

NEP SYLLABUS (CBCS 2023-24)

SEMESTER I - VI

BACHELOR OF SCIENCE

ZOOLOGY



सत्यं शिवं सुन्दरम्

Estd. 1949,
Accredited Grade "A+" by NAAC

DEPARTMENT OF ZOOLOGY

THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

INDEX & COURSE TITLE: BSc Zoology (Semester I - VI)

CODE	COURSE DETAILS	CREDIT	PAGE NO.
SEMESTER-I MAJOR		08 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
ZLM2001C	Non-Chordates-I	4 Cr	1
ZLM2011C	Chordates- I	4 Cr	2
SEMESTER-I MINOR		04 Cr	
THEORY:			
ZLE2001C	Non-Chordates and Chordates-I	4 Cr	3
SEMESTER-I (MULTIDISCIPLINARY COURSE-MDC)		04 Cr	
THEORY:			
MDC2281C	Diversity of Animals-I	4 Cr	4
SEMESTER-I (SKILL ENHANCEMENT COURSE-SEC)		02 Cr	
PRACTICAL:			
SEC2221C	Biodiversity of Animals-I	2 Cr	5
SEMESTER-I (INDIAN KNOWLEDGE SYSTEM - IKS)		02 Cr	
PRACTICAL:			
IKS2211C	Faunal Diversity of India and its Management	2 Cr	6
<i>Details of Prerequisites for various courses offered by Department of Zoology</i>			40

CODE	COURSE DETAILS	CREDIT	PAGE NO.
SEMESTER-II MAJOR		08 Cr	
THEORY (3Cr) & PRACTICAL (1CR):			
ZLM2002C	Non-Chordates-II	4 Cr	7
ZLM2012C	Chordates-II	4 Cr	8
SEMESTER-II MINOR		04 Cr	
THEORY:			
ZLE2002C	Non-Chordates and Chordates-II	4 Cr	9
SEMESTER-II (MULTIDISCIPLINARY COURSE-MDC)		04 Cr	
THEORY:			
MDC2272C	Diversity of Animals-II	4 Cr	10
SEMESTER-II (SKILL ENHANCEMENT COURSE-SEC)		02 Cr	
PRACTICAL:			
SEC2222C	Biodiversity of Animals-II	2 Cr	11
SEMESTER-II (VALUE ADDED COURSE-VAC)		02 Cr	
PRACTICAL:			
VAC2112C	Biodiversity Inventory and Assessment	2 Cr	12
<i>Details of Prerequisites for various courses offered by Department of Zoology</i>			40

CODE	COURSE DETAILS	CREDIT	PAGE NO.
SEMESTER-III MAJOR		12 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
ZLM2003C	Comparative account of Non-Chordates	4 Cr	13
ZLM2013C	Animal Adaptation and Animal Behaviour	4 Cr	14
ZLM2023C	Genetics I and Evolutionary Biology I	4 Cr	15
SEMESTER-III (MULTIDISCIPLINARY COURSE-MDC)		04 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
MDC2593C	Zoogeography, Biodiversity and Conservation Biology	4 Cr	16
SEMESTER-III (SKILL ENHANCEMENT COURSE-SEC)		02 Cr	
PRACTICAL:			
SEC2483C	Environmental and Animal Welfare Auditing	2 Cr	17
SEMESTER-III (INDIAN KNOWLEDGE SYSTEM - IKS)		02 Cr	
THEORY:			
IKS2393C	Animal Wealth in the Indian Economy	2 Cr	18
<i>Details of Prerequisites for various courses offered by Department of Zoology</i>			40

CODE	COURSE DETAILS	CREDIT	PAGE NO.
SEMESTER-IV MAJOR		12 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
ZLM2004C	Comparative Account of Chordates I	4 Cr	19
ZLM2014C	Comparative Account of Chordates II	4 Cr	20
ZLM2024C	Disease Biology and Parasitology	4 Cr	21
SEMESTER-IV MINOR		04 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
ZLE2004C	Disease Biology	4 Cr	22
SEMESTER-IV (SKILL ENHANCEMENT COURSE-SEC)		02 Cr	
PRACTICAL:			
SEC2474C	Medical Diagnostics	2 Cr	23
SEMESTER-IV (VALUE ADDED COURSE - VAC)		02 Cr	
THEORY:			
VAC2434C	Indian Health, Wellness and Psychology	2 Cr	24
<i>Details of Prerequisites for various courses offered by Department of Zoology</i>			40

CODE	COURSE DETAILS	CREDIT	PAGE NO.
SEMESTER-V MAJOR		12 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
ZLM3005C	Physiological Chemistry and Mammalian Physiology– I	4 Cr	25
ZLM3015C	Molecular Biology and Molecular Genetics– I	4 Cr	26
ZLM3025C	Animal Systematics, Ecology and Evolutionary Biology	4 Cr	27
SEMESTER-V MINOR		08 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
BASKET-I (Any One)			
ZLE3005C	Avian Biology and Wildlife Biology	4 Cr	28
ZLE3015C	Fisheries and Aquatic Biology		29
BASKET-II (Any One)			
ZLE3025C	General and Applied Toxicology	4 Cr	30
ZLE3035C	General and Applied Entomology		31
SEMESTER-V (SKILL ENHANCEMENT COURSE-SEC)		02 Cr	
PRACTICAL:			
SEC3535C	Instrumentation and Techniques in Biology	2 Cr	32

CODE	COURSE DETAILS	CREDIT	PAGE NO.
SEMESTER-VI MAJOR		12 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
ZLM3006C	Immunology and Endocrinology	4 Cr	33
ZLM3016C	Cell Biology and Developmental Biology– I	4 Cr	34
ZLM3026C	Environmental Biology and Natural Resource	4 Cr	35
SEMESTER-VI MINOR		04 Cr	
THEORY (3Cr) & PRACTICAL (1Cr):			
(Any One)			
ZLE3006C	Comparative Animal Physiology	4 Cr	36
ZLE3016C	General and Applied Reproductive Biology		37
SEMESTER-VI (Ability Enhancement Course - AEC)		02 Cr	
PRACTICAL (2Cr)			
AEC3306C	Applications of Basic Software in Biological Sciences	2 Cr	38
SEMESTER-VI INTERNSHIP		04 Cr	
PRACTICAL (4Cr)			
SEC3406C	Internship in Zoology	4 Cr	39

		The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Zoology Sayajigunj, Vadodara 390002, 2795329, Ext: 357 head-zoo@msubaroda.ac.in		ACADEMIC YEAR 2023-24								
Bachelor of Science: Regular Major												
<table><tr><td>Year</td><td>I</td></tr><tr><td>Semester</td><td>I</td></tr></table>		Year	I	Semester	I	ZLM2001C: Non-Chordates-I		<table><tr><td>Credit</td><td>4</td></tr><tr><td>Hours</td><td>75</td></tr></table>	Credit	4	Hours	75
Year	I											
Semester	I											
Credit	4											
Hours	75											
OBJECTIVES		The main objectives of the course are: 1) to develop an understanding of the taxonomy of non-chordates from Protists to Nematodes, 2) to study the body organization of each phylum, 3) to examine the general biology of selected representative species from each phylum, 4) to equip students to identify specimens of non-chordates, 5) to expose students to the structural peculiarities of respective non-chordate members, and 6) to study the adaptive peculiarities of selected species from each phylum and their respective members.										
COURSE CONTENT/SYLLABUS												
UNIT-I		1. Scheme of Classification 2. General account of non-chordate body plan 3. General characters: Protozoa 4. Detailed Study: <i>Amoeba</i> , <i>Paramecium</i> 5. General account of Porifera: Cell types, canal system, skeleton, reproduction 6. Detailed study: <i>Sycon</i>			15 hrs							
UNIT-II		1. General characters: Cnidaria 2. Detailed study: <i>Obelia</i> , <i>Hydra</i> 3. General characters: Ctenophora 4. General characters and parasitic adaptations: Platyhelminthes 5. Detailed study: <i>Fasciola hepatica</i> , <i>Taenia solium</i>			15 hrs							
UNIT-III		1. General characters and Parasitic adaptations: Nematoda 2. Detailed study: <i>Ascaris</i> , <i>Wuchereria bancrofti</i> 3. General characters: Annelida 4. Detailed study: <i>Pheretima</i> 5. Special features of <i>Nereis</i> and <i>Hirudinaria</i>			15 hrs							
UNIT-IV Practical		1. General Account of a Non-Chordate body plan 2. Protozoa : Classification (up to order level) Study of prepared slides, charts, specimens. Observation of common freshwater protozoans, demonstration of cyclosis in <i>Paramecium</i> . 3. Porifera : Classification (up to order level) Study of prepared slides and specimens. 4. Cnidaria : Classification (up to order level) Study of prepared slides and specimens. 5. Platyhelminthes : Classification (up to order level) Study of prepared slides and specimens. Parasitic adaptations. 6. Nematoda : Classification (up to order level) Study of prepared slides and specimens. Parasitic adaptations. 7. Annelida : Classification (up to order level) Study of prepared slides and specimens. Temporary mounting preparation of ovary septal nephridia, setae, spermatheca, etc of <i>Pheretima</i> .			30 hrs							
REFERENCES												
1. A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.												
2. Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.												
3. Biology of the Invertebrates, J. A. Pechenik, Tata-McGraw Hill Company, Ltd, New Delhi.												
4. Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.												
5. Invertebrate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi												
6. Practical Zoology Lal, S. Part I & II												

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Bachelor of Science: Regular Major					
Year	I	ZLM2011C: Chordates-I		Credit	4
Semester	I			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to understand the taxonomy of chordates from Protochordata to Amphibia, 2) to study the body organization of each phylum/class, 3) to examine the general biology of selected species from each phylum/class, 4) to equip students to identify specimens of chordates, 5) to expose students to the structural peculiarities of respective members of chordates, and 6) to study the adaptive peculiarities of selected species from each phylum and their respective members.			
COURSE CONTENT/SYLLABUS					
UNIT-I		1. General characters: Chordates 2. General characters: Protochordata and Urochordata 3. Detailed study: <i>Herdmania</i> and its affinities 4. General characters: Cephalochordates 5. Detailed study: <i>Branchiostoma</i> (Amphioxus)			15 hrs
UNIT-II		1. General characters: Vertebrata and Cyclostomata (Agnatha) 2. Detailed study: Petromyzon and its affinities. 3. General characters: Pisces 4. Detailed study: <i>Scoliodon</i> 5. Migration and parental care in fishes			15 hrs
UNIT-III		1. General characters: Tetrapods 2. General characters: Amphibians 3. Detailed study: <i>Hoplobatrachus tigerinus</i> (Indian bullfrog) 4. Metamorphosis, Parental care 5. Neoteny and Paedogenesis			15 hrs
UNIT-IV Practical		1. General Account of Chordate body plan 2. Protochordata: Classification (up to order level) - Study of prepared slides and specimens. 3. Cyclostomata (Agnatha): Classification (up to order level) Study of prepared slides and specimens. 4. Pisces: Classification (up to order level) Study of prepared slides and specimens. 5. Amphibians: Classification (up to order level) Study of prepared slides and specimens. 6. Study of Metamorphosis (Frog) through prepared slides and specimens.			30 hrs
REFERENCES					
1.	A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.				
2.	Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.				
3.	Chordate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi				
4.	Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.				
5.	Practical Zoology Lal, S. Part I & II				

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Bachelor of Science: Regular Minor					
Year	I	ZLE2001C: Non-Chordates and Chordates-I		Credit	4
Semester	I			Hours	60
OBJECTIVES		The main objectives of the course are: 1) to develop an understanding of the taxonomy of non-chordates from Protists to Nematodes, 2) to study the body organization of each phylum, 3) to examine the general biology of selected species from each phylum, 4) to understand the taxonomy of chordates from Protochordata to Amphibia, 5) to study the body organization of each phylum/class, and 6) to examine the general biology of selected species from each phylum/class.			
COURSE CONTENT/SYLLABUS					
UNIT-I		1. General account of Non-chordate body plan 2. Protozoa: General features and life history 3. Detailed Study: <i>Paramecium</i> 4. General account of Porifera: Cell types, canal system, skeleton, reproduction 5. Detailed study: <i>Sycon</i> 6. Cnidaria: General features and life history 7. Detailed study: <i>Hydra</i> 8. Coral reefs and their significance; Polymorphism in Cnidaria			15 hrs
UNIT-II		1. General account Triploblastic body plan 2. Platyhelminthes: General features and life history; Parasitic adaptations 3. Detailed study: <i>Taenia solium</i> 4. Nematoda: General features and life history; Parasitic adaptations 5. Annelida: General features and life history 6. Detailed study: <i>Pheretima</i> 7. Types and formation of coelom, Metamerism			15 hrs
UNIT-III		1. General account of Chordate body plan 2. Protochordata: General features and life history 3. Detailed study: Amphioxus 4. Vertebrata: General characters 5. Agnatha: General features 6. Detailed study: <i>Petromyzon</i>			15 hrs
UNIT-IV		1. Pisces: General features and life history 2. Detailed study: <i>Scoliodon</i> 3. Amphibia: General features and life history 4. Detailed study: <i>Hoplobatrachus tigerinus</i> 5. Metamorphosis, Paedogenesis, Parental care			15 hrs
REFERENCES					
1.	A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.				
2.	Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.				
3.	Biology of the Invertebrates, J. A. Pechenik, Tata-McGraw Hill Company, Ltd, New Delhi.				
4.	Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.				
5.	Invertebrate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi				

