

ARULMIGU PALANIANDAVAR ARTS COLLEGE
FOR WOMEN

(AUTONOMOUS)

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

Chinnakalayamputhur, Palani -624 615.



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

B.Sc., ZOOLOGY
SYLLABUS
BATCH 2026-2029

Dean

S. J. Ille
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

By 14/7/26
PRINCIPAL.
A.P.A.C for Women
PALANI.

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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]
25-5-2020
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.

[Signature]
25-5-2020
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]
25-5-2020
A. JEEVALATHA, M.Sc., M.Phil., SET Ph.D
ASSISTANT PROFESSOR
DEPARTMENT OF ZOOLOGY,
G.T.N. ARTS COLLEGE,
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Industrialist

Mr.R.Kathirvel., M.Sc., DMLT.,
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Ms.P.Gayathiri,
Assistant Professor,
Department of Microbiology,
Sakthi College of Arts and Science,
Oddanchatram

[Signature]
p. Gayathiri

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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.

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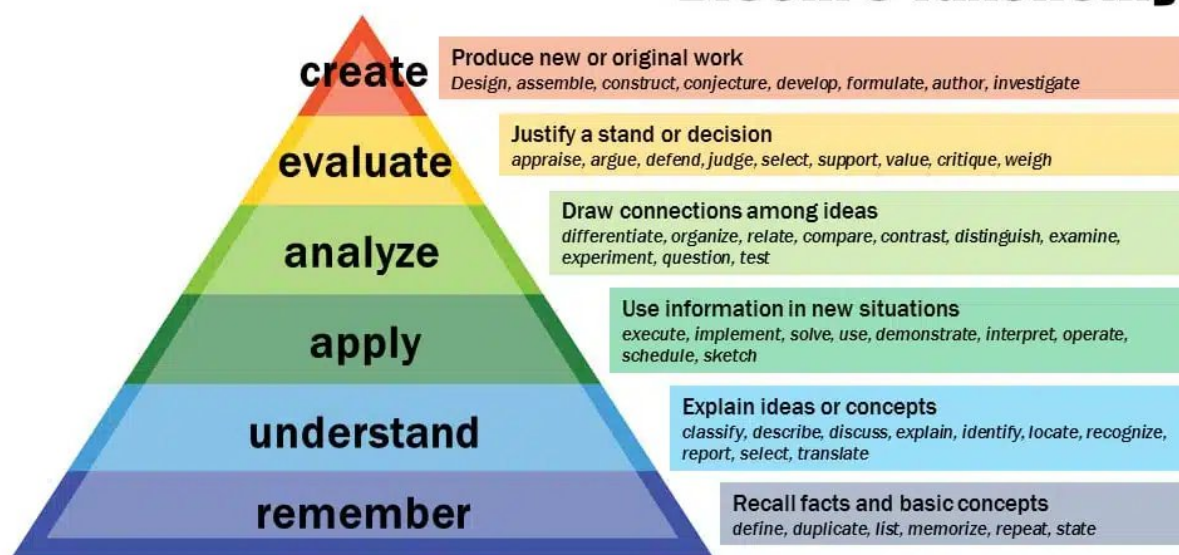
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B.Sc., Zoology

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.

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UG

UG- Internal Question pattern **Part III**

Knowledge Level	Section	Marks	Total
K1	A (Answer all) Q.No. 1 to 6	6x1	6
K2 and K3	B (Either or Pattern) Q.No. 7 and 8	2x4	8
K4 and K5	C (Open choice) any two out of three questions Q.No. 9 to 11	2x8	16
Total			30

Components of Continuous Assessment (Part III)

Components		Calculation	CIA Total
CIA1	30 Marks	$\frac{30+30}{4} = 15$	30 Marks
CIA2	30 Marks		
Assignment(any type)	5 Marks	5	
Seminar/presentation	5 Marks	5	
Curriculum based activity	5 Marks	5	

UG- Internal Question pattern **Part IV**

Knowledge Level	Section	Marks	Total
K1	A (Answer all) Q.No. 1 to 3	3x1	3
K2 and K3	B (Either or Pattern)Q.No. 4 and 5	2x3	6
K4 and K5	C (Open choice) any one out of two questions Q.No. 6 and 7	1x6	6
Total			15

Components of Continuous Assessment (Part IV)

Components		Calculation	CIA Total
CIA1	15 Marks	$\frac{15+15}{2}$	30 Marks
CIA2	15 Marks	=15	
Assignment (any type)	5 Marks	5	
Seminar/presentation	5 Marks	5	
Curriculum based activity	5 Marks	5	

EFFECT FROM THE ACADEMIC YEAR 2026-2027 ONWARDS

ACADEMIC STRUCTURE ZOOLOGY

Part No	Course code	COURSE TITLE	Lecture/ Practical (Hours /week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER I								
I		Tamil paper I	6	3	30	70	100	3
II		English paper I	6	3	30	70	100	3
III		Core paper I : Biological Diversity of Non-Chordates-I	4	3	30	70	100	4
		Core paper II: Biological Diversity of Non-Chordates-II	4	3	30	70	100	4
		Core practical I - Biological Diversity of Non-Chordates- I & II	2	-	-	-	-	-
		Ancillary paper I : Animal Diversity	3	3	30	70	100	3
		Ancillary Zoology Practical I	2	-	-	-	-	-
IV		SBC I :Poultry Farming	2	3	30	70	100	2
V		VBE-Value Education	1	3	30	70	100	2
TOTAL			30				700	21

Part .No	Course code	COURSE TITLE	Lecture/ Practical (Hours/week)	Duration Of exam(h ours)	Max Marks			Credit points
					Internal	External	Total	

SEMESTER II

I		Tamil paper II	6	3	30	70	100	3
II		English paper II	6	3	30	70	100	3
III		Core paper III - Chordata	4	3	30	70	100	4
		Core paper IV - Microbiology	4	3	30	70	100	4
		Core practical I : Biological Diversity	3	3	40	60	100	4
		Ancillary paper II :Integrated Zoology	3	3	30	70	100	3
		Ancillary Zoology Practical I	2	3	40	60	100	4
IV		SBC II : Women Empowerment	2	3	30	70	100	2

	Part No	Course code	TOTAL	30	Lecture /Practical (Hours/week)	Duration of exam (hours)	Max Marks			Credit points
							Internal	External	Total	
SEMESTER III										
I			Tamil paper III	6	3	30	70	100	3	

II		English paper III	6	3	30	70	100	3
III		Core paper V: Cell & Molecular Biology	6	3	30	70	100	5
		Core practical II: Cell & Molecular Biology	3	-	-	-	-	-
		Ancillary Theory paper: I	3	3	30	70	100	3
		Ancillary Practical paper I	2	-	-	-	-	-
		SBC III : Entomology	2	3	30	70	100	2
		Online Course : Economic Zoology	--	-	-			
IV		NME I: Apiculture	2	3	30	70	100	2
TOTAL			30				600	18

Part No	Course code	COURSE TITLE	Lecture /Practical (Hours/week)	Duration of exam (hours)	Max Marks			Credits points
					Internal	External	Total	
SEMESTER IV								
I		Tamil paper I	6	3	30	70	100	3
II		English paper VI	6	3	30	70	100	3

		Core paper VI: Ancient Zoological Practices	6	3	30	70	100	5
		Core practical II: Cell & Molecular Biology and Ancient Zoological Practices	3	3	40	60	100	4
		Ancillary Theory paper II	3	3	30	70	100	3
		Ancillary Practical paper I	2	3	40	60	100	4
IV		SBC IV: Intellectual Property Rights	2	3	30	70	100	2
		NME II Wildlife Conservation	2	3	30	70	100	2
V		Extension Activity	-	-	100	-	100	1
TOTAL			30				900	27

Part No	Course code	COURSE TITLE	Lecture/Practical (Hours/week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER V								
III		Core paper VII: Embryology	6	3	30	70	100	5
		Core paper VIII: Evolution	6	3	30	70	100	5
		Core practical III: Embryology &	6	-	-	-	-	-

		Evolution						
		Elective I Genetics /Animal Behaviour	5	3	30	70	100	4
		Elective II: Basics of Biomolecules/ Marine Biology	5	3	30	70	100	4
V		EVS	2	3	30	70	100	2
IV		Summer Internship (75 Hrs)	-	-	30	70	100	1
TOTAL			30				600	21

Part No	Course code	COURSE TITLE	Lecture /Practical (Hours/s/week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
SEMESTER VI								
		Core paper IX: Animal Physiology	6	3	30	70	100	5

III		Core paper X: Sericulture	6	3	30	70	100	5
		Core practical III : Embryology & Evolution	-	3	40	60	100	3
		Core Practical IV – Animal Physiology & Sericulture	6	3	40	60	100	3
		Elective III: Immunology/Human Reproductive Biology	5	3	30	70	100	4
		Elective V - Biotechnology/ Genetic Engineering	5	3	30	70	100	4
IV		SBC : Group Project	2	3	40	60	100	2
TOTAL			30				700	26

TOTAL CREDITS: 140
TOTAL MARKS: 4300

Extra Credit Courses (ECC)

Part No	Course code	COURSE TITLE	Lecture/	Duration	Max Marks			Credit points
					Internal	External	Total	
SEMESTER II, IV, V								
IV		SEM II Paper I: Vermiculture	-	-	-	100	100	2
		SEM IV Paper II: Dairy Farming	-	-	-	100	100	2
		SEM V Paper III: Swayam Plus / Medical Laboratory Techniques	-	-	-	100	100	2

		(MLT)						
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VALUE ADDED COURSE (Open to all students)

Part No	Course code	COURSE TITLE	Lecture/	Duration	Max Marks			Credits
					Internal	External	Total	
SEMESTER I, III, VI								
IV		SEM I Value added course I: Ornithology	30	-	-	100	100	
		SEM III Value added course II: Animal Husbandry	30			100	100	

		SEM V Value added course III: Aquaculture	30			100	100	
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PROGRAMME CODE	UGZOOA	PROGRAMME	B.SC., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	4 Hrs/Week	SEMESTER	I
CREDITS	4	COURSE TITLE	Core paper I: Biological Diversity of Non-Chordates-I

Course objective

- To understand the principles of animal classification and the salient features of Invertebrates.
- To know the economic importance of Invertebrates.
- To examine how Invertebrates have solved basic biological problems, such as feeding, locomotion, respiration, excretion, and reproduction.
- To gain an insight into the internal and external structure of representative invertebrate animals
- To learn the laboratory techniques required for identifying, collecting, preserving, and dissecting Invertebrate specimens.

Unit	Content	Hrs
I	TAXONOMY —Units of classification, Criteria of classification- types of coelom, types of symmetry, Principles of classification and binomial nomenclature. General characters and outline classification up to class level with one example – Protozoa, Porifera, Coelenterata, Helminthes and Annelida.	14
II	PROTOZOA - Type Study - Paramecium - General organisation, Cyclosis, Contractile vacuole and Reproduction only. General topic: Life cycle of Plasmodium. PORIFERA -Type study- <i>Ascon</i> sponge, <i>Leucosolenia</i> - General organisation, Histology, Spicules, Reproduction and Development only. Canal system in sponges-with reference to <i>Leucosolenia</i> .	12
III	COELENTERATA - Type study – Obelia - Structure of Obelia colony, Medusa, Nematocyst, Reproduction and development (Metagenesis). General topic: Polymorphism in Coelenterata, Coral reefs.	11
IV	HELMINTHES - Type study- Liver fluke - External characters, Digestive system, Excretion, Reproduction and development (life cycle). General topic: Parasitic adaptations of Platyhelminthes. <i>Ascaris</i> - Structure, Pathology and control measures.	11
V	ANNELIDA - Type study- Earth worm- External morphology, Setae, Nephridia, nervous system and reproductive system only. General topic: Metamerism in Annelida.	12
	TOTAL CONTACT HOURS	60

TEXTBOOK

N.C.Nair, S.Leelavathy, N.Soundrapandian, T.Murugan, N.Arumugam (2012). A text book of

Invertebrates. Saras Publication.

REFERENCE BOOK

1. Manual of Zoology Volume I Invertebrata. Ekambaranatha Ayyar,
2. A Text Book of Zoology M, Ananthakrishnan, T.N., S. Viswanathan
3. Invertebrate, Phylum series, Kotpal, R.L. Rostagi Meerut (1990)
4. Jordan: Invertebrate Zoology (S. Chand & Co)
5. R.D. Barnes: Invertebrate Zoology (Saunders)
6. Dhami and Dhami: Invertebrate Zoology
7. E.J.W. Barrington: Invertebrata structure and functions Mifflin & ELBS
8. L.H. Hymen: The Invertebrata Vol I to VI

E REFERENCE

- <https://www.aakash.ac.in/important-concepts/biology/phylum-platyhelminthes#:~:text=they%20are%20Acoelomates.,Parasitic%20Adaptations%20of%20Platyhelminthes,nutrients%20from%20the%20host's%20intestine.>
- <https://www.slideshare.net/slideshow/classification-of-animals-protozoa-porifera-and-coelenterata/150025267>
- <https://www.vedantu.com/biology/coelenterata>
- <https://gacbe.ac.in/pdf/ematerial/18MZO11C-U3.pdf>

COURSE OUTCOME (CO)		LO	K LEVEL
CO1	Classify non-chordate phyla up to the class level using standardized taxonomic principles.	PO6	K1, K2
CO2	Compare the physiological organization and reproductive mechanisms of unicellular and primitive multicellular organisms.	PO8	K2, K3
CO3	Evaluate the functional specialization in Coelenterates through polymorphism and their environmental contribution via reef formation.	PO2, PO3	K4
CO4	Critically assess the host-parasite relationship and the structural modifications required for a parasitic mode of life.	PO5	K4, K5
CO5	Analyze the advancement of organ-system level organization and locomotion strategies in Annelida.	PO7	K4

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	4 Hrs/Week	SEMESTER	I
CREDITS	4	COURSE TITLE	Core paper II: Biological Diversity of Non-Chordates-II

Course objective

- To enable the students to understand the classification of animals.
- To acquire knowledge about Invertebrates and their diversity.
- The course will discuss the classification, structural and functional aspects of Invertebrates.
- This course contents will introduce the students to the systematic and scientific studies of the various forms of Invertebrate animals present on Earth.
- Students can identify the relative importance of invertebrates in evolutionary processes.

Unit	Content	Hrs
I	General Classification: General characters and outline classification upto class level with following example Arthropoda, Mollusca and Echinodermata	12
II	Arthropoda Type Study: Prawn – External morphology, Appendages, Reproductive systems and development. Peripatus: Affinities (Living fossil)	14
III	General Topics Mouth parts in Insects, Insect metamorphosis Economic importance of Insect's. Commercial products of Insects	10
IV	Mollusca Type Study: Pila – External morphology, body organization, Digestive system, Reproductive system and Osphradium only. General Topics: Pearl culture, Cephalopods are advanced Molluscs	12
V	Echinodermata Type study: Star fish - External morphology, Pedicellariae, Water Vascular system only. General topic: Larval forms in Echinodermata.	12
	TOTAL CONTACT HOURS	60
TEXTBOOK 1. Invertebrate Zoology by E.L. Jordan and P.S. Verma. 2. Textbook of Invertebrate Zoology by R.L. Kotpal. 3. Invertebrate Zoology by Ruppert, Fox, and Barnes.		
REFERENCE BOOK 1. A manual of Zoology Volume I Invertebrata. Ekambaranatha Ayyar, M., Ananthakrishnan, 2. Invertebrata, Phylum series, Kotpal, R.L. Rostagi Meercut (1990)		

3. Jordan: Invertebrate Zoology (S.Chand & co).
4. R.D.Barnes: Invertebrate Zoology (Saunders)
5. Dhami and Dhami: Invertebrate Zoology
6. E.J.W.Barrington: Invertebrate structure and functions (Borton Houghton)
7. L.H.Hymen: The Invertebrata Vol I to VI

E REFERENCE

- https://jrc.ac.in/working_folder/DOWNLOAD-D-11-47-62BAC587465B6.pdf
- <https://www.scribd.com/document/389599890/Journal-Arthropods>
- <https://biozoomer.com/2014/11/phylum-arthropoda-characteristics.html>

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Describe the general classification and structural features of major non-chordate phyla.	PO1	K1, K2
CO2	Explain the physiological systems and developmental patterns in diverse Invertebrates.	-	K2
CO3	Apply anatomical and functional knowledge to interpret the survival mechanisms of non-chordates.	-	K3
CO4	Analyze evolutionary relationships and the socio-economic significance of various Invertebrates.	PO1, PO8	K4
CO5	Evaluate the ecological roles and commercial applications of non-chordate species.	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	1	1	2	1	-	1	-	2	-	1	1	-
CO2	3	1	2	1	1	-	1	-	1	-	-	-	1	-	-
CO3	3	2	3	2	1	-	1	3	2	-	-	1	-	-	-
CO4	3	2	3	2	2	-	2	2	2	2	-	-	-	-	-
CO5	2	2	2	3	1	-	2	2	2	-	-	-	-	-	-

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2 Hrs/Week	SEMESTER	I
CREDITS	-	COURSE TITLE	Core Practical I: Biological Diversity of Non - Chordates
COURSE OBJECTIVE ➤ To identify the different groups of Invertebrate animals by observing their external characteristics. ➤ To understand the organs, organ system and their functions in lower animals. ➤ To get knowledge about the different modes of life and their adaptation based on the environment. ➤ Able to dissect and display the internal organs and mount the mouthparts and scales of Invertebrates. ➤ Develop skills to accurately sketch and label museum specimens and observed anatomical structures.			

