SNDT Women's University, Mumbai

Undergraduate Degree / UG Programme (Syllabus as Per NEP) - Faculty of Science & Technology

Bachelor of Science (Zoology)

B.Sc. In Zoology

As Per NEP – 2020

Semester – V & VI

Syllabus
(W.E.F. Academic Year 2026-27)

Terminologies

Vertical	Full-Form/Definition	Remarks	Related To Major And Minor Courses
Major (Core)	Subject Comprising Mandatory and Elective Courses, Major Specific IKS, Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects Connected to Major	Minimum 50% Of Total Credits Corresponding to Three/Four - Year UG Degree- Mandatory Courses	Related To The Major
Minor Course	Course From Same Or Different Faculty	Minimum 18-20 Credits to Be Completed in The First Three Years of UG Programme	Related To the Minor
OEC	Open Elective Courses/ Generic Courses	10-12 Credits to Be Offered in I And/Or II Year. Faculty-Wise Baskets of OEC To Be Prepared	OEC Is to Be Chosen Compulsorily from Faculty Other Than That of the Major
VSC	Vocational Skill Courses, Including Hands On Training Corresponding To The Major And/Or Minor Subject	8-10 Credits, To Be Offered in First Three Years, Wherever Applicable Vocational Courses Will Include Skills Based on Advanced Laboratory Practical's of Major	Related To the Major or Minor
SEC	Skill Enhancement Courses	06 Credits, To Be Offered in I And II Year, To Be Selected from The Basket of Skill Courses Approved by University	Related To the Major or Minor Any Relevant Skill
AEC	Ability Enhancement Courses	08 Credits, To Be Offered in I And II Year, English: 04 Credits to Be Earned in Sem - I, Modern Indian Language Of 04 Credits to Be Offered in II Year	NA
VEC	Value Education Courses	Understanding India, Environmental Science/Education, Digital and Technological Solutions, Health &	NA

		Wellness, Yoga Education, Sports, And Fitness	
IKS	Indian Knowledge System	Generic IKS Course: Basic Knowledge Of The IKS To Be Offered At First Year Level	Major-Specific IKS Courses: Advanced Information About the Major, Part of the Major Credit to Be Offered at Second- Or Third-Year Level
OJT	On-Job Training (Internship / Apprenticeship)	Corresponding To the Major Subject	Related To The Major
FP	Field Projects	Corresponding To the Major Subject	Related To the Major
CC	Co-Curricular Courses	Health And Wellness, Yoga Education Sports, And Fitness, Cultural Activities, NSS/NCC And Fine/ Applied/Visual/ Performing Arts	NA
CE	Community Engagement and Service		Related To Major
RP	Research Project	Corresponding To the Major Subject	Related To Major

Programme Template

Degree		B.Sc.
Programme		Zoology
Preamble		In the dynamic field of zoology, where the principles of the National Education Policy (NEP) 2020 drive comprehensive learning, graduates find a wealth of career opportunities awaiting them. From roles as wildlife technicians, marine biologists, and veterinary technicians to positions as animal nutritionists, environmental scientists, and forest officers, the spectrum of options is vast and diverse. These professionals play pivotal roles in wildlife management, environmental conservation, and animal welfare, employing their knowledge and skills to make a tangible impact on the world around them. The curriculum's emphasis on practical training, research, and interdisciplinary learning equips graduates with the expertise needed to thrive in their chosen careers. Beyond financial considerations, professionals in this field derive immense satisfaction from contributing to the well-being of animals, ecosystems, and the broader community. Whether working in laboratories, research institutions, governmental agencies, or educational settings, zoologists play a vital role in advancing scientific knowledge, promoting environmental sustainability, and fostering a deeper understanding of the natural world. As stewards of biodiversity and champions of animal welfare, they stand at the forefront of efforts to safeguard our planet's rich tapestry of life for generations to come.
Programme Specific Outcomes (PSOs)		After completing this programme, the learner will be able to,
	1.	Demonstrate advanced knowledge and skills in the study of non-chordates, chordates, genetics, evolution, and other fundamental concepts in zoology.
	2.	Conduct laboratory experiments, fieldwork, and observational studies to explore various aspects of animal biology, behavior, and ecology.
	3.	Analyze and interpret data related to zoological research, contributing to scientific literature and advancements in the field
	4.	Apply a deep understanding of animal physiology, including comparative physiology, nutrition, and health, to address real-world challenges in animal welfare and conservation

	5.	Adhere to professional standards and ethical guidelines in interactions with animals and the environment, fostering ethical awareness and responsibility
	6.	Communicate effectively, both written and orally, to disseminate scientific findings, engage in scientific discussions, and communicate zoological concepts to diverse audiences
	7.	Prepare for further education and research in zoology or related fields, as well as for careers in wildlife conservation, animal welfare, environmental consultancy, and science education
Eligibility Criteria for Programme		12 standard Science
Intake		120

Structure with Course Titles

B.Sc. In Zoology

Semester – V

Sr. No.	Course	Type of Course	Credits	Marks	Int Marks	Ext Marks
	Semester – V					
50132411	Enzymology & Molecular Biology (Th+Pr) (2+2)	Major (Core)	4	100	50	50
50132412	Developmental Biology (Th+Pr) (2+2)	Major (Core)	4	100	50	50
51032411	Animal Husbandry in Ancient India (Th)	IKS (Major Specific)	2	50	0	50
50232411	Ecology & Zoogeography (Th+Pr) (2+2)	Major (Elective**) (Any One)**	4	100	50	50
50232412	Aquaculture (Th+Pr) (2+2)					
50332411	Sociobiology (Th+Pr) (2+2)	Minor Stream	**4**	100	50	50
50632401	Nature Educator (Pr)	VSC-4	2	50	50	0
51332401	Field Project (Pr)	FP	2	50	50	0
			22	**550**	**300**	**250**

Semester – VI

Sr. No.	Course	Type of Course	Credits	Marks	Int Marks	Ext Marks
	Semester - VI					
60132411	Hematology (Th+Pr) (2+2)	Major (Core)	4	100	50	50
60132412	Biomolecules (Th+Pr) (2+2)	Major (Core)	4	100	50	50
60232411	Parasitology (Th+Pr) (2+2)	Major (Elective) (Any One)	4	100	50	50
60232412	Forensic Science (Th+Pr) (2+2)					
60332411	Homeostasis (Th)	Minor Stream	2	50	0	50
60332412	Parasitology (Th+Pr) (2+2)	Minor Stream	**4**	100	50	50
61232421	OJT (Pr)	OJT	4	100	50	50
			22	**550**	**250**	**300**

Exit with Degree (3-year)

Course Syllabus

Semester – V

.5.1 Major (Core)