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Bachelor of Science: Regular Multidisciplinary Course-(MDC)					
Year	I	MDC2281C: Diversity of Animals - I		Credit	4
Semester	I			Hours	60
OBJECTIVES		The course aims to: 1) develop an understanding of the taxonomy of non-chordates from Protists to Nematodes, 2) study the body organization of each phylum, 3) examine the overall diversity of non-chordates and the general biology of selected species from each phylum, 4) understand the taxonomy of chordates from Protochordata to Amphibia, 5) study the body organization of each phylum/class, and 6) examine the overall diversity of chordates and the general biology of selected species from each class.			
COURSE CONTENT/SYLLABUS					
UNIT-I		1. General account of Non-chordate body plan 2. Protozoa: General features and life history 3. Detailed Study: <i>Paramecium</i> 4. General account of Porifera: Cell types, canal system, skeleton, reproduction 5. Detailed study: <i>Sycon</i> 6. Cnidaria: General features and life history 7. Detailed study: <i>Hydra</i> 8. Coral reefs and their significance; Polymorphism in Cnidaria			15 hrs
UNIT-II		1. General account Triploblastic body plan 2. Platyhelminthes: General features and life history; Parasitic adaptations 3. Detailed study: <i>Taenia solium</i> 4. Nematoda: General features and life history; Parasitic adaptations 5. Annelida: General features and life history 6. Detailed study: <i>Pheretima</i> 7. Types and formation of coelom, Metamerism			15 hrs
UNIT-III		1. General account of Chordate body plan 2. Protochordata: General features and life history 3. Detailed study: <i>Amphioxus</i> 4. Vertebrata: General characters 5. Agnatha: General features 6. Detailed study: <i>Petromyzon</i>			15 hrs
UNIT-IV		1. Pisces: General features and life history 2. Detailed study: <i>Scoliodon</i> 3. Amphibia: General features and life history 4. Detailed study: <i>Hoplobatrachus tigerinus</i> 5. Metamorphosis, Paedogenesis, Parental care			15 hrs
REFERENCES					
1.		A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.			
2.		Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
3.		Biology of the Invertebrates, J. A. Pechenik, Tata-McGraw Hill Company, Ltd, New Delhi.			
4.		Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
5.		Invertebrate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi			

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Bachelor of Science: Regular Skill Enhancement Course – (SEC)				
Year	I	SEC2221C: Biodiversity of Animals-I	Credit	2
Semester	I		Hours	60
OBJECTIVES	The main objectives of the course are: 1) to equip students to identify, classify, and name specimens of non-chordates and chordates, 2) to expose students to the structural peculiarities of respective members of non-chordata and chordata, and 3) to study the adaptive peculiarities of selected species from each phylum and their respective members.			
COURSE CONTENT/SYLLABUS				
Practical	- General Account of the Body Plan in Non-Chordates and Chordates Protozoa: General characters and classification up to order level. Observation and identification of common freshwater protozoans, with emphasis on <i>Amoeba</i>, <i>Arcella</i>, <i>Euglena</i>, <i>Paramecium</i>, <i>Opalina</i>, <i>Balantidium</i>, <i>Vorticella</i>; Demonstration of cyclosis in <i>Paramecium</i> Porifera: General characters and classification up to order level. Study of prepared slides and specimens Cnidaria: General characters and classification up to order level. Study of prepared slides and specimens' Permanent preparation of <i>Hydra</i> and <i>Obelia</i> Platyhelminthes: General characters and classification up to order level. Study of prepared slides and specimen Nematoda: General characters and classification up to order level. Study of prepared slides and specimens Annelida: General characters and classification up to order level. Study of prepared slides and specimens; Permanent preparation of ovary and septal nephridia of <i>Pheretima</i>; Glycerin preparation of setae in situ from <i>Pheretima</i> Protochordata: General characters and classification up to order level. Study of prepared slides and specimens Cyclostomata (Agnatha): General characters and classification up to order level. Study of prepared slides and specimens Pisces: General characters and classification up to order level. Study of prepared slides and specimens, Temporary mounting of Scales Amphibia: General characters and classification up to order level. Study of prepared slides and specimens - Visit to Zoo and Field studies (Report submission)			60 hrs
REFERENCES				
1.	A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.			
2.	Practical Zoology Lal, S. Part I & II			
3.	Chordate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi			
4.	Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			

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Bachelor of Science: Regular (Indian Knowledge System- IKS)									
Year Semester		I I		IKS2211C: Faunal Diversity in India and its Management		Credit Hours		2 60	
OBJECTIVES		The main objectives of the course are: 1) to understand the importance of faunal diversity in India, 2) to study the major wildlife habitats of India, 3) to examine the tools and techniques used in studying faunal diversity, 4) to enable students to learn the concepts of conservation, and 5) to study conservation breeding programs in India.							
COURSE CONTENT/SYLLABUS									
Practical		1. Forest and biodiversity conservation in ancient India. 2. Deo-rahati: Sacred grooves conservation in India. 3. Diversity of simple (Protozoa) and complex multicellular (Porifera and Cnidarian) organisms. 4. Diversity of complex multicellular organisms (Platyhelminthes and Annelida). 5. Diversity of lower vertebrates (Fishes and Amphibians) 6. Some Success stories of wildlife conservation India – Project Tiger, Conservation of Asiatic Lion, Cheetah Reintroduction. 7. Visit to Zoo and Field studies (Report submission)				60 hrs			
REFERENCES									
1.		Ranjitsinh, M.K. (2017). A life with wildlife: From Princely India to the Present. Harper Collins							
2.		http://www.wiienviis.nic.in/SiteMap.aspx							
3.		B.K. Tikadar. Threatened Animals of India, ZSI Publication, Kolkatta.							
4.		Faunal Diversity in India (2 Volumes); Ranbir Chander Sobti (Editor), Kamal Kumar Jaiswal (Editor), Suman Mishra (Editor); 2015							
5.		Faunal Diversity in India, A Commemorative Volume in the 50th Year of India’s Independence, Edited by J.R.B. Alfred, A.K. Das, A.K. Sanyal, ENVIS Centre, ZSI, Calcutta, 1998.							

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Bachelor of Science: Regular Major					
Year	I	ZLM2002C: Non-Chordates-II		Credit	4
Semester	II			Hours	75
OBJECTIVES		The course aims to: 1) develop an understanding of the taxonomy of non-chordates from Mollusca to Echinodermata and Hemichordata, 2) study the body organization of each phylum, 3) examine the general biology of selected species from each phylum, 4) equip students to identify specimens of non-chordates, 5) expose students to the structural peculiarities of respective members of non-chordata, and 6) study the adaptive peculiarities of selected species from each phylum and their respective members.			
COURSE CONTENT/SYLLABUS					
UNIT-I		1. General characters: Mollusca 2. Detailed study: <i>Pila</i> 3. Detailed study: <i>Unio</i> 4. Detailed Study: <i>Sepia</i> 5. Torsion and Detorsion in Mollusca			15 hrs
UNIT-II		1. General characters: Arthropoda 2. Detailed study: <i>Palaeomon</i> 3. Parasitic crustaceans 4. Larval forms of Arthropods 5. Social organization in honey bee and termites			15 hrs
UNIT-III		1. General characters: Echinodermata 2. Detailed study: <i>Asterias</i> 3. General characters: <i>Hemichordata</i> 4. Detailed study: <i>Balanoglossus</i> 5. Affinities of <i>Balanoglossus</i> to other animal phyla			15 hrs
UNIT-IV Practical		1. Arthropoda: General characters (up to order level), Study of prepared slides and specimens; temporary mountings of mouth parts of housefly and mosquito (both sexes). <i>Palaeomon</i> - Digestive system, Central nervous system and temporary mountings of appendages and body parts. 2. Mollusca: General characters and classification up to order level, Study of prepared slides and specimens 3. Echinodermata: General characters and classification up to order level, Study of prepared slides and specimens			30 hrs
REFERENCES					
1.		A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.			
2.		Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
3.		Biology of the Invertebrates, J. A. Pechenik, Tata-McGraw Hill Company, Ltd, New Delhi.			
4.		Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
5.		Invertebrate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi			

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Bachelor of Science: Regular Major					
Year	I	ZLM2012C: Chordates-II		Credit	4
Semester	II			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to understand the taxonomy of chordates from Reptilia to Mammalia, 2) to study the body organization of each phylum/class, 3) to examine the general biology of selected species from each phylum/class, 4) to equip students to identify specimens of non-chordates and chordates, 5) to expose students to the structural peculiarities of respective members of non-chordata and chordata, and 6) to study the adaptive peculiarities of selected species from each phylum and their respective members.			
COURSE CONTENT/SYLLABUS					
UNIT-I		1. General characters: Amniotes 2. General characters: Reptilia 3. Detailed study: <i>Calotes versicolor</i> 4. Venomous/non-venomous snakes and types of venom 5. Types of Skulls in reptiles			15 hrs
UNIT-II		1. General characters: Aves 2. Detailed Study: <i>Columba livia</i> 3. General characters: Flightless Birds and their distribution 4. Flight adaptations in birds 5. Migration of birds			15 hrs
UNIT-III		1. General characters: Mammalia 2. Detailed Study: <i>Oryctolagus</i> (Rabbit) 3. General account of Aquatic mammals 4. Placenta in mammals 5. Integumentary derivatives of mammals			15 hrs
UNIT-IV Practical		1. Reptilia: General characters and classification up to order level: Study of prepared slides and specimens, Study of carapace and plastron, skulls. 2. Aves: General characters and classification up to order level: Study of prepared slides and specimens; beak and feet adaptations, types of feathers. 3. Mammalia: General characters and classification up to order level: Study of prepared slides and specimens, types of animal hair, Canid and felid pugmark study. 4. Visit to Zoo and Field studies (Report writing and submission).			30 hrs
REFERENCES					
1.		A Manual of Zoology Vol. II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.			
2.		Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
3.		Chordate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi			
4.		Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
5.		Life of Vertebrates, J. Z. Young, Oxford University Press, UK			

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Zoology Sayajigunj, Vadodara 390002, 2795329, Ext: 357 head-zoo@msubaroda.ac.in			ACADEMIC YEAR 2023-24
Bachelor of Science: Regular Minor				
Year	I	ZLE2002C: Non-Chordates and Chordates-II	Credit	4
Semester	II		Hours	60
OBJECTIVES	The course aims to: 1) develop an understanding of the taxonomy of non-chordates from Mollusca to Echinodermata and Hemichordata, 2) study the body organization of each phylum, 3) examine the general biology of selected species from each phylum, 4) understand the taxonomy of chordates from Reptilia to Mammalia, 5) study the body organization of each phylum/class, and 6) examine the general biology of selected species from each class.			
COURSE CONTENT/SYLLABUS				
UNIT-I	1. Mollusca: General features and life history 2. Detailed study: <i>Unio</i> 3. Torsion and Detorsion in Mollusca – Mechanism and Significance 4. Arthropoda: General features and life history 5. Detailed study: <i>Palaeomon</i>			15 hrs
UNIT-II	1. Echinodermata: General features and life history 2. Detailed study: <i>Asterias</i> 3. Water vascular system 4. Hemichordata: General features and life history 5. Detailed study: <i>Balanoglossus</i>			15 hrs
UNIT-III	1. Origin of amniotes 2. Reptilia: General characters 3. Detailed study: <i>Calotes versicolor</i> 4. Aves: General characters 5. Detailed Study: <i>Columba livia</i>			15 hrs
UNIT-IV	1. Flight adaptations in birds 2. Mammalia: General characters 3. Detailed Study: <i>Oryctolagus</i> (Rabbit) 4. General account on Aquatic mammals 5. Placenta in mammals			15 hrs
REFERENCES				
1.	A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.			
2.	Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
3.	Biology of the Invertebrates, J. A. Pechenik, Tata-McGraw Hill Company, Ltd, New Delhi.			
4.	Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
5.	Invertebrate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi			