UNIT	CONTENT	Hrs
I	Dissection: Cockroach: Digestive system, Nervous system & Reproductive system. Earthworm: Nervous System & Reproductive system	8
II	Mounting: Earthworm: Body setae & Pineal setae. Prawn: Appendages. Cockroach: Salivary apparatus. Mouth parts – House fly and Mosquito.	6
III	Spotters: Protozoa: <i>Amoeba</i> , <i>Paramecium</i> , <i>Paramecium Binary fission</i> and <i>Conjugation</i> , <i>Vorticella</i> , <i>Entamoeba histolytica</i> , <i>Plasmodium vivax</i> Porifera: <i>Sycon</i> , <i>Sycon - T.S & L.S</i> , <i>Spicules</i> , <i>Gemmule</i> . Coelenterata: <i>Obelia</i> – Colony & Medusa, <i>Aurelia</i> , <i>Physalia</i> , <i>Velella</i> ,	6
IV	Platyhelminthes: <i>Planaria</i> , <i>Fasciola hepatica</i> , <i>Fasciola larval forms</i> – <i>Miracidium</i> , <i>Redia</i> , <i>Cercaria</i> , <i>Taenia solium</i> . Nemathelminthes: <i>Ascaris</i> (Male & Female), <i>Wuchereria</i> . Annelida: <i>Nereis</i> , <i>Aphrodite</i> , <i>Chaetopteurs</i> , <i>Hirudinaria</i> .	5
V	Arthropoda: <i>Palaemon</i> , <i>Sacculina</i> , <i>Limulus</i> , <i>Peripatus</i> , <i>Larvae - Nauplius</i> , <i>Mysis</i> , <i>Zoea</i> , Mollusca: <i>Pila</i> , <i>Unio</i> , <i>Pteredo</i> , <i>Sepia</i> , <i>Octopus</i> , <i>Nautilus</i> , <i>Glochidium larva</i> . Echinodermata: <i>Asterias</i> , <i>Ophiothrix</i> , <i>Echinus</i> , <i>Antedon</i> , <i>Bipinnaria larva</i> .	5
TOTAL CONTACT HOURS		30

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Identify and describe the morphological features of various invertebrate and chordate specimens.		PO5	K1
CO2	Understand the physiological systems, life cycles, and structural adaptations of animals.		-	K2
CO3	Apply laboratory skills in dissection, mounting, and specimen handling to study biological structures.		PO6, PO7	K3
CO4	Analyze the structural and functional adaptations of animals in relation to their environment.		PO8	K4
CO5	Evaluate biological specimens and experimental preparations for clinical and academic significance.		PO9	K5

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	3 Hrs/Week	SEMESTER	I
CREDITS	3	COURSE TITLE	Ancillary Paper I: Animal Diversity
Course objective ➤ To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterate, Helminthes and Annelida ➤ To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata ➤ To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia ➤ To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia ➤ To acquire detailed knowledge of select Invertebrate and chordate forms.			

Unit	Content	Hrs
I	Principles of animal taxonomy: Outline classification of animal kingdom upto phylum level with example(flow chart only). General characters of the following phyla - Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata. Protozoa - <i>Entamoeba histolytica</i> - Structure, Lifecycle, Pathology, Prevention and treatment.	11
II	Coelenterate: Types of coral reefs Platyhelminthes: <i>Fasciola hepatica</i> external morphology only Aschelminthes: Parasitic adaptations in Helminthes Annelida: Earth worm - External morphology and Reproductive system. Arthropoda: Cock roach - External features, Mouth parts. Echinodermata: Star fish- Water vascular system	8
III	Chordates: Classification of phylum chordate upto class level with any (example Flow chart only) External morphology of - Amphioxus, Ascidian, Balanoglossus Pisces: Shark- External structure, Migration of fishes	10
IV	Amphibians: Frog - External morphology and Reproductive system Reptiles: Calotes- External morphology and Digestive system. Identification of poisonous snakes	8
V	Aves: Pigeon - External morphology and Respiratory system Mammals: Rabbit - External morphology and Excretory system Dentition in mammals.	8
	TOTAL CONTACT HOURS	30

TEXTBOOK

Ekambaranatha Iyer, - Outlines of Zoology Viswanathan Publication

REFERENCE BOOK

- 1.Ekambaranatha Iyer and T.N. Anantha Krishnan, - A Manual of Zoology
- 2.Invertebrata –Vol II: Viswanathan Publishers.
- 3.Ekambaranatha Iyer and T.N. Anantha Krishnan, -A Manual of Zoology: Chordata Viswanathan Publishers.
- 4.Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand & Co.

E REFERENCE

- www.sanctuaryasia.com
- www.iaszoology.com

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Identify the basic classification, morphological structures and general characteristics of representative animals.	PO1	K1
CO2	Explain the physiological systems, life cycles, and taxonomic principles governing animal diversity.	-	K2
CO3	Apply morphological and anatomical knowledge to solve identification and functional challenges.	PO4, PO7	K3
CO4	Analyze the evolutionary adaptations and specialized structures that enable animals to survive in diverse niches.	PO1, PO3	K4
CO5	Evaluate the biological significance and ecological impact of animal structures and behaviors.	PO3	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	1	1	1	1	-	1	2	2	-	1	1	-
CO2	3	1	2	2	1	2	1	-	1	1	-	-	-	1	-
CO3	3	2	3	2	2	2	1	-	1	2	-	-	-	1	-
CO4	3	2	3	2	2	2	2	-	2	2	-	-	-	1	1
CO5	2	2	3	3	1	3	2	2	2	1	-	2	-	2	-
CO6	2	3	2	2	3	3	3	3	3	3	-	2	2	3	-

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2 Hrs/Week	SEMESTER	I
CREDITS	-	COURSE TITLE	Ancillary Practical I: Animal Diversity & Integrated Zoology
COURSE OBJECTIVES ➤ To understand the structure and label the various parts of the dissected organisms and to sketch the required system using virtual dissections, charts and web resources. ➤ To compare and discuss the difference in the mouth parts of cockroach and mosquitoes by mounting and drawing ➤ To identify and understand the different invertebrate and chordate forms and classify them using lab manuals ➤ To identify and discuss the significance of pigeon feathers. ➤ Field trip helps students to understand and apply theoretical knowledge. To plan the area of research. Campus fauna enables them to understand, identify and classify the various fauna surrounding them			

UNIT	CONTENT	Hrs
I	DISSECTION 1. Cockroach - Digestive system 2. Cockroach - Nervous system 3. Fish - Digestive system	8
II	MOUNTING 1. Mouth parts- Cockroach & Mosquito 2. Scales - Placoid 3. Prawn - Appendages	8
III	SPOTTERS <i>Amoeba, Entamoeba, Paramecium, Plasmodium, Leucosolenia, Sycon sponge, Spicule, Gemmules, Obelia, Physalia, Velella, Corals, Fasciola hepatica, Taenia solium, – entire, Ascaris male and female. Earthworm, Nereis, Prawn, Hirudinaria, Scorpion, Peripatus, Pila, Sepia, Octopus, Nautilus, Asterias, Ophiophrix, Echinus.</i>	7
IV	<i>Amphioxus, Ascidian, Balanoglossus, Shark, Frog, Calotes, Naja naja, Krait, Pigeon, Pigeon feather, Rabbit, Bat.</i>	7
V	Field visit – Study of fauna in the campus	2

	TOTAL CONTACT HOURS	30
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COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Identify and name diverse animal taxa and their anatomical structures through direct observation.		PO1, PO7	K1
CO2	Understand the structural organization, life forms and habitat-specific adaptations of animals.		-	K2
CO3	Apply laboratory and field techniques to observe, mount and dissect various biological specimens.		PO6, PO7, PO8	K3
CO4	Analyze the structural diversity and functional specialization among different animal groups.		PO1	K4
CO5	Evaluate biological specimens and field data to draw conclusions about animal health and ecology.		PO9, 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	1	1	1	2	2	-	1	1	-	1	-	1	-
CO2	3	2	2	2	1	2	2	-	1	2	-	-	-	1	-
CO3	2	3	2	3	2	3	3	-	2	2	-	-	-	2	-
CO4	3	2	3	3	2	3	2	-	2	2	-	-	2	1	-
CO5	2	3	3	3	2	3	2	-	3	2	-	-	-	2	-

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2Hrs/Week	SEMESTER	I
CREDITS	2	COURSE TITLE	Skill Based Course [SBC]–I Poultry Farming

Course objective

- Students should know basic concepts in Poultry farming.
- To learn the technical knowledge of Poultry management
- To understand the key success factors in Poultry farming
- To impart practical skills in hatchery operations, incubation, brooding, and identifying healthy
- To know the business sustainability

Unit	Content	Hrs
I	Introduction to Poultry Farming - History and development of poultry farming - Types of poultry farming (broiler, layer, breeder) - Importance of poultry farming in agriculture and economy.	8
II	Poultry Breeds and Breeding - Different breeds of chickens (layers, broilers, dual-purpose) - Breeding objectives and selection criteria - Hatchery management.	6
III	Poultry Nutrition - Nutritional requirements of poultry- Feed formulation and manufacturing - Feeding systems and management.	7
IV	Poultry Health Management - Poultry diseases and their prevention (Bacterial,viral,Coccidiosis)- Vaccination and medication - Biosecurity measures.	4
V	Poultry Farm Management - Farm planning and layout - Record keeping and accounting - Marketing and sales- Poultry Waste Management - Manure management- Environmental impact and mitigation.	5
	TOTAL CONTACT HOURS	30

TEXTBOOK

- 1.North & bell, Commercial Chicken Production Manual
- 2.Dr. S.P.Singh, Poultry Production.

REFERENCE BOOK

1. Sreenivasaiah.,P.V.,2015.Textbook of PoultryScience.1st Edition. Write &Print Publications, New Delhi 2.
- 2.Jull A.Morley, 2007. Successful Poultry Management.2nd Edition. Biotech Books, New Delhi"
- 3.HurdM.Louis,2003. Modern Poultry Farming.1stEdition. International Book Distributing Company, Lucknow."
- 4.Life and General Insurance Management"

E REFERENCE

- <http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf>
- https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf

- <http://ecoursesonline.iasri.res.in/course/view.php?id=335>
- https://swayam.gov.in/nd2_nou19_ag09/preview.

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Describe the fundamental principles, breeds, and management aspects of poultry farming.		PO7	K2
CO2	Explain the biological, economic, and environmental processes involved in commercial poultry production.		-	K2
CO3	Apply practical poultry management techniques in breeding, feeding, and disease control.		PO4	K3
CO4	Analyze the efficiency of production, health, and marketing systems in a poultry enterprise.		-	K4
CO5	Evaluate the operational efficiency, biosecurity protocols, and environmental sustainability of a poultry farm.		PO7	K5

BLOOM'S MAPPING

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

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	1Hrs/Week	SEMESTER	I
CREDITS	2	COURSE TITLE	VBE: Value Education
COURSE OBJECTIVES			
➤ Build physical and mental strength of the learners ➤ Strengthen the emotional and spiritual aspects of the learners. ➤ Make the learners responsible and cooperative citizens ➤ Develop democratic way of thinking and inculcate spirit of national integration ➤ Develop the practice of paying respect for dignity of individual and diversity in society			

COURSE CONTENT

- 1) யோகமும் உடல்நலமும் (16 hours)
- 1.1 உடல்மைப்பு - 3 உடல்கள் - ஐந்தில் அளவுமுறை
 - 1.2 எளியமுறை உடற்பயிற்சி - கைப்பயிற்சி - கால் பயிற்சி - மூச்சுப்பயிற்சி - கண் பயிற்சி - கபாலபதி
 - 1.3 மகராசனம் 1-2 - உடல் தேய்த்தல் - அகிராசனம் பயிற்சி - உடல் தளர்த்தல்
 - 1.4 யோகாசனங்கள்: ~~சூரியநாமஸ்காசனம்~~ - பத்மாசனம் - வஜ்ராசனம் - சக்கராசனம் (பக்கவாட்டில்) - விருச்சாசனம் - யோக முத்திரா - பச்சி மோத்தாசனம் - உஸ்ட்ராசனம் - வக்கராசனம் - சலபாசனம்
- 2) உயிர்வளமும் - மனவளமும் (16 hours)
- 2.1 இளமை காலத்தல் - முதுமையைத் தள்ளிப்போடுதல்
 - 2.2 பாலுணர்வும் ஆன்மீகமும் - வித்தின் மகிமை - இல்லற வாழ்வு - கற்புநெறி
 - 2.3 மனதின் பத்து படிநிலைகள்
 - 2.4 மன அலைச்சுழல் - மன ஓர்மைக்கான பயிற்சிகள்
- 3) குணநலப்பேறு (16 hours)
- 3.1 வாழ்வின் நோக்கம் - வாழ்க்கைத் தத்துவம்
 - 3.2 அகத்தாய்வு - எண்ணம் ஆராய்தல்
 - 3.3 ஆசை சீரமைத்தல்
 - 3.4 சினம் தவிர்த்தல்
- 4) மனிதவள மேம்பாடு (16 hours)
- 4.1 கவலை ஒழித்தல்
 - 4.2 வாழ்த்தும் பயணம்
 - 4.3 நட்பு நலம்
 - 4.4 தனிமனித அமைதி - உலக அமைதி
- 5) இயற்கை நியதி (16 hours)
- 5.1 ஒருங்கிணைப்பு ஆற்றல் - செயல்விளைவுத் தத்துவம்
 - 5.2 மனத்தாய்மை, வினைத்தாய்மை - கருமையம்
 - 5.3 அன்பும் கருணையும்
 - 5.4 பண்பாட்டுக் கல்வி - ஐந்தொழுக்கப் பண்பாடு

TextBooks

1.Vethathiri Maharishi Kundalini Yoga and Kayakalpa Research Foundation

Reference Books

1. Mana valakalai Yoga, Vethathri Publications, Tamil Nadu, 2008.

E-RESOURCES

- https://www.google.com/url?sa=t&source=web&rct=j&url=https%3A%2F%2Fwww.bdu.edu.in/batches%2Fsyllabi%2Faffcol%2Fug%2Fvalue_education_tamil.pdf&ved=0CAUQ1fkOg
- <https://www.google.com/url?sa=t&source=web&rct=j&url=https%3A%2F%2Fbaschw.ac.in>

COURSE OUTCOME		LO	K LEVEL
CO1	Identify the fundamental philosophies	PO3, PO4	K1

		and categories of value-based education.		
	CO2	Explain the importance of ethical behavior and social responsibility in a globalized world.	PO5, PO8	K3
	CO3	Apply learned values effectively across various real-life personal and professional scenarios.	PO5, PO7	K3
	CO4	Analyze social and ethical dilemmas to understand their underlying causes and effects.	PO3, PO4, PO5,	K4
	CO5	Evaluate and select appropriate ethical solutions for complex moral and social challenges.	PO2, PO4,	K5

BLOOM'S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	1	2	1	1	1	1	2	1	2	1	-	-	-	-	-
CO2	1	3	2	1	1	1	3	1	-	1	-	-	-	-	-
CO3	1	3	2	2	1	1	-	1	-	1	-	-	-	-	-
CO4	1	2	3	2	2	1	-	2	-	2	2	-	-	-	-
CO5	1	2	3	2	2	2	-	2	-	2	-	-	-	2	-
CO6	1	3	3	3	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	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	4 Hrs/Week	SEMESTER	II
CREDITS	4	COURSE TITLE	Core III - Chordata
Course objective ➤ To understand the structures and distinct features of Phylum Chordata. ➤ To understand and able to distinguish the characteristic features of each Subphylum and class. ➤ To understand the economic importance of Vertebrates ➤ To know about the adaptations of Vertebrates ➤ To understand the evolutionary position of different groups of Vertebrates.			

Unit	Content	Hrs
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I	General Characters and Classification of Phylum Chordata: Origin of Chordata, General characters, Classification of Vertebrata up to Class level, Affinities and Systematic position of Hemichordata (<i>Balanoglossus</i>), Urochordata (<i>Ascidia</i>), Cephalochordata (<i>Amphioxus</i>).	12
II	Prochordates and Agnatha: Characteristics of sub phylum Vertebrata, Agnatha(<i>Petromyzon</i>), - Pisces (<i>Scoliodon sorrakowah</i>) General characters and classification, Origin of fishes, Migration of fishes and Economic importance.	10
II	Amphibia: General characters and classification - Origin of Amphibia - Type study - <i>Rana hexadactyla</i> –External morphology, Sexual dimorphism, Respiratory system, Sound producing Organ and Circulatory system only. Parental care in Amphibia.	12
IV	Reptilia: General characters and classification – Type study – <i>Calotes versicolor</i> - External morphology, Digestive system, Reproductive system. Golden age of Reptiles. Snakes of India. Poison apparatus and biting mechanism of Poisonous Snakes.	12
V	Aves and Mammalia: Aves: General characters and classification –Type study - <i>Columba livia</i> - External morphology, Exoskeleton, Respiratory system, Flight adaptations, Migration. Mammalia: General characters and classification - Type study- <i>Rabbit</i> –External morphology, Digestive system, Reproductive system. Egg laying mammals, Marsupials, Dentition in mammals.	14
TOTAL CONTACT HOURS		60
TEXTBOOK 1. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p. 2. Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal 3. Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp. 4. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar - 144008, 942. 5. Ganguly, Sinha, Bharati Goswami and Adhikari, 2004. Biology of animals Vol.II - New central book Agency (p) Ltd.		
REFERENCE BOOK 1. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co. 2. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc. 3. Hickman, C.P. Jr., F.M. Hickman and L.S. Roberts, 1984. Integrated 4. Principles of Zoology, 7th Edition, Times Merril/Mosby College Publication. St. Louis. 1065 pp. 5. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra – 282 003, 477 pp. 6. Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T, B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp. 7. Pough H. Vertebrate life, VIII Edition, Pearson International.		
E REFERENCE • http://tolweb.org/Chordata/2499 • https://www.nhm.ac.uk/ • https://bit.ly/3Av1Ejg • https://bit.ly/3kqTfYz		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Demonstrate fundamental knowledge of chordate classification and the morphological features of diverse vertebrate groups.		PO1, PO5	K1, K2
CO2	Analyze and compare the physiological systems and anatomical structures across different vertebrate classes.		PO1, PO7	K4
CO3	Evaluate evolutionary relationships, origins, and specialized adaptations within the vertebrate lineage.		PO3, PO8, PO9	K5
CO4	Examine specialized biological mechanisms including defense, locomotion, and reproductive strategies in vertebrates.		-	K3, K4
CO5	Apply taxonomic and morphological knowledge to identify and categorize species in laboratory and field settings.		PO1, PO6,	K3, K4

BLOOM'S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	1	2	-	-	-	-	-	-	-	2	2	-	-	2
CO2	3	-	2	-	1	-	-	3	-	-	-	-	-	-	-
CO3	2	-	3	-	-	-	-	2	-	-	2	3	-	-	-
CO4	2	-	2	2	-	-	-	2	-	-	-	1	2	-	-
CO5	3	2	-	2	-	3	2	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	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	4 Hrs/Week	SEMESTER	II
CREDITS	4	COURSE TITLE	Core Paper IV: Microbiology
Course objective ➤ To understand the basics and applied aspects of Microbiology. ➤ To acquaintance with the different applications of Microbial techniques. ➤ Comprehend nutrient uptake, energy generation, and the various metabolic pathways involved in microbial growth.			