Course Titles	**Enzymology & Molecular Biology (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Describe the various enzyme actions
	2. Describe as well as relate the enzyme kinetics
	3. Describe as well as analyse the various molecular processes
	4. Perform various practicals based on enzymology
	5. Solve the problems based on molecular biology
Module 1 (Credit 1)	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe various classes of enzymes
	2. Describe various enzyme actions
	3. Describe as well as analyse the enzyme kinetics
Content Outline	• Introduction and Nomenclature: Definition; nomenclature and classification (based on IUB – Enzyme Commission) of enzymes • Chemical nature of enzyme, co-factors and coenzymes • Enzyme Action: o Mechanism: Fischer's Lock and Key Model, Koshland's Induced Fit Model; o Factors affecting enzyme activity – pH, temperature, substrate concentration, enzyme concentration • Enzyme Kinetics: o Derivation of Michaelis-Menten equation and Lineweaver-Burk plot; o Concept and significance of Km, Vmax • Enzyme Inhibition: Competitive, non-competitive and uncompetitive inhibitors and their kinetics • Allosteric regulation
Module 2 (Credit 1): Molecular Biology	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe and evaluate the process of DNA replication
	2. Analyse the genetic code

	3. Describe and evaluate the process of transcription
	4. Analyse the process of translation with respect to transcription
Content Outline	• DNA Replication in a prokaryotic and eukaryotic cell • Characteristics of Genetic Code • Transcription in a prokaryotic and eukaryotic cell • Translation in a prokaryotic and eukaryotic cell
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Perform various experiments based on enzymology
	2. Solve various problems based on molecular biolog
Content Outline	• Effect of varying pH on activity of enzyme Acid Phosphatase • Effect of varying temperature on enzyme Acid Phosphatase • Effect of varying enzyme concentration on activity of enzyme Acid Phosphatase • Effect of varying substrate concentration on activity of enzyme Acid Phosphatase • Effect of inhibitor on the activity of enzyme Acid Phosphatase • Estimation of SGOT enzyme activity from the given sample of the liver • Estimation of SGPT enzyme activity from the given sample of the liver • Estimation of Catalase enzyme activity from the given sample of the liver (Titrimetric method) • Estimation of Succinate dehydrogenase enzyme with methylene blue reduction test • Problems based on molecular biology – DNA replication • Problems based on molecular biology – Genetic code • Problems based on molecular biology – Transcription • Problems based on molecular biology – Translation

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Project based on IUB nomenclature of enzymes where they will select any three enzymes from classification and write down their characteristics with respect to substrate, cofactor, etc.
- Model-making of DNA replication, transcription and translation

Note: Rubrics to be developed for subjective type of assessment

References:

Semester – V

.5.2 Major (Core)

Course Titles	**Developmental Biology (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Describe the different processes of development in various animals
	2. Compare the different processes of development in various animals
	3. Describe the human reproductive system and its hormonal control
	4. Interpret the importance of Assisted Reproductive Technology
	5. Perform practicals based on the various topics of the practical syllabus
Module 1 (Credit 1): Introduction to Developmental Biology	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe the various processes of development in different animals
	2. Compare the various processes of development in animals
Content Outline	• Gametogenesis – Oogenesis and Spermatogenesis • Types of Egg – Based on amount and distribution of yolk • Structure and Types of Sperm • Process of fertilization – Activation of sperm, recognition of sperm and ovum, acrosomal reaction, activation of ovum, cortical reaction • Planes and types of cleavage • Types of blastulae • Types of gastrulae • Coelom formation in brief
Module 2 (Credit 1): Human Reproduction	
Learning Outcomes	After learning the module, learners will be able to
	1. Interpret the importance of the human reproductive system and its hormonal control
	2. Relate the various methods of contraception
	3. Analyse the various methods available for Assisted Reproductive Technology and others
Content Outline	• Anatomy of human male and female reproductive system

	• Hormonal regulation of reproduction and impact of age on reproduction • Menopause and andropause • Contraception and birth control – o Difference between contraception and birth control; o Natural methods: abstinence, rhythm method, temperature method, cervical mucus or billings method, coitus interruptus, lactation amenorrhea; o Artificial methods: barrier methods, hormonal methods, intrauterine contraceptives, sterilization, termination, abortion • Treatment of infertility – o Removal or reduction of causative environmental factors; o Assisted reproductive technology (art) – in vitro fertilization (ivf), embryo transfer (et), intra-fallopian transfer (ift), gamete intra-fallopian transfer (gift) and intra-zygote transfer (zift), intra-cytoplasmic sperm injection (icsi) with ejaculated sperm and sperm retrieved from testicular biopsy, testicular sperm extraction (tese); sperm bank, cryopreservation of gametes and embryos; o Surrogacy
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Perform the practicals based on the life cycle by setting up the systems
	2. Perform various identifications based on the practical syllabus
Content Outline	• Study of permanent slides, museum specimens and materials – mammalian sperm and ovum; types of egg (fish, frog and hen); cleavage, blastula and gastrula (Amphioxus, frog and bird) • Study of development of zebrafish embryo up to 72 hours (only observation without disturbing larvae) • Study of Caenorhabditis elegans life cycle • Study of Drosophila culture for its life cycle • Study of development of chick embryo up to 72 hours from permanent slides • Study of terrestrial snail for observing its life cycle • Study of germ layers – o Diploblastic (T.S. of body wall of sponges and cnidarians), o Triploblastic acoelomate (T.S. of body wall of

	Platyhelminthes), ○ Triploblastic pseudocoelomate (T.S. of body wall of Ascaris), ○ Triploblastic coelomate (T.S. of body wall of earthworm) • Study of larvae of non-chordates – ○ Porifera (amphiblastula), ○ Cnidaria/coelenterata (planula), ○ Annelida and Mollusca (trochophore), Mollusca (glochidium), ○ Crustacea ✓ Nauplius, ✓ Zoea, ✓ mysis, ✓ Megalopa) ○ Echinodermata (auricularia, echinopluteus), ○ Hemichordata (tornaria) • Study of male and female reproductive system through charts and visuals • Histology of male and female accessory reproductive glands – human prostate gland, bulbourethral gland and placenta (permanent slides) • Detection of pregnancy from given sample of urine • Study of birth control measures applicable to humans – IUD, condom (male and female) and hormonal pills • Watching YouTube video on Assisted Reproductive Technology and writing a report based on it

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Making of infographics based on the life cycles of various animals
- Project based on the various topics given in unit 2

Note: Rubrics to be developed for subjective type of assessment

References:

1. Arora, M. P., & Arora, H. (2017). *Embryology*. Himalaya Publishing House
2. Balinsky, B. I. (2012). *An Introduction to Embryology* (5th ed.). Cengage Learning India
3. Gilbert, S. F. (1997). *Developmental Biology* (5th ed.). Sinauer Associates Inc.
4. Johnson, M. H. (2018). *Essential Reproduction* (8th ed.). Wiley-Blackwell Publication
5. Knobil, E. K., & Neil, J. D. (2015). *The Physiology of Reproduction* (Vol I & II) (4th ed.). Raven Press, New York

6. Marieb, E. L. (2012). *Human Anatomy and Physiology* (9th ed.). Pearson Education Low Price Edition
7. Wolpert, L., Tickle, C., & Arias, A. M. (2015). *Principles of Development* (5th ed.). Oxford University Press

Semester – V

.5.3 Indian Knowledge System (IKS) (Major Specific)

Course Titles	**Animal Husbandry in Ancient India (Th)**
Course Credits	**2 Credit's**
Course Outcomes	After going through the course, learners will be able to
	1. Relate the history of animal husbandry in ancient India
	2. Relate animal husbandry with farming and domestication practices from Indus Valley Civilization
Module 1 (Credit 1): Human-animal interactions	
Learning Outcomes	After learning the module, learners will be able to
	1. Relate the ancient prey-predator interactions with animal husbandry
	2. Analyse the changing human interaction in terms of animal husbandry
Content Outline	• Transition from ancient prey-predator interaction to balanced co-existence • Archeo-faunal data recovered from the palaeolithic and mesolithic sites in the Indian subcontinent • Understand the changing human relation with animals and the long-term and far-reaching consequences thereof for human society
Module 2 (Credit 1): Domestication & Farming Practices	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyse and evaluate the various faunal records found in the Indus Valley Civilisation
	2. Relate the ancient animal husbandry practices with recent ones
Content Outline	• The animals in the Indus Valley Civilisation • Different processes of domestication of animals in ancient India • The early farming cultures and animal husbandry in ancient India

References:

1. Joglekar, P. P., & Goyal, P. (2015). *Animal Husbandry and Allied Technologies in Ancient India*. Pentagon Press
2. Jha, A. *Traditional Knowledge System in India*. Atlantic Publishers and Distributors (P) Ltd.
3. *Indian Knowledge Systems*. https://iksindia.org/

Semester – V

.5.4 A. Major (Elective)

Course Titles	**Ecology & Zoogeography (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Relate the geological processes to the distribution of animals
	2. Interpret the role of barriers in distribution of animals
	3. Identify the zoogeographic features in the world map
	4. Prepare field report based on observations done during the field visit
Module 1 (Credit 1): Animal Distribution	
Learning Outcomes	After learning the module, learners will be able to
	1. Interpret the patterns of animal distribution and the factors functioning as barriers
	2. Evaluate the role of different means in dispersal of animals
Content Outline	• Plate tectonics and continental drift theory • Patterns of animal distribution – continuous, discontinuous and bipolar • Barriers of distribution – topographic, climatic, vegetative, large water masses, landmass, lack of salinity and special characteristic habit (homing instinct) • Means of dispersal – land bridges, natural rafts and drift wood, favouring gales, migration by host, accidental transportation and by human agencies
Module 2 (Credit 1): Zoogeographical Realms	
Learning Outcomes	After learning the module, learners will be able to
	1. Differentiate between the climate and habitat conditions of different zoogeographic realms
	2. Interpret the relationship between the animal life and zoogeographic conditions
Content Outline	• Geographic scope, climate, features of habitat and fauna of zoogeographical realms – o Palearctic, o Ethiopian, o Oriental, o Australian, o Neotropical,

	○ Nearctic, ○ Antarctic
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify the zoogeographic realms in the world map
	2. Relate the animals to the specific zoogeographical realms
	3. Prepare a report based on field study
Content Outline	• Indicate the distribution of fauna in the world map with respect to its realm and comment on the pattern of distribution – ○ Palearctic (giant panda, japanese macaque, musk deer, mole rat); ○ Ethiopian (common ostrich, okapi, gorilla, african bush elephant); ○ Oriental (indian one-horned rhinoceros, colugo, indian pangolin, gharial); ○ Australian (platypus, red kangaroo, koala, kiwi); neotropical (guanaco, south american tapir, capuchin monkey, hummingbird); n ○ Earctic (virginia opossum, sea otter, pronghorn, mountain beaver); ○ antarctic (emperor penguin, antarctic minke whale, leopard seal, antarctic midge) • Estimation of dissolved oxygen from the given samples of water • Estimation of free carbon dioxide from the given samples of water • Estimation of hardness from the given samples of water • Estimation of phosphate content from the given water sample • Estimation of nitrate and nitrite content from the given water sample • Visit to zoo or suitable habitat to record animals and prepare a report with respect to their respective zoogeographical realm

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Documentation using photography (biodiversity observation) or videography (self-made videos uploaded on social media)
- Analysis of water parameters from nearby aquatic body and submission of report
- Submission of field report based on actual study trip or virtual

Note: Rubrics to be developed for subjective type of assessment

References:

1. Cox, C. Barry & Moore, P. D. (2010). *Biogeography: An Ecological and Evolutionary Approach*. Wiley-Blackwell
2. Udvardy, M. D. F. (1969). *Dynamic Zoogeography*. Van Nostrand Reinhold
3. Umesh Bharti, U., & Kaur, R. (2020). *Concepts of Zoogeography and Wildlife*. ISBN 978-81-945148-1-7

Semester – V

.5.4 B. Major Elective

Course Titles	**Freshwater Aquaculture (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Evaluate different systems and types of aquaculture
	2. Interpret the criteria for selection of candidate species for aquaculture
	3. Evaluate the techniques in induced breeding
	4. Perform experiments based on water quality
	5. Prepare field report based on observations done during field excursions
Module 1 (Credit 1): Principles of Aquaculture	
Learning Outcomes	After learning the module, learners will be able to
	1. Differentiate between the various systems of aquaculture
	2. Evaluate the types of rearing practices
Content Outline	• Basics of aquaculture – definition and scope • Systems of aquaculture – o Pond culture, o pen culture, o Cage culture, o rope culture, o running water culture, o Zero water exchange system, o recirculatory aquaculture system (ras) • Factors affecting productivity of ponds • Criteria for selection of candidate species for aquaculture – Indian major carps, exotic carps, cat fish • Monoculture, polyculture, composite culture and integrated culture systems • Rearing practices – traditional, extensive, semi intensive, intensive, • sustainable aquaculture
Module 2 (Credit 1): Breeding and Management in Major Carps	
Learning Outcomes	After learning the module, learners will be able to
	1. Evaluate the techniques of induced breeding in carps and

	operation of hatchery
	2. Evaluate the management of nursery ponds

Content Outline	• Induced breeding –
	  ○ History of induced breeding of fishes
	  ○ Method of pituitary extract preparation
	  ○ Dosage determination and injection to the brood fishes
	  ○ Spawning and hatching
	  ○ Use of synthetic hormones and analogues for induced spawning
	  ○ Induced breeding in indian carps and exotic carps
	• Hatchery design and operation –
	  ○ Site selection,
	  ○ Essential components of hatchery,
	  ○ Management of hatchery,
	  ○ types of hatcheries
	• Nursery pond management
	• Packaging and transport

PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Perform experiments based on water quality parameters of aquaculture ponds
	2. Identify components of fish hatchery set up
	3. Sketch and label developmental stages of fish
	4. Prepare report based on field study

Content Outline	• Analysis of pond water –
	  ○ Estimation of pH and Turbidity
	  ○ Estimation of Dissolved Oxygen
	  ○ Estimation of Total Hardness
	  ○ Estimation of Carbon Dioxide
	  ○ Estimation of BOD
	• Study of developmental stages in fish – eggs, hatchlings, fingerlings
	• Study of various components of fish hatchery
	• Visit to freshwater hatchery or aquaculture farm and submit report

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Documentation using photography (biodiversity observation) or videography (self-made videos uploaded on social media) related to taxonomy and biodiversity in and around the local vicinity
- Project based on feasibility report for aquaculture development
- Submission of field report based on actual study trip or virtual
- Note: Rubrics to be developed for subjective type of assessment

References:

1. Beavea, R. (1990). *Handbook of the Freshwater Fishes of India*. Narendra Publishing House, India
2. Boyd, C. E. (1982). *Water Quality Management for Pond Fish Culture*. Elsevier Scientific Publishing Company
3. Jhingran, V. G. (1982). *Fish and Fisheries of India*. Hindustan Publishing Corporation, India
4. Khanna, S. S., & Singh, H. R. (2006). *A Textbook of Fish Biology and Fisheries*. Narendra Publishing House, India
5. Pillay, T. V. R., & Kutty, M. N. (2005). *Aquaculture: Principles and Practices*. Blackwell
6. Rath, R. K. (2000). *Freshwater Aquaculture*. Scientific Publishers

Semester – V

.5.5 Minor Strem

Course Titles	**Sociobiology (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Critically assess the empirical evidence and research methodologies used in Sociobiology studies to draw informed conclusions
	2. Analyse the adaptive significance and evolutionary mechanisms underlying social behaviour and communication in different species
Module 1 (Credit 1): Animal Behaviour and Biological Rhythms	
Learning Outcomes	After learning the module, learners will be able to
	1. Introduce the principles, concepts and role of genetics of Sociobiology
	2. Interpret the evolutionary mechanisms behind animal communication and social organization
Content Outline	• Genetics of Behaviour: Role of genes in animal behavior, breeding experiments, knockout experiments, control of behaviors by gene cascades • Genetic Variation and the Evolution of Behaviour: Variation in prey selection, variation in migratory patterns, altruism, reciprocal altruism, inclusive fitness, Hamilton's Rule and kin selection • Reproductive behaviour: parental investment and mate choice, evolution of sex and reproductive strategies, mating systems, courtship, sperm competition, sexual selection • Biological rhythms: circadian and circa-annual rhythms, orientations and navigation
Module 2 (Credit 1): Communication and Social Behaviour in Animals	
Learning Outcomes	After learning the module, learners will be able to
	1. Demonstrate comprehension of Sociobiology theories, principles and concepts
	2. Apply Sociobiological frameworks to analyse and interpret animal behaviour in various ecological contexts
Content Outline	• Communication: chemical, visual, light, audio communication; specificity of songs; evolution of language (primates) • Learning: imprinting, spatial learning and cognitive map, associative learning, cognition and problem solving, development of learned behaviours, memory and learning

	(short-term vs long-term), neural basis of learning • Social behaviour: aggression, schooling in fish, flocking in birds, herding in mammals, group selection, kin selection, social organization in insects and primates (human and langur)
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Explore the role of genetics and the environment in shaping behaviour
	2. Analyse the adaptive significance of social behaviour in different species
Content Outline	• Study of general organization in honeybees, termites and elephants • Mounting mouth parts of honeybees • Mounting legs of honeybees to study functions • Mounting sting apparatus of honeybees • Study of phototactic and chemotactic responses in Drosophila using behavioural assay techniques • Quantification of phototactic and chemotactic responses in Drosophila melanogaster using choice chamber assays • Documentation and interpretation of animal behaviour (mating, courtship, feeding, communication, aggression, dominance hierarchies) using systematic observation • Preparation of ethogram and calculation of time budget of a selected animal using focal animal sampling • Analysis of bird vocalizations using sonograms to identify frequency, duration and sound patterns • Application of Hamilton's Rule (rB > C) to analyse altruistic behaviour and inclusive fitness • Study of circadian rhythms in humans using chronogram • Assessment of behavioural changes under altered environmental conditions (light, temperature and crowding) • Interpretation of behavioural sampling techniques used in ethological studies • Interpretation of cost-benefit models in social behaviour • Observation and documentation of animal behaviours in field or videos and classification into categories • Field study to observe and document behaviour of a particular animal species in natural habitat and submission of report • Demonstration of rapid diagnostic test (RDT/ICT) procedure for

	parasitic infections • Maintenance of practical record with labelled diagrams and key identifying features

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Demonstration through charts or models of social behaviour in animals
- Documentation using photography or videography of communication mechanisms in animals
- Submission of field report on animal behaviour based on visit to diverse habitats

Note: Rubrics to be developed for subjective type of assessment

References:

1. McFarland, D. (1998). Animal behaviour: Psychobiology, ethology, and evolution (3rd ed.). Longman Scientific & Technical / Pearson Education.
2. Arora, M. P., & Arora, H. (2025). Animal behaviour (8th ed.). Himalaya Publishing House.
3. Mathur, R. (2021). Animal behaviour (6th ed.). Rastogi Publications.
4. Agarwal, R. A. (2011). Animal behaviour. S. Chand & Company Ltd.
5. Kappeler, P. M. (2021). Animal behaviour: An evolutionary perspective. Springer Nature.