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Bachelor of Science: Regular Multidisciplinary Course (MDC)				
Year	I	MDC2272C: Diversity of Animals-II	Credit	4
Semester	II		Hours	60
OBJECTIVES				
The course aims to: 1) develop an understanding of the taxonomy of non-chordates from Mollusca to Echinodermata and Hemichordata, 2) study the body organization of each phylum, 3) examine the overall diversity and general biology of selected species from each phylum, 4) understand the taxonomy of chordates from Reptilia to Mammalia, 5) study the body organization of each phylum/class, and 6) examine the overall diversity of chordates and the general biology of selected species from each class.				
COURSE CONTENT/SYLLABUS				
UNIT-I	1. Mollusca: General features and life history 2. Detailed study: <i>Unio</i> 3. Torsion and Detorsion in Mollusca – Mechanism and Significance 4. Arthropoda: General features and life history 5. Detailed study: <i>Palaeomon</i>			15 hrs
UNIT-II	1. Echinodermata: General features and life history 2. Detailed study: <i>Asterias</i> 3. Water vascular system 4. Hemichordata: General features and life history 5. Detailed study: <i>Balanoglossus</i>			15 hrs
UNIT-III	1. Origin of amniotes 2. Reptilia: General characters 3. Detailed study: <i>Calotes versicolor</i> 4. Aves: General characters 5. Detailed Study: <i>Columba livia</i>			15 hrs
UNIT-IV	1. Flight adaptations in birds 2. Mammalia: General characters 3. Detailed Study: <i>Oryctolagus</i> (Rabbit) 4. General account on Aquatic mammals 5. Placenta in mammals			15 hrs
REFERENCES				
1.	A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.			
2.	Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
3.	Biology of the Invertebrates, J. A. Pechenik, Tata-McGraw Hill Company, Ltd, New Delhi.			
4.	Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
5.	Invertebrate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi			

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Bachelor of Science: Regular Skill Enhancement Course (SEC)						
Year	I	SEC2222C: Biodiversity of Animals-II		Credit	2	
Semester	II			Hours	60	
OBJECTIVES		The main objectives of the course are: 1) to equip students to identify, classify, and name specimens of non-chordates and chordates, 2) to expose students to the structural peculiarities of respective members of non-chordata and chordata, and 3) to study the adaptive peculiarities of selected species from each phylum and their respective members.				
COURSE CONTENT/SYLLABUS						
Practical		1. Arthropoda: General characters and classification up to order level: Study of prepared slides and specimens; Glycerin preparation of mouth parts of housefly and mosquito (both sexes); Permanent preparation of statocysts; <i>Palaemon</i> : Appendages, Hastate plate, Dissection of Digestive system, Central nervous system 2. Mollusca: General characters and classification up to order level: Study of prepared slides and specimens 3. Echinodermata: General characters and classification up to order level: Study of prepared slides and specimens 4. Hemichordata: General characters and classification up to order level: Study of prepared slides and specimens 5. Reptilia: General characters and classification up to order level: Study of prepared slides and specimens Study of carapace and plastron, skulls, poisonous and non-poisonous snakes 6. Aves: General characters and classification up to order level: Study of prepared slides and specimens; Beak modifications, Study of feathers 7. Mammalia: General characters and classification up to order level: Study of prepared slides and specimens, Comparative study of different animal hairs, Canid and felid paw pattern. 8. Visit to Zoo and Field studies (Report submission)			60 hrs	
REFERENCES						
1.		A Manual of Zoology Vol. I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.				
2.		Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.				
3.		Chordate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi				
4.		Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.				
5.		G.G. Simpson. Principle of animal taxonomy, Oxford IBH Publishing Company.				

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Bachelor of Science: Regular Value Added Course (VAC)					
Year	I	VAC2112C: Biodiversity Inventory and Assessment		Credit	2
Semester	II			Hours	60
OBJECTIVES		The main objectives of the course are: 1) to understand the basics of the science of macrofaunal diversity in an ecological context, 2) to learn tools and techniques relevant to the monitoring of biological diversity, and 3) to study biodiversity using museum specimens.			
COURSE CONTENT/SYLLABUS					
Practical		1. Biodiversity assessment and sampling methods and analysis. 2. Study of biodiversity of Mollusca and Arthropoda through Museum specimens. 3. Study of biodiversity of Echinodermata and Hemichordata through Museum specimens 4. Study of diversity of Aves and Mammalia through Museum specimens, charts and photographs. 5. Habitat and faunal studies: Lentic and Lotic ecosystems 6. Habitat and faunal studies: Anthropogenic ecosystems 7. Study of larval forms through prepared slides, charts and other sources. 8. Study of planktons through prepared slides, charts and other sources.			60 hrs
REFERENCES					
1.		A Manual of Zoology Vol.I & II, Ekambarnath Ayyar and Ananthakrishnan, Viswanathan Pvt. Ltd. Madras.			
2.		Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
3.		Chordate Zoology Jordan, E. L. and Verma, P.S, S. Chand & Co. New Delhi			
4.		Integrated principals of Zoology, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
5.		Life of Vertebrates. J. Z. Young, Oxford University Press, UK			

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Bachelor of Science: Regular Major					
Year	II	ZLM2003C: Comparative Account of Non-Chordates		Credit	4
Semester	III			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to appreciate the structural and functional correlation between different animal groups, 2) to understand the anatomical organization of animals, and 3) to comprehend taxonomy-based anatomical and physiological comparisons of systems.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		1. Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia 2. Integumentary System: Development, General structure and function of integument; Derivatives of integument 3. Locomotion: Amoeboid movement and mechanism, Flagella & ciliary movement in Protozoa and molecular mechanism; Hydrostatic movement in Coelenterata, Annelida and Echinodermata, Appendages of Arthropods			15 hrs
UNIT-II		1. Nutrition in Invertebrate: Types of Nutrition, Digestive Mechanism in Protozoa, Filter feeding in Porifera, Annelida, Mollusca and Echinoderm 2. Digestive System: Brief account of alimentary canal and digestive glands in invertebrates 3. Excretion: Organs of excretion: Contractile Vacuoles in Protozoa, Protonephridia, Nephridia, Malpighian tubules, Green gland and Axial gland; Mechanisms of excretion; Excretion and osmoregulation.			15 hrs
UNIT-III		1. Respiration and Respiratory organs: Gaseous exchange in protozoa, Types of Gills and Respiratory mechanisms in Mollusca, Ctenidial respiration in Mollusca, Types of Gills and Respiratory mechanisms in Arthropoda, Aerial Respiration in Arthropoda (Lung, Book lung and tracheal system), Respiratory Pigments in Invertebrates 2. Nervous system: Primitive nervous system: Coelenterata, Platyhelminthes and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and insecta) and Mollusca (Cephalopoda); Trends in neural evolution 3. Sense Organs: Types of receptors- Mechanoreceptors; Photoreceptors; Phonoreceptors			15 hrs
UNIT-IV Practical		1. Understanding of coelom formation using models (1 day) 2. Demonstration of anatomical organization of animal based on Models, charts, Slides and Computer Aided Techniques (3 days) 3. To learn paramecium culture for observation of ciliary movement (1 day) 4. Dissection of Prawn for understanding anatomical organization of nervous system and digestive system (2 days) 5. Temporary slide preparation of Earthworm setae (1 day) 6. Temporary slide preparation of Gills and appendages of prawn (1 day) 7. Submission of three whole mount slides (1 day)			30 hrs
REFERENCES					
1.	Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. The Invertebrates: A Synthesis. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.				
2.	Dechenik, J. A. Biology of Invertebrates, McGraw Hill Education (India) Private Limited.				
3.	Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.				
4.	Kotpal, 2019. R.L. Modern Textbook of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut				
5.	C. P. Hickman, L. S. Roberts, and A. Integrated Principals of Zoology. Larson, McGraw Hill Company, New York.				
6.	J. A. Pechenik. Biology of the Invertebrates, Tata-McGraw Hill Company, Ltd, New Delhi.				
7.	Barrington, E. J.W. Invertebrate Form & Function East-West Press Pvt. Ltd.-New Delhi				

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Bachelor of Science: Regular Major					
Year	II	ZLM2013C: Animal Adaptation and Animal Behaviour		Credit	4
Semester	III			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to impart basic knowledge of animal adaptations, focusing on habitat-specific structural and functional changes for efficient survival, and 2) to introduce students to various types of animal behaviour and its ecological and evolutionary significance.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		Animal Adaptation 1. Structural & Functional Adaptations: Aquatic, pelagic, deep sea, desert, aerial, cursorial, fossorial parasitic 2. Physiological adaptation: Dormancy, camouflage, hibernation and migration 3. Mimicry: Batesian Mimicry, Aggressive Mimicry, Mullerian Mimicry			15 hrs
UNIT-II		Animal Behaviour-I 1. History and understanding of terminology of ethology 2. Innate behaviour-Taxes, reflexes, instincts (Fixed action pattern), motivation 3. Learned behaviour- Habituation, Imprinting, classical & operant conditioning, and cognitive learning 4. Communication: Visual, Chemical and Auditory			15 hrs
UNIT-III		Animal Behaviour-II 1. Reproductive Behaviour in Animal: Courtship and Mating 2. Parental Behaviour 3. Social behaviour Schooling in fishes, flocking in birds, Herding in mammals, Group selection and Kin selection 4. Social organization in Insects and Primates			15 hrs
UNIT-IV Practical		1. Study of mimicry in insects: stick insect, leaf insect, moth, cicada, sea horse, flat fish (02 day) 2. Parasitic adaptations in internal parasites with special reference to protozoa and helminths (01 day) 3. Understating of birds, bats and Insect flight adaptation (02 day) 4. Preparation of behaviour ethogram of fishes (01 day) 5. Observation of captive behaviour (Sayajibag Zoo Visit) (01 day) 6. Understating of habituation using mosquito larva (01 day) 7. Demonstration of cockroach antennal grooming behaviour (01 day) 8. Study of chemotaxis in <i>Paramoecium</i> (01 day)			30 hrs
REFERENCES					
1	Drickamen and Vessey. Animal behaviour-Concepts, processes and methods, Wadsworth Publishers				
2	P.J.B. Slater (1999). Essentials of Animal behaviour, Cambridge University Press				
3	Arora M.P. Animal behaviour, Himalaya Publishing House, New Delhi				
4	Nelson K. S. Animal Physiology: Adaptation and Environmental, Cambridge University Press, Cambridge, UK				
5	Price and Stoker. Animal behaviour in Laboratory and field. Freeman Publishers				

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Bachelor of Science: Regular Major					
Year	II	ZLM2023C: Genetics I and Evolutionary Biology I		Credit	4
Semester	III			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to understand the historical overview and laws of inheritance of life, 2) to update students on the concepts of linkage and crossing over, 3) to familiarize students with different aspects of evolution, and 4) to develop quantitative problem-solving skills related to genetic problems and issues.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		Mendelian Genetics 1. Mendel’s work on transmission of traits: 2. Law of Segregation: Monohybrid cross, back cross and Test cross 3. Law of Independent Assortment: Dihybrid cross, Back cross and Test cross 4. Principles of inheritance, Chromosome theory of inheritance 5. Multiple Alleles: Definition, ABO blood groups and Rh factor in Human 6. Deviations from Mendelism: Incomplete inheritance and co-dominance, Epistasis, Non-Epistasis (with an example for each trait) Lethal alleles, Pleiotropy			15 hrs
UNIT-II		Classical Genetics 1. Linkage: cis and trans arrangement of genes, Linkage group, Types of linkage – complete and incomplete linkage maps. Linkage map – E.g. Drosophila, construction of linkage maps. 2. Crossing over: Types, mechanism of crossing over, interference and coincidence, Factors affecting linkage and crossing over, significance of linkage and crossing over. 3. Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy 4. Sex Determination and sex-linked inheritance			15 hrs
UNIT-III		Evolutionary Biology 1. Origin of life on earth – Physical Evolution and Chemical Evolution 2. Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism 3. Organic variations; Isolating Mechanisms; Natural Selection-Types of natural selection 4. Concept of micro evolution, macro evolution, mega evolution 5. Genetic basis of evolution – Population genetics: Gene pool, gene frequencies and Hardy- Weinberg equilibrium			15 hrs
UNIT-IV Practical		1. Genetic Problems on Monohybrid cross (01 days) 2. Genetic Problems on Dihybrid cross (02 days) 3. Genetic Problems Non-Mendelian Interactions (01 day) 4. Problems on Linkage and crossing over (02 day) 5. Problems based on construction of genetic map (01 day) 6. Buccal smear preparation for sex chromatin (01 day) 7. Study of fossil (01 day) 8. To learn Hardy-Weinberg equilibrium with appropriate problems to predict allele frequencies in a population (01 day)			30 hrs
REFERENCES					
1 Snustad, D. P., & Simmons, M. J. (2015). Principles of genetics. John Wiley & Sons.					
2 Strickberger, M.W. 2005. Genetics. Prentice-Hall of India, New Delhi.					
3 Robert.H.Tamarin, Principles of Genetics Tata McGraw-Hill pub					
4 Gardener, E.J. Principles of Genetics. John Wiley & Sons Inc., New York.					
5 Ridiey, M. (2004) Evolution. III Edition. Blackwell Publishing					
6 Barton.N.H. Briggs, D.E.G., Eisen, J.A., Goldstein, D.B.and N.H. (2007). Evolution. Cold Spring, Harbour					
7 V. B. Rastogi, Organic Evolution. Medtech Scientific International, Kedarnath Ramnath. Meerut					