- Explore the role of microbes in agriculture, food production, environmental processes and industrial fermentation
- Learn and apply safe laboratory practices (Good Laboratory Practices - GLP) and identify ethical issues regarding recombinant DNA technology and biohazards.

Unit	Content	Hrs
I	Introduction: History, Scope, and Applications of Microbiology Virus: Characteristics of Virus, Classification of Virus, Structure and Multiplication of Bacteriophage, Sterilization Methods, Culture Methods, Culture Media. Bacterial growth: Methods of Bacterial growth, Growth Rate and Growth Curve.	14
II	Food and Dairy Microbiology Microorganism in Milk - Sources and types of Pasteurization and Preservation of Milk. Food microbiology - Spoilage of food in Toxification and Food Infection, Canned Food. Preservation: Objectives, Principles and Methods.	14
II	Agricultural Microbiology Biofertilizer - Role of Microbes in Fertility Crop production. Microorganism as Biofertilizers. Bacteria- <i>Rhizobium</i> , Algae: <i>Azolla</i> , Fungi: <i>VAM</i> Biopesticide, Bacterial: <i>Bacillus thuringiensis</i> ,	11
IV	Industrial Microbiology Fermentation process – Stages, Types and methods of Fermentation. Industrial production and Application: Penicillin and Streptomycin	11
V	Medical Microbiology Bacterial Disease - Causative organism, Transmission and Preventive measures: Hepatitis-B & Covid	10
TOTAL CONTACT HOURS		60

TEXTBOOK

1. N. Arumugam *et al.*, (2011), Microbiology, Saras Publication.

REFERENCE BOOK

1. Dr.R.C.Dubey, Dr.D.K.Maheswari, (2010), A Textbook of Microbiology, S.Chand & CO Ramnager, New Delhi.
2. Samuel Baron, Medical microbiology, II Ed., Wesley publishing company, California.

E REFERENCE

- http://herba.msu.ru/shipunov/school/biol_154/textbook/intro_botany.pdf
- http://www.survivorlibrary.com/library/strasburgers_text_book_of_botany_1921.pdf
- https://biolympiads.com/wp-content/uploads/2018/09/1-Botany_Basics.pdf.

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and explain the fundamental principles of microbiology across diverse	PO1	K1, K2

		fields like history, food, agriculture, and medicine.		
	CO2	Demonstrate an understanding of microbial structures, growth kinetics, and physiological mechanisms in various environments.	PO1, PO8	K2, K3
	CO3	Apply microbiological techniques and microbial products to solve problems in agriculture, food safety, and industrial production.	PO4, PO7	K3
	CO4	Analyze microbial life cycles, contamination sources, and the efficiency of microbial applications in health and industry.	PO8	K4
	CO5	Evaluate the effectiveness of microbiological protocols, industrial yields, and public health interventions.	PO4, PO5	K5

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029

HOURS	3 Hrs/Week	SEMESTER	II
CREDITS	4	COURSE TITLE	Core Practical I: Biological Diversity of Non – Chordates, Chordata and Microbiology
Course objective ➤ To understand the structures and distinct features of phylum Chordata. ➤ To understand and able to distinguish the characteristic features of each subphylum and class. ➤ To understand and compare the structure of various internal organs in different classes of Vertebrates. ➤ To know about the classification, adaptations and affinities of Chordate animals. ➤ To gain technical skills in mounting, such as preparing body setae, mouthparts, radula, and scales for microscopic examination.			

Unit	Content	Hrs	
I	Dissections: Fish: Digestive system	9	
II	Mounting: Shark: Placoid scales.	9	
II	Specimen and Slides: (i) Hemichordata: <i>Balanoglossus</i> , <i>Tornaria larva</i> (ii) Protochordata: <i>Amphioxus</i> (iii) Cyclostomata: <i>Petromyzon</i> , <i>Myxine</i> , <i>Ammocoetus larva</i> (iv) Pisces: <i>Channa</i> , <i>Hippocampus</i> , <i>Clarius</i> , <i>Anguilla</i> and <i>Protopterus</i> (v) Amphibia: <i>Ichthyophis</i> , <i>Amblystoma</i> , <i>Rachophous</i> , <i>Bufo</i> , <i>Rana</i> . (vi) Reptilia: <i>Draco</i> , <i>Chamaeleon</i> ,, <i>Vipera russelli</i> , <i>Naja</i> , (vii) Aves: <i>Archaeopteryx</i> , <i>Columba</i> , Collection and study of different types of feathers: Quill, Contour, Filoplume, down (viii) Mammalia: <i>Ornithorhynchus</i> , <i>Pteropus</i> .	9	
IV	Microbiology • Sterilization of glassware and media • Preparation of Culture media • Serial dilution Technique	9	
V	Spotters: • Hot air oven • Autoclave • Agar Plate • Inoculation needle	9	
TOTAL CONTACT HOURS		45	
COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Identify and describe the morphological features of diverse animal specimens and microbiological laboratory tools.	-	K1, K2
CO2	Demonstrate proficiency in dissection.	PO4, PO7	K3

		microscopic slide preparation and basic microbiological techniques.		
	CO3	Analyze the structural adaptations and evolutionary differences among various Vertebrate classes.	-	K4
	CO4	Utilize logical reasoning to manage experimental setups and troubleshoot sterilization and culture processes.	PO4. PO7	K4
	CO5	Evaluate the success of practical protocols and the biological significance of key evolutionary specimens.	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	-	1	-	-	-	2	-	-	-	-	-	-	-	-
CO2	2	-	-	3	-	3	3	-	1	-	-	-	2	-	-
CO3	3	-	3	-	-	-	-	-	-	-	2	2	-	-	1
CO4	1	-	2	3	2	2	2	3	-	-	-	-	-	-	-
CO5	1	-	3	-	-	2	-	2	3	-	-	-	3	-	-

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	3 Hrs	SEMESTER	II
CREDITS	3	COURSE TITLE	Ancillary Paper II: Integrated Zoology

Course objective

- To enable students to learn basic concepts relating to aspects of Respiratory, Circulatory, Excretory Nervous and Sensory physiology.
- To enable students to comprehend the processes involved during development
- To enable students to learn basic concepts of Immunity and the working of Immune organs and familiarize them with the recommended vaccination schedule
- To enable students to comprehend the basic concepts of Human genetics and patterns of Inheritance
- To enable students to learn about aspects of animal behaviour such as Foraging, Courtship, Nest construction, Parental care and Learning

Unit	Content	Hrs
I	Animal Physiology : Respiration- Respiratory pigments and Transport of gases. Circulation - Mechanism of Blood clotting. Excretion - Types of Excretory products –Ornithine cycle. Structure of Neuron – Conduction of nerve impulse, Mechanism of Vision and Hearing.	10
II	Embryology : Fertilization, Cleavage, Gastrulation and Organogenesis of Frog; Placentation in mammals. Test tube baby, Twins, IVF.	8
II	Immunology : Immunity Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunological organs– responses in humans; Vaccination schedule.	10
IV	Human Genetics : Human Chromosomes – Sex Determination in Humans. Sex linked inheritance in man, ABO blood grouping and Rh typing. Erythroblastosis and foetalis, Syndromes.	8
V	Animal Behaviour : Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour.	9
TOTAL CONTACT HOURS		45
1. 1. Bhasin Kamala, Understanding Gender: Gender Basics, New Delhi: Women Unlimited, 2004		
REFERENCE BOOK		
1. R.W. Hill, G.A. Wyse, and M. Anderson: A comprehensive and detailed text covering a wide range of physiological concepts.		
2. G.J. Tortora and B. Derrickson, Principles of Anatomy and Physiology.		
E REFERENCE		
• https://ncert.nic.in/textbook/pdf/kebo114.pdf • https://byjus.com/neet/important-notes-of-biology-for-neet-breathing-and-exchange-of-gases/ • https://bieap.apcfss.in/Uploads/Materials/Zoology-II.pdf		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and explain the fundamental concepts of animal physiology, embryology, immunology, genetics, and ethology.	PO1	K1, K2
CO2	Demonstrate a comprehensive understanding	PO1	K2, K3

		of the physiological mechanisms and developmental pathways in animals.		
	CO3	Apply zoological principles to clinical scenarios, public health, and ecological survival strategies.	PO8, PO9	K3
	CO4	Critically analyze physiological systems, genetic patterns, and behavioral adaptations in animals.	PO3, PO8	K4
	CO5	Evaluate the biological efficiency and clinical importance of physiological, genetic, and behavioral systems.	PO3, PO4	K5

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2 Hrs/Week	SEMESTER	II
CREDITS	4	COURSE TITLE	Ancillary Practical I: Animal Diversity and Integrated Zoology

Course objective

- To understand the experimental concepts of Genetics, Developmental biology, Animal physiology & Immunology.
- To Learn the procedure for the Frog Blastoderm
- To study the complex & diverse approaches of Animal Behaviour.
- To understand animals by linking their anatomical structures with physiological, biochemical, and cellular functions.
- To develop practical expertise in techniques such as microscopy, dissection, histology and the collection/analysis of field data.

Unit	Content	Hrs
I	• Detection of Protein, Lipid and Carbohydrate. • Qualitative Detection of Excretory Products: Ammonia, Urea and Uric Acid. • Estimation of Haemoglobin Sahlis method.	7
II	• Observation and studies of prepared micro slide: Frog • Two cell stage • Four cell stage • Blastula • Gastrula	6
II	• ABO Blood grouping in Man. • Rh Blood grouping • Blood smear Preparation. • Structure of Immunoglobulin • Separation of Lymphocytes.	6
IV	• Observation of simple Mendelian Traits • Sex Linked inheritance in Man: Colour blindness and haemophilia. • Syndromes: Down's Syndrome, Klinefelter's Syndrome, Turner's Syndrome.	5
V	• Construction of Nest in Amphibian – Mud Nests, Foam Nests, Gelatinous Bags • Construction of Nest in Fishes – Bubble Nest, Weed Nest, Pit Nest. • Earthworm behaviors: Investigating Hydrotaxis, Chemotaxis and Phototaxis.	6
TOTAL CONTACT HOURS		30

COURSE OUTCOME (CO)			PO	K LEVEL
	CO1	Identify biological molecules, embryological stages, and genetic traits through systematic observation.	PO1	K1, K2
	CO2	Demonstrate technical proficiency in biochemical analysis, hematological testing, and behavioral experiments.	PO1, PO4, PO6	K3
	CO3	Analyze developmental pathways, genetic variations, and adaptive behaviors across different animal groups.	PO8	K4
	CO4	Apply logical reasoning to interpret experimental data in genetics, hematology, and animal behavior.	PO4, PO5	K4
	CO5	Critically evaluate experimental outcomes, diagnostic accuracy, and the biological success of adaptive traits.	PO6	K5

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2 Hrs/week	SEMESTER	II
CREDITS	2	COURSE TITLE	SBC II: Women Empowerment
Course objective - To make students to aware of Gender constructions and gendering Process - To explore existing gender biases in society and to understand the need to work towards the inclusive society - To inculcate sensitivity and build gender perspectives. - To use the course to bring attitudinal cum behavioural changes towards gender neutral ambience and promote the humanistic values. - To foster social commitment and awareness of social issues affecting women.			

Unit	Content	Hrs
I	INTRODUCTION TO GENDER STUDIES CONCEPTS Gender Spectrum - Gender distinction – Biological Determinism – Gender Sensitivity and Awareness – Gender Equity – Equality Gender and Gender Analysis.	5
II	AREAS OF GENDER DISCRIMINATION Gender Socialization - Sex Ratio– Health and Nutrition– – Literacy and Education. Employment - Governance – participation in Decision making- Politics - Property rights and access to credit - Gender based violence.	6
III	WOMEN DEVELOPMENT AND GENDER EMPOWERMENT International Women's Decade – International Women's Year – National Policy for Empowerment of Women 2001.	4
IV	WOMEN'S MOVEMENTS AND SAFEGUARDING MECHANISM: In India National /State Commission for Women (NCW) – All Women Police Station – Family Court Legislations safeguarding women –Transgender Policy.	7
V	CURRENT CONTOURS Analysis of regressive and progressive High court and Supreme Court Judgments- Women proactive policies, Programmes and Interventions.	8
TOTAL CONTACT HOURS		30

TEXTBOOK

Veena Majumdar – Women Workers and Feminism
Uma Chakravarti – Gendering Caste
Nivedita Menon – Gender and Politics in India
A. R. Desai – Social Background of Indian Nationalism

REFERENCE BOOK

1. Bhasin Kamala , What is Patriarchy? : Gender Basics, New Delhi :Women Unlimited ,1993

2. Arya Sadhna Women ,Gender Equality and the State ,New Delhi :Deep &Deep Publication ,2000
3. Mishra .O.P, Law Relating to Women & Child ,Allahabad :Central Law Agency ,2001
4. Uma Chakravarti, Gendering Caste Through a Feminist Lens, Sage Publication 2003
5. 28. Bhattacharya Malini , Sexual Violence and Law ,Kolkata; West Bengala Commission for Women ,2002

E REFERENCE

https://www.rawatbooks.com/sociology/women-gender-studie?utm_source

https://en.wikipedia.org/wiki/The_History_of_Doing?utm_source

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Recall and explain fundamental concepts, historical milestones and institutional frameworks related to gender and women's empowerment.		PO3	K1, K2
CO2	Demonstrate awareness of gender socialization and the societal mechanisms intended to safeguard and empower women.		PO2	K2
CO3	Apply gender analysis and legal knowledge to real-world scenarios involving economic rights, policy implementation, and social inclusion.		PO2, PO6	K3
CO4	Analyze social, legal, and political structures to identify barriers to gender equity and the effectiveness of safeguarding mechanisms.		PO2, PO4	K4
CO5	Evaluate the efficacy of policies, legal judgments, and institutional mechanisms in promoting women's empowerment and justice.		PO2, PO3	K5

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6	SEMESTER	III
CREDITS	5	COURSE TITLE	Core V: Cell and Molecular Biology
Course objective ➤ To understand the principles of different Microscopes. ➤ To learn various cytological techniques to understand ultra-structure of Cellular organelles ➤ To enhance the knowledge on Cell organelles and their role in metabolic activities. ➤ To understand the cell division and Genetic makeup of the cell and its significance. ➤ To know about Cancer and its types, causes and Diagnosis.			

Unit	Content	Hrs
I	History of Cell biology: History of Cell biology – History, Scope and Theories. Structure of Prokaryotes (<i>E. coli</i>) and Eukaryotes (Animal cell), difference between Prokaryotic and Eukaryotic cell. Plasma membrane – Models the Structure, and Functions.	14
II	Microscopy and Cytological techniques: Microscopy: Compound and Electron Microscopes – Transmission Electron Microscope and Scanning Electron Microscope (TEM and SEM). Cytological techniques – Microtome, Fixation and Staining.	12
II	Cell Organelles: Ultra-Structure and functions of Endoplasmic reticulum, Ribosomes, Golgi complex, Lysosomes, Mitochondria, Nucleus and Nucleolus.	10
IV	Cell division and Cancer: Chromosomes – Types, Structure, and functions. Special types of chromosomes –Polytene, Lamp brush and Super Numerary Chromosomes. Cell Division - Cell Cycle, Amitosis, Mitosis and Meiosis. Cancer types and causes Properties, Diagnosis and Treatment and Oncogenes. Senescence – Changes occurring during Aging and causes of Aging.	12
V	Nucleic acids Nucleic acids – Structure of DNA (Watson & Crick Model), Replication of	12

DNA -Semi Conservative Replication. RNA – Types (mRNA, rRNA, tRNA & ssRNA) and functions. Central Dogma of Protein Synthesis- Transcription and Translation.	
TOTAL CONTACT HOURS	60
TEXTBOOK	
1. Text Book of Cell biology, Arumugam, N.A. (2008 Edition) Saras Publication, Kottar, Nagarcoil.	
REFERENCE	
BOOK	
1. Verma, P.S., and V.K.Agarwal, 1995, cell and Molecular Biology, 8th edition, S. Chand & Co., New Delhi – 110 055, 567. 2. De Roberties E.D.P and E.M.F.De Roberties. 2011. Cell and Molecular Biology. 8th edition. B.I. Publicatons Pvt. Ltd., India 3. Rastogi, S.C., 2010, Cell and Molecular Biology, Second Edition, New Age International (p) Ltd., New Delhi. 4. Power, C.B. 2009. Cell Biology. Himalayan Publishing House, New Delhi. 5. Karp G. 2013. Cell and Molecular Biology Concepts and Experiments. John Wiley & Sons, Inc 6.Lodish <i>et al.</i> 2008 Molecular Cell Biology.6th Ed., W.H. Freeman & Co.USA	
E REFERENCE	
http://compbio.case.edu/koyuturk/teaching/eecs600/slides/Molecular_and_Systems_Biology.pdf - file:///C:/Users/ACER/Downloads?Full.pdf	

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Students will be able to identify and compare fundamental cell types and their historical discovery.	PO1	K1
CO2	Students will master the technical ability to visualize and prepare biological samples for study.	PO6	K2
CO3	Students will explain how cellular components interact to maintain homeostasis and energy production.	PO8	K3
CO4	Students will critically analyze the breakdown of cell cycle regulation leading to malignancy and aging.	PO3	K4
CO5	Students will demonstrate an understanding of the genetic code and the flow of biological information.	PO1	K5

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

CO4	-	-	3	-	-	-	-	2	-	-	-	-	-	-
CO5	2	-	-	-	3	-	-	-	-	1	-	-	-	-

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	
HOURS		SEMESTER	III
CREDITS		COURSE TITLE	Core Practical II: Cell & Molecular Biology
Course objective ➤ Acquainting and skill enhancement in the usage of laboratory microscope ➤ Hands-on experience of different phases of cell division by experimentation ➤ Develop skills on human karyotyping and identification of chromosomal disorders ➤ To apply the basic concept of inheritance for applied research ➤ To get familiar with phylogeny and geological history of origin & evolution of animals			

Unit	Content	Hrs
I	Preparation of temporary slides of Mitotic divisions with onion root tips, Preparation of Human Blood Smear.	10
II	Mounting of salivary gland chromosomes of Chironomus (Demo)	5
III	Identification of Meiotic stages in Tradescantia	5
IV	Spotters / Models Cellular organelles: Golgi bodies, Endoplasmic Reticulum, Nucleus, Mitochondria and Chromosome. Giant chromosomes in Chironomus larvae.	15
V	Spotters / Models Watson & Crick model of DNA - Model. DNA replication - Semi	10

	conservative Replication - Model.	
TOTAL CONTACT HOURS		45

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and identify the fundamental structures of cells.	PO1, PO8,	K2
CO2	Explain and classify biological processes, organelle functions, and their purpose.	PO6, PO8,	K4
CO3	Extract and purify DNA, RNA, and proteins from various biological sources	PO1, PO2	K3
CO4	Perform qualitative and quantitative estimations of biomolecules.	PO2, , PO15	K4
CO5	Prepare slides, stain organelles (like mitochondria and nuclei), and distinguish between prokaryotic and eukaryotic	PO11,	K5

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2	SEMESTER	III
CREDITS	2	COURSE TITLE	SBC III: Entomology
Course objective ➤ Explain the basic concepts of entomology and observe the pest status of agriculture. ➤ Illustrate and examine the systemic and functional morphology of various groups of agricultural insect pests. ➤ Differentiate and classify the various groups of insect animals and estimate biodiversity. ➤ To compare and distinguish the general and specific characteristics integrated pest management. ➤ Infer and integrate the economic importance of insect species.			

