definition, Types I to IV and immune manifestations; Auto-immune diseases: onset, spectrum of diseases, and major immune responses; Immunodeficiency diseases: types including SCID and consequences; Viral (HIV), bacterial (tuberculosis) and parasitic (malaria) diseases: etiology, host immune responses and evasion by pathogens; Vaccines: types, preparations, efficacies and recent developments.	18
TOTAL CONTACT HOURS		75
REFERENCE BOOK Kuby, J. 1997. Immunology. W. H. Freeman & Co., New York, pp-670. Male, D. J. Brostoff, D. B. Roth and I. Roitt. 2006. Immunology (7th edition), Mosby / Elsevier, Philadelphia, pp-472 Abbas, A. K and A. H. Lichtman. 2007. Cellular and Molecular Immunology (6th edition), W. B. Saunders, Philadelphia, pp-564 Coica, R. Sunshine, G. 2015. Immunology (Seventh Edition), Wiley Blackwell, UK, pp- 406.		
E REFERENCE https://www.ncbi.nlm.nih.gov/books/NBK279396/ https://pmc.ncbi.nlm.nih.gov/articles/PMC6156898/ https://www.dhemajicollege.in/class/pdf/1654936285_267124360.pdf https://www.ncbi.nlm.nih.gov/books/NBK459471/ https://courses.lumenlearning.com/wm-biology2/chapter/t-and-b-lymphocytes/		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and identify the fundamental organs, cells, and molecules of the immune system and the basic terminology of immunological defence.	PO1,PO2	K3
CO2	Explain the molecular and cellular mechanisms of immune recognition, antigen presentation, and the various effector pathways of humoral	PO2,PO5,PO6	K3

CO5	1	2	2	1	3	2	1	2	2	1	2	2	2	1	2
CO6	2	2	1	2	2	2	2	2	2	2	2	3	3	2	-

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council
08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	III
CREDITS	3	COURSE TITLE	Core Practical III: Molecular Genetics, Sericulture and Immunology

Course objective

- ❖ To obtain practical knowledge in genetics, sericulture and immunology
- ❖ To understand the concepts of genetics through experiments.
- ❖ To comprehend physiological activity of organ systems
- ❖ Offer training in post-harvest handling, marketing, and the overall economics of the silk industry
- ❖ Promote sericulture as a profitable agribusiness and improve rural employment opportunities.

Unit	Content	Hrs
-------------	----------------	------------

I	Genetics Mendel's Law of Segregation with Beads of Two different Colors. Mendel's Law of Independent Assortment with Beads of Four different Colors Probability-Tossing of Coins. Correlation of Length and Width of leaves. Observation of Simple Mendelian Traits.	19
II	Spotter Chromosomal Disorders in Man – Down's Syndrome, Turner's Syndrome, Klinefelter's Syndrome. Sex Linked Inheritance in Man -Colour Blindness and Haemophilia. Multiple Alleles - ABO, Rh blood group. Twins – Mono and Dizygotic Twins.	19
III	Sericulture Dissection-Silk gland, Digestive system of Silkworm Reeling- Assessment of Cocoon characters, Denier, Shell ratio and Renditta.	19
IV	Spotter Morphology of Egg, larva. Pupa and adult moth, Life cycle of Silkworm, Mouth parts of Silkworm, Rearing House, Rearing appliances, Egg card, Mountages, Identification of Diseased worms, Reeling appliances: three pan system, Jettebout, Croissure. Field visit Report	17
V	Spotters Lymphoid organ, Blood grouping. Visit to immunology Lab Report	16
TOTAL CONTACT HOURS		90

COURSE OUTCOME (CO)			PO	K LEVEL
	CO1	Identify and describe the anatomical structures, laboratory tools, and clinical markers related to genetics, sericulture, and immunology.	PO4,PO5	K3

CO2	Explain the biological principles underlying genetic inheritance, silkworm physiology, and the functional organization of the immune system.	PO2,PO4,PO6	K4
CO3	Demonstrate technical proficiency in dissections, genetic modeling, blood typing, and the operation of sericulture equipment.	PO6,PO7,PO8	K3
CO4	Analyze experimental data, quantitative sericulture parameters, and clinical spotters to draw meaningful biological conclusions.	PO8,PO10	K4
CO5	Evaluate the quality of biological products and the accuracy of experimental outcomes in genetic and immunological contexts.	PO3,PO7	K5
CO6	Synthesize comprehensive practical reports and technical documents based on field visits, laboratory experiments, and clinical observations.	PO10,PO12	K6