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Bachelor of Science: Regular Multidisciplinary Course-(MDC)					
Year	II	MDC2593C: Zoogeography, Biodiversity and Conservation Biology	Credit	4	
Semester	III		Hours	75	
OBJECTIVES		The main objectives of the course are: 1) to understand the concepts of habitat- and species-level conservation of wild animals, 2) to study major zoogeographical landscapes and patterns of animal distribution, and 3) to develop students' writing and comprehension skills through laboratory and field sessions.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		1. Major Zoogeographical realms of the world and their fauna 2. Principals and patterns of animal distribution 3. Role of barriers in animal distribution		15 hrs	
UNIT-II		1. Characterization of biodiversity – Compositional, structural, and functional attributes 2. Economic and ecological importance of biodiversity 3. Threats to biodiversity and remedial measures		15 hrs	
UNIT-III		1. Habitat and species level wildlife conservation: Case studies 2. Conservation laws and bylaws in India 3. Biotechnological approaches in wildlife conservation		15 hrs	
UNIT-IV Practical		1. Mapping study of various Zoogeographical realms and animal distribution 2. Protected areas in India and animal distribution (mapping and distribution study) 3. IUCN status of some indigenous species 4. Field sampling techniques 5. Bird/Animal census techniques and field study 6. Visit to zoological parks/ex-situ conservation sites 7. Visit to protected areas/in situ conservation sites 8. Studying key species of wild animals and their conservation status		30 hrs	
REFERENCES					
1	P.S. Verma and V.K. Agarwal (2007). Cell Biology, genetics, molecular biology, evolution and ecology; S Chand and Co., New Delhi				
2	R.L. Kotpal (2022). Modern textbook of Zoology (animal diversity – II). Rastogi Publications, Meerut.				
3	M.F. Tritsch. Wildlife of India; Harper Collins Publishers, London				
4	S. Israel & T. Sinclair (Eds.), Indian Wildlife. APA Publications, Singapore				
5	C.P. Hickmann, L.S. Roberts and A. Larson. Integrated Principals of Zoology, McGraw Hill Company, New York.				
6	Ian Deshmukh. Ecology and Tropical Biology; Blackwell Scientific Publication.				
7	Lloyd J.R. Man and Ecosystem; Macmillan Education Ltd.				

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Bachelor of Science: Regular Skill Enhancement Course – (SEC)						
Year	II	SEC2483C: Environmental and Animal Welfare Auditing		Credit	2	
Semester	III			Hours	60	
OBJECTIVES		The main objectives of the course are: 1) to understand the concept and importance of environmental auditing, 2) to generate data and draw conclusions in the interest of sustainable development, and to apply this knowledge in real-life situations, and 3) to prepare strategies for the welfare of captive animals.				
COURSE CONTENT/ SYLLABUS						
Practical		1. Electricity consumption auditing – Identifying a workplace/house, tabulation of total energy consumption, awareness (questionnaire survey) about electrical hazards and their mitigation. 2. Water consumption auditing - Identifying a house/industry/office, tabulation of total water consumption, leak detection/water loss survey, awareness (questionnaire survey) about water conservation/water loss. 3. Domestic Solar energy use auditing - Identifying a locality/industry/office, inspection of solar panels and other components, tabulating total electricity generated and its cost effectiveness, regulatory compliances and performance optimization (questionnaire survey) 4. Auditing of Zoo animals –Space utilization, hygiene, sex ratio, enclosure characteristics, food consumption, etc 5. Auditing of Zoo animals – Anthropogenic disturbance quantification (footfall), public awareness towards animal welfare (questionnaire survey) <i>(All practicals may involve Data collection/working with existing data)</i>			60 hrs	
REFERENCES						
1		Sasibhushan Rao P and Mohan Rao P. Environment management and Audit, Regal Publications				
2		Simon W. Pain. Safety health and environmental auditing: A practical Guide, Routledge publ. Taylor and Francis group.				
3		A.K. Shrivastava. Environmental Auditing, Ashish Publication House.				
4		David D Nelson. International Environmental Auditing, JSTOR				
5		Sunil Mittal. E-Book: Environmental Auditing, Simple Book Publishing				
6		Temple Grandin (Eds). Improving animal welfare: A practical approach, CABI digital library				

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Bachelor of Science: Regular (Indian Knowledge System- IKS)					
Year	II	IKS2393C: Animal Wealth in the Indian Economy	Credit	2	
Semester	III		Hours	30	
OBJECTIVES		The main objectives of the course are: 1) to understand the basics of traditional Indian animal-keeping techniques, 2) to study species of economically viable animals, and 3) to explore Bhartiya traditions of profitable animal husbandry.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		1. Traditional and modern methods Aquaculture 2. Traditional and modern methods in apiculture 3. Traditional and modern methods in poultry			15 hrs
UNIT-II		1. Species of Indian Cow and Buffalo used traditionally in dairy industry 2. Species of sheep and goat used reared traditionally in India 3. Traditional and modern methods in sericulture, lac culture, apiculture			15 hrs
REFERENCES					
1	P.S. Verma and V.K. Agarwal (2007). Cell Biology, genetics, molecular biology, evolution and ecology; S Chand and Co., New Delhi				
2	R.L. Kotpal (2022). Modern textbook of Zoology (animal diversity – II). Rastogi Publications, Meerut.				
3	M.F. Tritsch. Wildlife of India; Harper Collins Publishers, London				

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Bachelor of Science: Regular Major					
Year	II	ZLM2004C: Comparative Account of Chordates I	Credit	4	
Semester	IV		Hours	75	
OBJECTIVES		The main objectives of the course are: 1) to develop a holistic understanding of the structural and functional units of chordates, 2) to study the similarities and adaptive differences in organ systems, and 3) to examine the unique features of organ systems in each phylum/class.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		1. Fundamentals of biological design of vertebrates- Relationships Among size, surface area, mass and rate of metabolism. 2. Variations in Vertebrate integument and its derivatives. 3. Development, general structure and functions of skin and its derivatives. 4. Glands, scales, horns, claws, nail, hoofs, feathers and hairs.	15 hrs		
UNIT-II		1. Osmoregulation, Osmoconformers and Osmoregulators, comparison of mechanisms adopted with respect to different habitats. 2. Comparison of development of kidney- archinephros, pronephros, mesonephros and metanephros. 3. Removing the Products of Nitrogen Metabolism- ammonotelism, uricotelism, ureotelism, adaptations to balancing competing habitat demands 4. Thermoregulation- ectothermy, endothermy, animal adaptation to extreme temperatures	15 hrs		
UNIT-III		1. Respiratory Organs; ventilatory mechanism in water and air. 2. Patterns of gas transfer – counter-current and cross-current mechanisms, Acid base regulation. 3. Components of cardiovascular System; hemodynamics of circulation, physiological adjustments in diving birds and mammals 4. Comparative account of aortic arches and vertebrate hearts.	15 hrs		
UNIT-IV Practical		1. Measuring osmosis and tonicity of RBC 2. Effect of water temperature on opercular movement of fish. 3. Comparative study of vertebrate heart models. 4. Comparative study of aortic arches 5. Analysis of rate of respiration by simple respirometer in different vertebrate classes. 6. Measurement of cardiac rate in different vertebrate classes. 7. Effect of adrenalin on cardiac rate.	30 hrs		
REFERENCES					
1	Principles of Animal Physiology, Moyces C and Schulte P, Pearson International Edition, USA.				
2	Comparative Animal Physiology. C. Ladd Prosser. John Wiley & Sons Inc				
3	Vertebrates: Comparative Anatomy, Function, Evolution, Kenneth Kardong, McGraw Hill Company, New York				
4	Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.				
5	Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.				
6	Kotpal, 2019. R.L. Modern Textbook of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut				
7	C. P. Hickman, L. S. Roberts, and A. Integrated Principals of Zoology. Larson, McGraw Hill Company, New York.				

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Bachelor of Science: Regular Major					
Year	II	ZLM2014C: Comparative Account of Chordates II		Credit	4
Semester	IV			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to develop a holistic understanding of the structural and functional units of chordates, 2) to study the similarities and adaptive differences in organ systems, and 3) to examine the uniqueness of organ systems in each phylum/class.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		1. Modes of nutrition and mechanisms of feeding 2. Variations in Alimentary Canal and regional digestive functions. 3. Associated glands of digestive system 4. Adaptations of vertebrate digestive system- dental, mutualistic; Feedback circuits of energy storage and appetite			15 hrs
UNIT-II		1. Axial Skeletal System- Variations in vertebrate skull and vertebral column 2. Appendicular Skeletal System – Girdles and Appendages 3. Locomotion and skeletal adaptation for speed, speed versus power 4. Digging and burrowing habits, limbless locomotion, aerial locomotion, aquatic locomotion			15 hrs
UNIT-III		1. Organization of nervous system- central and peripheral, structure and function of neurons and supporting cells 2. Comparative account of vertebrate brain 3. Lateral line system and Electroreception 4. Sense organs: Simple receptors, Organs of olfaction and taste			15 hrs
UNIT-IV Practical		1. Microscopic examination of neuron anatomy 2. Measurement of basic reflex physiology- motor reflex, pupil reflex. 3. Comparative study of vertebrate brain models 4. Comparative study of vertebrate skulls. 5. Comparative study of vertebral column 6. Comparative study of vertebrate skeletal appendages. 7. Anatomical and function significance of gait and speed in Vertebrates.			30 hrs
REFERENCES					
1.		Principles of Animal Physiology, Moyces C and Schulte P, Pearson International Edition, USA.			
2.		Comparative Animal Physiology. C. Ladd Prosser. John Wiley & Sons Inc			
3.		Vertebrates: Comparative Anatomy, Function, Evolution, Kenneth Kardong, McGraw Hill Company, New York			
4.		Biology of Animals, C. P. Hickman, L. S. Roberts, and A. Larson, McGraw Hill Company, New York.			
5.		Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.			
6.		Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut			
7.		C. P. Hickman, L. S. Roberts, and A. Integrated Principals of Zoology. Larson, McGraw Hill Company, New York.			

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Bachelor of Science: Regular Major					
Year	II	ZLM2024C: Disease Biology and Parasitology		Credit	4
Semester	IV			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to learn about insects, vectors, and related diseases, 2) to study the basic concepts of nutrition, cell biology, and endocrine diseases, and 3) to understand the fundamental concepts of infectious and non-infectious diseases.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		1. Vector borne diseases 2. Nutrition and diseases 3. Endocrine gland and diseases 4. Cell organelles and diseases			15 hrs
UNIT-II		1. Metabolic diseases 2. Lifestyle related diseases 3. Genetic basis of diseases 4. Infectious diseases			15 hrs
UNIT-III		1. Protozoan Parasites: Life history and pathogenesis 2. Helminth Parasites: Life history and pathogenesis 3. Arthropod Parasites: Life history and pathogenesis			15 hrs
UNIT-IV Practical		1. Study of histopathology through permanent slides 2. Identification of Protozoan Parasites through slides 3. Identification of Helminth Parasites through slides and specimen 4. Identification of Arthropod Parasites through slides and specimen 5. Measurement of BMI. 6. Measurement of Glucose in blood samples 7. Measurement of TSH in blood samples			30 hrs
REFERENCES					
1	Nessar Ahmed, Maureen Dawson, Chris Smith, Ed Wood. 2006. Biology of Disease; Taylor & Francis; 1st edition				
2	Subhash Chandra Parija, Textbook of Medical Parasitology: Protozoology & Helminthology				
3	Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK				
4	Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication				
5	Jeremy Farrar, Peter J Hotez, Thomas Junghanss, Gagandeep Kang, David Laloo, Nicholas J. White, Patricia J. Garcia: Manson's Tropical Diseases.				