Unit	Content	Hrs
I	Basics of Entomology: Definition, scope and importance of Entomology. - Insect classification and their distinctive characters Impact of Physical, Chemical & Biological control of pest managemaint.	7
II	Pests of Crops: Coconut Pests - <i>Oryctes rhinoceros</i> and <i>Rhyncophorus ferrugineus</i> ,	

	Paddy Pests - <i>Leptocorisa acuta</i> and <i>Spodoptera mauritia</i> , Stored grain pests - <i>Trogoderma granarium</i> and <i>Tribolium castaneum</i> . Pests of vegetables: Brinjal - <i>Leucinodes orbonalis</i> . Pests of fruits: Citrus - <i>Phyllocnistis citrella</i>	6
III	Insect vectors and pests: Introduction and history of medical entomology- Vectors of public health importance – Mosquitoes, Housefly, Sand fly & Bedbugs. Vector-borne diseases - (Malaria, Dengue, Filariasis) and their control measures.	5
IV	Integrated pest management (IPM): Need for IPM. Planning of IPM, Different techniques used in IPM, Few examples and advantages of IPM, Pest surveillance.	5
V	Insect Pollinators: Importance of Insect Pollinators with example- honey bee, wasp, butterfly. Edible insects & human nutrition.	7
TOTAL CONTACT HOURS		30
TEXTBOOK - David, B and Ananthakrishnan, T.N. 2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India. - Vasanthraj David, B. and Ramamurthy, VV. 2012. Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai. - Textbook of Applied Entomology Vol. I & II by K. P. Srivastava - Awasthi, V.B. 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers.		
REFERENCE BOOK - Abishek Shukla, D. 2009. A Handbook of Economic Entomology, Vedamse Books, New Delhi. - Ministry of Agriculture, Government of India, 1995. Manual on Integrated Pest Management in Rice and Cotton. - Pruthi, S. 1969. Textbook on Agricultural Entomology, I.C.A.R. Publication, New Delhi. - John William. S. 1995. Management of Natural Wealth, Loyola College Publications, Chennai.		
E REFERENCE  http://www.fao.org  http://flybase.bio.indiana.edu/  http://www.ipm.ucdavis.edu  http://www.ent.iastate.edu/list/www.entsoc.org		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and explain the fundamental aspects of insect biology, pest identification, and the significance of insects in health and agriculture.	PO1, PO3	K1 K2
CO2	Apply entomological concepts to interpret	PO1, PO4	K3

	pest behaviour, disease transmission, and the implementation of pest control strategies.		
CO3	Analyze insect physiological adaptations, pest damage trends, and the comparative advantages of biological and integrated control methods.	PO4	K4
CO4	Critically evaluate the economic and health impacts of insects and the efficacy of various management and utilization strategies.	PO2, PO4, PO7	K5
CO5	Design comprehensive pest management plans and social awareness strategies to mitigate insect-related challenges.	PO2, PO5	K4

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2	SEMESTER	III
CREDITS	2	COURSE TITLE	NME I: Apiculture
Course objective ➤ To understand the standard of Indian bee keeping and compare with the International standard. ➤ To acquaint with the issues and challenges in primitive Bee keeping. ➤ Understand honeybee species, biology, behavior, and their role in pollination.			

- Develop entrepreneurial skills and project planning for profitable apiary ventures.
- Promote the use of apiculture in pollination services, agricultural diversification, and environmental stability.

Unit	Content	Hrs
I	Scope of Apiculture. Honeybee–Classification, type of Honeybees – <i>Apis dorsata</i> , <i>Apis cerana</i> , <i>Apis florea</i> , <i>Apis indica</i> and <i>Apis mellifera</i> . Biology of Honeybee – External structure and Lifecycle. Role of Central Honey Bee Research and Training Institute.	6
II	Basic concepts of morphology, mouth parts and sting of Honeybees – Social organization in honeybees: Colony life – Queen, drone, worker – Life cycle of the Honeybee.	6
III	Modern appliances for Apiaries, Products: Honey, Bee wax, Bee venom, Pollen, Royal jelly, Propolis Chemical composition, nutritional and medical value of honey.	6
IV	Principles of Bee keeping – Methods of bee keeping in India – Primitives hives – Wall type, Movable type, Bamboo Hive. Modern hives – Lang troth hive, Newton hive. Appliances used in Bee keeping	5
V	Diseases of Honey bee – Symptoms and control measures - Bacterial: American foul brood, European Foul brood – Viral: Thai sac brood, Sac brood virus – Fungal: Chalk brood, Stone brood and Nosemosis – Bee enemies: Wax moth, Ants, Wasp and Birds.	7
TOTAL CONTACT HOURS		30
TEXTBOOK		
1. Dr.N.Arumugam, Dr.S.Murugan, Dr.J.Johnson Rajeshwar and Dr.R.Ram Prabhu, (2005), Applied Zoology, Saras Publication, Nagerkovil.		
REFERENCE		
BOOK		
1. Dhami.P.S & Dhami .J.K,(1976). Invertebrate Zoology, R.Chand &Co., Publishers, New Delhi		
2. Ekambaranath Ayyar.M.(1973). A manual of Zoology Vishwanathan Printers and Publishers Private Ltd., Chennai.		
E REFERENCE		
• https://ag.tennessee.edu/EPP/Redbook/Apiculture%20(Beekeeping).pdf • https://drive.google.com/file/d/1rpz8Qhqyy6UoOOVpLjIVDZP3ZXqjNBte/view • http://studymaterial.unipune.ac.in:8080/jspui/bitstream/123456789/7420/1/		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Identify and list the fundamental biological species, social structures, hive types, and diseases related to Apiculture.	PO1, PO2, PO4,	K2
CO2	Explain the biological significance of	PO1, PO2	K2

		honeybees, the value of their products, and the characteristics of various beekeeping methods.		
	CO3	Execute beekeeping techniques and apply biological knowledge to manage a hive and identify bee species.	PO4, PO5, PO6	K3
	CO4	Analyze the social dynamics of bees and evaluate the relative effectiveness of different hive designs and disease treatments.	PO1, PO2, PO3,	K3

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6	SEMESTER	IV
CREDITS	5	COURSE TITLE	Core Paper VI: Ancient

		Zoological Practices
Course objective		
➤ Grasp the breadth and depth of IKS, including its philosophical foundations, scientific heritage (math, astronomy, medicine), arts, literature, and spiritual traditions. ➤ Identify and apply principles from IKS (like Ayurveda, Yoga, sustainable practices) to address modern challenges in health, environment, and society. ➤ Bridge gaps between traditional knowledge and modern science, fostering innovation and new research pathways. ➤ Recognize the integrated, holistic approach of IKS that connects spirituality, science, and practical life, moving beyond disciplinary silos. ➤ Cultivate a sense of cultural identity, respect for heritage, and appreciation for India's intellectual contributions.		

Unit	Content	Hrs
I	Introduction to Indian Knowledge System and Zoology: Meaning and importance of Indian Knowledge System (IKS). Origin and development of Zoological knowledge in ancient India. Contribution of common people, farmers, hunters, healers, and tribal communities to zoology. Relationship between nature, animals, and humans in ancient Indian culture	17
II	Ancient Zoological Practices and Indigenous Techniques: Use of animals in traditional medicine. Leech therapy for blood purification. Use of animal products in Ayurveda and Siddha. Domestication of animals and traditional animal husbandry.	15
III	Animal Behaviour and Life Processes in Ancient Knowledge: Social behaviour in animals (ants, bees, birds, mammals). Ethical treatment of animals in Indian traditions.	14
IV	Zoology in Scriptures, Mythology, and Literature: Zoological concepts in Vedas, Upanishads, Puranas, and Epics. Symbolic representation of animals in mythology (e.g., Nandi, Garuda, Hanuman).	12
V	Archaeological Zoology, Conservation, and Modern Relevance: Ancient Indian practices of nature and wildlife conservation. Role of environmentalists and traditional conservation methods. Relevance of Indian Zoological Knowledge in modern Science and sustainable development.	17
TOTAL CONTACT HOURS		75
TEXTBOOK		
1. Dwivedi, O. P., & Tiwari, B. K. (2014). Indian Tradition of Zoology and Environmental Conservation. Scientific Publishers, Jodhpur.		
REFERENCE		
BOOK		
1. Sharma, P. V. (2006). <i>History of Medicine in India</i> . Indian National Science Academy, New Delhi.		
2. Altekar, A. S. (1999). Education in Ancient India. Motilal Banarsidass Publishers, New Delhi.		
E REFERENCE		
• https://www.worldwidejournals.com/international-journal-of-scientific-research-JSR/recent_issues_pdf/2025/May/indian-knowledge-system-in-the-context-of-		

- <https://iksindia.org/>

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Recall and identify the terminology, contributors, and symbolic representations within ancient Indian zoological history.		PO1, PO2	K1
CO2	Explain the principles of indigenous veterinary techniques, animal behaviour, and conservation ethics in ancient India.		PO1, PO2, PO3	K2
CO3	Use and apply ancient zoological knowledge and ethical principles to interpret historical and modern biological contexts.		PO1, PO3, PO9	K3
CO4	Analyze and differentiate the social, medicinal, and symbolic facets of animals within ancient and archaeological frameworks.		PO1, PO3	K4
CO5	Evaluate and critique the scientific and cultural significance of ancient practices and their impact on modern sustainability.		PO4, PO9	K5

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	3	SEMESTER	IV
CREDITS	4	COURSE TITLE	Core Practical II : Ancient Zoological Practices
Course objective			
➤			

Unit	Content	Hrs
I		10
II		5
III		5
IV		5
IV		5
TOTAL CONTACT HOURS		30

COURSE OUTCOME (CO)			PO
K2	CO1		PO1, PO7
K4	CO2		PO1, PO5
K3	CO3		PO1, PO6
K4	CO4		PO1, PO3
K5	CO5		PO1, PO2, PO3, PO6

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2	SEMESTER	IV
CREDITS	2	COURSE TITLE	SEC IV: Intellectual Property Rights
Course objective ☛ To introduce the basic concepts, need, and nature of Intellectual Property Rights (IPRs). ➤ To provide knowledge about different forms of IPR such as Patents, Copyrights, Trademarks, Geographical Indications, Industrial Designs, and Trade Secrets. ☛ To understand the evolution and development of IPRs in India and abroad, including WTO, WIPO, and TRIPS agreements. ➤ To familiarize students with national and international IPR laws, acts, treaties, and conventions. ➤ To create awareness about digital innovations, cyber laws, infringement issues, enforcement mechanisms, and emerging challenges in IPR through case studies.			

Unit	Content	Hrs
I	Introduction to IPR: Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad - Genesis and Development - the way from WTO to WIPO - TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations - Important examples of IPR.	6
II	Meaning and practical aspects: Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad	7
III	International Treaties: International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.	7
IV	Digital Innovations: Digital Innovations and Developments as Knowledge Assets - IP Laws, Cyber Law and Digital Content Protection - Unfair Competition - Meaning and Relationship between Unfair Competition and IP Laws - Case Studies.	5
V	Infringement of IPRs, Enforcement Measures, Emerging issues - Case Studies.	5
TOTAL CONTACT HOURS		30
TEXTBOOK		
1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd,		

2012

2. S.V Satakar Intellectual Property Rights and Copy Rights, Ess Publication, New Delhi, 2002.

REFERENCE

BOOK

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

E REFERENCE

- <https://www.wipo.int>
- <https://www.wto.org>
- <https://www.ipindia.gov.in>
- <https://copyright.gov.in>

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and explain the fundamental concepts, legal frameworks, and international treaties governing Intellectual Property Rights.	PO5	K1 & K2
CO2	Apply the practical aspects of IP registration and international treaty provisions to protect industrial and digital innovations.	PO4	K3
CO3	Analyze the evolution of global IP laws and the functional differences between various forms of intellectual property protection.	PO3	K4
CO4	Critically evaluate the effectiveness of IP legislation and digital protection measures in safeguarding innovations and research.	PO7, PO8	K5
CO5	Design comprehensive strategies for the registration, protection, and ethical management of intellectual and digital assets.	PO6, PO7	K4

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	2	SEMESTER	IV
CREDITS	2	COURSE TITLE	NME II: Wildlife Conservation
Course objective ➤ To understand and discuss the wildlife management, and relevant conservation policies. ➤ To assess and in still strong foundations on wildlife policies and be familiar with a variety of laws and regulations. ➤ To analyse and design appropriate approaches to turn conflict into tolerance and coexistence, with an emphasis on the human dimensions of human-wildlife interactions. ➤ Train in techniques to identify, protect, and restore endangered species and their natural environments. ➤ Provide skills for creating wildlife management plans, handling wildlife conflict, and managing rescue/rehabilitation.			

Unit	Content	Hrs
I	Biodiversity Extinction and Conservation Approaches: Perspectives and Expressions. Identification and prioritization of Ecologically sensitive area (ESA). Coarse filter and fine filter approaches. Regional and National approaches for biodiversity conservation.	6
II	Theory and Analysis of Conservation of Populations: Stochastic perturbations - Environmental, Demographic, spatial and genetic stochasticity. Population viability analysis-conceptual foundation, uses of PVA models.	6
III	National and International Efforts for Conservation: International agreements for conserving marine life, Convention on wetlands of International Importance (Ramsar convention), Conservation of Natural Resources. Overview of conservation of Forest & Grassland resources. CITES, IUCN, CBD National Forest Policy, 1988, National Wildlife Action Plan 2017-2031,	6

IV	Wildlife in India: Wildlife wealth of India & threatened wildlife, Reasons for wildlife depletion in India, Wildlife conservation approaches and limitations. Wildlife Habitat: Characteristic, Fauna and Adaptation with special reference to tropical forest. Protected Area concept: National Parks, Sanctuaries and Biosphere Reserves, cores and Buffers, Nodes and Corridors. Community Reserve and Conservation Reserves	6
V	Management of Wildlife: Distribution, status. Habitat 12 CO5 utilization pattern, threats to survival of Slender Loris, Musk deer, Great Indian Bustard, Olive Ridley turtle. Wildlife Trade & legislation, Assessment, documentation, Prevention of trade, Wildlife laws and ethics.	6
TOTAL CONTACT HOURS		30
TEXTBOOK		
1. Robinson W L and Eric G Bolen, 1984. Wildlife Ecology and Management, Maxmillan Publishing Company, New York, p 478. 2. Aaron, N.M.1973 Wildlife ecology, W.H. Freeman Co. San Francisco, U.S.A. 3. Dasmann R F, 1964. Wildlife Biology, John Wiley & Sons, New York, p 231. 4. Justice Kuldip Singh 1998. Handbook of Environment, Forest and Wildlife Protection Laws in India, Natraj Publishers, Dehradun 5. Hosetti, B.B. 1997 Concepts in Wildlife Management, Daya Publishing House, Delhi. 6. Sutherland, W.J 2000. The conservation handbook: Research, Management and Policy. Blackwell Science.		
REFERENCE		
BOOK		
1. Gilas R H Jr.(ed.), 1984. Wildlife Management Techniques, 3rd ed. The Wildlife Society, Washington D.C., Nataraj Publishers, Dehra Dun, p 547. 2. Rodgers W A, 1991. Techniques for Wildlife Census in India - A Field Manual: Technical Manual - T M - 2. WII. 3. Saharia V B, 1982. Wildlife of India, Natraj Publishers, Dehra Dun. 4. Goutam Kumar Saha and Subhendu Mazumdar, 2017. Wildlife Biology: An Indian Prospective, PHI Publisher, Delhi.		
E REFERENCE		
• https://moef.gov.in • https://wii.gov.in • https://www.worldwildlife.org • https://www.iucn.org		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Understand the fundamental principles of biodiversity, conservation approaches, and the biological status of key wildlife species.	PO6, PO7	K2
CO2	Analyze the various ecological and stochastic factors that influence population viability and lead to species depletion.	PO3, PO5, PO8	K4
CO3	Apply standardized conservation filters, population models, and spatial design strategies (Cores/Buffers/Corridors) to wildlife management.	PO1	K3
CO4	Evaluate the efficacy of national policies,	PO8, PO9	K3

		international agreements, and ethical frameworks in protecting wildlife and their habitats.		
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BLOOM'S MAPPING

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	-	SEMESTER	IV
CREDITS	1	COURSE TITLE	Extension Activity

Objectives:

- To arouse social consciousness of the students by providing them opportunities to work with and among the people.
- To develop an awareness and knowledge of social realities to have concern for the well being of the community and engage in creative and constructive social action.
- To provide with rich and meaningful educational experiences to them in order to make their education complete and meaningful.
- To develop skill needed in the exercise of democratic leadership and programme development to help them get self-employed.
- To give them the opportunities for their personality development.
- Understand the community in which they work.
- Understand themselves in relation to their community.
- Identify the needs and problems of the social and involve them in problem solving process.
- Develop among themselves a sense of civic responsibility.
- Utilize their knowledge in finding practical solution to individual and community

problems.