PO CO	PO1	PO2	PO3	PO4
CO1	3	2	1	2
CO2	1	2	1	3
CO3	2	1	2	1
CO4	2	2	1	2
CO5	1	2	3	1
CO6	2	2	1	2

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council
08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	III
CREDITS	4	COURSE TITLE	Elective III: Bio composting for Entrepreneurship

Course objective

- ❖ To highlight the importance of bio composting in waste management.
- ❖ To enable students to set up bio compost units and bins for waste reduction.
- ❖ Learn the science behind microbial decomposition, including the role of bacteria, fungi, and earthworms in breaking down organic materials.
- ❖ Train individuals to set up, operate, and manage small-scale or industrial-level bio-compost units
- ❖ Learn the science behind microbial decomposition, including the role of bacteria, fungi, and earthworms in breaking down organic materials.

Unit	Content	Hrs
-------------	----------------	------------

I	Fundamentals of Composting Biology and Ecology: Principles and scope of bio composting and vermicomposting. Bio composting - Definition, types and ecological importance. Composting in the context of Soil Ecology and Environmental Microbiology. Decomposer communities: bacteria, fungi, actinomycetes. Role of detritivores in organic matter breakdown- Biogeochemical cycles: carbon, nitrogen, phosphorus. Humification and formation of stable organic matter.	10
II	Vermibiology and Composting Organisms: Biology and taxonomy of earthworms with emphasis on <i>Eisenia fetida</i> , <i>Eudrilus eugeniae</i> , and <i>Perionyx excavates</i> . Anatomy, physiology, and reproductive biology of earthworms. Gut microbiota and enzymatic digestion in worms. Earthworm–microbe interactions and their role in decomposition. Other composting fauna (mites, springtails, nematodes).	12
III	Composting and Vermicomposting Technologies: Types of composting: aerobic, anaerobic, windrow, in-vessel. Vermicomposting techniques: Bed method and pit method, Tank and commercial unit design. Substrate preparation: agro-wastes, municipal waste, animal Waste Process optimization: temperature, moisture, aeration, pH, C:N ratio. Use of microbial inoculants and bioactivators. Production of vermiproducts: vermicompost, vermiwash, vermicast.	12
IV	Quality Control, Process Monitoring and Environmental Impact: Compost maturity indicators: C:N ratio, humic substances, respiration rate. Physico-chemical and microbiological analysis (NPK, pathogens). Standards and certification (as per Fertilizer Control Order). Waste management and pollution control. Role in climate change mitigation and carbon sequestration. Environmental and ecological benefits of composting systems.	14
V	Entrepreneurship and Enterprise Management: Scope of compost and vermicompost industries in India. Business planning: site selection, infrastructure, costing and profit analysis. Government schemes and financial support (e.g., National Bank for Agriculture and Rural Development schemes). Marketing strategies for organic manure and value-added products. Branding, packaging, and distribution channels. Case studies of successful entrepreneurs in composting sector. Preparation of project report and startup model. Preparation of	12

	bio compost pit and bed using different amendments.	
TOTAL CONTACT HOURS		60
REFERENCE BOOK Bikas R. Pati& Santi M. Mandal (2016). Recent trends in composting technology. Van der Wurff, A.W.G., Fuchs, J.G., Raviv, M., Termorshuizen, A.J. (Editors). 2016. Handbook for Composting and Compost Use in Organic Horticulture. Bio Greenhouse COST Action FA 1105.		
E REFERENCE www.biogreenhouse.org		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Identify the fundamental biological agents, technical methods, and regulatory frameworks involved in the biocomposting industry.	PO1,PO2,PO6	K3
CO2	Explain the ecological principles, physiological mechanisms of earthworms, and the environmental benefits of organic waste transformation.	PO2,PO7,PO8	K4
CO3	Demonstrate technical skills in substrate preparation, process monitoring, and the practical setup of composting and vermicomposting units.	PO4,PO8	K3
CO4	Analyze the efficiency of different composting technologies and the biochemical quality of end-products against industry standards.	PO3,PO5,PO6,PO12	K5
CO5	Assess the environmental impact, technical feasibility, and economic viability of various biocomposting systems and business models.	PO6,PO7,PO9,PO14	K5
CO6	Synthesize comprehensive business plans and innovative technological designs for sustainable entrepreneurship in the biocomposting sector.	PO7,PO13,PO15	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	2	3	1	1	1	2	2	1	1	-	-
CO2	2	3	1	1	1	2	3	2	-	2	1	1	1	1	1
CO3	2	1	2	2	2	1	1	3	1	1	2	-	1	-	1
CO4	2	2	3	2	2	3	2	2	2	2	1	2	2	2	1
CO5	1	2	2	1	2	2	3	2	3	1	2	2	2	2	2
CO6	2	2	1	2	2	2	2	2	2	2	2	2	3	2	2