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Bachelor of Science: Regular					
Minor					
Year	II	ZLE2004C: Disease Biology		Credit	4
Semester	IV			Hours	75
OBJECTIVES		The main objectives of the course are: 1) to learn about insects, vectors, and associated diseases, 2) to study the basic concepts of nutrition, cell biology, and endocrine disease biology, and 3) to understand the fundamental concepts of non-infectious and infectious diseases.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		1. Vector borne diseases - General Features of Insects, Mouthparts and feeding habits 2. Brief introduction of Carrier and Vectors (mechanical and biological vectors) 3. Reservoirs, Host-vector relationship, Vector adaptations features			15 hrs
UNIT-II		1. Cell organelles and diseases 2. Endocrine gland and diseases 3. Genetic basis of diseases			15 hrs
UNIT-III		1. Nutrition and diseases 2. Metabolic diseases 3. Lifestyle related diseases 4. Infectious diseases			15 hrs
UNIT-IV Practical		1. Study of histopathology through permanent slides 2. Identification of protozoan parasites through slides 3. Identification of Helminth parasites through slides and specimen 4. Identification of Arthropoda parasites through slides and specimen 5. Measurement of BMI 6. Measurement of Glucose in blood samples			30 hrs
REFERENCES					
1.		Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK			
2.		Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication			
3.		Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell			
4.		Nessar Ahmed, Maureen Dawson, Chris Smith, Ed Wood. 2006. Biology of Disease; Taylor & Francis; 1st edition			
5.		Saunders, D.S. Insect Clocks. New York, USA: Barends and Noble Inc. 2002			

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Bachelor of Science: Regular Skill Enhancement Course (SEC)					
Year	II	SEC2474C: Medical Diagnostics		Credit	2
Semester	IV			Hours	60
OBJECTIVES		The main objectives of the course are: 1) to understand the fundamental characteristics of medical diagnostics, 2) to develop an in-depth understanding of diagnostic techniques and their applications, and 3) to identify and specify key aspects of non-infectious diseases.			
COURSE CONTENT/ SYLLABUS					
Practical		1. Introduction to Medical Diagnostics and its Importance 2. Diagnostics Methods Used for Analysis of Blood: Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.) 3. Non-infectious Diseases: Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit 4. Infectious Diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis 5. Diagnostic Methods Used for Urine Analysis: Urine Analysis: Physical characteristics; Abnormal constituents 6. Tumours Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).			60 hrs
REFERENCES					
1.		Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders			
2.		Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House.			
3.		Park, K. (2007), and Social Medicine, B.B. Publishers.			
4.		Chesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses.			
5.		Asis. Das. (2012). Medical Physiology, Books & Allied Pvt. Ltd			

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Bachelor of Science: Regular Value Added Course (VAC)					
Year	II	VAC2434C: Indian Health, Wellness and Psychology		Credit	2
Semester	IV			Hours	30
OBJECTIVES		The main objectives of the course are: 1) to help students trace, identify, and develop ancient knowledge systems, 2) to understand the rational, verifiable, and universal solutions offered by the ancient Indian knowledge system for the holistic development of physical, mental, and spiritual well-being, and 3) to instill in learners a deep-rooted pride in Indian knowledge, with a commitment to well-being and sustainable societal development.			
COURSE CONTENT/ SYLLABUS					
UNIT-I		Understanding human body 1. Introduction to Ayurveda, the Knowledge of Life 2. Basics of health and treatment aspects in Ayurveda 3. Understanding the Mind – Body Constitution.			15 hrs
UNIT-II		Understanding the communication between body & mind and psychology 1. Establishing communication between body and mind by understanding the language of body. 2. Understanding the concept of Agni (fire), Koshta, Sara and Ojas (vigour) and their relevance in enhancing our immunity to protect from various infections 3. Looking at the world through the lenses of Dravya (substance), Guna (qualities) and Karma (actions) 4. Mind body intellect and consciousness complex, Understanding Consciousness and solution to issues within Human Mind.			15 hrs
REFERENCES					
1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.					
2. SK Das, The education system of Ancient Hindus, Gyan publication house, India					
3. Swami BB Vishnu, Vedic Science and History - Ancient Indian's Contribution to the Modern World, Gosai publication, 2015					
4. Hamilton-West, K. (2011). Psychobiological processes in health and illness. London: Sage Publication.					
5. Manickam, L. S. S. (2008). Research on Indian concepts of psychology: Major challenges and perspectives for future action. In Rao, K.R., Paranjpe, A.C., & Dalal, A.K. (Eds.) Handbook of Indian Psychology. New Delhi: Foundation Books					
6. Rao, K.R.,& Paranjpe, A.C. (2015). Psychology in the Indian tradition. Springer publication.					

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Bachelor of Science: Regular (NEP) MAJOR					
Year	III	ZLM3005C: Physiological Chemistry and Mammalian Physiology-I		Credit	4
Semester	V			Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to help students understand the properties, structure, and function of biomolecules; 2) to study the regulation of various metabolic processes; 3) to enable students to demonstrate a working knowledge of basic chemical concepts and methods used in biological samples to describe fundamental physiological processes; 4) to enhance students' knowledge and appreciation of mammalian physiology; 5) to develop an understanding of the basic concepts of each physiological system and its coordination; and 6) to understand how different physiological systems interact to produce integrated physiological responses.			
COURSE CONTENT / SYLLABUS					
UNIT I		Physiological Chemistry-1			15 hrs
		1. Cellular, chemical, physical, genetic, and evolutionary foundations 2. Structure and catalysis – water, amino acids, peptides, and proteins 3. Enzymes, carbohydrates, nucleotides and nucleic acids, and lipids 4. Bioenergetics, metabolism, and its regulation			
UNIT II		Physiological Chemistry-2			15 hrs
		1. Glycolysis, gluconeogenesis, the pentose phosphate pathway, and the citric acid cycle 2. Fatty acid catabolism, amino acid oxidation and urea production, and oxidative phosphorylation 3. Hormonal regulation and the integration of mammalian metabolism 4. DNA metabolism, RNA metabolism, and protein metabolism			
UNIT III		Mammalian Physiology			15 hrs
		1. Physiology of Digestion: Anatomical features and cell types of the gastrointestinal tract (GIT), gastric emptying, digestive enzymes, endocrine control of digestion, and dietary composition affecting digestion. 2. Physiology of Respiration: Anatomical features and cell types, external and internal respiration, physiology of gaseous exchange, factors affecting respiration, and hypoxia. 3. Muscular System: Types of muscle tissues, structure of skeletal muscles, physiology of muscle contraction, and its regulation.			
UNIT IV		Practical			30 hrs
		1. Qualitative and quantitative (spectrophotometric) analysis of carbohydrates, proteins, lipids, and nucleic acids. 2. Determination of pK values of amino acids: preparation of buffers and determination of pH. 3. Enzyme assays: salivary amylase and lactate dehydrogenase. 4. Determination of kinetic properties of salivary amylase and alkaline phosphatase. 5. Study of digestive glands using slides and charts. 6. Study of the gastrointestinal tract and its physiological functions using slides and charts. 7. Blood oxygen study using a pulse oximeter. 8. Measurement of vital lung capacity using a peak flow meter. 9. Effect of mild exercise on respiratory rate and pulse rate, performed on volunteers. 10. Estimation of blood urea nitrogen (BUN). 11. Estimation of blood creatinine.			
REFERENCES					
1. An Introduction to Practical Biochemistry by David T. Plummer, McGraw Hill Education (India).					
2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry by I. H. Segel, John Wiley & Sons.					
3. Biochemistry by Lubert Stryer, W.H. Freeman & Co.					
4. Biochemistry by Donald Voet and Judith G. Voet, John Wiley & Sons Inc.					
5. Lehninger Principles of Biochemistry by David L. Nelson and Michael M. Cox, Worth Publishers Inc.					
6. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker.					
7. Principles of Anatomy and Physiology by Gerard J. Tortora and Sandra R. Grabowski, John Wiley & Sons.					
8. Principles of Animal Physiology by Christopher D. Moyes and Patricia M. Schulte, Benjamin Cummings, New York.					
9. Textbook of Medical Physiology by Guyton & Hall, 11th Edition, Harcourt Asia PTE Ltd.					

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Bachelor of Science (NEP) MAJOR					
YEAR	III	ZLM3015C: Molecular Biology and Molecular Genetics – I		Credit	4
Semester	V			Hours	75
OBJECTIVES:	The main objectives of the course are: 1) to understand the fundamental mechanisms of DNA replication, transcription, and translation in prokaryotic and eukaryotic systems; 2) to explore the molecular basis of gene regulation, including operons in prokaryotes and transcriptional control in eukaryotes; 3) to examine DNA damage, repair mechanisms, and factors affecting DNA stability; 4) to analyze the structural organization of viral, bacterial, and eukaryotic genomes, as well as alternate forms of the DNA double helix; 5) to develop proficiency in molecular biology techniques such as DNA and RNA isolation, agarose gel electrophoresis, polymerase chain reaction (PCR), and restriction enzyme digestion; and 6) to gain hands-on experience in transcriptional regulation studies, including promoter-reporter construct strategies, Drosophila culture maintenance, and polytene chromosome analysis.				
COURSE CONTENT / SYLLABUS					
UNIT-I	Molecular Biology-1				15 hrs
	1. DNA replication in prokaryotes 2. DNA damage and repair 3. Transcription in prokaryotes and operons 4. Translation in prokaryotes				
UNIT-II	Molecular Biology-2				15 hrs
	1. Basic mechanisms of replication, transcription, and translation in eukaryotes 2. Gene regulation in eukaryotes 3. RNA processing and post-transcriptional regulation 4. Eukaryotic transcription factors, enhancers, silencers, and insulators				
UNIT-III	Molecular Genetics				15 hrs
	1. An overview of molecules involved in the flow of genetic information 2. Organization of viral, bacterial, and eukaryotic genomes 3. Alternative forms of the DNA double helix 4. Denaturation and renaturation of DNA 5. Factors affecting DNA stability				
UNIT-IV	Practical				30 hrs
	1. Isolation of DNA from animal tissues or bacteria 2. Isolation of RNA from Baker’s yeast or animal tissues 3. Isolation of plasmid DNA and design of plasmid vectors 4. Interpretation of the nucleic acid 260/280 ratio for DNA and RNA 5. Agarose gel electrophoresis 6. Understanding non-coding RNA 7. Demonstration of DNA damage due to UV or chemical exposure in bacteria 8. Polymerase chain reaction (PCR) and primer designing 9. Restriction enzyme digestion 10. Transcriptional regulation project: promoter-reporter construct strategy 11. Establishment and maintenance of Drosophila culture 12. Temporary mounting of polytene chromosomes				
REFERENCES					
1.	Cell and Molecular Biology: Concepts and Experiments by Gerald Karp, John Wiley & Sons Inc.				
2.	Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P.S. Verma and V.K. Agarwal, S. Chand & Co., New Delhi.				
3.	Concepts of Genetics by William S. Klug and Michael R. Cummings, Pearson Education.				
4.	Genetics by Daniel J. Fairbanks and W. R. Anderson, Wadsworth Publishing.				
5.	Lewin’s Genes X by Jocelyn E. Krebs, Elliott S. Goldstein, and Stephen T. Kilpatrick, Jones & Bartlett Publishers.				

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Bachelor of Science: Regular (NEP) MAJOR					
YEAR	III	ZLM3025C: Animal Systematics, Ecology and Evolutionary Biology		Credit	4
Semester	V			Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to understand different taxonomic keys; 2) to explore the species concept and mechanisms of speciation; 3) to demonstrate the construction and interpretation of cladograms; 4) to develop an understanding of ecological concepts and their components; 5) to analyze intra- and interspecific interactions; 6) to understand the role of living organisms within each ecological stratum; 7) to gain a comprehensive overview of the concept of evolution; 8) to acquire knowledge of micro-evolutionary changes, speciation, and adaptive radiation; and 9) to explore phylogenetic trees, including their construction and interpretation.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Animal Systematics			15 hrs
		1. Concept and importance of animal systematics, including conventional and modern approaches in biosystematics: chemotaxonomy, cytotaxonomy, immunotaxonomy, and molecular taxonomy 2. Taxonomic procedures: the process of classification and nomenclature, methods of identification, and the use of different taxonomic keys (detailed use of keys to be covered in practical sessions) 3. Species concept and speciation 4. Cladistic classification of animals, including cladogram descriptions of major taxa: Protista, Deuterostomia, Ecdysozoa, and Lophotrochozoa 5. Animal phylogeny and phylogeography			
UNIT-II		Ecology			15 hrs
		1. Principles of ecology 2. Ecosystem energetics, the concept of turnover, and ecological efficiency 3. Decomposers and nutrient cycling 4. Community structure and dynamics: physical structure of a community, food chains, food webs, and trophic levels; interconnectivity of terrestrial and aquatic habitats through biodiversity and ecological processes; primary and secondary production. 5. Niche determination: realised and fundamental niche 6. Intra- and interspecific interactions			
UNIT-III		Evolutionary Biology			15 hrs
		1. Geology and palaeontology: the tree of life and phylogeny 2. Natural selection: populations, gene frequencies, and equilibrium 3. Quantitative genetics: phenotypic evolution 4. Evolution of mammals: primate evolution and human origins 5. Races to species: culture and the control of human evolution			
UNIT-IV		Practicals			30 hrs
		1. Comparative osteology: its significance in animal systematics 2. Study of life tables: plotting survivorship curves of different types using provided hypothetical data 3. Study of zooplankton: observation through permanent slides or water samples and preparation of temporary mounts 4. Morphological basis of animal identification: data sheet preparation 5. Specimen collection: handling, preservation, mounting, and display techniques 6. Use of descriptive and illustrative keys: classification of animals 7. Determination of pH and dissolved oxygen content 8. Determination of chemical oxygen demand 9. Study of homology and analogy: analysis using suitable specimens, models, or charts 10. Study and verification of Hardy-Weinberg Law: application of chi-square analysis 11. Study of fossils: examination of specimens, models, or images 12. Study of skull types: anapsid, synapsid, and diapsid 13. Study of primate skulls			
REFERENCES					
1.		Evolution by Monroe W. Strickberger, Prentice Hall.			
2.		Evolution: Making Sense of Life (3rd edition) by Douglas Emlen and Carl Zimmer (2020).			
3.		Environment and Ecology by Neeraj Nachiketa, GK Publications.			
4.		Phylogeny and Conservation edited by Andrew Purvis, John L. Gittleman, and Thomas Brooks, Cambridge University Press.			