- Develop competence required for group-living and sharing of responsibilities.
- Gain skill in mobilizing community participation.
- Acquire leadership qualities and democratic attitude.
- Develop capacity to meet emergencies and natural disasters.
- Practice national integration and social harmony.

Evaluation:

The performance of the students in extension activities throughout the semester will be assessed and the credit will be awarded by the faculty.

COURSE OUTCOME (CO)			PO	K LEVEL
K2	CO1	Understand the socio-economic realities of the community and the relationship between the individual and society.	PO8	K2
K3	CO2	Apply theoretical knowledge to find practical solutions for individual and community-level problems.	PO4	K3
K4	CO3	Analyze social needs and problems to involve community members in an effective problem-solving process.	PO3	K4
K5	CO4	Evaluate personal growth in leadership, civic responsibility, and the capacity to handle emergencies or natural disasters.	PO7, PO9	K5
K4	CO5	Organize and mobilize community participation through group-living, sharing responsibilities, and democratic attitudes.	PO7	K4

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6	SEMESTER	V
CREDITS	5	COURSE TITLE	Core VII: Embryology
Course objective ➤ Embryological processes of different organisms are described, and developmental patterns are well explained. ➤ To appreciate and accept the origin of life and Evolutionary processes. ➤ Understand human reproduction, gametogenesis, fertilization, early embryogenesis, and pre-implantation embryo development. ➤ Understand IVF laboratory setup, equipment calibration, quality control (KPIs), and safety protocols. ➤ Study genetic/epigenetic factors in embryo viability and prenatal diagnostics.			

Unit	Content	Hrs
I	THEORIES OF EMBRYOLOGY AND GAMETOGENESIS: Theories of Embryology: Preformation theories, Epigenetic theory, Von Baer's Law, Germplasm theory. Gametogenesis: Origin of primordial germ cells, Spermatogenesis – Formation of Spermatid, Spermiogenesis, Morphology of spermatozoan (mammal), Oogenesis – Proliferative phase, Growth phase – Pre-vitellogenesis, Vitellogenesis, Maturation of egg, Types of eggs.	14

II	FERTILIZATION: Fertilization: mechanism of fertilization – Encounter of Spermatozoa and Ova, Capacitation and contact, Acrosome reaction and penetration, Cortical reaction, Activation of ovum – Change in ionic permeability and potential of egg's plasma membrane, Transient intracellular rise in calcium ions, Transient intracellular increase in pH, Monospermy & Polyspermy, Theories of Fertilization, Migration of Pronuclei and Amphimixis, Ooplasmic segregation; Significance of Fertilization, Parthenogenesis.	14
III	CLEAVAGE & GASTRULATION: Cleavage – Peculiarities of cell division in Cleavage, Patterns of Cleavage. The Nuclei of Cleaving cells, Distribution of Cytoplasmic substances in the egg during Cleavage, Role of egg cortex, The Morphogenetic gradients in the egg cytoplasm, Effect of yolk on cleavage, Cleavage in Chick. Gastrulation in Chick. – The fate map, Morphogenetic movement, Metabolism during gastrulation, Activity of gene during gastrulation.	18
IV	ORGANOGENESIS: Formation of primary organ rudiments – Methods of organ formation – Tubulation – Neurogenesis, Notogenesis, Mesogenesis and Enterogenesis. Development of eye, brain, ear and heart in Frog, Developmental defects or abnormalities (Teratogenesis).	14
V	METAMORPHOSIS: Metamorphosis in Amphibia, Hormonal regulation of Amphibian metamorphosis, Tissue reactivity in Amphibian Metamorphosis. Metamorphosis in insects. Regeneration in Planarian and Amphibian.	15
TOTAL CONTACT HOURS		75
TEXTBOOK		
1. Dr.R.C.Delela and R.Verma., (1986 – 87), A Textbook of Chordate Embrology, V Ed.,Jai Prakashnathan & co, Meerut city, India. 2. P.S.Verma and V.K.Agarwal (1975) Chordate Embryology X Ed., S.Chand & Co PvtLtd, Ramnager, New Delhi.		
REFERENCE		
BOOK		
1. B.I Balinsky (1981), An Introduction to Embryology, V Ed., Saunders College Publishing, Newyork. 2. Bradley M.Pttern., (1957), Early Embryology of the Chick IV Ed., McGraw – Hill Bookcompany, Newyork. 3. Bradley M.Pattern., (1948), Embryology of the pig III Ed., McGraw – Hill Book Company.		
E REFERENCE		
• https://nptel.ac.in/courses/102/106/102106084/		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Describe the origin of germ cells, the process of gamete formation, and the structural morphology of eggs and spermatozoa.		PO1	K2
CO2	Analyze the molecular events of fertilization, the significance of amphimixis, and the mechanisms preventing polyspermy.		PO3, PO4	K4
CO3	Apply knowledge of morphogenetic gradients and yolk distribution to understand embryonic		PO1, PO3	K3

		cell division and the formation of the fate map.		
	CO4	Analyze the processes of neurogenesis, notogenesis, and organ formation in frogs, while assessing the factors leading to developmental abnormalities.	PO1, PO6,	K4
	CO5	Critically evaluate the tissue reactivity and endocrine control governing metamorphosis and the biological mechanisms of regeneration.	PO1, PO3, PO8	K5

BLOOM'S MAPPING															
LO CO	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12	LO13	LO14	LO15
CO1	3	2	1	-	-	1	-	2	2	-	-	-	-	-	-
CO2	3	1	3	2	-	2	-	3	1	-	-	-	2	-	-
CO3	3	2	3	1	2	2	-	2	1	1	-	-	-	-	1
CO4	3	2	2	2	-	3	-	2	2	1	2	-	3	1	-
CO5	3	1	3	2	-	2	-	3	1	-	-	1	-	-	-

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6	SEMESTER	V
CREDITS	5	COURSE TITLE	Core VIII: Evolution
Course objective ➤ To understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance. ➤ To know about the basic concepts of Evolution. ➤ Evaluate evidence supporting the theory of evolution, including molecular, anatomical, and fossil records. ➤ Trace the history of life, patterns of speciation, and construct phylogenetic trees to understand species relationships. ➤ Apply principles to modern contexts, including antibiotic resistance, human evolution, and conservation biology			

Unit	Content	Hrs
I	Historical development and concept of evolution Theory of special creation. Theory of spontaneous generation or Abiogenesis, Biogenesis. Biochemical Origin of Life, Urey and Miller's Experiment.	12
II	Theories of Evolution Lamarckism, criticism of Lamarckism, Neo – Lamarckism, Darwinism, criticisms of Darwinism, Neo- Darwinism, certain generalizations about Evolution – Atavism, Williston's Rule, Cope's Rule and Allometry.	14
III	mechanism of Evolution Variations - kinds of variation, sources of variation. Hybridization in Evolution – Introgressive hybridization. Polyploidy in Evolution. Isolating mechanisms – Prematic mechanisms and Postmating mechanisms. Role of isolation in Evolution. Natural selection – Nature of natural selection – differential reproduction, Types of Natural selection. Mutation as raw materials for Natural Selection.	16
IV	Speciation Species – Morphological, Genetic and biological species concept, sibling species, monotypic and polytypic speciation. Subspecies categories – Clines and Demes, Origin of species – factors causing Genetic Divergence in the population of species Patterns of speciation – Allopatric, Sympatric, Quantum and Parapatric speciation	15
V	Evolution of Man Human Evolution- place of origin, time of origin, causes of Evolution of Man, characteristics of Man. Evolutionary trends, Evolution of Man as seen in fossil record - Propliopithecus, Dryopithecus, Oreopithecus, Ramapithecus and Australopithecus (first Man Ape), Homoerectus – Java and Peking Man. Homosapiens – Heidelberg Man, Neanderthal Man, Solo man, Rhodesian Man, Cro- Magnon Man (Homo sapiens sapiens) Culture and Control of Evolution – learning society and culture, relative rates of culture of Biological Evolution and Social Darwinism.	18
TOTAL CONTACT HOURS		75
TEXTBOOK		
1. Organic Evolution: Arumugam, (2005), Organic Evolution, Saras Publication.		
REFERENCE		
BOOK		
1. Paul Amos Moody, 1978, Introduction to Evolution, Kalyani Publishers, New Delhi.		
2. Theodosius Dobzhansky, Francisco J. Ayala, G. Ledyard Stebbins, James W. Valentine, 1973, Evolution, Surject Publications, New Delhi. E. Peter Volpe, 1989, Understanding Evolution, Universal Book Stall, New Delhi.		
3. Mohan, P. Arrora, 2000, Organic Evolution Himalayan Publishing House, New Delhi.		
4. G.L Stebbins, 1979, Process of Organic Evolution, Prentice Hall India, New Delhi. Monroe.		
5. W. Strickberger, 2000 Evolution, Jones & Barlett publishers, Boston		
E REFERENCE		
https://www.classcentral.com/course/early-vertebrate-evolution-5417 https://www.classcentral.com/course/molecularevolution-3555		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Summarize the fundamental concepts of the origin of life and the experimental proofs supporting biochemical evolution.	PO1, PO2	K2
CO2	Critically analyze traditional and modern theories of evolution and the generalizations governing morphological changes.	PO1, PO3	K4
CO3	Explain the genetic and environmental mechanisms that facilitate variation and reproductive isolation in the animal kingdom.	PO2, PO3	K4
CO4	Evaluate the different patterns of speciation and the factors contributing to the formation of new biological species.	PO3, PO4, PO8	K4
CO5	Demonstrate an understanding of human evolution, fossil history, and the intersection of social Darwinism with biological evolution.	PO1, PO5, PO6	K3

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

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council 08.06.2026

PROGRAMME CODE	UGZOOA		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE			BATCH	2026-2029
HOURS	5		SEMESTER	V
CREDITS	4		COURSE TITLE	Elective I: Genetics
	Course objective ➤ To understand the basic concepts of hereditary and environmental variations. ➤ To appreciate the mechanism of allelic and non-allelic interaction ➤ Predict phenotypes, interpret pedigree charts, and evaluate pedigree-based			

	inheritance patterns. ➤ Explore mechanisms of mutation, recombination, and population genetics ➤ Apply modern techniques like genomics, genome editing, and diagnostic tools to solve problems in healthcare and biotech.
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Unit	Content	Hrs
I	Mendel's Law of Inheritance: Gregor Mendel's life – Monohybrid cross and Law of Segregation – Dihybrid cross and Law of Independent Assortment – Alleles – Homozygote and Heterozygote – Genotype and Phenotype – Back Cross and Test Cross.	16
II	Gene interactions: Allelic interaction - Incomplete dominance - Co-dominance – Lethal genes. Coding and Non-coding regions. Non-allelic gene interaction - Complementary Gene interaction. Supplementary Gene interaction - Epistasis - Dominant and Recessive.	16
III	Multiple alleles: ABO and Rh blood group – Polygenic Inheritance – Inheritance of Skin Colour in Man. Linkage – Definition - Types of Linkage - Complete and Incomplete Linkage in Drosophila. Crossing over - Definition - Mechanism of Crossing over- Theories of Crossing over – Kinds of Crossing over - Cytological. Basis of Crossing Over- Stern's experiment- Tetrad-analysis.	14
IV	Sex Determination in Man: Sex Linked Inheritance in Man - Colour Blindness and Haemophilia. Extra Chromosomal Inheritance- Kappa particles in Paramecium and Shell coiling (torsion) in Snail. Twin studies – Monozygotic and Dizygotic Twins.	15
V	Mutation type: Syndromes - Down's Syndrome- Klinefelter's Syndrome- Turner's Syndrome. Pedigree chart, Eugenics-Positive and Negative measures. Inbreeding and Outbreeding.	14
TOTAL CONTACT HOURS		75
TEXTBOOK		
1. R. P. Meyyan, (2013). Genetics, Saras Publications, Nagercoil, VII Ed.		
REFERENCE BOOK		
1. P.S.Verma and T.K.Agarwal.,(2007) S.Chand & Co.,New Delhi.		
2. McKusick,V.A.,(1968)Human Genetics, Prentice Hall of India Private Limited, New Delhi.		
E REFERENCE		
• https://thunderbooks.files.wordpress.com/2009/05/introduction-to-biotechnology-and-genetic-engineering-infinity-2008.pdf • http://www.ifsc.usp.br/~ilanacamargo/FFI0740/2.pdf • https://ingeniumcanada.org/sites/default/files/2019-01/education-genetics-and-biotechnology.pdf		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Apply Mendelian laws of inheritance to predict genotypic and phenotypic ratios through monohybrid and dihybrid crosses.	PO1, PO3	K3
CO2	Differentiate between various allelic and non-allelic	PO1, PO2	K4

		gene interactions, including epistasis and lethal genes.		
	CO3	Examine the mechanisms of linkage, crossing over, and polygenic inheritance in humans and model organisms like <i>Drosophila</i> .	PO4, PO8	K4
	CO4	Illustrate the principles of sex determination and extra-chromosomal inheritance using specific biological examples.	--	K2
	CO5	Analyze the chromosomal basis of genetic syndromes and evaluate the ethical implications of eugenics and pedigree studies.	PO3, PO6	K4

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	5	SEMESTER	V
CREDITS	4	COURSE TITLE	Elective I: Animal Behavior
Course objective ➤ Recall and record genetic basis and evolutionary history of behaviour. ➤ Classify movement and migration behaviours and explain environmental influence upon behaviour.			

- Analyse and identify innate, learned and cognitive behaviour and differentiate between various mating systems.
- Assess complexity involved in behavioural traits and evaluate hormones and their role in aggression and reproduction.
- Discuss the rhythmicity of behavioural expressions and the scientific concepts in behaviour and behavioural ecology.

Unit	Content	Hrs
I	Genetics and Behaviour: Genetic material, Genes and chromosomes, Genetic variation, Heritability of behaviour, Natural selection and behaviour, Frequency distribution of phenotypes, Darwinian fitness.	14
II	Evolution and Social Behaviour: Sexual selection, Altruism, Sexual strategy and social organisation, Animal perception, Neural control of behaviour. Visual adaptations to unfavourable environments.	16
III	Animal and the Environment: Coordination and Orientation, Animal Learning, Conditioning and Learning, Biological aspects of learning.	15
IV	Understanding Complex Behavior: Decision making in behavior Animals, Complex behavior 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.	16
V	Chronobiology: Organization of Circadian system in multicellular animals; Circadian pacemaker system invertebrates with particular reference to Drosophila. The physiological clock and measurement of day length. The relevance of biological clocks for human welfare. Clock function (dysfunction); Human health and diseases - Chrono pharmacology, Chrono medicine, Chronotherapy.	12
TOTAL CONTACT HOURS		75

TEXTBOOK

1. Abhijit Dutta, 2009. Experimental biology: A Laboratory Science, Narosa, New Delhi.
2. DAS H.K., 2005. Textbook of Biotechnology. Wiley Dreamtech Pvt Ltd, New Delhi.
3. Rastogi, S.C., 2005. Experimental physiology, New age International publishers, New Delhi.
4. Ramesh, R and M, Anbu 1996. Chemical methods for environmental Analysis of water and sediment. Macmillan India Limited, Chennai.
5. Micheal, P, 1984. Ecological Methods for field visit and laboratory investigation. Tata McGraw Hill, New Delhi.
6. Agarwal, A. State of India's Environment: A Citizens Report, Centre for Science and Environment, New Delhi.
7. Goel, P.K. Water Pollution: Causes, Effects and Control. New Age International, Publishers, New Delhi (2006).

REFERENCE

BOOK

1. Michael D. Breed and Janice Moore, 2012. Animal Behavior, Academic Press, USA,
2. Aubrey Manning and Martin Stamp Dawkins, 2012. An Introduction to

- Animal Behavior, 6th Edition, Cambridge University Press, UK. 458pp.
3. Davis E. Davis, 1970. Integral Animal Behaviour, MacMillan Company, London, 118pp.
 4. Jay, C. Dunlap, Jennifer, J. Loros, Patricia J. De Coursey (ed). 2004. Chronobiology Biological time Keeping, Sinauer Associates Inc, Publishers, Sunderland, MA.