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council

08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	III
CREDITS	4	COURSE TITLE	Elective III: Aquaculture
Course objective ❖ Understand the concepts of Aquatic Ecosystems ❖ To understand nutrition requirements and manage aquatic animal health through disease diagnosis and prevention. ❖ To gain expertise in aquaculture reproduction, breeding, genetics, and seed selection from hatchery or wild sources. ❖ To understand and design various culture systems, such as ponds, raceways, cages, pens, and rafts. ❖ To train students for self-employment, agribusiness, and management of aquaculture ventures.			

Unit	Content	Hrs
I	Introduction: Importance of aquaculture-Basic qualification of candidate	

	species-Cultivable fresh water and marine species-Construction of ponds-Site Selection-Soil and water types -Types of ponds-Preparation and management –Aquatic plants and their control –Fish enemies and their control-Fertilization of ponds.	12
II	Fish Breeding and Fish Feed: Brooders care and management –Bund breeding –Artificial breeding –Induced spawning of carps-Application of synthetic hormones-Transportation of fish seed-Natural culture of fish feed organisms-Phytoplankton (diatom) zooplankton (<i>Rotifers cladocerans</i>) Artemia, Tubifex-Artificial feed –Feed formulations and management.	14
III	Fish Diseases: Animal husbandry cum aquaculture, agriculture cum aquaculture –Fish diseases: Ectoparasite, Bacterial, viral and fungal diseases	11
IV	Fishing Methods: Fishing Gears – Line fishing (Hand lines), Barbet trap, Cover pot, Gillnet, beam trawl, Bull trawl- Modern method- Echo sounding method, Electric fish.	12
V	Preservation- Extrinsic and intrinsic factors on food spoilage, Drying, salting, smoking, canning, refrigeration- marketing.	11
TOTAL CONTACT HOURS		60
REFERENCE BOOK		
Fish and Fisheries of India, Jingran, V.G.,1997. Hindustan Publishing Co., New Delhi. A Handbook of Fish forming, Agarwal, S.C., 1994, Narandra Publishing House Delhi. Fresh water aquaculture, Rath, R.K., 1993, Scientific Publishers, Jodhpur. Pond and Fish culture, Hall, C.B. 1999, Agro Botanical Publishers, India. Manual of fish genetics, Karl Marx, K,Sundararaj, V.and Vasu, 1996, Chennai.		
E REFERENCE		
https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1608.pdf https://www.fao.org/4/ac169e/ac169e00.htm https://bieap.apcfss.in/Uploads/Materials/II_FISHERIES.pdf		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and identify the essential species, feeding	PO1,PO2	K3

		components, disease types, and preservation techniques used in aquaculture.		
	CO2	Explain the biological and technical principles of pond management, fish breeding, integrated farming, and post-harvest technology.	PO2,PO4,PO6	K4
	CO3	Demonstrate practical skills in pond preparation, hormone application for breeding, disease control, and fish preservation.	PO4,PO6,PO7	K3
	CO4	Analyze the factors affecting pond productivity, the efficiency of breeding techniques, and the comparative merits of various fishing and preservation technologies.	PO7,PO8,PO10	K4
	CO5	Evaluate the technical and economic feasibility of aquaculture operations, breeding programs, and integrated farming models.	PO7,PO11,PO13	K5
	CO6	Synthesize integrated management plans and innovative strategies for fish production, disease prevention, and commercial aquaculture entrepreneurship.	PO12,PO14,PO15	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	2	1	1	1	1	2	2	1	1	-	-
CO2	2	3	1	2	1	2	1	1	-	2	1	1	1	1	1
CO3	2	1	2	3	1	2	2	-	1	1	1	-	1	-	1
CO4	2	2	1	2	2	3	2	2	2	2	1	2	1	-	2
CO5	1	2	2	1	1	1	2	2	2	1	2	1	3	1	-
CO6	2	1	1	2	2	2	1	2	2	2	2	3	1	3	2

P.G Department of Zoology OBE syllabus 2026-27 onwards BOS dt 22.05.2026 Academic council

08 .06.2026

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	-	SEMESTER	III
CREDITS	2	COURSE TITLE	INTERNSHIP
Course objective ❖ To apply theoretical knowledge learned in the classroom to real-world projects and professional tasks. ❖ To establish relationships with professionals and mentors in the industry for future opportunities. ❖ To develop technical competencies, industry-specific skills, and soft skills like teamwork, communication, and problem-solving. ❖ To explore potential career paths, understand industry expectations, and assess personal			

interest in a field.