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Bachelor of Science: Regular (NEP)					
MINOR					
YEAR	III	ZLE3005C: Avian Biology and Wildlife Biology		Credit	4
Semester	V			Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to provide a detailed study of the body structure and unique physiology of birds; 2) to explore avian anatomy and physiology; 3) to provide training in the use of avian experimental models, including avian eggs; 4) to conduct an in-depth study of the physiography, biogeography, and climate of the Indian subcontinent; 5) to develop a basic understanding of wildlife laws and conservation policies; and 6) to provide training in field-based studies related to ornithology and wildlife biology.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Avian Biology				15 hrs.
	1. Avian integuments and the biomechanics of avian flight 2. Physiology of respiration and thermoregulation in birds 3. Courtship, breeding, and reproductive physiology of birds 4. Bird migration and navigation				
UNIT-II	Wildlife Biology-1				15 hrs.
	1. Physiography, climate, and vegetation types of India 2. Biogeographic provinces of India 3. Protected area network in India and wildlife laws 4. Quantitative population ecology 5. Mammals, reptiles, and amphibians of India				
UNIT-III	Wildlife Biology-2				15 hrs.
	1. Wildlife diseases, wildlife forensics, and conservation genetics 2. Captive breeding and reintroduction 3. Silviculture, mensuration, and forest fire management 4. GIS, remote sensing, and LULC assessments in wildlife				
UNIT-IV	Practicals				30 hrs.
	1. Topography of birds: study of cabinet specimens 2. Study of types of nests 3. Handling and dosing of avian experimental models: blood collection and general anatomy 4. Study of avian endocrine glands: anatomy and permanent slides 5. Avian egg: structure, handling, and dosing 6. Identification of water birds and their census techniques 7. Identification of dryland and terrestrial birds 8. Habitat analysis: census techniques (quadrats, transects, point count) and sampling techniques (software and field-based) for biodiversity quantification 9. Use of remote sensing and GIS in wildlife studies 10. Wildlife census through visual encounters and indirect evidence: pugmark study, scat sampling, and analysis 11. Use of rangefinders, binoculars, data loggers, bat detectors, camera traps, and audio recorders 12. Field studies and/or institutional visits				
REFERENCES:					
1.	Avian Anatomy: Integument by Alfred M. Lucas and Peter R. Stettenheim, U.S. Government Printing Office.				
2.	Avian Biology, Volumes 1–8, edited by Donald S. Farner, James R. King, and Kenneth C. Parkes, Academic Press.				
3.	Avian Physiology by Paul D. Sturkie, Springer.				
4.	Birds of the Indian Subcontinent by Richard Grimmett, Carol Inskipp, and Tim Inskipp, Oxford University Press.				
5.	Forest Ecology by Burton V. Barnes, Donald R. Zak, Shirley H. Denton, and Stephen H. Spurr, Wiley.				
6.	Life of Birds (Saunders Series in Organismic Biology) by Joel Carl Welty and Luis Felipe Baptista, Cengage Learning.				
7.	Physiology and Biochemistry of the Domestic Fowl by B. M. Freeman, Academic Press.				

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Bachelor of Science: Regular (NEP) MINOR					
YEAR	III	ZLE3015C: Fisheries and Aquatic Biology		Credit	4
Semester	V			Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to introduce various freshwater and marine ecosystems and their components; 2) to understand the biodiversity and productivity of freshwater environments; 3) to develop a fundamental understanding of marine ecosystems and their importance; 4) to provide advanced knowledge on the unique adaptations of various biological systems in fish and shellfish; 5) to explore the physiology of different systems in fish; and 6) to impart modern knowledge on the biotechnological applications of marine organisms.			
COURSE CONTENT / SYLLABUS					
Unit I		1. Taxonomy of fishes and Distribution of fishes 2. Diversity of cultivable fish and shellfish 3. Principles of aquaculture 4. Biology of cultivable organisms 5. Basics of Oceanography 6. Planktonology			15 hrs
Unit II		1. Fish development and genetics 2. Freshwater finfish culture 3. Freshwater shellfish culture 4. Brackish water aquaculture 5. Integrated aquaculture 6. Fish farm management			15 hrs
Unit III		1. Economics and management of fisheries 2. Fish pathology and fish endocrinology 3. Migration of fishes 4. Post-harvest technology for fishes 5. Ornamental fisheries 6. Biotechnological applications of marine organisms			15 hrs
UNIT IV		Practicals			30 hrs.
		1. Water quality analysis: estimation of pH, dissolved oxygen, alkalinity, hardness, carbon dioxide, and nutrients 2. Visit to any one of the Ramsar wetland sites in Gujarat and preparation of a field report and mapping of a wetland or stream 3. Phytoplankton: methods of collection, enumeration, and identification of common phytoplankton and zooplankton 4. Collection and preservation of crustaceans, molluscs, and fishes 5. Identification of common finfishes using dichotomous keys (only a few selected orders) 6. Gut content analysis of fishes and molluscs 7. Catch data analysis on major freshwater resources 8. Field visits to different types of inland aquatic habitats 9. Study of crafts and gear used in inland fishing 10. Culture of live feed organisms: Artemia 11. Identification of cultured shrimps and different larval stages 12. Identification of common ornamental fishes and ornamental aquarium plants 13. Identification of common diseases and parasites of fish			
REFERENCE					
1.		Aquaculture and Fisheries Biotechnology: Genetic Approaches by Rex A. Dunham, CABI Publishing, USA.			
2.		Aquaculture: Principles and Practices by T. V. R. Pillay and M. N. Kutty, Blackwell Publishing, USA.			
3.		Biology of Fishes by Quentin Bone and Richard H. Moore, Taylor and Francis Group, CRC Press, UK.			
4.		Fish Physiology, edited by William Stewart Hoar and D. J. Randall, Academic Press.			
5.		Fisheries Ecology and Management by Carl J. Walters and Steven J. D. Martell, Princeton University Press.			
6.		Forest Ecology by Burton V. Barnes, Donald R. Zak, Shirley H. Denton, and Stephen H. Spurr, Wiley.			
7.		The Physiology of Fishes by David H. Evans and James B. Claiborne, Taylor and Francis Group, CRC Press, UK.			

 THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty of Science, Department of Zoology Sayajigunj, Vadodara 390002, 2795329, Ext: 357 head-zoo@msubaroda.ac.in			ACADEMIC YEAR 2025-2026
Bachelor of Science: Regular (NEP) MINOR				
YEAR	III	ZLE3025C: General and Applied Toxicology	Credit	4
Semester	V		Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to understand the effects of toxicants that impact the entire body or multiple organs; 2) to study the various metabolic processes that facilitate the excretion of both exogenous and endogenous substances; 3) to examine the effects of xenobiotics as genotoxicants or carcinogens on animal and public health; 4) to develop knowledge of the collection, processing, and evaluation of epidemiological and experimental toxicology data to support toxicologically based decisions for health protection against harmful xenobiotics; and 5) to evaluate the toxic effects of xenobiotics on the liver and kidneys through experimental studies.		
COURSE CONTENT / SYLLABUS				
UNIT-I		General and Applied Toxicology-1 1. History, scope, principles of toxicology 2. Toxicokinetics 3. Biotransformation 4. Toxic responses of liver, lung, kidney	15 hrs.	
UNIT-II		General and Applied Toxicology-2 1. Neurotoxicology 2. Reproductive toxicology 3. Developmental toxicology 4. Genotoxicity	15 hrs.	
UNIT-III		General and Applied Toxicology-3 1. Toxicology of heavy metals 2. Toxicology of Pesticides 3. Occupational and Industrial toxicology 4. Regulatory and analytical toxicology	15 hrs.	
UNIT-IV		Practicals 1. Methods of animal housing, handling 2. Dosing methods, tissue collection and preservation for analysis (for rodent and fish model systems) 3. Probit analysis, calculation of LC50 and LD50 4. Liver function tests 5. Kidney Function tests 6. Neurobehaviour assays 7. Neurotransmitter estimation 8. AMES test to assess the mutagenicity potential of a chemical 9. Estimation of ovarian/testicular hydroxysteroid dehydrogenase activity. 10. Monitoring of estrous cycle in the laboratory rodent model.	30 hrs.	
REFERENCES:				
1.		Casarett & Doull's Essentials of Toxicology by Curtis D. Klaassen and John B. Watkins, McGraw Hill.		
2.		Drug Discovery and Evaluation: Pharmacological Assays by H. Gerhard Vogel and Wolfgang H. Vogel, Springer.		
3.		Practical Toxicology: Evaluation, Prediction, and Risk, Third Edition by David Woolley and Adam Woolley, CRC Press.		
4.		Principles of Toxicology by Karen E. Stine and Thomas M. Brown, CRC Press.		
5.		Regulatory Toxicology by Shayne C. Gad, Taylor & Francis.		
6.		Toxicology Laboratory Manual by Govind Pandey and Yash Pal Sahni, Satish Serial Publishing House		

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Bachelor of Science: Regular (NEP) MINOR					
YEAR	III	ZLE3035C: General and Applied Entomology		Credit	4
Semester	V			Hours	75
OBJECTIVES:		The main objective of the course are: 1) To make students understand insect adaptation and evolutionary processes, learn the basic external morphology of insects and how it is used in classification, 2) Learn the basic internal anatomy of insects, and how it is adaptive to their respective habitats. 3) The life cycles of important insect groups and the diseased conditions arising due to their life cycles 4) Understanding how insects affect humans medically, economically and socially can let the students rationalize the acts of killing insects according to their roles in ecosystem in a longer practical run.			
COURSE CONTENT / SYLLABUS					
UNIT-I		General and Applied Entomology -1			15 hrs.
		1. Insect Systematics and Taxonomy 2. Anatomy of Insects - General Body plan (Head, Thorax and Abdomen) 3. Integument – Structure, Function and modifications of integument 4. Wing and wing venation; mechanics of wing movement 5. Alimentary canal, digestion and absorption in Insects			
UNIT-II		General and Applied Entomology-2			15 hrs.
		1. Gaseous exchange in Insects 2. Excretion and salt & water regulation 3. Circulatory system, Blood and Immune system 4. Reproductive system, Hormonal Regulation during insect development 5. Embryogenesis and Post-Embryonic Development in Insects			
UNIT-III		General and Applied Entomology-3			15 hrs.
		1. Visual, Mechanical and Chemical communication in insects 2. Insects as Agricultural and house pests, Insects of Public health 3. Resistance to insecticides in insects 4. Concepts of IPM: Achievements and challenges 5. Forest Entomology: An overview			
UNIT-IV		Practicals			30 hrs.
		1. Detailed study and identification of important insect orders. 2. General morphology of insects (Types of Antennae, Simple & Compound eyes, Types of mouthparts, Types of Legs, Wing modifications & venation, Abdomen & its modification) – laboratory and field observations. 3. Dissections- Digestive system of insects 4. Temporary mountings (Antennae, Compound eyes, Mouthparts, Salivary gland, Legs, Wings, Gizzard, Malpighian tubule, Sting of Honey bees, Polytene chromosomes) 5. Permanent mountings of various insect structures 6. Types of insect larvae 7. Study of insect vectors of clinical significance 8. Localization of neurosecretory cells in Cockroach 9. Chitin localization 10. Hemocyte count in larvae 11. Economic entomology (a. Apiculture b. Lac culture c. Sericulture) 12. Visit to agricultural fields			
REFERENCES:					
1.		Advances in Insect Chemical Ecology by Ring T. Cardé and Jocelyn G. Millar, Cambridge University Press.			
2.		General and Applied Entomology by B. V. David and T. N. Ananthkrishnan, Tata-McGraw Hill, New Delhi.			
3.		General and Applied Entomology by V. A. Little, Oxford University Press.			
4.		Insecticides: Toxicology and Uses by H. C. L. Gupta, Agrotech Publishing Academy.			
5.		The Insects: Structure and Function by R. F. Chapman, Cambridge University Press, Cambridge.			
6.		The Insects: Structure, Function and Biodiversity by P. A. Dunston, Kalyani Publishers, New Delhi.			