E REFERENCE

- <https://www.ncbs.res.in/content/animal-behaviour>
- <https://bit.ly/3i6wUxR>
- <https://www.behaviour.univie.ac.at/>
- <https://www.ru.nl/bsi/>

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Recall and explain the genetic, physiological, and environmental foundations of animal behaviour and chronobiology.		PO1, PO2	K1
CO2	Apply behavioural principles to interpret social structures, learning patterns, and the clinical relevance of biological rhythms.		PO1, PO7	K3
CO3	Analyze the evolutionary, neurological, and temporal factors that govern complex behavioural decision-making.		PO1, PO6	K4
CO4	Critically evaluate behavioural theories, cognitive capabilities of animals, and the consequences of chronobiological disruptions.		PO1, PO8	K5
CO5	Design research frameworks and practical solutions to address behavioural challenges and Chronobiological applications.		PO8	K5

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOO A	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	5	SEMESTER	V
CREDITS	4	COURSE TITLE	Elective II: Basics of Biomolecules
Course objective ➤ To understand the role of Carbohydrates, Protein and Lipids. ➤ To study the different Metabolic cycles. ➤ To know the importance of Enzymes and Vitamins. ➤ To understand the role of Nucleic acids ➤ Learn how molecules are synthesized and broken down in cells, including the distinction between primary and secondary metabolites			

Unit	Content	Hrs
I	Introduction to Biomolecules: Biomolecules- Major characteristics of Biomolecules, Carbon as the main component of Biomolecule, Origin of life, Chemical composition of Life, Elements of life - Atom and Chemical bonds.	14
II	Carbohydrates: Carbohydrates - Classification, Structure, Properties and Physiological significance. Monosaccharides: Glucose, Fructose & Ribose. Disaccharides: Sucrose, Lactose & Mannose, Polysaccharides: Homopolysaccharides – Starch & Glycogen. Heteropolysaccharides: Neutral sugar Mucopolysaccharides: Hyaluronic acid & Heparin.	14
III	Aminoacids & Proteins: Amino acids: Classification, Structure, Properties and Biological importance. Proteins: Structure - Primary, Secondary, Tertiary and Quaternary.	14
IV	Lipids: Lipids - Classification, Structure, Properties and Physiological significance. Simple lipids: Triglyceride - Saturated, Unsaturated fatty acids, Essential, Non-essential fatty acids and Waxes. Compound lipids: Structure and Physiological significance. Derived lipids: Structure and Physiological significance (Steroid, Cholesterol, Terpenes)	16
V	Metabolism and Enzymes: Carbohydrate: Glycolysis, Kreb's cycle. Protein: Deamination, Transamination, and Decarboxylation Lipid: β oxidation of Palmitic acid with its Energetics Enzymes: Classification, Properties and Physiological significance.	17

Mechanism of Enzymatic action.	
TOTAL CONTACT HOURS	75
TEXTBOOK 1. N. Arumugam <i>et al.</i>, Prescribed Text: of Biochemistry, Saras publications. 2. Ambika Shanmugam, 1998, Fundamentals of Biochemistry for Medical students, Published by the Author, Madras. 3. Satyanarayana, U. and Chakrapani, U. 2009. Biochemistry, Books and Allied Pvt. Ltd., Kolkata. 4. Deb-Biochemistry.	
REFERENCE BOOK 1. Harpers Illustrated Biochemistry, 30th Edition. The McGraw- Hill Education, 2011. 2. Nelson, D.L., Leininger, A.L. and Cox, M.M., Lininger Principles of Biochemistry, W.H. Freeman Co., 2012. 3. Deb, AC. Fundamental of Biochemistry, 10th Edition New Central Book Agency. Pvt.Ltd, Kolkata, 2011. 4. Lubers - Biochemistry.	
E REFERENCE • https://swayam.gov.in/nd2_cec20_bt19/preview https://swayam.gov.in/nd1_noc20_cy10/preview • https://www.mooc-list.com/course/biochemistry-biomolecules-methods-and-mechanisms-edx	

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Recall and explain the chemical composition, structural classification, and biological importance of major biomolecules and enzymes.		PO1, PO8	K1, K2
CO2	Apply structural knowledge of biomolecules to understand their functional roles in human physiology and cellular stability.		PO1, PO5	K3
CO3	Analyze the structural differences between diverse biomolecules and the intricate steps of major metabolic pathways.		PO1, PO5	K4
CO4	Evaluate metabolic energetics and the structural-functional relationships of complex biological molecules.		PO1, PO8	K5
CO5	Synthesize comprehensive models of biomolecular assembly and integrate metabolic pathways for amino acids, lipids, and carbohydrates.		PO1, PO6, PO8	K6

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

CO4	2	2	3	2	3	2	-	-	1	-	-	-	1	-	-
CO5	2	2	3	3	2	3	1	-	2	1	-	-	-	1	-

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	5	SEMESTER	V
CREDITS	4	COURSE TITLE	Elective II: Marine Biology
Course objective ➤ To understand and learn the physical, chemical and biological aspects of marine environment and to gain knowledge about the management of oceans. ➤ To introduce students to the marine environment and its indigenous organisms. ➤ To study the principles, concepts and facts through which the student can better understand and appreciate the nature of the sea and its inhabitants. ➤ To acquaint the student with the characteristics used to identify and classify marine plants and animals and to develop an awareness of the career possibilities available to students in this area. ➤ Develop skills in field sampling, laboratory experiments, and data analysis to solve complex marine science problems.			

Unit	Content	Hrs
I	Marine Ecology: Marine environment- ecological factors - light, temperature, salinity, pressure; Classification of marine environment; Pelagic environment – Plank tonic and Nektonic adaptations; Benthic environment-intertidal, in terrestrial and deep-sea adaptations; Distribution and ecological role of other coastal environments - coral reefs, estuaries, mangroves, sea grass beds, kelp forests, polar rise and hydrothermal vents.	15
II	Physical Oceanography: Physical Properties of Seawater-density, viscosity, surface tension, conductivity and their relationship; temperature distribution in the sea – heat budget, UV radiation; El Nino/La Nina – global impact; Dynamics of the ocean-general surface circulation, Waves, Currents and Tides, Tsunami.	10
III	Chemical Oceanography: Chemical composition of seawater- ionic, major and minor constituents, constancy- ionic compositions and factors affecting constancy- major and minor elements, trace elements their importance, distribution.	10
IV	Biological Oceanography: Sea as a biological environment- Plankton	10

	classification based on size, mode of life and habitat. Phytoplankton and Zooplankton-methods of collection, estimation of standing crop-wet and dry weight estimation-plankton volume settling and displacement methods. Oxidation as carbon (as organic matter). Primary productivity– estimation and factors affecting primary productivity.	
V	Marine Pollution and Ocean Management: Ocean pollution- kinds and quantities of pollutants, toxic effects and control measures– oil spills, plastics, nuclear waste disposal in marine environment, Eutrophication. Role of National and international agencies and organizations in ocean management-FAO, UNEP, DOD, WOCE, WHOI, IOI Malta, IMOINMARSAT- IUCN, SCAR, SCOR, Marpol, Traffic. Ocean policy (India)- research and management.	15
TOTAL CONTACT HOURS		60
TEXTBOOK		
1. Venkataraman. K, Raghunathan C, Raghuraman R, Sreeraj C. R, 2012. Marine diversity in India. Zoological Survey of India, Kolkata.178 pp.		
REFERENCE		
BOOK		
1.Barbara. E. Curry, 2016. Advances in Marine Biology, Volume 74, Edition I. Academic Press. ISBN:9780128036075		
2. Peter Castro, Michael E. Huber, 2015. Marine Biology; Botany, Zoology, Ecology and Evolution. McGraw-Hill Education.		
3. Philip. V. Mladenov, 2013 Marine Biology: A very short introduction, I Edition. Oxford University Press.		
4. Amy Hill. 2002. Marine Biology: An Introduction to Ocean Ecosystems (Marine Biology Ser) Walch publishing. Pickard,		
5. RaymontJ.E.G.,1980. Plankton and Productivity in the oceans: Volume1: Phytoplankton, Pergamon Press.		
6. Gage. J.D. and P.A. Tyler, 1991. Deep Sea Biology, Cambridge University Press, Cambridge		
E REFERENCE		
• https://www.livescience.com • https://www.icriforum.org • https://www.cbd.int		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and describe the foundational ecological, physical, chemical, and biological components of the marine ecosystem.	PO1, PO8	K1, K2
CO2	Apply principles of oceanography and marine ecology to understand organismal adaptations and environmental management.	PO1	K3
CO3	Analyze the complex interactions between physical ocean dynamics, chemical compositions, and biological productivity.	PO1	K4
CO4	Critically evaluate oceanographic data and the effectiveness of policies governing marine resource management.	PO6	K5
CO5	Synthesize diverse oceanographic data to	PO7	K4

		design strategies for marine conservation and ecosystem monitoring.		
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BLOOM'S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	1	2	1	-	-	2	-	-	-	-	-	-	1	-
CO2	3	2	2	1	-	-	-	-	-	1	-	-	-	-	-
CO3	2	1	3	2	-	-	1	-	-	-	-	1	1	-	-
CO4	2	2	3	2	-	2	-	3	1	-	-	-	-	-	-
CO5	2	2	3	3	-	-	2	3	2	2	-	-	-	-	-

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	75 Hours	SEMESTER	V
CREDITS	1	COURSE TITLE	Summer Internship (75 hrs)

Course objective

- To offer a hands-on-learning experience, that allows the learners to maximize the outcome and benefits of their theoretical knowledge through practical implementation.
- By adding technical skills, soft skills and professional experience to the learners' resume, they can enhance their chances of securing the job they deserve.
- To provide the learners an experience of the real corporate world and thus help them understand the expectations and requirements of the industry.
- To enable the learners, build their network and professional relationships, which turns them into confident future professionals.
- Gain first hand experience with industry culture, modern tools, technology, and work ethics.

Duration of the Training:

The learners of all the Under-Graduation Programmes are to undergo the Internship / Training during the summer vacation, after completion of the III Semester examinations. The training period is 30 working days.

Evaluation:

After completion of the training, the evaluation of the performance of the learners will be done in the V semester. Two credits will be awarded for the best performers. Viva-voce examination will be conducted, and the learners have to appear for the Viva voce individually. At the time of Viva-voce, the learners have to submit the given records to the examiner. Work Diary, endorsed by the trainer. A complete report on the objectives, modules and outcomes. A certificate, duly signed and issued by the trainer.

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Formulate clear learning objectives and prepare for professional integration into a scientific or industrial work environment.		PO4	K1 & K2
CO2	Apply academic knowledge to execute practical tasks, operate bio-instruments, and solve problems in a professional setting.		PO6, PO7,	K3
CO3	Analyze practical findings and maintain systematic documentation of daily technical activities and learning milestones.		PO2, PO4, PO8	K4
CO4	Critically evaluate the internship experience, personal skill development, and the ethical implications of biological practices.		PO5	K5
CO5	Synthesize the internship experience into a structured technical report and develop professional plans for future specialization.		PO2, PO6	K5

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6	SEMESTER	VI
CREDITS	5	COURSE TITLE	Core IX : Animal Physiology
Course objective ➤ To learn the digestion, respiration and circulatory system ➤ To study the structure and function of internal organs ➤ To know the excretory mechanism and its significance ➤ To get knowledge about the nerve, muscle and receptors of human body. ➤ To aware of hormonal roles in reproductive process.			

Unit	Content	Hrs
I	Physiology of Digestion: Structural organization and functions of Gastrointestinal tract, Mechanical and Chemical digestion of food; Absorptions of food, Hormonal control of secretion of enzymes in Gastrointestinal tract.	16
II	Respiration Circulation: Respiration – Types of respiratory organs – Respiratory pigments – transport and exchange of gases control of respiration – biological oxidation anaerobiosis respiratory quotient. Structure and function of human Heart, Haemodynamic, ECG, Blood pressure	14
II	Excretion: Structure of kidney and its functional unit; Mechanism of urine formation; 10 Regulation of water balance; Regulation of acid-base balance. Origin and Types of Nitrogenous wastes – Ammoniotelic, Ureotelism and Uricotelism	15
IV	Receptors and effectors: Structure of neuron, Resting Membrane Potential, Conduction of action potential across the Myelinated and Unmyelinated nerve fibres; Types of synapses, Synaptic transmission and Neuromuscular junction;	14

	Reflex action and its types - Reflex arc. Ultra structure of Skeletal muscle; Molecular and chemical basis of Muscle Contraction; Characteristics of Muscle twitch; Motor unit, Summation and Tetanus	
V	Endocrine glands – Pituitary, Thyroid, Parathyroid, Adrenal and Sex glands – their secretions and physiological role, Human Reproductive cycle and the Role of hormones.	16
TOTAL CONTACT HOURS		75
TEXTBOOK		
Animal Physiology – Arumugam et al., Saras Publication 2021.		
REFERENCE		
BOOK		
Textbook of Medical Physiology, Elsevier Inc. Hall, J.E., 2013, Animal Physiology- P. S Verma, B. S. Tyagi, V.K. Agarwal, II ed, 1978, S. Chand & Company Ltd. Ram Nagar, New Delhi – 110 055. General comparative physiology by Hoar, S. William, 3 rd ed, 1987, Prentice Hall of India Pvt. Ltd. New Delhi, 18 BN-0-87692-337-6.		
E REFERENCE		
Animal Physiology: https://www.classcentral.com/course/swayam-animal-physiology-12894		
Animal Physiology: https://swayam.gov.in/nd1_noc20_bt42/preview .		
Respiration in the Human Body: https://www.classcentral.com/course/edx-respiration-in-the-human-body-3050		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Describe the fundamental anatomical structures and physiological components of the human body systems.		PO1, PO8	K1
CO2	Explain the integrated mechanisms and chemical processes governing human physiological functions.		PO1, PO8	K2
CO3	Apply physiological principles to interpret biological data, clinical readings, and regulatory feedback loops.		PO5, PO6	K3
CO4	Analyze the functional relationships and comparative differences between various metabolic and regulatory pathways.		-	K4
CO5	Evaluate complex physiological interactions and justify the importance of homeostatic balance in human health.		PO7	K5

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6	SEMESTER	VI
CREDITS	5	COURSE TITLE	Core X: Sericulture

Course objective

- To enlighten the students about sericulture is a profitable culture practice.
- To enhance the skills, competitiveness and employability of the students.
- To provide practical, hands-on training in mulberry nursery management, silkworm rearing techniques, and silk reeling processes.
- To gain knowledge of silk production, disease management, quality of silk and marketability.
- Non major elective students can become entrepreneur.

Unit	Content	Hrs
I	Introduction to Sericulture: Life cycle, Types (Eri, Muga) External morphology and biology of mulberry silkworm. Internal morphology of Silkworm – Digestive, Respiratory, Nervous, Excretory and Reproductive systems.	16

II	Moriculture: Importance of soils with reference to mulberry cultivation, Propagation of Mulberry, Planting systems, Manures and Fertilizers, Micronutrients; Composting and Vermicomposting. Irrigation, Leaf harvesting, Classification of Mulberry, Popular varieties in India, Draught Resistant varieties, Pests and diseases of Mulberry – Fungal, Bacterial and Viral diseases and their control. Pests of Mulberry.	16
II	Seed / Silkworm eggs: Structure – Commercial and reproductive, Seeds, Voltinism, Hibernating and Non hibernating eggs. Diseases of <i>Bombyx mori</i> -Viral, bacterial protozoan and fungal, Preventive and control measures. Insect and vertebrate Pests of silkworm and their management.	14
IV	Rearing: Rearing House and Rearing Appliances. Rearing operations, Rearing methods. Identification, and separation of defective and diseased Cocoons. Harvest, Storage and Transport of Cocoons and Cocoon Marketing.	15
V	Reeling: Steps to be followed before Reeling-Stifling, Drying and Storing, Cooking and Boiling, Deflossing and Ridding. Process of Reeling- Reeling appliances, Methods of reeling - Charka, Cottage basin and Filatures, Re-reeling, Lacing Skeining, Booking, Raw Silk testing and uses of Silk.	14
TOTAL CONTACT HOURS		75
TEXTBOOK 1. M. S. Nalina sundari, Entomology M. J. P Publications, Chennai, 2006. 2. Sharma P.L & Singh S. Handbook of Bee Keeping, Agrobios Publ, India, 2001. 3. Ravindranathan K. R. A text book of Economic Zoology. Dominant Publishing & distributors, New Delhi, 2005		
REFERENCE BOOK 1. Ganga & J. Sulochana Chetty, An introduction to sericulture (Oxford & IBH publ.Co.Pvt. Ltd.) 2001. 2. Handbook of Practical Sericulture by Ullal and Narsimhanna. CSB Bangalore.2002		
E REFERENCE • http://www.survivorlibrary.com/library/silk_culture-a_manual_with_complete_instructions_1885.pdf • https://n-modell.hu/11kopjts/178679-introduction-to-sericulture-pdf		

COURSE OUTCOME (CO)			PO	K LEVEL
	CO1	Describe the fundamental biological, agricultural, and technical terminology associated with the sericulture industry.	-	K2
	CO2	Demonstrate an understanding of silkworm biology, mulberry cultivation techniques, and the silk extraction process.	PO1, PO4	K2
	CO3	Apply standardized sericulture practices to mulberry cultivation, silkworm rearing, and raw silk production.	PO4	K3

	CO4	Analyze the factors affecting the health of silkworms and the quality of mulberry leaves and cocoons.	PO3, PO5	K4
	CO5	Evaluate sericulture management strategies and the commercial viability of silk production outputs.	PO3, PO5	K5

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6 Hrs/ Weak	SEMESTER	V
CREDITS	3	COURSE TITLE	Core Practical III: Embryology & Evolution
Course objective ➤ To provide in-depth knowledge of embryology, from gamete maturation and fertilization to cleavage, gastrulation, and organogenesis. ➤ To train in techniques for freezing and thawing gametes and embryos, including vitrification methods. ➤ To explore the genetic basis of developmental defects, infertile disorders, and to evaluate how embryo development reflects evolutionary processes.			

- To teach the fundamentals of setting up an IVF lab, maintaining equipment calibration, managing quality control.
- To explore the genetic basis of developmental defects, infertile disorders, and to evaluate how embryo development reflects evolutionary processes.