- ❖ To gain relevant experience that makes the student more competitive in the job market.

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Applying classroom knowledge to practical work		PO4,PO5	K4
CO2	Strengthening competencies in communication, time management, problem-solving, and adaptability within a professional environment.		PO2,PO4,PO6	K3
CO3	Developing a deep understanding of industry standards, organizational structure, and building professional relationships that may lead to future employment.		PO4,PO6,PO7	K3
CO4	Increasing self-confidence, identifying career preferences, and validating professional goals through hands-on experience.		PO8,PO10	K4
CO5	Understanding professional ethics and standards required in the industry		PO11,PO13	K5
CO6	Strengthen professional communication by delivering a final project presentation to stakeholders		PO12,PO14,PO15	K6

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	-	2	1	1	1	1	2	2	1	1	-	-
CO2	2	3	1	-	1	2	1	1	-	2	1	1	1	1	1
CO3	2	1	2	-	1	2	2	-	1	1	1	-	1	-	1
CO4	2	2	1	-	2	3	2	2	2	2	1	2	1	-	2
CO5	1	2	2	3	1	1	2	2	2	1	2	1	3	1	-
CO6	2	1	1	2	2	2	1	2	2	2	2	3	1	3	2

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	IV
CREDITS	5	COURSE TITLE	Core–X: Environmental Biology

Course objective

- ❖ Knowing the ecology and climatic changes at world level and its impact on natural resources.
- ❖ Understanding the contributing factors for pollution in the environment and the ways in controlling and restoring to natural conditions.
- ❖ Evaluate the consequences of human population growth, pollution, and resource consumption on ecosystems.
- ❖ Develop critical thinking and research skills to investigate environmental problems, analyze data, and create evidence-based solutions.
- ❖ Understand how organisms adapt to changing environments and the implications of environmental stressors on biological systems

Unit	Content	Hrs
I	The Environment: Ecosystem: Concept, trophic structure, structure and functions, food chains, food webs, ecological pyramids. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche.	15
II	Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (<i>r</i> and <i>K</i> selection); concept of meta population-demes and dispersal, interdemec extinctions.	15
III	Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.	15
IV	Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). Leibigs and Shelford laws of limiting factors.	15
V	Applied ecology: Ecosystems services to the Society: maintenance of gaseous composition of the atmosphere, climate control by forests and ocean systems, natural	20

	pest control, pollination of plants by insect, birds and mammals, formation and protection of soil, conservation and purification of water. Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).	
TOTAL CONTACT HOURS		80
REFERENCE BOOK Sharma, P.D. 2009. Ecology and Environment, Rastogi Publication, India, pp-616. Calabrese, E.J. 1978. Pollutants and High-Risk Groups, John Wiley, pp-286. Raven, P.H. and L.R. Berg, G.B. Johnson, 1993. Environment, Saunders College Publishing, pp-579. Cunningham, W. P. and B. W. Saigo, 1999. Environmental Science, McGraw Hill Boston, 5th Edition. Odum, E.P. 1893. Basic Ecology, Saunders & Co., Philadelphia, pp-383. Barthwl, R.R. 2002. Environmental Impact Assessment, New Age International Publishers, New Delhi, India, pp-425. United Nations Environment Programme (UNEP). 1995. Global Biodiversity Assessment, Cambridge University Press, pp-1140.		
E REFERENCE Online courses.nptel.ac.in / noc 19 - g e 23/preview. Class central.com/course/swayam -ecology - and environment – 14021.		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Demonstrate a holistic understanding of ecological principles—from individual populations to global ecosystem services—and apply this knowledge to evaluate conservation practices and environmental sustainability in the Indian context.		PO1,PO2,PO15	K5
CO2	Analyze the internal and external factors governing population stability, community structure, and ecosystem efficiency to predict environmental responses.		PO3,PO5	K4
CO3	Apply quantitative tools and ecological laws to solve problems related to biodiversity loss, resource limitation, and ecosystem degradation.		PO3,PO7	K3
CO4	Evaluate the health of natural systems and the effectiveness of conservation management strategies in maintaining global and local ecological balance.		PO5,PO8	K5

	CO5	Integrate ecological knowledge with societal needs to advocate for the protection of essential ecosystem services and biodiversity.	PO9	K6
	CO6	Demonstrate mastery over the unique structural and functional aspects of Indian ecosystems and the regulatory mechanisms that govern life at multiple scales.	PO11,PO13	K4