Semester – V

.5.6 Vocational Skill Courses (VSC-4)

Course Titles	**Nature Interpreter (Pr)**
Course Credits	**2 Credit's**
Course Outcomes	After going through the course, learners will be able to
	1. Implement ethical forest practices and effectively use wildlife photography equipment to document species and habitats
	2. Interpret the IUCN status of animals
	3. Develop the skills to identify and track animals in field
PRACTICAL COURSE (2 Credits)	
Content Outline	• Practicing forest etiquette for responsible nature educators (dos and don'ts during forest visit) • Introduction to basic equipment for wildlife photography: camera (DSLR/digital/point & shoot), lenses, tripod, monopod, memory cards and batteries, smartphone, binoculars, weather protection gear • Observation of social behaviour: alarm calls and mating calls in animals (birds, amphibians, mammals) based on field visits or recordings • Studying tips to track wildlife: reading footprints and scat • Common animal species found in Indian forests – insects (weaver ant, tortoise beetle, blue mormon butterfly, globe skimmer dragonfly, atlas moth, painted grasshopper), amphibians (tree frog, bull frog, skittering frog, common toad), reptiles (spectacled cobra, Russell's viper, common sand boa, Indian rock python, wolf snake, checkered keelback snake, oriental garden lizard), aves (bulbuls, mynas, babblers, parakeets, bee-eater, Asian koel, kingfisher, lapwing), mammals (langurs, bonnet macaques, grey mongoose, jackal, leopard, Indian flying fox) • Identification of marine intertidal fauna: sea anemone, hermit crab, Conus, mud skipper, fiddler's crab, chiton, Nereis, Chthalamus • Identification of homes and architectural designs by animals: tailor bird nest, weaver bird nest, lapwing nest, bat crevices, ant pagoda, termite hill, harvester ant nest, orb-weaver spider web • Study of Indian fauna based on IUCN Red List categories – extinct (pink-headed duck), extinct in wild (Asiatic cheetah), critically endangered (snow leopard), endangered (Asiatic lion), vulnerable (sloth bear), near threatened (purple frog), least concern (Indian peafowl), data deficient (slender racer snake), not evaluated (dromedary camel)

	• Visit to any national park / sanctuary / suitable habitat and submission of report

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Journal assessment and certification
- End semester practical examination
- Submission of visit report

Semester – V

.5.7 Field Project (FP)

Course Titles	**Field Project (Pr)**
Course Credits	**2 Credit's**
Course Outcomes	After going through the course, learners will be able to
	1. Demonstrate evidence of research aptitude and skills of critical thinking, analytical skills, and ethical research conduct in field work
	2. Display problem-solving abilities in making informed decisions in complex scenarios through practical situations
	3. Work in teams and collaborate to achieve common goals in work field environments through collaborative efforts
	4. Prepare presentation and a detailed report based on research findings
Content Outline	**Field Projects can be given on various topics listed below**
	• Vertical rise in the locality and its impact assessment • Green audit of campus • Occupational health hazards • Observation of aquaculture practices • Water audit or energy audit in school, college, apartments, etc • Documenting the hatching or nesting behaviour of insects or birds in natural habitats • Hydrological parameters of lentic or lotic habitats • Seasonal survey of fishes in local markets or landing centres • Census of stray dogs or animals in locality • Preparing checklist of birds in eco-habitats • Proximate composition of ready-to-eat or fresh products from markets • Seasonal measurement of sound pollution • Impact of bursting crackers in AQI • Measurement of BMI of selected human groups • Documentation of genetic traits in human population

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Rubrics for Assessment

	Criteria for Evaluation			
	Project Design and Planning	**Research methods and data collection**	**Report submission**	**Presentation**
Total Marks Allotted	**10 marks**	**20 marks**	**10 marks**	**10 marks**
	Levels of Evaluation			
	Outstanding	Good	Satisfactory	Needs Improvement
Range of Marks (%)	**80 -100%**	**60 -79%**	**59 – 40%**	**Below 40%**

Course Syllabus

Semester – VI

.6.1 Major (Core)

Course Titles	**Haematology (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Know the composition of blood, hemorrhage and hematopoiesis
	2. Understand the physiology of blood clotting
	3. Learn clinical aspects of haematology
Module 1 (Credit 1): Basic Haematology	
Learning Outcomes	After learning the module, learners will be able to
	1. Describe various components of blood
	2. Describe various processes of hemorrhage and hematopoiesis
	3. Identify various components of hemostatic systems
Content Outline	• Composition of plasma – water, respiratory gases, dissolved salts, plasma proteins, nutrients, hormones, nitrogenous waste products • Haematopoiesis – erythropoiesis, leucopoiesis and thrombopoiesis • Erythrocytes – structure and functions, abnormalities in structure, total count, variation in number, ESR, types of anaemia • Haemoglobin – structure, formation and degradation, variants of haemoglobin, abnormalities in haemoglobin • Leucocytes – types and functions, total count, leukemia and its types • Thrombocytes – structure, factors and mechanism of clotting, failure of clotting mechanism • Blood volume – total quantity and regulation, hemorrhage
Module 2 (Credit 1): Applied Haematology	
Learning Outcomes	After learning the module, learners will be able to
	1. Understand basics of applied haematology
	2. Impart knowledge of techniques used in pathology
Content Outline	• Introduction and scope of applied haematology • Clinical significance of diagnostic techniques – o microscopic examination of blood:

	✓ blood cancer, ✓ infectious diseases, ✓ haemoglobinopathies o Biochemical examinations of blood – ✓ liver function test (AST, ALT, LDH), ✓ kidney function test (serum creatinine, BUN), ✓ blood hormones (TSH, FSH, LH)
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	1. Perform various experiments related to total blood count 2. Analyse different pathological reports
Content Outline	• Enumeration of erythrocytes – total count • Enumeration of leucocytes – total count • Differential count of leucocytes • Erythrocyte sedimentation rate by suitable method – Westergren or Wintrobe method • Estimation of haemoglobin by Sahli's acid haematin method • Determination of serum LDH using colorimeter or spectrophotometer • Estimation of total serum or plasma proteins by Folin's method • Estimation of serum or plasma total triglycerides by phosphovanillin method • Latex agglutination test – rheumatoid arthritis • Determination of bleeding and clotting time

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Making charts of various types of blood cells
- Project on applied haematology – different instruments used in haematology

Note: Rubrics to be developed for subjective type of assessment

References:

1. Chatterjee, C. C. *Human Physiology – Volume 1*
2. Kawthalkar, S. M. *Essentials of Haematology*. Jaypee Brothers
3. Kaushansky, K., Lichtman, M. A., Beutler, E., Kipps, T. J., Prchal, J., & Seligsohn, U. *Williams Hematology*
4. Hoffbrand, V., Moss, P., & Pettit, J. *Essential Haematology*
5. Nayak, R. *Rapid Review of Hematology*. Jaypee Brothers
6. Rusia, U., Sikka, M., & Saxena, R. *Precise Haematology*. Wiley India