Unit	Content	Hrs
I	Blastoderms mounting- Chick embryo – 24, 72, 96 hours	14
II	Spotters: Egg of frog, Cleavage of frog, Blastula of frog, Placenta of sheep, Human foetus.	12
III	Experiments Variation – Fingerprints. Use of Models to study selection in large and small populations and principles of genetic drift.	11
IV	Spotters: Homologous & Analogous organs, Vestigial organs, Fossils- Archeopteryx, Examples of Evolutionary importance – Peripatus. Animals with adaptive coloration - Leaf insect, Stick insect.	9
V	Blood Grouping. Total WBC and RBC. Estimation of Haemoglobin. Preparation of Serum components. Automatic blood pressure monitor. Digital glucometer.	14
TOTAL CONTACT HOURS		60

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Develop technical skills in mounting chick blastoderms and identifying developmental stages in chordate embryology.	PO1, PO6	K3
CO2	Execute experimental models to analyze biological variations and the mechanisms of genetic drift in populations.	PO5	K4
CO3	Evaluate morphological evidence of evolution through the study of fossils, adaptive coloration, and comparative anatomy.	PO1	K4
CO4	Perform Clinical Hematological tests including blood grouping, cell counting, and hemoglobin estimation with high precision.	PO1, PO7	K2
CO5	Operate modern diagnostic tools such as digital glucometers and automatic blood pressure monitors for health assessment.	PO5, PO6	K3

BLOOM'S MAPPING															
PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	-	-	3	2	-	2	-	-	-	1	-	-
CO2	3	2	3	2	3	-	-	-	2	1	2	-	-	-	-
CO3	3	2	3	-	2	-	2	-	-	-	-	2	-	-	1
CO4	3	3	2	3	3	-	3	2	-	-	-	-	2	1	-
CO5	3	3	2	3	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	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	6	SEMESTER	VI
CREDITS	3	COURSE TITLE	Practical IV: Animal Physiology & Sericulture

Course objective

- ❖ Analyze how the body regulates its internal environment to maintain stability.
- ❖ Explore the chemical and physical processes behind cellular functioning.
- ❖ To obtain practical knowledge in doing experiments and uptraining the real time visualising the appliances used in sericulture.
- ❖ To relate physiological knowledge to practical rearing techniques, including the feeding of silkworms for maximum cocoon yield.
- ❖ To develop entrepreneurial abilities for setting up small-scale sericulture enterprises, such as egg production

Unit	Content	Hrs
I	Mounting Estimation and Observations Preparation of human blood smear. ABO blood grouping. Counting of different types of blood cells using Haemocytometer - Demonstration of WBC & RBC count. Differential leukocyte count.	13
II	Blood Analysis – Hb Estimation (Sahli's method), Use of Kymograph unit, Demonstration of Blood pressure in Sphygmomanometer. Spirometer. Survey of Digestive enzymes in cockroach.	11
III	Estimations of excretory products of fish, bird and mammal and detections of ammonia, urea and uric acid. Urine Analysis – Detections of Albumins, Sugar and Deposits. Observations & Study of Mantoux test, Widal test.	14
IV	Dissection-Silk gland, Digestive system	10
V	Spotters: Silkworm, Cocoon, Mulberry shoot, Mulberry leaf, Netrika /Chandrika, Leaf Mosaic disease, Leaf Blight disease, Pebrine Aquaculture, Common Carp.	12
TOTAL CONTACT HOURS		60

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Identify and name the biological specimens, laboratory instruments, and biochemical reagents used in physiology and sericulture practicals.	-	K1
CO2	Explain the principles of physiological estimations, clinical diagnostic tests, and the morphological features of sericulture specimens.	-	K2
CO3	Execute laboratory protocols for hematology, biochemical analysis, and silkworm dissection with technical precision.	PO6, PO7, PO8	K3
CO4	Analyze physiological data and anatomical structures to differentiate between healthy and pathological biological states.	PO4, PO5	K4
CO5	Interpret and evaluate experimental results to draw valid conclusions regarding human health and sericulture productivity.	PO4, PO5	K5

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	5	SEMESTER	VI
CREDITS	4	COURSE TITLE	Elective III: Immunology
Course objective ➤ To acquire knowledge on immunity and immune system. ➤ Identify the cells, tissues, and organs that make up the immune system. ➤ To understand the significance of the organs and cells and their functions during the immune reactions. ➤ Compare and contrast the mechanisms, receptors, and effector functions of innate and adaptive immune responses. ➤ Explore the principles of vaccines, immunotherapy, and diagnostic techniques.			

Unit	Content	Hrs
I	Introduction History and scope of Immunology – Types of Immunity – Innate and Acquired Immunity. Innate – Physical and Mechanical factors, Biochemical, Cellular, Genetic factors and other factors. Acquired Immunity – Active & Passive Immunity – Natural and Artificial Immunity.	17
II	Organs of immune system Primary Lymphoid organs- Thymus and Bone Marrow. Secondary Lymphoid organs- Spleen and Lymph node.	12
II	Cells of the Immune system – T-lymphocytes, B-lymphocytes, Null cells, Mononuclear phagocytes, Granulocytes, Neutrophils, Basophils, Eosinophil, Basophil Mast cells and Dendritic cells.	14
IV	Antigens and Antibodies Immunogens: Types of Antigens, General properties of Antigens, Adjuvants, Haptens, Epitopes and Paratopes. Immunoglobulins: Immunoglobulin basic structure, Types, Properties and Function. Hybridoma Technology: Production and Application of Monoclonal Antibodies.	16
V	Basic concepts of Immune system Major Histocompatibility Complex: Structure of MHC molecules and HLA system. Complement system: Classical and Alternate pathway. Vaccines: Designed Vaccine and whole organism. Hypersensitivity: Type I, II, III, IV & V. Transplantation Immunology – Graft Rejection. Autoimmune Disease – Haemolytic anaemia. Immunodeficiency disease – AIDS.	18
TOTAL CONTACT HOURS		75
TEXTBOOK		
1.Dr.N. Arumugam et al., (2013) – Textbook of Immunology, Saras Publication.		

REFERENCE BOOK

1. Kuby ., (1992), Immunology, IV Ed., - W.H. Freeman and company.
2. Evan M.Roitt., (1988), Essentials Immunology- VI Ed., ELBS imprint. Shailendra Kumar Sinha., (2009) Serial dilution Technique.
3. Immunology and Medical Zoology- I Ed., - Oxford Book Company.
4. David male., (2008), Immunology VII Ed., Elsevier Health sciences.
5. I.Kannan., (2007), Immunology I Ed., - MJP Publisher .

E REFERENCE

- https://labscientists.files.wordpress.com/2017/12/microbiology_immunology-1.pdf
- http://lib.rudn.ru/file/Immunology_Microbiology_Catalogue_eBook.pdf
- <https://www.moscomm.org/pdf/Ananthanarayan%20microbio.pdf>
- <https://alraziuni.edu.ye/book1/Laboratories/microbiology%20immunology.pdf>

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Describe the fundamental terminology, organs, and cellular components of the human immune system.	PO1, PO8	K1
CO2	Explain the structural properties and functional mechanisms that govern immune responses and recognition.	-	K2
CO3	Apply immunological principles to understand vaccination, monoclonal antibody production, and defense mechanisms.	-	K3
CO4	Analyze the comparative roles of immune cells, organs, and molecules in health and disease states.	PO2, PO4	K4
CO5	Evaluate the complexity of immune regulation and the consequences of immune system malfunctions.	PO3, PO4	K5

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	5	SEMESTER	VI
CREDITS	4	COURSE TITLE	Elective III : Human Reproductive Biology
➤ To enable students to understand the endocrine structures and hormones associated with the physiology of reproductive system ➤ To enable students to learn about the male reproductive system and accessory glands and regulation ➤ To enable students to learn about the female reproductive system and regulation of its function ➤ To enable students to comprehend about fertilization, pregnancy, parturition and lactation ➤ To equip students with knowledge on causes of infertility, reproductive health, assisted reproductive technology and associated ethical issues			

Unit	Content	Hrs
I	Gonadal hormones and mechanism of Hormone action, Steroids, Glycoprotein hormones, and Prostaglandins, Hypothalamo – Hypophyseal – Gonadal axis, regulation of gonadotrophin secretion in Male and Female; Reproductive System: Development and differentiation of Gonads, Genital ducts, External Genitalia, mechanism of Sex Differentiation; Puberty	12
II	Outline and histoarchitecture of male reproductive system; Testis: Cellular functions; Spermatogenesis and its Hormonal regulation; Androgen synthesis and metabolism; Epididymal function and Sperm maturation; Accessory glands functions; Sperm transportation in male tract; Andropause	12
II	Outline and Histo architecture of Female Reproductive system; Ovary: Oogenesis and its hormonal regulation; Steroid oogenesis and secretion of ovarian hormones; Reproductive cycles and their regulation, changes in the female tract; Menopause	12
IV	Ovum transport in the Fallopian tubes; Sperm transport in the female tract, Fertilization; Hormonal control of implantation; Hormonal regulation of Gestation, Pregnancy diagnosis, Foetal – maternal relationship; Mechanism of Parturition and its Hormonal regulation; Lactation and its regulation	12
V	Infertility in Male and Female: causes, Diagnosis and Management; Sexually transmitted Infections; Modern contraceptive technologies; Assisted Reproductive Technology: Sex selection, Sperm banks, Frozen embryos, Stem Cell banks, <i>in vitro</i> fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; ethical issues related to ART; Surrogate motherhood; ethical issues; Consanguinity; Foetal Loss and Birth Defects and Adoption	12
TOTAL CONTACT HOURS		60

TEXTBOOK

1. Dr.N. Arumugam, (2013), Developmental Zoology, Saras Publication, Nagercoil.

REFERENCE BOOK

1. P.S.Verma and Agarwal, (1975), Chordate Embryology, X Ed.,S.Chand& Company Pvt Ltd. Ramnager, New Delhi.
2. Dr.R.C.Dalela and Verma, (1986-1987), A Text book of Chordate Embryology, VI Ed.,Jai Prakashnath& Co., Meerut city, India.

E REFERENCE

- https://mobot-biodiversity.jc.weebly.com/uploads/1/8/6/0/18603232/the_evolutionary_biology_of_species_by_t_g_barracough_2019.pdf
- <http://bgc.org.in/pdf/study-material/developmental-biology-7th-ed> sf-gilbert.pdf

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Recall and identify the fundamental anatomical structures, hormones, and clinical terminology of human reproduction.	PO1, PO8	K1
CO2	Demonstrate an understanding of the physiological and hormonal mechanisms governing the human reproductive life cycle.	PO1, PO8	K2
CO3	Apply principles of reproductive biology to explain developmental transitions, diagnostic results, and clinical interventions.	PO4, PO5	K3
CO4	Analyze the structural and functional interdependencies within the reproductive system during health and disease.	PO4, PO5	K4
CO5	Evaluate complex reproductive scenarios and justify clinical or ethical decisions in the management of reproductive health.	PO3,	K5

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	5	SEMESTER	VI
CREDITS	4	COURSE TITLE	Elective IV : Biotechnology
Course objective ➤ To know the concepts of biotechnology and familiarize yourself with the tools and techniques of Biotechnology ➤ To acquire knowledge on tissue culture and learn the fundamentals of patenting of biological products. ➤ To be familiar with microbial degradation of bioremediation and biomining process. ➤ To understand the production and application of stem cell production ➤ To elucidate the production of transgenic animals and their importance.			

Unit	Content	Hrs
I	Introduction to Biotechnology: History and scope of Genetic Engineering and biotechnology, Basic steps in Gene cloning, Restriction enzymes. Cloning Vectors -Bacterial plasmids (p BR 322) Bacteriophage Vector – (Lambda) Animal Vector – (SV 40)	14
II	Introduction of DNA into cells: Bacteria – Transformation, Plants –Electroporation, Animals – shot gun method, Liposome mediated fusion. Identification of recombinant hosts – Bacteria, Transgenic plants a brief note. Application of Recombinant DNA in medicine and industry, Biohazards of Recombinant DNA, PCR, DNA Finger Printing.	15
II	Animal cell and Tissue culture : Animal cell, culture media physical, chemical functions of different constituents of culture medium, Role of carbon dioxide, growth factors, Glutamine in culture medium, serum and protein free media and their applications. Types of cell culture; Primary and established culture, Organ culture, Disaggregation of tissue, Cell separation, cell Synchronization, Cryopreservation.	18
IV	Environmental Biotechnology: Pollution control –Waste Treatment, Anaerobic, Aerobic Waste Treatment, Biodegradation, Microorganism in Pollution Control. Bioremediation, Biosensors and Biofuels	17
V	Transgenic animals: Production, application advantages. Transgenic animals in livestock improvement, Ethical issues in animal Biotechnology. Stem Cell Culture - Production and Application.	11
TOTAL CONTACT HOURS		75

TEXTBOOK

1. P. K. Gupta Rastogi and Co, Elements of Biotechnology. Meerut. 2016.
2. S.K. Agarwal, Environmental Biotechnology APH Publication Co, New Delhi – 2010.
3. V. Kumaresan ,Biotechnology – Saras Publication , (2015)

REFENCE BOOK

1. R.C Dubey, A Text book of Biotechnology. III Ed.,S.Chand& company Ltd. 2003.
2. H.K.Das Text book of Biotechnology . III Ed., Wiley India (P) Ltd. ,2004.
3. S.C.Rastogi, Biotechnology – Principles and Applications – I Ed., Narosa Publ 2007.

E REFERENCE

- <https://thunderbooks.files.wordpress.com/2009/05/introduction-to-biotechnology-and-genetic-engineering-infinity-2008.pdf>
- <http://www.ifsc.usp.br/~ilanacamargo/FFI0740/2.pdf>
- <https://ingeniumcanada.org/sites/default/files/2019-01/education-genetics-and-biotechnology-eak.pdf>

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Recall and identify the core tools, techniques, and biological agents used in modern biotechnology.		PO1, PO5	K1
CO2	Demonstrate an understanding of the fundamental principles of recombinant DNA technology and cell culture.		-	K2
CO3	Apply biotechnological methods to solve problems in gene delivery, cell maintenance, and environmental management.		PO4, PO6	K3
CO4	Analyze the structural, functional, and safety components of biotechnological systems and products.		PO1, PO8	K4
CO5	Evaluate the socio-economic, ethical, and environmental impacts of biotechnological advancements.		PO3, PO5	K5

BLOOM'S MAPPING

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

PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS	5	SEMESTER	VI
CREDITS	4	COURSE TITLE	Elective IV: Genetic Engineering
Course objective ➤ Explain the mechanisms of Gene cloning, Gene expression, Regulation, and Vector systems used in Genetic engineering. ➤ Recall the basic concepts of Molecular biology, Gene structure, and the principles underlying Genetic engineering and Recombinant DNA technology. ➤ Analyze recombinant DNA constructs, gene expression data, and molecular biology results using appropriate experimental and Bioinformatics approaches. ➤ Evaluate the applications, advantages, limitations, and risks of Genetic engineering in Medicine, Agriculture, Industry and environmental Biotechnology. ➤ Design basic Genetic engineering strategies or experimental workflows for the development of Recombinant products or genetically modified organisms, considering biosafety and ethical guidelines.			

Unit	Content	Hrs
I	History and scope of Genetic Engineering and biotechnology-Basic steps in Gene cloning, Restriction enzymes. Cloning Vectors -Bacterial plasmids (p BR 322) Bacteriophage Vector – (Lambda) Animal vector – (SV 40)	14
II	Bacteria – Transformation, Plants –Electroporation, Animals – shot gun method, Liposome mediated fusion. Identification of recombinant hosts – Bacteria, Transgenic plants a brief note. Application of Recombinant DNA in medicine and industry, Biohazards of recombinant DNA.	16
III	Animal cell, Culture media, physical, chemical functions of different constituents of culture medium. Role of carbon dioxide, growth factors, Glutamine in culture medium, Serum and Protein free media and their applications. Types of Cell culture; Primary and established culture, Organ culture, Disaggregation of tissue,	17

	Cell separation, Cell Synchronization and Cryopreservation.	
IV	Pollution control –Waste Treatment Anaerobic, Aerobic Waste Treatment, Biodegradation, Microorganism in Pollution Control. Bioremediation, Biosensors and Biofuel - Production, application advantages	16
V	Transgenic animals in livestock improvement, PCR, DNA Finger Printing, Ethical issues in animal Biotechnology. Stem cell culture - Production and Application.	12
TOTAL CONTACT HOURS		75
TEXTBOOK		
1. P. K. Gupta Rastogi and Co, Elements of Biotechnology. Meerut. 2016. 2. S.K. Agarwal, Environmental Biotechnology APH Publication Co, New Delhi –2010. 3. V. Kumaresan, Biotechnology – Saras Publication, (2015)		
REFERENCE		
BOOK		
1. R.C Dubey, A Textbook of Biotechnology. III Ed., S. Chand& company Ltd. 2003. 2. H.K. Das Textbook of Biotechnology. III Ed., Wiley India (P) Ltd. ,2004. 3. S.C. Rastogi, Biotechnology – Principles and Applications – I Ed., Narosa Publishing house. 2007.		
E REFERENCE		
• https://thunderbooks.files.wordpress.com/2009/05/introduction-to-biotechnology-and-genetic-engineering-infinity-2008.pdf • http://www.ifsc.usp.br/~ilanacamargo/FFI0740/2.pdf • https://ingeniumcanada.org/sites/default/files/2019-01/education-genetics-and-biotechnology-eak.pdf		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Recall and identify the fundamental tools, vectors, and methodologies used in genetic engineering and biotechnology.		PO1, PO8	K1
CO2	Demonstrate an understanding of the mechanisms governing gene manipulation, cell culture, and environmental biotechnology.		PO1, PO8	K2
CO3	Apply genetic engineering techniques to practical problems in molecular biology, medicine, and the environment.		PO4, PO6	K3
CO4	Analyze the structural and functional differences between biotechnological systems and assess their associated risks.		-	K4
CO5	Evaluate the technological, ethical, and environmental outcomes of genetic engineering practices.		PO3	K5

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

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

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PROGRAMME CODE	UGZOOA	PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2022-2025
HOURS	2 Hrs/Week	SEMESTER	VI
CREDITS	2	COURSE TITLE	SBC: GROUP PROJECT

COURSE OBJECTIVE

- To obtain research knowledge Biological field.
- To access the Microenvironment and Report preparation.
- Improve interpersonal communication, conflict resolution, project management, and leadership abilities.
- Boost student involvement through collaborative effort, often resulting in higher quality output than individual work.
- Prepare students for professional settings where collaborative, team-based work is the standard.