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	3	2	2	1	2	2	2	1	1	2	-	1	-	1
CO2	2	-	2	2	3	1	1	1	2	-	1	-	1	1	2
CO3	1	2	3	1	2	1	2	1	1	2	2	-	1	1	1
CO4	2	1	1	2	2	2	1	3	2	1	-	1	2	-	1
CO5	-	2	2	1	2	-	2	2	3	2	1	2	1	2	-
CO6	1	2	1	2	-	1	2	1	2	-	2	1	3	1	1

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	IV
CREDITS	5	COURSE TITLE	Core XI: Animal Physiology
Course objective ❖ Students acquire the basic knowledge on physiology of different organs in animals and human. ❖ Understand the functions of different systems such as digestion, excretion, blood circulatory system, respiration and nervous system of animal relating them to structure and functions of various organs. ❖ Link cellular and molecular mechanisms to organismal-level functions, such as metabolism, reproduction, and muscular action ❖ Gain detailed knowledge of major physiological systems, including cardiovascular, respiratory, digestive, excretory, nervous, and endocrine systems. ❖ Analyze how nervous impulses and hormonal signaling regulate bodily functions to maintain homeostasis and respond to stimuli.			

Unit	Content	Hrs
I	Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood pressure, blood groups, haemoglobin. Cardiovascular system: heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure.	19
II	Respiratory system: respiratory organs in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration	16
III	Nervous system: Neurons, action potential, Neuro muscular junction, Neurotransmitters. Muscle: Structure of skeletal muscle. Mechanism of muscle contraction, Properties of muscle. Sense organs: vision, hearing and tactile response	18
IV	Digestive system: Digestion, absorption, energy balance, BMR. Excretory system: Physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, electrolyte balance, acid-base balance	19

V	Endocrinology and reproduction: Endocrine glands- Pituitary, Thyroid, Islets of Langerhans, basic mechanism of hormone action, hormones responsible for reproductive processes- gametogenesis, ovulation, neuro endocrine regulation.	18
TOTAL CONTACT HOURS		90
REFERENCE BOOK Prosser C. L. 1991, Comparative Animal Physiology. Part A: Environmental and Metabolic Animal Physiology. Wiley-Liss Publishers, Hoar, S.W. 1983, General and Comparative Physiology, Prentice Hall Publication, pp-928. Randall, D., W. Burggren, K. French and R. Eckert.2001, Animal Physiology Mechanisms and Adaptations, New York: W.H. Freeman and Co., Nelson K. S. 1997. Animal Physiology: Adaptation and Environment, Cambridge University Press. Dantzler, W.H. 1997. Comparative Physiology (Handbook of Physiology), Volumes I and II. Edited by William H. Dantzler. pp - 1824 Published for the American Physiological Society by Oxford University Press Inc., New York. Oxford University Press Canada, Toronto.		
E REFERENCE https://swayam.gov.in/nd1_noc20_bt42/preview https://www.classcentral.com/course/swayam-animal-physiology-12894		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Demonstrate a comprehensive understanding of the structural components and basic nomenclature of various physiological systems in animals.		PO2,PO4	K3
CO2	Analyze the underlying physiological mechanisms and biochemical processes that sustain life at the cellular and organ levels.		PO1,PO2	K4
CO3	Evaluate the complex regulatory and feedback systems that maintain internal stability amidst changing environmental conditions.		PO3,PO8	K5
CO4	Synthesize knowledge of individual organ systems to understand the integrated functional performance of the whole organism.		PO7,PO9	K6
CO5	Apply physiological principles to interpret diagnostic data and predict the outcomes of system imbalances or external stressors.		PO10,PO13	K3

	CO6	Demonstrate an advanced ability to critique and summarize the evolutionary adaptations and physiological complexities of animal life.	PO6,PO7	K5
--	------------	---	----------------	-----------

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	2	2	3	1	2	2	2	1	1	2	-	2	2	1
CO2	2	3	1	2	-	2	3	1	2	-	1	2	1	1	-
CO3	1	2	2	1	2	1	2	3	1	2	2	1	1	1	1
CO4	2	2	1	2	1	2	1	1	2	1	-	1	2	-	1
CO5	-	2	2	1	2	-	2	2	1	2	1	2	2	2	-
CO6	1	2	1	2	-	2	2	1	2	-	2	1	-	1	1

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	IV
CREDITS	3	COURSE TITLE	Core Practical IV: Environmental Biology & Animal Physiology

Course objective

- ❖ To know about the environment.
- ❖ To study the basis for various systems in the Animal kingdom.
- ❖ Explore how animals adapt to extreme environments, covering themes like thermoregulation, water balance, and specialized respiration.
- ❖ Apply experimental approaches to analyze and interpret physiological data and understand experimental techniques
- ❖ Comprehend how animals maintain a stable internal environment despite external environmental changes.