7. Shah, B. S. *Short Textbook of Haematology*. CBS Publisher and Distributor
8. Ghose, K. C., & Manna, B. *Practical Zoology* (2nd ed.). New Central Book Agency
9. Easton, D. M. *Mechanisms of Body Functions* (2nd ed.). Prentice-Hall of India
10. Ranade, V. G. *A Textbook of Practical Physiology*
11. Tortora, G. J., & Derrickson, B. *Principles of Anatomy & Physiology* (13th ed.)
12. Satyanarayana, U., & Chakrapani, U. *Biochemistry* (4th ed.). Elsevier

Semester – VI

.6.2 Major (Core)

Course Titles	**Biomolecules (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Review the intricacies of biomolecules in living systems
	2. Evaluate the importance of biomolecules and their clinical significance
Module 1 (Credit 1): Carbohydrates and Lipids	
Learning Outcomes	After learning the module, learners will be able to
	1. Study the structural and functional organization of carbohydrates in living systems
	2. Study the structural and functional organization of lipids in living systems
Content Outline	• Overview of Biomolecules: Concept of micromolecules and macromolecules; significance in biological systems • Carbohydrates: Introduction and classification; structural features and chemical properties; formation of glycosidic linkages; monosaccharides (glucose, fructose); disaccharides (lactose, sucrose); polysaccharides (cellulose, glycogen, chitin); functional importance and medical relevance • Lipids: Introduction and classification; ester bond formation; physicochemical characteristics; saturated and unsaturated fatty acids; essential fatty acids and importance; physiological functions and health-related implications
Module 2 (Credit 1): Proteins and Nucleic Acids	
Learning Outcomes	After learning the module, learners will be able to
	1. Acquaint the learner with biological role of proteins and correlate their role in diseases
	2. Acquaint the learner with biological role of nucleic acids and correlate their role in diseases
Content Outline	• Amino Acids and Proteins: General structure and classification of amino acids; essential and non-essential amino acids; peptide bond formation; structural organization of proteins (primary, secondary, tertiary, quaternary); functional roles and clinical importance • Nucleic Acids: Composition and molecular structure; Watson and Crick model of DNA; conformational forms of DNA (A, B, Z, H); organization of genetic material in prokaryotes (chromosomal DNA and plasmids); RNA classification (mRNA, tRNA, rRNA),

	structure and functions
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Perform qualitative and quantitative estimation of biomolecules
	2. Study clinical disorders in relation to biomolecules
Content Outline	• To estimate concentration of glucose by GOD-POD method. • To estimate concentration of proteins by Folin-Lowry method. • To estimate amino acids using the Ninhydrin method. • Qualitative tests for detection of Carbohydrates: Molisch's test, Benedict's test, Barfoed's test, Anthrone test • Qualitative tests for detection of Protein: Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test • Qualitative test for detection of Lipids: Solubility test, Sudan III test, Saponification test, Salkowski test • Estimation of Cholesterol by FeCl3 Method of Wybenga & Pileggi • Study of clinical disorders due to carbohydrates, proteins & lipids imbalance (Photograph to be provided / symptoms to be given & disorder to be identified) o Diabetes Type I & II o Rheumatoid Arthritis o Hyperglycaemia & Hypoglycaemia o Obesity o Lactose Intolerance o Fatty liver disease o Atheroclerosis o Gout's disease • To separate different classes of lipids using Thin Layer Chromatography. • To separate amino acids by paper chromatography • To extract & estimate concentration of DNA by Diphenylamine method. • To extract & estimate concentration of RNA by Orcinol method. • To detect Rheumatoid Factor in the given serum sample

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Survey on topics related to nutrients and balanced diet

- Documentation using photography or videography of diseases and disorders
- Preparation of best out of waste models of biomolecules

Note: Rubrics to be developed for subjective type of assessment

1. References:
2. Powar, C. B. (2019). *Cell Biology* (3rd ed.)
3. Jain, J. L., & Jain, S. J. (2022). *Fundamentals of Biochemistry* (9th ed.). S. Chand Publishing
4. Cooper, G. M., & Adams, K. W. (2022). *The Cell: A Molecular Approach* (6th ed.). Oxford University Press
5. Stryer, L., Berg, J., Tymoczko, J., & Gatto, G. (2019). *Biochemistry* (8th ed.). W. H. Freeman
6. Conn, E., & Stumpf, P. (2009). *Outlines of Biochemistry* (5th ed.). Wiley
7. Nelson, D. L., & Cox, M. M. (2021). *Lehninger Principles of Biochemistry* (8th ed.).

Semester – VI

.6.3 Major (Elective)

Course Titles	**Parasitology (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Understand concepts of parasitism, host–parasite interactions and diversity of protozoan and helminth parasites
	2. Explain life cycles, transmission, pathogenicity and control measures of medically important parasites
Module 1 (Credit 1): General Parasitology & Protozoa	
Learning Outcomes	After learning the module, learners will be able to
	1. Identify major parasites and their life cycle stages based on morphology and characteristics of protozoans
	2. Interpret modes of transmission, diagnosis and prevention strategies of parasitic diseases caused by protozoans
Content Outline	• Concept of parasitology: parasite, parasitism, host types (definitive, intermediate, reservoir), host–parasite relationship, scope and importance • Types of parasites: ectoparasite, endoparasite, obligate, facultative; host specificity; parasite adaptations (morphological, physiological, reproductive) • Transmission of parasites: direct, vector-borne, trophic; life cycle patterns (monoxenous, heteroxenous) • Protozoa: general characteristics and classification • Amoebiasis – morphology, life cycle, pathogenicity, diagnosis, control • Malaria – life cycle, transmission, control • Sleeping sickness – life cycle and vector • Leishmaniasis – life cycle and pathology • General account of Giardia, Trichomonas, sporozoans • Laboratory diagnosis of protozoan infections
Module 2 (Credit 1): Helminths, Arthropods & Applied Parasitology	
Learning Outcomes	After learning the module, learners will be able to
	1. Understand host–parasite interactions and diversity of protozoan and helminth parasites
	2. Elaborate life cycles, transmission, pathogenicity and control measures of helminths and arthropod parasite
Content Outline	• Helminths: general characteristics; classification