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Bachelor of Science (NEP) SKILL ENHANCEMENT COURSE				
YEAR	III	SEC3535C: Instrumentation and Techniques in Biology	Credit	2
Semester	V		Hours	60
OBJECTIVES:		The main objectives of the course are: 1) to provide students with a comprehensive and practical introduction to modern microscopy techniques, including optical research tools and contrast mechanisms; 2) to develop proficiency in essential biological instrumentation, including micropipette handling, pH determination, centrifugation techniques, spectrophotometry, and chromatography; 3) to introduce molecular biology techniques such as polymerase chain reaction (PCR) and sterilization methods; 4) to enhance students' understanding of microscopy through the study of image formation, bright field, phase contrast, dark field, and fluorescence microscopy; and 5) to provide hands-on experience in histological techniques, including microtomy, permanent slide preparation, histometrical measurements, and histochemical localization of proteins and enzymes.		
COURSE CONTENT / SYLLABUS				
Practical 1:		Practical 1: Instrumentation in Biology 1. Understating the use of micropipette and Handling 2. Understating of pH meter and calibration 3. Experiment on determination of pH 4. Understanding of centrifugation techniques 5. To learn principle of Spectrophotometry- 6. Understating of Beer and Lamber’s by performance 7. To learn Polymerase chain reaction 8. To perform PCR (Demonstration) 9. Understanding of various chromatography 10. To perform paper chromatography 11. To perform thin layer chromatography 12. To learn sterilization techniques (theory and demonstration)	30 hrs.	
Practical 2:		Practical 2: Microscopy, Histology and Histochemistry 1. To study different parts of microscope 2. To learn the principles of image formation 3. Demonstration of contrast mechanisms in optical light microscopy 4. Demonstration and understating of bright field, phase contrast and dark field microscopy 5. Understating basics of fluorescent microscopy 6. Study different type of epithelial 7. Microtomy and permanent slide preparation 8. Histometrical measurements of a few organs. 9. Observations of permanent slides of mammalian organs – stomach, intestine, liver, kidney, lungs, testis, ovary 10. Study of histopathological changes (permanent slides) 11. Histochemical localization of proteins 12. Histochemical localization of SDH	30 hrs	
REFERENCES				
1. An Introduction to Practical Biochemistry by David T. Plummer, McGraw-Hill.				
2. Cells and Tissues: An Introduction to Histology and Cell Biology by A. W. Rogers, Academic Press.				
3. Fundamentals of Light Microscopy and Electronic Imaging by Douglas B. Murphy and Michael W. Davidson, Wiley-Blackwell.				
4. Histochemistry: Theoretical and Applied by A. G. E. Pearse, J & A Churchill Ltd., London.				
5. Imaging: A Laboratory Manual by Rafael Yuste (Editor), Cold Spring Harbor Laboratory Press.				
6. Introduction to Functional Histology by I. R. Telford and C. F. Bridgman, Harper and Row.				

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Bachelor of Science: Regular (NEP) MAJOR					
YEAR	III	ZLM3006C: Immunology and Endocrinology		Credit	4
Semester	VI			Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to provide students with an intensive and in-depth understanding of immunology and endocrinology; 2) to explore the role of immunological and endocrine mechanisms in maintaining human health and well-being; 3) to familiarize students with recent developments in immunology and endocrinology, including their applications in disease diagnosis, treatment, and prevention; 4) to study the fundamental aspects of immunology, including host-pathogen interactions, innate and adaptive immune responses, antigen recognition, and immunologic tolerance; 5) to examine the mechanisms of autoimmunity, immunodeficiency, immunotherapy, and vaccine development; 6) to understand the structure and function of endocrine glands, hormone biosynthesis, mechanisms of hormone action, and regulatory pathways; and 7) to gain practical experience in immunological and endocrinological techniques, including serological tests, immunoprecipitation, PCR-based pathogen detection, histological analysis of endocrine glands, and biochemical assays for thyroid hormones and cholesterol levels.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Immunology-1				15 hrs.
	1. Historical perspectives in Immunology; Host-pathogen interactions 2. Introduction to the Immune System; Cells and Organs of the Immune system 3. Innate immune responses; Cells of the innate immune system 4. Antibody structure and function 5. Inflammatory response; Cytokines an cytokine receptors				
UNIT-II	Immunology-2				15 hrs.
	1. Antigen capture and presentation to lymphocytes 2. Antigen recognition in the adaptive immune system 3. Cell-mediated & humoral immune responses and their effector mechanisms 4. Immunologic tolerance and autoimmunity 5. Immunodeficiency, Immunotherapy, Vaccines				
UNIT-III	Endocrinology				15 hrs.
	1. Introduction to endocrine system; Types of endocrine gland and its structure 2. Mechanism of hormone action: Membrane receptors, cytosolic receptors & second messengers 3. Hypothalamo-hypophysial System 4. Thyroid hormones: biosynthesis, control of secretion and physiological roles 5. Adrenal medulla: Physiological role of catecholamine 6. Role of parathormone, calcitonin and vitamin D in calcium homeostasis; Endocrine pancreas; Gastrointestinal hormones				
UNIT-IV	Practical				30 hrs.
	1. Demonstration of primary and secondary immune organs in rat 2. Radial immunodiffusion (RID) 3. Tube agglutination test: Widal test 4. Blood grouping experiment 5. PCR based detection of potential pathogens 6. Immunoprecipitation using serum 7. Histoarchitectural study of endocrine gland 8. Determination of T3, T4 and TSH in serum 9. Estimation of cholesterol in serum				
REFERENCES					
1.	Immuno Biology: The Immune System in Health and Disease by Charles A. Janeway Jr., Paul Travers, Mark Walport, and Mark J. Shlomchik, Garland Science Publishing, New York, USA.				
2.	Immunology by Ivan M. Roitt, Jonathan Brostoff, and David K. Male, Mosby & Elsevier Publishing, Canada, USA.				
3.	Kuby Immunology, 8th Edition, by Jenni Punt, Sharon Stranford, Patricia Jones, and Judy Owen, W.H. Freeman, New York.				
4.	Mammalian Physiology and Endocrinology by Kishore R. Pawar and Ashok E. Desai, Nirali Prakashan.				
5.	Williams Textbook of Endocrinology by Shlomo Melmed, Kenneth S. Polonsky, P. Reed Larsen, and Henry M. Kronenberg, Elsevier.				

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Bachelor of Science (NEP) MAJOR					
YEAR	III	ZLM3016C: Cell biology and Developmental biology - I		Credit	4
Semester	VI			Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to provide students with an intensive and in-depth understanding of cell biology; 2) to familiarise students with recent developments in the field of cell biology; 3) to develop an understanding of cell staining techniques, cell division, and organelle-specific staining; 4) to introduce the fundamental concepts and processes in developmental biology; 5) to enable students to learn the basics of embryology and modern developmental biology; and 6) to provide hands-on training in the isolation, staining, and preservation of embryos.			
COURSE CONTENT / SYLLABUS					
UNIT-I	Cell Biology-1				15 hrs.
	1. An overview of Cells -The Composition of Cells 2. Cell Organelles -Nucleus, Endoplasmic reticulum, Golgi Apparatus, Mitochondria, Lysosome, Peroxisome, Plasma membrane 3. Cellular division – Mitosis and Meiosis 4. Cell cycle, Cell death				
UNIT-II	Cell Biology-2				15 hrs.
	1. Cell adhesions, cell communication and cell signalling pathways 2. Cytoskeleton & Cell Movement 3. Protein Sorting & Transport 4. Cancer biology				
UNIT-III	Developmental Biology				15 hrs.
	1. Comparative, experimental and evolutionary embryology 2. Germ cell specification and migration; Fertilization and egg activation 3. Genetic basis of development; Cell-cell communication in development 4. Early development in invertebrates and vertebrates				
UNIT-IV	Practical				30 hrs.
	1. Differential staining technique 2. Use of ocular micrometer-standardization and measurements of cell height and nuclear diameters 3. To understand the process and different stages of mitosis through onion root tip 4. Study of cell organelles using specific staining techniques. 5. Vital staining technique 6. To understand cell death through cell morphology. 7. Cell cycle analysis 8. To study cancer characteristics through permanent slides 9. Study of whole mounts and sections of chick embryo at different stages, primitive streak, 24, 28, 33, 48, 72 and 96 hours. 10. Preparation of chick embryo whole mounts 11. Stages of regeneration in Fish 12. Study of different stages (Gosner) of metamorphosis in Frog				
REFERENCES:					
1.	Developmental Biology by Scott F. Gilbert, Sinauer Associates.				
2.	Karp's Cell and Molecular Biology: Concepts and Experiments by Gerald Karp, Janet Iwasa, and Wallace Marshall, Wiley.				
3.	Molecular Biology of the Cell by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, and Keith Roberts, W.W. Norton & Company.				
4.	Molecular Cell Biology by Harvey Lodish et al., W.H. Freeman & Co.				
5.	The Cell: A Molecular Approach by Geoffrey M. Cooper, ASM Press.				

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Bachelor of Science: Regular (NEP) MAJOR					
YEAR	III	ZLM3026C: Environmental Biology and Natural Resource Management	Credit	4	
Semester	VI		Hours	75	
OBJECTIVES:		The main objectives of the course are: 1) to develop a conceptual understanding of various integral aspects of population dynamics; 2) to understand the fundamental concepts of environmental degradation caused by pollution and its impact on health; 3) to explore the importance of bioremediation in mitigating environmental damage; 4) to compare pollution with broader environmental changes; 5) to understand the significance of natural resources and learn conservation techniques; 6) to analyse the general scientific principles underlying conservation; 7) to study water quality parameters and their implications for ecosystem health; 8) to assess soil quality and its role in sustainable land use; 9) to understand the principles of landscape planning; and 10) to gain knowledge of carbon footprint and its impact on the environment.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Environmental Biology-1 1. Concept and scope of Environmental Biology. 2. Population dynamics – concept of population, population growth: density, natality, mortality and growth curves, life curves, age structure, function and equilibrium; population regulation: biotic potential and environmental resistances; Factors of population regulation – density dependent and density independent; carrying capacity 3. Pollution and health hazards 4. Concept and types of bioremediations, Environment indicators	15 hrs		
UNIT-II		Environmental Biology-2 1. Climate change: Elements of weather and climate, climatic controls, energy balance in atmosphere, elementary ideas about weather systems, climatic classifications; feed-back processes in climate system, concepts of global warming potential (GWP) 2. Climate change scenarios of India: impact of climate change on agriculture, forest, water resources, monsoon system of India 3. Environment Impact Assessment (EIA) 4. Natural Hazards: Flood, landslides, cyclones, tsunamis, earthquake seismology, forest fires	15 hrs		
UNIT-III		Natural resources 1. Forest resources, Land resources, Water resources 2. Biomass energy, Bioconversion technologies, bioethanol and biohydrogen 3. Energy Resources: Non-conventional forms of energy; Nuclear energy; Geothermal energy 4. Sustainable development and sustainability indicators; Resource modelling for sustainability, carbon footprint 5. Critical review of drawbacks in traditional (based on economics) evaluation of development and cost benefit analysis 6. Geoinformatics: Application of remote sensing techniques in natural resource management, land use planning, urban planning, ground water mapping; coastal zone management, protected area management	15 hrs		
UNIT-IV		Practicals 1. Determination of total hardness by EDTA titration 2. Determination of acidity and alkalinity of water by titrimetric method 3. To measure the pH of soil 4. Grain size analysis of soil 5. To determine the total residual chlorine in water sample. 6. Landscape planning using geoinformatics software 7. Carbon footprint calculation using hypothetical data 8. Field visits	30 hrs		
REFERENCES:					
1.	Environmental Science: A Practical Manual by G. Swarajya Lakshmi, Prabhu Prasadini, Ramesh Thatikunta, and V. N. L. V. Tayaru, BS Publications.				
2.	Landscape Planning: Environmental Applications by W. M. Marsh and J. Dozier, John Wiley and Sons.				
3.	The Nature and Properties of Soils (13th edition) by N. C. Brady and R. R. Weil, Pearson Education Inc.				