Unit	Content	Hrs
I	Experiments Estimation of primary productivity by using aquatic plants - Light and Dark bottle method. Analysis of Water samples - Estimation of dissolved Carbon dioxide, Carbonate and Bicarbonate. Analysis of Soil Samples - Determination of Soil moisture, Soil Texture, Humus and Chloride. Measurement of biodiversity – Alpha and Beta diversity Indices.	20
II	Spotters Pollution bioindicators – Chironomus larva, Mosquito larva, Leech, Pila and Tilapia.	15
III	Effect of Temperature on Oxygen consumption of fish & calculation of Q ₁₀ Effect of Temperature on Opercular movements of fish & calculation of Q ₁₀ Effect of salinity on Oxygen consumption of fish.	15
IV	Effect of salinity on Opercular movement of fish Estimation of Salt loss in a fish Estimation of Salt gain in a fish	20

	Mounting of Haemin crystals. Estimation of Blood sugar.	
V	Spotters: Blood pressure recording apparatus, Glucometer. Kymograph, Haemoglobinometer.	
TOTAL CONTACT HOURS		90

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Demonstrate basic knowledge of experimental protocols, specimen identification, and laboratory instrumentation used in ecology and physiology.		PO1,PO8	K3
CO2	Apply analytical techniques to quantify environmental parameters and biological responses in field-simulated laboratory conditions.		PO6	K4
CO3	Execute mathematical calculations and statistical indices to evaluate biodiversity and physiological thresholds.		PO3,PO4	K3
CO4	Demonstrate competence in performing chemical estimations and biochemical assays essential for physiological research.		PO6,PO8	K3
CO5	Critically analyze experimental results to draw meaningful conclusions about organismal adaptation and ecosystem function.		PO8,PO10	K4
CO6	Demonstrate professional-level laboratory skills, ethical specimen handling, and the ability to maintain rigorous scientific documentation.		PO6,PO12	K5

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	2	2	2	1	2	2	3	1	1	1	1	2	-	1
CO2	2	1	1	2	-	3	3	1	2	-	1	2	1	1	2
CO3	1	2	3	2	2	1	2	1	1	2	2	1	1	1	1
CO4	2	1	1	2	1	2	1	2	2	1	-	1	2	-	1

CO5	-	2	2	1	2	-	2	2	1	2	1	2	1	2	-
CO6	1	2	1	2	-	3	2	1	2	-	2	3	1	1	1

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	IV
CREDITS	4	COURSE TITLE	Elective IV: Cancer Biology
Course objective ❖ To understand the fundamentals of Cancer Biology. ❖ To analyze the mechanisms of Carcinogenesis. ❖ To decipher molecular signaling and explore the cancer genetics and genomics. ❖ Explore the role of the immune system in cancer surveillance and the impact of the tumor microenvironment on progression. ❖ Understand current clinical approaches, including imaging for staging and modern therapeutics			

Unit	Content	Hrs
I	Cancer: Definition, causes, properties, classification, prevalence, clonal nature. Cancer risk factors: Theory of carcinogenesis, Chemical carcinogenesis, Physical carcinogenesis: x-ray radiation – mechanisms of radiation carcinogenesis. Etiologic of cancer: Stages of cancer: initiation, promotion, progression. Carcinogenesis. Prevalence of cancer in India and World	19
II	Cancer metastasis: Clinical significances of invasion – Heterogeneity of metastatic phenotype –Metastatic cascade: basement membrane disruption, invasion – Recent approach to identify key factors controlling metastasis – Angiogenesis. Cancer stem cell and role of EMT in cancer metastasis	17
III	Molecular oncology: Oncogenes and Tumour suppressor genes: Retroviral oncogenes, Proto-oncogenes, Function and roles of oncogenes and tumour suppressor genes in tumour development. Cancer and Apoptosis: Genetics of cell death, Bcl-2 family, role of apoptosis in tissue homoeostasis, caspases. Cell Cycle: Loss of check points control and genetic instability in cancer, Replicative senescence	17
IV	Cancer cell signalling and gene regulation: Signal transduction pathways (GPCR, TGFβ, Ras, STAT and RTK signalling), apoptotic pathways, signal molecules, effects on receptor. Alteration of signalling pathways in cancer cells. Autophagy. Transcriptional, post-transcriptional, and post-translational regulation of oncogenes and tumour	18