	(Platyhelminthes, Nematoda) • Fascioliasis – life cycle, pathogenicity, control • Schistosomiasis – life cycle, pathology and control • Taeniasis – life cycle, pathogenicity and control • Ascariasis – life cycle and control • Filariasis – transmission, pathology, control • Arthropods as vectors: mosquitoes, lice, ticks, mites; mechanical and biological transmission • Host immune response: innate and adaptive immunity; immune evasion • Applied parasitology: zoonoses, epidemiology, prevention and control measures
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to 1. Identify parasites based on morphology and adaptations 2. Demonstrate various vector control methods
Content Outline	• Preparation and observation of thin blood smear for identification of malarial parasite stages • Examination of stool samples/slides for identification of protozoan cysts and helminth ova • Observation of protozoan culture techniques (demonstration-based) • Identification of protozoan parasites (Entamoeba, Plasmodium, Trypanosoma) using slides/charts • Study and identification of helminths (Fasciola, Taenia, Ascaris) based on morphology and adaptations • Study and identification of arthropod vectors (mosquito, lice, tick, mite) and their life stages • Interpretation of life cycle charts of Plasmodium, Taenia and Ascaris to identify infective stages • Estimation of parasite load using tally counter or visual field method (simulated) • Analysis of case studies to identify parasitic disease and suggest diagnostic method • Demonstration of vector control methods (chemical, biological, environmental) • Identification of permanent slides of cysts, ova and larval stages of parasites • Field survey on mosquito breeding sites and preventive

	measures • Observation of rapid diagnostic test (RDT/ICT) procedure for parasitic infections (demonstration) • Maintenance of practical record with labelled diagrams and key identifying features

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Survey report and presentation on communicable and non-communicable diseases
- Submission of field report based on epidemiological case studies
- Note: Rubrics to be developed for subjective type of assessment

References:

1. Arora, D. R., & Arora, B. (2005). *Medical Parasitology*. CBS Publishers & Distributors
2. Chatterji, K. D. *Parasitology (Protozoology & Helminthology)*. Medical Publishers
3. Noble, E. R., & Noble, G. A. (1976). *Parasitology: The Biology of Animal Parasites*. Lea & Febiger
4. Chandler, A. C., & Read, C. P. (1961). *Introduction to Parasitology*. John Wiley & Sons
5. Dogiel, V. A. (1964). *General Parasitology*. Academic Press
6. Cheng, T. C. (1964). *The Biology of Animal Parasites*. Saunders
7. Yamaguti, S. (1960). *Systema Helminthum* (Vols. 1–3). Interscience Publishers

Semester – VI

.6.3 B. Major (Elective)

Course Titles	**Forensic Science**
Course Credits	
Course Outcomes	After going through the course, learners will be able to
	1. Apply standard procedures for collection, preservation and preliminary examination of biological evidence in forensic investigations
	2. Interpret biological evidence using microscopic, biochemical and DNA-based techniques to support forensic conclusions and reporting
Module 1 (Credit 1): Crime Scene Investigation	
Learning Outcomes	After learning the module, learners will be able to
	1. Demonstrate proper handling, packaging and documentation of biological evidence while maintaining chain of custody and preventing contamination
	2. Perform and interpret forensic analyses including blood tests, hair and saliva examination, DNA fingerprinting and case-based evaluations
Content Outline	• **Crime Scene Investigation and Analysis:** Protection of crime scene, recognition of biological evidence, search methods, documentation, chain of custody, collection and marking of evidence, packaging and transportation, final survey and release of the crime scene, crime scene reconstruction • **Crime Scene Bloodstain Pattern Analysis:** Formation of bloodstains, analysis of spatter stains (velocity of blood droplets, directionality of stains, angle of impact and area of origin), types of bloodstain patterns (passive, transfer and projected) • **Sources of Biological Evidence:** Extracellular nucleic acids, cell membrane markers, nucleated cells, mitochondria and other organelles, cytosol (mRNA and miRNA), skin, hair, bone and teeth as sources of DNA evidence • **Forensic Laboratory Services:** Forensic pathology, forensic anthropology, forensic entomology, forensic odontology, autopsy and post-mortem examination, reporting of results and expert testimony
Module 2 (Credit 1): Molecular Techniques in Forensic Biology	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyse individualization of biological evidence and blood group typing

	2. Demonstrate various molecular identification techniques in forensic investigation
Content Outline	• **Individualization of Biological Evidence and Blood Group Typing:** Principles of individualization in forensic science, **ABO Blood Group System**, biosynthesis and molecular basis of antigens, inheritance of A and B antigens, forensic applications of blood group typing, **Lattes Crust Assay**, **Absorption–Elution Assay** • **Forensic Protein Profiling:** Matrices supporting protein electrophoresis, separation by molecular weight and isoelectric point, erythrocyte protein polymorphisms, serum protein polymorphisms • **DNA-Based Identification Techniques:** Sex chromosome haplotyping (pseudoautosomal and male-specific Y regions, polymorphic sequences), X chromosome haplotyping, **Amelogenin locus**, mitochondrial DNA profiling (maternal inheritance, hypervariable regions, heteroplasmy, forensic applications and interpretation) • **Basic Molecular Techniques in Forensic Biology:** Nucleic acid extraction (phenol–chloroform, boiling lysis, silica-based methods), **PCR and its types** (real-time PCR, RT-PCR, TaqMan), electrophoresis (agarose, polyacrylamide, capillary), DNA sequencing (Sanger method), blotting techniques (Southern, Northern, Western)
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Study evidence collection, preservation and identification techniques
	2. Prepare report based on case study analysis
Content Outline	• Evidence collection and preservation techniques: Use of personal protective equipment (gloves, mask, safety glasses, shoe covers), collection and packaging of biological evidence, labelling, sealing and chain of custody • Identification of errors in evidence collection and prevention of contamination • Detection of blood using phenolphthalein and benzidine tests; visual examination of bloodstains • Identification of bloodstain patterns (passive, transfer, projected); directionality and angle of impact • Microscopic examination of hair samples • Detection of saliva using amylase radial diffusion assay • Study and comparison of DNA banding patterns for identity and

	relationship analysis • DNA fingerprinting problems and sample matching • DNA extraction techniques (phenol–chloroform, boiling, silica-based methods) • Estimation of blood group and Rh factor • Agarose gel electrophoresis study • Determination of post-mortem interval using insect life cycle data • Case study analysis – Aarushi Talwar–Hemraj Case (2008), Unnao Rape Case (2017), Star Tortoise Smuggling Case (2020), Saraswati Tiger Poaching Case (2013) • Preparation and presentation of forensic reports based on experimental or case data • Visit to Forensic Science Laboratory and submission of report

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Role-play recreating crime scene for forensic investigation
- Visit to Forensic Science Laboratory and submission of report

Note: Rubrics to be developed for subjective type of assessment

References:

1. Richard Li. *Forensic Biology* (2nd ed.). Taylor & Francis (2017)
2. Mishra, A., Puri, A., Mahalakshmi, N., Bhatnagar, P., & Chauhan, T. *Fundamentals of Forensic Biology*. Springer (2024)
3. Gunn, A. *Essential Forensic Biology* (3rd ed.). Wiley (2019)
4. Primrose, S. B., & Twyman, R. *Principles of Gene Manipulation and Genomics* (7th ed.). Wiley (2013)