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Bachelor of Science: Regular (NEP)					
MINOR					
YEAR	III	ZLE3006C: Comparative Animal Physiology		Credit	4
Semester	VI			Hours	75
OBJECTIVES:		The main objectives of the course are: 1) to gain knowledge of the basic concepts and processes of physiological regulation, from the cellular level to organ systems and the whole organism; 2) to understand how different groups of animals have developed distinct physiological adaptations to perform essential functions; 3) to explore the diversity of physiological mechanisms that animals have evolved; 4) to examine the gradual development of physiological complexity across different animal groups; 5) to demonstrate the function of Malpighian tubules as an excretory system; and 6) to develop practical skills in temporary mounting and tissue identification.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Comparative animal physiology-1 1. Integumentary: comparative account of Epidermis, Basement membrane zone, dermis, appendageal system, Skin derivative, subcutaneous muscle and fat 2. Physiology of Digestion and Nutrition: Nutrition and digestion in unicellular, multicellular organisms and other non-chordates. Comparative account of Digestion in chordates-Fishes, amphibians, reptiles, and Birds. 3. Physiology of Respiration and Circulation: Respiration and Circulation in unicellular and multicellular organisms. Comparative account of Respiratory structures, Heart, and circulation in non-chordates. Comparative account of physiology of respiration and circulation in chordates-Fishes, amphibians, reptiles, and Birds.			15 hrs.
UNIT-II		Comparative animal physiology-2 1. Physiology of Excretion and Osmoregulation: Excretion and osmoregulation in unicellular and multicellular organisms. Comparative account of excretion and osmoregulation in non-chordates. Comparative account of physiology of respiration and circulation in chordates-Fishes, amphibians, reptiles, and Birds. 2. Physiology of Movement and Locomotion: Movement and Locomotion in unicellular and multicellular organisms. Comparative account of Movement and Locomotion in non-chordates. Comparative account of Movement and Locomotion in chordates- Fishes, amphibians, reptiles, and Birds. 3. Bone and Cartilage: Structure and types of bones and cartilages, Ossification, bone growth and resorption.			15 hrs.
UNIT-III		Comparative animal physiology-3 1. Physiology of Nervous System and Sense Organs: Nervous System and Sensory structures in unicellular and multicellular organisms. Comparative account of Nervous System and Sense Organs in non-chordates. Comparative account of Nervous System and Sense Organs in chordates-Fishes, amphibians, reptiles, and Birds. 2. Physiology of Reproduction and Role of Hormones: Reproduction in unicellular and multicellular organisms. Comparative account of Reproduction in non-chordates. Comparative account of Reproduction in chordates-Fishes, amphibians, reptiles, aves and mammals.			15 hrs.
UNIT-IV		Practical 1. Study of blood pigments in non-chordates and chordates 2. Estimation of rate of respiration in cockroach 3. Demonstrate the function of Malpighian tubules in cockroach 4. Differential count of WBC 5. Preparation of haemin crystals 6. Histoarchitectural study of muscle 7. Recording of simple muscle twitch with electrical stimulation (or Virtual) 8. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibers and nerve cells 9. Study of permanent slides of Mammalian skin Cartilage, Bone 10. Integumentary and its derivatives			30 hrs.
REFERENCES:					
1.		Biology of Animals by Cleveland P. Hickman Jr., Larry S. Roberts, and Allan Larson, McGraw-Hill, New York.			
2.		Biology of the Invertebrates by Jan A. Pechenik, Tata McGraw-Hill, New Delhi.			
3.		Invertebrate Form and Function by E. J. W. Barrington, PHI Learning, New Delhi.			
4.		Principles of Animal Physiology by Christopher D. Moyes and Patricia M. Schulte, Pearson International Edition, USA.			
5.		Biology of Animals by Cleveland P. Hickman Jr., Larry S. Roberts, and Allan Larson, McGraw-Hill, New York.			

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Bachelor of Science: Regular (NEP)					
MINOR					
YEAR	III	ZLE3016C: General and Applied Reproductive Biology	Credit	4	
Semester	VI		Hours	75	
OBJECTIVES:	The main objectives of the course are: 1) to demonstrate the structure of male and female gonads and the process of gametogenesis; 2) to understand the concept of puberty and its physiological regulation; 3) to comprehend male and female infertility issues and their underlying causes; 4) to explore assisted reproductive technologies and their applications in fertility treatment; 5) to study the histoarchitecture of gonads and their functional organization; and 6) to analyze the number and functional status of male gametes to assess reproductive potential.				
COURSE CONTENT / SYLLABUS					
UNIT-I	Male Reproductive Biology				15 hrs.
	1. Functional anatomy of male reproduction				
	2. Histological feature of male gonad				
	3. Spermatogenesis: kinetics and hormonal regulation				
	4. Androgen synthesis and metabolism				
	5. Epididymal function and sperm maturation				
	6. Accessory glands functions				
	7. Puberty & Regulation of onset of Puberty in males				
UNIT-II	Female Reproductive Biology				15 hrs.
	1. Functional anatomy of female reproduction				
	2. Histological feature of female gonad				
	3. Folliculogenesis, ovulation, corpus luteum formation and regression				
	4. Steroidogenesis and secretion of ovarian hormones				
	5. Reproductive cycles and their regulation				
	6. Ovum transport in the fallopian tubes				
	7. Puberty & Regulation of onset of Puberty in females				
UNIT-III	Applied Reproductive biology				15 hrs.
	1. Physiology of pregnancy: fertilization, Implantation and hormonal control, formation of the fetus and placenta, Hormonal regulation of gestation and fetal development, endocrinology of parturition				
	2. Birth defects and prenatal diagnosis				
	3. Male and female infertility				
	4. Assisted reproductive technology: sperm banks, frozen embryos, in vitro fertilization				
UNIT-IV	Practical				30 hrs.
	1. Examination of histological sections from permanent slides of male and female reproductive system (comparative account)				
	2. To study estrous cycle in rodents				
	3. Superovulation induction technique (using PMSG/hCG)				
	4. Sperm count and sperm motility in rat				
	5. Sperm capacitation test				
	6. Estimation of gonadal steroid hormone levels (estrogen, testosterone)				
	7. Papanicolaou staining technique				
	8. Histochemical localization of gonadal 17B/3B hydroxysteroid dehydrogenase activity				
	9. Isolation of rat granulosa, Leydig, and Sertoli cells				
	10. Study of reproductive disorders				
REFERENCES:					
1.	Guyton and Hall Textbook of Medical Physiology by John E. Hall, 13th edition, Saunders, 2015.				
2.	Knobil and Neill's Physiology of Reproduction, Fourth Edition, edited by Tony M. Plant and Anthony J. Zeleznik, Academic Press, 2014.				
3.	Medical Physiology: The Big Picture by Jonathan D. Kibble and Colby R. Halsey, McGraw-Hill Education.				
4.	Textbook of Assisted Reproductive Techniques, edited by David K. Gardner, Colin M. Howles, Zeev Shoham, and Ariel Weissman, CRC Press.				

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Bachelor of Science: Regular (NEP) ABILITY ENHANCEMENT COURSE					
YEAR	III	AEC3306C: Applications of Basic Software in Biological Sciences		Credit	2
Semester	VI			Hours	60 hrs
OBJECTIVES:		The main objectives of the course are: 1) to introduce fundamental concepts and practical skills required to use basic software for preparing documents, creating PowerPoint presentations, and analysing biological data; and 2) to equip students with the ability to represent biological data using different software tools through lectures, discussions, assignments, and tutorials.			
COURSE CONTENT / SYLLABUS					
UNIT-I		1. Introduction to Ms. Word- Document typing, editing a document-move and copy text-formatting text and paragraph, Finding and replacing text and spelling checking-using tabs, Tables and other features, Enhancing documents-using email merge and other features, track changes 2. Introduction to Worksheet-Getting started with Excel-Editing cells and using commands and functions- moving and coping, Inserting, and deleting raw and Column-Getting help and formatting worksheet, printing worksheet formatting- 3. Biostatics using Excel- Mean, Mode, Standard Error, Standard Deviation, t test, One way ANOVA, creating various charts-using formulae and functions			30 hrs
UNIT-II		1. Create and Manage PowerPoint Presentation - Insert and Format Slides, Modify Slides, Handouts, and Notes, Change Presentation Options and Views, Insert and Format Text, Shapes, and Images, Insert Tables, Charts, SmartArt, and Media. Apply Transitions and Animations 2. Science Illustration tools - Bio Render, Affinity designer, Adobe Illustrator 3. Plagiarism tools, Reference/Bibliography tools			30 hrs
REFERENCES:					
1.		Learn Microsoft Office 2021 by Linda Foulkes, Packt Publishing.			
2.		Microsoft Office and Beyond: Computer Concepts and Applications by Theodor Richardson and Charles Thies, Mercury Learning & Information.			
3.		Multimedia: Computing, Communications, and Applications by Ralf Steinmetz and Klara Nahrstedt. Pearson			

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Bachelor of Science: Regular (NEP) INTERNSHIP					
YEAR	III	SEC3406C: Internship in Zoology	Credit	4	
Semester	VI		Hours	120 hrs	
OBJECTIVES:		The main objectives of the course are: 1) to provide hands-on exposure to real-world zoological practices through institution-based internships, in-house projects, or community outreach activities, enabling students to apply theoretical knowledge to practical challenges and develop professional ethics, teamwork, and communication skills; and 2) to build analytical thinking and subject-relevant skills using field/laboratory tools and digital platforms, thereby enhancing employability, interdisciplinary awareness, and social responsibility through structured mentorship and reflective learning.			
COURSE CONTENT / SYLLABUS					
UNIT-I		Students shall complete the internship through ANY ONE of the following models approved by the Department and the Faculty Board , in accordance with UGC and NEP 2020 guidelines: 1. Industry/Institution-Based Internship – Placement in wildlife NGOs, fisheries/veterinary/pathology labs, ecological parks, zoological research institutions, or biotechnology/biomedical labs. 2. In-House Mini Project (FoSSIP Model) – Department-guided research projects involving laboratory techniques, fieldwork, data analysis, and reporting. 3. Science Outreach and Education – Delivery of biology-based demonstrations or tutorials in local government schools or NGOs, fostering science communication and social engagement. 4. Campus Biodiversity or Sustainability Audit – Ecological surveys and resource audits (waste, water, biodiversity) within the university campus using field tools and analysis protocols. 5. Field-Based Mini Projects – Documentation of local fauna, water/soil surveys, or ecological assessments within the Vadodara region using taxonomic and sampling tools. 6. Data Mining from Public Databases – Retrieval and analysis of zoology-relevant data from sources such as NCBI, GBIF, IUCN, or BOLD Systems to develop insights or support hypothesis testing. 7. Skill Development Workshops – Participation in department-approved workshops on bioinformatics, scientific writing, data analysis, or lab techniques relevant to zoological sciences. 8. Institutional Collaborations – Internships at museums, environmental agencies, conservation trusts, or citizen science initiatives involving zoology-focused projects. 9. Any other model approved by the Faculty Board – Subject to prior approval, other innovative or interdisciplinary internship modes consistent with NEP 2020 outcomes may be adopted.		120 hrs	
REFERENCES:					
1.		Curriculum and Credit Framework for Undergraduate Programmes (CCFUP) under NEP 2020 by University Grants Commission, New Delhi, 2022.			
2.		Guidelines for Internship/Research Internship for Undergraduate Students by University Grants Commission, New Delhi, 2023.			
3.		National Education Policy (NEP) 2020, Ministry of Education, Government of India, 2020.			

PREREQUISITES FOR COURSE ELIGIBILITY

Semester 1 & 2

1. **Zoology Major (Core):** B-group students of Class XII Science will be eligible to take up this major (core).
2. **Zoology Minor (Elective):**
 - a. B-group students of Class XII Science will be eligible to opt for this Minor (Elective).
 - b. Minor (Elective) offered by Zoology is open to all except for those who have Zoology Major (Core).
3. **Multi/interdisciplinary (MDC):**
 - a. Both B-group and A-group of Class XII Science will be eligible to opt for MDC offered by Department of Zoology.
 - b. MDC offered by Zoology is open to all except for those who have Zoology Major (Core) and Zoology Minor (Electives).
4. **Skill enhancement course (SEC):**
 - a. SEC offered by Zoology is ONLY for Zoology Minor.
5. **Value-added course (VAC)/IKS (Semester-I):**
 - a. IKS/VAC offered by Zoology is ONLY for those who opt for MDC offered by Zoology Department.

Semester 3 & 4

1. **MDC, Minor & SEC:** offered by the department of Zoology may be opted by all students except those having Zoology as Major.
2. **IKS & VAC:** offered by the department of Zoology may be opted by all students including those having Zoology as Major.