	suppressor genes.	
V	Genetic basis of Cancer: Basic concepts of cancer genetics, types of genetic risk factors for Cancer. Cancer Genomics: Cancer Genome database: analysis and application. Chromosomal abnormalities in cancer.	19
TOTAL CONTACT HOURS		90
REFERENCE BOOK Raymond W. Ruddon, Cancer Biology. Robert Gilmore McKinnell, The Biological Basics of Cancer. Weinberg R.A. Biology of Cancer. Taylor and Francis Inc. Lewis J. Kleinsmith, Principles of Cancer biology.		
E REFERENCE https://www.klyuniv.ac.in/dodl/download/SLM2023/Zoology-SLM-SEM-IV/ZDSE(MN)T-408-Cancer%20Biology%20and%20Medical%20Genetics.pdf https://www.ncbi.nlm.nih.gov/books/NBK9840/#:~:text=The%20viral%20and%20cellular%20oncogenes,transcription%20factors%20(Figure%2015.26). https://www.cancer.org/content/dam/CRC/PDF/Public/6647.00.pdf https://www.longdom.org/open-access/role-of-oncogenes-and-tumor-suppressor-genes-in-cancer-progression.pdf		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Demonstrate a comprehensive understanding of cancer etiology, terminology, and the fundamental transitions from normal to malignant phenotypes.	PO1,PO2	K4
CO2	Analyze the biological and physical mechanisms that drive tumor progression, tissue invasion, and genomic instability.	PO3	K5
CO3	Evaluate the complex interplay between cell death pathways, stemness, and genetic predisposition in the lifecycle of a cancer cell.	PO1	K4
CO4	Discriminate between normal and aberrant cellular signaling and gene regulatory networks that sustain oncogenic transformation.	PO1,PO12	K3
CO5	Apply bioinformatic tools and genomic databases to analyze cancer patterns and molecular signatures for research and clinical applications.	PO6,PO8	K3

	CO6	synthesize multifaceted molecular, genetic, and epidemiological data to develop a holistic view of cancer biology and the future of personalized medicine.	PO7,PO10	K6
--	------------	--	-----------------	-----------

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	3	2	-	1	2	2	2	-	1	2	1	2	1	1
CO2	2	1	3	1	2	2	-	1	2	-	1	-	1	1	2
CO3	3	2	1	1	2	1	2	1	1	2	2	-	1	1	1
CO4	2	1	1	2	1	2	1	1	2	1	-	1	2	-	2
CO5	-	2	2	1	2	2	2	2	1	2	1	2	1	2	-
CO6	1	2	1	2	-	1	2	1	2	3	2	1	3	1	1

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	IV
CREDITS	4	COURSE TITLE	Elective IV: Animal Culture & Ethics
Course objective ❖ Learn the mechanisms of social learning and cultural transmission in diverse animal taxa. ❖ Understanding the moral status of animals using foundational ethical theories. ❖ Knowing the evolutionary significance of culture and its role in species survival and adaptation. ❖ Recognize the ability of non-human animals to experience emotions, including joy, pleasure, pain, and fear. ❖ Explore scientific evidence regarding animal consciousness, pain perception (nociception), self-recognition, memory, and emotions.			

Unit	Content	Hrs
I	Fundamentals of Animal Culture: Definition of culture in non-human animals; biological vs. cultural evolution. Mechanisms of social learning: Imitation, emulation, and local enhancement. The concept of traditions and dialects in animal populations	17
II	Cultural Diversity in Taxa: Primates: Tool use, grooming rituals, and social hierarchies in chimpanzees and macaques. Cetaceans: Song patterns in whales and foraging tactics in dolphins. Avian Culture: Regional dialects in bird songs and migratory route learning. Invertebrates: Social learning in insects.	18
III	Foundations of Animal Ethics: Introduction to Bioethics; Anthropocentrism vs. Biocentrism. Major ethical theories: Utilitarianism (Peter Singer), Deontology (Tom Regan), and the Five Freedoms of animal welfare. Moral standing of animals: Sentience, consciousness, and cognitive complexity.	19
IV	Regulatory Frameworks and Animal Research: Ethics of animal experimentation: The 3Rs Principle (Replacement, Reduction, Refinement). Institutional Animal Ethics	19