Semester – VI

.6.4 Minor Stream

Course Titles	**Homeostasis (Th)**
Course Credits	**2 Credit's**
Course Outcomes	After going through the course, learners will be able to
	1. Know concept of homeostasis—thermoregulation and osmoregulation
	2. Understand life processes and relate adaptations of body according to the environment
Module 1 (Credit 1): Thermo-regulation	
Learning Outcomes	After learning the module, learners will be able to
	1. Relate the basis of body metabolism
	2. Analyse the change in behaviour according to environmental change
Content Outline	• External and internal environment; acclimation and acclimatization • Body clock – circadian and diurnal rhythm • Endothermy and ectothermy • Temperature balance: heat production – shivering and non-shivering thermogenesis; brown fat; mechanisms of heat loss • Adaptive response to temperature – daily torpor, hibernation, aestivation
Module 2 (Credit 1): Osmotic and Ionic Regulation	
Learning Outcomes	After learning the module, learners will be able to
	1. Analyse and evaluate various processes for balance with surrounding changes
	2. Relate changes in body according to different habitats
Content Outline	• Living in hypo-osmotic, hyper-osmotic and terrestrial environments – water absorption, • salt water ingestion and salt excretion, salt glands, metabolic water • Role of kidney in ionic regulation

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Models of thermoregulation
- Project based on topics related to osmotic and ionic regulation

Note: Rubrics to be developed for subjective type of assessment

References:

1. Comparative Animal Physiology – Knut Schmidt-Nielsen, Cambridge Press
2. Comparative Animal Physiology – Prosser and Brown
3. Comparative Animal Physiology – William S. Hoar
4. Textbook of Comparative Physiology – R. Nagabhushanam, M. S. Kodarkar, Sarojini R., India Book House Pvt. Ltd.
5. Animal Physiology – N. Arumugam, A. Mariakuttikan, Saras Publication
6. Textbook of Endocrinology – Williams
7. Textbook of Endocrinology – Dharmalingam (2010)
8. Endocrinology (6th Edition) – Mac Hadley, Jon E. Levine
9. Bailey's Textbook of Histology – Frederick R. Bailey
10. Mechanisms of Body Functions (2nd Edition) – Dexter M. Easton, Prentice-Hall of India

Semester – VI

.6.5 Minor Stream

Course Titles	**Parasitology (Th+Pr)**
Course Credits	**4 Credit's (2 Th + 2 Pr)**
Course Outcomes	After going through the course, learners will be able to
	1. Describe types of parasites and analyse parasitological significance
	2. Describe retrogressive, necrotic and pathological conditions in the body
	3. Learn clinical aspects of pathogenesis
Module 1 (Credit 1): General Parasitology	
Learning Outcomes	After learning the module, learners will be able to
	1. Classify types of parasites, explore host–parasite relationship and host specificity
	2. Describe prophylaxis related to certain diseases
	3. Analyse reports of diseases
Content Outline	• Introduction to Parasitology and types of parasites • Host–parasite relationship; host specificity • Ectoparasite – (Morphology, life cycle, pathogenicity and prophylaxis) Hookworm, Pinworm • Endoparasite – (Morphology, life cycle, pathogenicity and prophylaxis) Plasmodium, Trypanosoma
Module 2 (Credit 1): Common Parasites	
Learning Outcomes	After learning the module, learners will be able to
	1. Co-relate symptoms and type of disease
	2. Impart knowledge in the field of pathology
	3. Compare morphology, life cycle, pathogenicity, control measures and treatment of different parasites and summarize parasitological significance
Content Outline	• Life cycle, pathogenicity, control measures and treatment – Entamoeba histolytica • Life cycle, pathogenicity, control measures and treatment – Fasciola hepatica • Life cycle, pathogenicity, control measures and treatment – Taenia solium • Morphology, life cycle, pathogenicity, control measures and treatment – Head louse (Pediculus humanus capitis) • Morphology, life cycle, pathogenicity, control measures and

	treatment – Mite (Sarcoptes scabiei) • Morphology, life cycle, pathogenicity, control measures and treatment – Bed bug (Cimex lectularius) • Parasitological significance
PRACTICAL COURSE (2 Credits)	
Learning Outcomes	After learning the module, learners will be able to
	1. Perform experiments related to mode of transmission of diseases
	2. Recognize different types of parasites and understand their life cycles
Content Outline	• Study of protozoan parasites – Trypanosoma gambiense, Giardia intestinalis • Study of helminth parasites – Ancylostoma duodenale, Dracunculus medinensis • Parasitic adaptations – Scolex and mature proglottid of tapeworm • Study of ectoparasites – leech, tick, mite • Study of endoparasites – Plasmodium, liver fluke, Ascaris • Life cycle of Plasmodium • Life cycle of round worm • Life cycle of tapeworm

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

- Charts / infographics based on infections and transmission of diseases
- Project based on topics related to unit 2

Note: Rubrics to be developed for subjective type of assessment

References:

1. Arora, D. R., & Arora, B. (2005). *Medical Parasitology*. CBS Publishers & Distributors
2. Chatterji, K. D. *Parasitology (Protozoology & Helminthology)*. Medical Publishers
3. Noble, E. R., & Noble, G. A. (1976). *Parasitology: The Biology of Animal Parasites*. Lea & Febiger
4. Chandler, A. C., & Read, C. P. (1961). *Introduction to Parasitology*. John Wiley & Sons
5. Dogiel, V. A. (1964). *General Parasitology*. Academic Press
6. Cheng, T. C. (1964). *The Biology of Animal Parasites*. Saunders
7. Yamaguti, S. (1960). *Systema Helminthum* (Vols. 1–3). Interscience Publishers

Semester – VI

.6.6 On Job Training (OJT)

Course Titles	**On Job Training (OJT) (Pr)**
Course Credits	**4 Credit's**
Course Outcomes	After going through the course, learners will be able to:
	1. Get industry experience
	2. Demonstrate strong initiative; anticipate challenges and solve problems independently
	3. Gain up-to-date knowledge about recent emerging trends
Content Outline	• Students can undertake OJT in the following areas: • Research laboratories • Pharmaceutical industry • Market value sectors such as Gadre fisheries etc. • National Parks • NGOs related to environment conservation

Assignments/Activities towards Comprehensive Continuous Evaluation (CCE)

Project report written: 25 marks

Presentation of OJT: 25 marks

External Evaluation

Punctuality and professional attitude: 10 marks

Tasks performed: 40 marks