COURSE OUTCOME (CO)			PO	K LEVEL
	CO1	Identify and define a researchable problem in Zoology based on literature review.	PO6, PO8	K1, K2
	CO2	Explain and select appropriate laboratory or field-based methodologies to address the research goal.	PO5, PO6	K3

	CO3	Execute experiments or field surveys to collect reliable biological data.	PO6,	K4
	CO4	Utilize mathematical and biostatistical tools to interpret the collected biological data.	PO6, PO8	K4,K5
	CO5	Compile the research process and results into a structured technical report or dissertation.	PO7, PO12	K5

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

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS		SEMESTER	II
CREDITS	2	COURSE TITLE	EXTRA CREDIT COURSE I : Vermiculture
Course objective ➤ To get thorough knowledge on making Vermicompost and Vermiculture. ➤ To learn about South Indian and North Indian species used in Vermicomposting and Culture techniques of earthworms ➤ To study the Vermicompost production ➤ To encourage the self-employment practice and save the human being by the way of minimizing the use of chemical fertilizers.			

Unit	Content	Hrs
I	Taxonomy of Earthworm: Earthworm taxonomy – Morphological and anatomical – Classification of earthworms – Food habits – Digestive system – Excretion – Reproduction and Life cycle – Earthworm as farmer's friend.	
II	Types of earthworm: Types of earthworm – Exotic and native species – South Indian and North Indian species used in Vermicomposting – Collection and Preservation of earthworms for vermicomposting – Culture techniques of earthworms	
III	Vermicompost production: Vermicompost production – Requirements – Different methods of Vermicomposting – Heap method – Pot method and Tray method – changes during Vermicomposting.	

IV	Role of Earthworms in soil fertility: Role of Earthworms in soil fertility – Use of Vermicompost for crop production – Use of earthworms in land improvement and land reclamation – Economics of Vermicompost and vermiwash production. Earthworms as animal feed – Medicinal value of earthworm meal – Role of Earthworms in Solid Waste, Sewage and faecal waste management and Vermifilters. Earthworms as bioreactors.	
V	Interaction of earthworms: Interaction of earthworms with other organisms – Influence of chemical inputs on earthworm activities – Large scale manufacture of Vermicompost, packaging of vermicompost and its marketing – Financial supporting – Government and NGOs for vermiculture work.	
TOTAL CONTACT HOURS		
TEXTBOOK		
➤ Sreenivasan Ettammal, Handbook of Vermicomposting Technology the Western India technology, Council for Advancement of People's Action and Rural Technology, New Delhi, India. 40 pp. 1997. ➤ Vermicology: The Biology of Earthworms, (Ismail, S.A.) Orient Longman. 92pp. 1997. ➤ Ismail, S.A Mannpuzhu: Valarppum, Tozhilnutpamum, Payankalum. Orient Longman. 115pp. 2001. ➤ Alvares,C., Shiva,V., Ismail, S.A., Vijayalakshmi, K., Mathen, K., and Declercq, B The Organic Farming Reader, ARISE and Other India Press, India. 1999. 298 pp. ➤ Ismail, S.A The Earthworm Book, Other India Press, Goa. 2005.		
REFERENCE BOOK		
➤ Talashilkar.S.C. and A A K Dosani, Earthworms in Agriculture ISBN 10: 8177542494 / ISBN 13: 9788177542493, Agrobios, Jodhpur, 2005 ➤ S.C. Talashikar and Dosani, Earthworm in Agriculture –, Agrobios Publications, Near Nasarani Cinema, Jodhpur, 342 002. 2010. ➤ Ismail. SA , "Vermicology: Biology of Earthworms", Orient Longman Ltd, Chennai, India. 1997.Hall Publication.		
E REFERENCE		
➤ https://clarkcountycomposts.org/images/class_3_-_red_worm_composting.pdf ➤ https://www.free-ebooks.net/academic-science/Handbook-of-Vermicomposting/pdf?dl&preview ➤ file:///C:/Users/ACER/Downloads/5c55d33672e19.pdf ➤ https://www.uvm.edu/sites/default/files/Extension-Master-Gardener/compostingwithworms.pdf		

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	To gain knowledge about taxonomy of earthworms	PO3	K3
CO2	To know the types of earthworms and species used in vermicomposting	PO1	K2
CO3	To understand and analyse the different methods of vermicomposting	PO5	K3
CO4	To apply the knowledge on earthworms in soil fertility.	PO1	K4
CO5	To gather information about influence of chemical inputs on earthworm activities and Large scale manufacture of Vermicompost	PO2	K3

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

ROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS		SEMESTER	IV
CREDITS	2	COURSE TITLE	EXTRA CREDIT COURSE II: Dairy Farming
Course objective ➤ Impart knowledge on disease prevention, vaccination, and clean milk production to ensure high-quality dairy products. ➤ Educate on the construction and maintenance of proper animal housing, ventilation, and waste management systems. ➤ Teach participants how to select high-yielding breeds, optimize animal nutrition, and manage breeding and lactation cycles. ➤ Develop business skills such as financial planning, record-keeping, and supply chain marketing to promote self-employment.			

Unit	Content	Hrs
I	Dairy Farming: Definition, Scope and Maintenance of Cattle, Techniques adapted in Cattle breeding-Outbreeding, Crossbreeding and Artificial insemination.	
II	Dairy Breeds: Important Cattle breeds and their characteristics-Milch breeds (Sindhi), Dual Purpose Breeds (Ongole), Draught Breeds (Kangayam) and Exotic Breeds (Jersey).	
III	Dairy Feed: Common Cattle feed and their Nutritive value, Balanced ratio for cattle.	

	Milk : Composition, Nutritive value and Pasteurization of Milk and Milk Products – Butter, Ghee and Cheese.	
IV	Common Disease and Control Bacterial Diseases- Anthrax, Mastitis. Viral Diseases – Foot and Mouth Diseases. Non-Contagious Disease – Milk fever and Constipation.	
V	Farm Business & Technology Maintaining daily logs for inventory, health, and milk production and Application of IT solutions, herd management software, and automated data tracking	
TOTAL CONTACT HOURS		
TEXTBOOK Banerjee G.C, A Text Book of Animal Husbandry, Oxford & IBH Publishing Co.Pvt., Ltd, New Delhi.		
REFERENCE BOOK Ibraheem Kutty and Sheeba Khameer, Milk Production and Processing. Daya Publishing House, Delhi, 2014		
E REFERENCE http://www.fao.org/3/y5169e/y5169e.pdf http://dahd.nic.in/sites/default/files/Excerpts%20of%20Poultry%20Farmn%20Manual-ilovepdf-compressed.pdf		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	To gain knowledge about Dairy farming and new techniques adapted for Cattle Breeding.		PO3	K2
CO2	To understand about various Dairy breeds and their importance		PO4	K2
CO3	To learn the techniques and apply for the preparation of Cattle feed and their nutritive values.		PO2	K3
CO4	To analyse the composition and Nutritive value of Milk and gain in-depth knowledge about Pasteurization of milk and Milk products.		PO1	K4
CO5	Have an enhanced knowledge about Bacterial and Viral disease in Dairy farms.		PO3	K5

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

CO4	1	2	2	2	-	3	-	-	-	1	1	-	1	1	-
CO5	1	1	2	2	-	2	-	-	-	-	-	1	-	-	-
CO6	3	3	2	3	2	3	2	-	-	2	-	2	3	2	-

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	
HOURS		SEMESTER	V
CREDITS	2	COURSE TITLE	Extra Credit Course: Swayam, JNU

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	
HOURS		SEMESTER	V
CREDITS	2	COURSE TITLE	Extra Credit Course: MEDICAL LABORATORY TECHNIQUES

Learning Objectives	
CO1	To understand the different protocols and procedures to collect clinical samples.
CO2	To demonstrate skill in handling clinical equipment.
CO3	To explain the characteristics of clinical samples.
CO4	To evaluate the safety precautions while handling clinical samples.
CO5	To summarise the control measures to avoid contamination of clinical samples.

UNIT	Details	No. of Hrs
I	Laboratory Safety and Human Health and Hygiene: Laboratory safety –toxic chemicals and bio hazards waste- biosafety level- physiology effect of alcohol, tobacco, smoking, junk food its treatment - biomedical waste management.	6
II	Clinical Biochemistry: Hands-on work focuses on testing metabolic panels (e.g., blood glucose, lipid profile) using photometers and automated analyzers	6
III	Hematology: Procedures involve Complete Blood Count (CBC) analysis, Erythrocyte Sedimentation Rate (ESR), bone marrow differentials, and preparing peripheral blood smears	6
IV	Microbiology: Practical skills cover Gram staining, acid-fast bacilli (AFB) staining, culture media preparation, and antibiotic susceptibility testing.	6
V	Diagnostic Pathology: Handling and labelling of histology. specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation.	6
	Total	30

Text Books

1.	Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.
2.	Guyton and Hall, 2000. Text Book of medical Physiology, 10 th edition, Elseiner, New Delhi.
3.	Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol,I, II, III. Tata MC Graw Hill, New Delhi.
4.	Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.

Reference Books

(Latest editions, and the style as given below must be strictly adhered to)

1.	Manoharan, A, and Sethuraman, 2003. Essential of Clinical Hematology, Jeypee brothers, New Delhi.
2.	Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia. Published by Tata McGraw-Hill Education Pvt. Ltd.,
3.	Ochei. J., A. Kolhatkar (2000). Medical Laboratory science:Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition.
Web Resources	
1.	https://bit.ly/3tUs8In
2.	https://bit.ly/2XKu7mT
3.	https://bit.ly/3hNS1EP
4.	https://bit.ly/2ZgrLga

COURSE OUTCOME (CO)		PO	K LEVEL
CO1	Understand protocols and procedures to collect clinical samples for blood analysis and to study human physiology.	PO2	K2
CO2	Explain the characteristics of clinical samples.	PO3	K2
CO3	Demonstrate skill in handling clinical equipment	PO4	K3
CO4	Evaluate the hematological and histological parameters of biological samples.	PO4	K4
CO5	Elaborate the role of medical laboratory techniques in health care industry.	PO1	K3

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

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS		SEMESTER	I
CREDITS		COURSE TITLE	VAC I : Ornithology
Course objective ➤ To give an introduction to bird science ➤ To understand about the method of studying migration ➤ To understand the diversity of foods and foraging ➤ To understand the breeding territories of birds ➤ To know about the bird distribution and its population studies			

Unit	Content	Hrs
I	Introduction to ornithology: Terminology used in ornithology- types of bills, types of feet- Identification of birds in the field based on tail, bill, crest, leg & color	
II	Equipments used in the field study: Fields guides- Photography- Identification of calls- feet and beak modification in birds. Bird migration- method of studying migration.	
III	Diversity of foods and foraging behavior : Social foraging, mating preferences- Pair bonds, courtship and divorce – production and control of the song – functions of bird song.	
IV	Timing of breeding: Breeding territories nest and nest building egg & clutch size, clutch and egg replacement. Incubation and hatching – caring for young	
V	Avian population change : Over time and space – methods of estimation- classifying bird species assemblages- recent avian extinctions causes of avian population decline.	
TOTAL CONTACT HOURS		

TEXTBOOK

- Salim Ali.S. and Ripley SD. Handbook of the birds of india and Pakistan. Compact edition Oxford University Press and BNHS Mumbai .2011.
- Chinnasathan and Bal Pandey.The Nesting behavior of Indian Birds, Sugeeth Publication,2001.

REFERENCE

BOOK

- Caughley G.Sinclair.AR.Wildlife ecology and management. Back well Science.2000.
- Dewsbur, D.A Comparative animal behavior. McGraw Hill Book Company. 1998.
- Drickamer , L.C. S.H. Vessey and E.M. Jakob Animal Behavior. Mc Graw Hill. 2002.

E REFERENCE

<http://www.jnkvv.org/PDF/13042020153242134201400.pdf>
<https://txmn.org/elcamino/files/2010/03/Ornithology-Basic- Concepts.pdf>

COURSE OUTCOME (CO)			PO	K LEVEL
	CO1	Able to know the introduction and terminology of ornithology	PO1	K3
	CO2	Know the importance of equipments used in the field to apply for ornithology studies	PO2	K3
	CO3	Learn about diversity of foods and foraging behavior	PO3	K4
	CO4	Assess their breeding and migration	PO3	K3
	CO5	Create awareness to protect them from extinction	PO2	K4

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

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS		SEMESTER	III
CREDITS		COURSE TITLE	VAC II: Animal Husbandry

Course objective

- To understand the principles and practices of animal husbandry.
- To learn scientific management of livestock and poultry.
- To study breeding, feeding, disease control, and economic importance of domesticated animals.
- To introduce students to modern technologies used in animal production.

Unit	Content	Hrs
I	Definition, scope and importance of animal husbandry in India. Livestock resources and economic significance. Breeds of cattle, buffalo, sheep, goat, pig and poultry in India. Role of animal husbandry in rural development and sustainable agriculture.	
II	Principles of animal breeding. Selection methods and breeding systems. Artificial insemination and embryo transfer technology. Reproductive cycles in livestock. Genetic improvement and conservation of indigenous breeds.	
III	Housing systems for cattle, poultry, sheep and goat. Hygienic management practices. Common livestock diseases: bacterial, viral and parasitic diseases. Vaccination schedule and disease prevention. Role of veterinary services.	
IV	Dairy management and milk production. Poultry farming: broiler and layer management. Sheep and goat farming practices. Pig farming basics.	
V	Modern trends: organic livestock farming, biotechnology in animal husbandry, waste management.	
TOTAL CONTACT HOURS		

TEXTBOOK

Gupta P.R. Dairy India Yearbook – (2007 b)

REFERENCE

BOOK

Eiri Board Handbook of Dairy Farming: To Produce Milk with Packaging Engineers India Research Institute (2008).

Lampert., Modern Dairy Products Chemical Publishing Co Inc., U.S.; 3 edition (1998)

Varnam, A., Sutherland, Jane P., Milk and Milk Products Technology, chemistry and microbiology publishers, Springer, U.S (1994).

E REFERENCE

<http://www.fao.org/3/y5169e/y5169e.pdf>

<http://dahd.nic.in/sites/default/files/Excerpts%20of%20Poultry%20Farmn%20Manual-ilovepdf-compressed.pdf>

PROGRAMME CODE		PROGRAMME	B.Sc., ZOOLOGY
COURSE CODE		BATCH	2026-2029
HOURS		SEMESTER	V
CREDITS		COURSE TITLE	VAC III: Aquaculture

Course objective

- To understand the importance and scope of aquaculture
- To gain knowledge in cultivable fishes and its economic importance
- To understand the Preparation of pond and methods of fish cultures
- To gain knowledge on aquatic farm management
- To Provide in depth knowledge on fish diseases and its diagnosis

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Remember knowledge of dairy farming and milk product		PO1	K1
CO2	Deduce the Breeding practices in dairy farm		PO3	K2
CO3	Apply the knowledge in Production of condensed and dried milks		PO6	K3
CO4	Sort of the Food safety and quality assurance.		PO5	K4
CO5	To Assess the knowledge of dairy Product		PO4	K5

BLOOM'S MAPPING

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

Unit	Content	Hrs
I	Importance of Aquaculture: Prospects and scope – Aquaculture farm- site selection, topography, water availability and supply, soil condition and quality design and layout of farms.	
II	Cultivable species: see weeds. Crustacean (Prawns and Lobsters), Molluscs (Mussels and oysters) and fishes – Economic importance's market values and its by products.	
III	Pond Preparation & Production Culture Systems: Traditional, Extensive, Semi- Extensive, and Intensive Systems. Composite fish culture, paddy cum fish culture – Integrated fish culture sewage water fish culture	
IV	Water quality management: temperature, salinity, pH, O ₂ , CO ₂ , level, nutrients and trace elements. Control of parasites & predators	

V	Diseases in culture ponds: disease diagnosis, ELISA Western blotting, DNA based diagnosis of disease and Fish vaccines.	
TOTAL CONTACT HOURS		
TEXTBOOK ➤ Arumugam, Aquaculture, Saras Publications,2014. ➤ K.Pandey & J.P.Shukla, Fish and Fisheries, Rastogi Publication,2016. ➤ Das. M.K. and R.K. Das .Fish and fisheries in India- Diagnosis and control inland Fisheries Society of India, Barrack pore, west Bengal,2011		
REFERENCE BOOK ➤ Govindan, T.K.Fish Processing Technology. Oxford & IBH Publishing Co. Pvt.Ltd.,Kolkata.2010 .		
E REFERENCE https://www.mooc-list.com/course/oceanography-key-better-understand-our-world-coursera https://igor.crew.c-base.org/aquaculture.pdf http://www.agrifs.ir/sites/default/files/AQUACULTURE.pdf https://www.cabi.org/uploads/CABeBooks/CAB-eBooks-Col-Aquaculture-and-Fisheries.pdf https://www.blackwellpublishing.com/pdf/catalogue_2007_online_aquaculture.pdf		

COURSE OUTCOME (CO)			PO	K LEVEL
CO1	Learn, rear the cultivable aquatic animals		PO2	K2
CO2	Find out the cost benefit analysis in maintaining aqua farms.		PO3	K2
CO3	Know the pond preparation and production culture system		PO4	K3
CO4	Know the importance of quality of the water to maintain the aquaculture			K4
CO5	Gain knowledge to prevent disease and parasitic infestations		PO1	K5

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