	Committee (IAEC) and CPCSEA guidelines in India. The Prevention of Cruelty to Animals Act and Wildlife Protection Act	
V	Applied Ethics in Modern Zoology: Zoo ethics: Captivity, enrichment, and the role of zoos in conservation. Ethics in livestock production, aquaculture, and the "One Health" approach. Human-wildlife conflict and the ethical dilemmas of culling and relocation	17
TOTAL CONTACT HOURS		90
REFERENCE BOOK Animal Behavior: An Evolutionary Approach by John Alcock. Animal Welfare: A World in the Balance by David Fraser. The Evolution of Culture in Animals by John Tyler Bonner. Wildlife (Protection) Act, 1972 and subsequent amendments. Integrated Principles of Zoology by Hickman et al..		
E REFERENCE https://www.researchgate.net/publication/333710066_Cultural_Evolution_in_Animals https://en.wikipedia.org/wiki/Animal_culture https://pmc.ncbi.nlm.nih.gov/articles/PMC5566806/ https://egyankosh.ac.in/bitstream/123456789/68649/1/Block-6.pdf https://caf.iisc.ac.in/wp-content/uploads/2020/10/CPCSEA-Guidelines.pdf https://www.researchgate.net/publication/226598856_Animal_Welfare_and_the_Intensification_of_Animal_Production		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Demonstrate a fundamental understanding of the definitions, biological examples, and regulatory frameworks governing animal culture and bioethics.		PO1,PO3	K3
CO2	Analyse the evolution of non-human cultures and the philosophical foundations that govern their ethical treatment in scientific and social contexts.		PO13	K4
CO3	Apply major ethical theories and welfare standards to design research, management, and conservation strategies that respect animal sentience.		PO12,PO13	K6
CO4	Evaluate the legal and moral frameworks protecting animals, ensuring compliance with national laws and international bioethical standards.		PO11,PO12	K5
CO5	Synthesize biological evidence of animal culture with		PO7,PO8	K6

		ethical theories to resolve complex dilemmas in research, industry, and conservation.		
	CO6	Demonstrate professional mastery of animal cultural theory and bioethical regulations, acting as a steward for animal welfare and scientific ethics.	PO12,PO14	K5

BLOOM'S MAPPING

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	2	3	1	1	2	1	2	1	1	2	-	1	2	-
CO2	2	1	1	2	-	2	-	1	2	-	1	-	3	1	2
CO3	1	2	1	1	2	1	2	1	1	2	2	2	2	1	1
CO4	2	1	1	2	1	2	1	1	2	1	2	2	2	-	1
CO5	-	1	2	1	2	2	2	2	1	2	1	2	1	2	-
CO6	1	2	1	2	-	1	2	1	2	-	2	2	1	2	1

PROGRAMME CODE	PGZOOA	PROGRAMME	M.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2028
HOURS	6	SEMESTER	IV
CREDITS	4	COURSE TITLE	Core Project

Course objective

- ❖ To investigate the development of students' ability in research field.
- ❖ To supply the students basic information on literature survey.
- ❖ Encourage students to develop new ideas, innovative designs, and creative solutions to engineering or business problems.
- ❖ Cultivate skills to work effectively in diverse teams, manage stakeholders, and take on leadership roles.
- ❖ Train students to document their work rigorously (reports, proposals) and present findings professionally.

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Conduct a comprehensive review of existing scientific literature to identify research gaps and formulate a valid research problem in Zoology.		PO8, PO9	K4
CO2	Design and validate experimental protocols or field-based methodologies specific to the chosen area of specialization		PO9, PO12	K6
CO3	Execute laboratory experiments or field surveys with precision, adhering to ethical guidelines, safety protocols, and biosafety norms.		PO11	K3
CO4	Analyze raw biological data using advanced statistical tools and software to derive meaningful scientific conclusions.		PO10,PO11	K5
CO5	Compile research findings into a structured dissertation and defend the thesis through oral presentations and technical viva-voce.		PO6,PO8,PO15	K6
CO6	Apply the principles of research integrity, avoiding		PO13,PO14	K3

		plagiarism, and ensuring the ethical treatment of animal subjects per national/international guidelines.		
--	--	--	--	--

BLOOM’S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	2	2	2	1	2	2	3	1	1	2	1	1	1	1
CO2	2	1	1	2	-	2	1	1	2	-	1	2	1	1	2
CO3	1	2	1	1	2	1	2	1	1	2	3	1	1	1	1
CO4	2	1	1	2	1	2	1	1	2	2	-	1	2	-	1
CO5	-	2	2	1	2	1	2	2	1	2	1	2	1	2	-
CO6	1	2	1	2	-	3	2	1	2	-	2	1	3	1	1