

SYLLABUS
for
Choice Based Credit System
(CBCS)
On the basis of
Outcome Based Education
(OBE)
B.Sc
ZOOLOGY HONOURS

PATNA WOMEN'S COLLEGE

Autonomous

PATNA UNIVERSITY

3rd Cycle NAAC Accredited at 'A' Grade with CGPA 3.58/4
"College with Potential for Excellence" (CPE) Status Accorded by UGC

Vision

Rooted in the life, vision, and teachings of Jesus Christ and inspired by Mother Veronica, the foundress of the Apostolic Carmel, Patna Women's College strives to become a center of academic excellence in higher education, social responsibility, and empowerment of women.

Mission Statement

Patna Women's College, the first college for women in Bihar, is committed to the holistic development of women so as to make an effective contribution to the creation of a better society.

To this end, we strive

- To become a center of excellence in higher education for women in an atmosphere of autonomy.
- To excel in teaching-learning, research, and consultancy.
- To provide education that promotes capacity building and holistic development of a person.
- To offer subjects for competency building and motivate/animate a workforce imbued with human values.
- To promote patriotism, communal harmony and cultural integration to maintain a free and peaceful atmosphere on the campus.
- To train the students in creative arts, social service, critical thinking, and leadership in order to make an effective contribution to the creation of a new and value based society.
- To create women leaders and to make them agents of social change.
- To develop skill oriented and value based courses, for the all-round development of individuals.
- To promote academic exchange and academia-industry interface.
- To form young women who are 'always wise' and who will dare to 'go ahead and conquer knowledge' through, competence, commitment, delicate conscience, and compassion.

Programme Outcomes (POs)

After the completion of B.Sc. Honours Degree Programme, the students will be able to:

PO1. Disciplinary knowledge: Acquire comprehensive knowledge of major concepts, theoretical principles and experimental findings in zoology, and some of the applied areas of study such as wildlife conservation and management; environmental science; various techniques, instruments, used for analysis of animals' forms and functions.

PO2. Effective communication and Critical thinking: Convey the intricate zoological information effectively and efficiently, analyze and solve the problems related to animal sciences without relying on assumptions and guesses.

PO3. Research & Leadership quality: Recognize and mobilize relevant resources essential for a research project, and manage the project in a responsible way by following ethical scientific conduct and bio-safety protocols.

PO4. Digitally literate and Ethical awareness: Use computers for computation and data analysis with appropriate software for biostatistics, and employ search tools to locate and retrieve relevant information, recognize and avoid unethical behaviour such as fabrication, or misrepresentation of data or commit plagiarism.

PO5. Environment and Sustainability: Understand the environmental and sustainability issues, acquire self-paced and self-directed learning aimed at personal and social development.

Programme Specific Outcomes (PSOs)

Students enrolled in B.Sc. (Hons.) degree program in Zoology will study and acquire complete knowledge of disciplinary as well as allied biological sciences. At the end of graduation they should possess expertise which will provide them competitive advantage in pursuing higher studies from India or abroad, seek jobs in academia, research or industries.

After the completion of B.Sc. Honours Degree Programme, the students will be able to:

PSO1. Identify, classify and differentiate diverse chordates and non-chordates based on their morphological, anatomical and systemic organization.

PSO2. Describe economic, ecological and medical significance of various animals in human life. This will create a curiosity and awareness among them to explore the animal diversity and take up wild life photography or wild life exploration as a career option. The knowledge about identifying and classifying animals will provide students professional advantages in teaching, research and taxonomist jobs in various government organizations; including Zoological Survey of India and National Parks/Sanctuaries.

PSO3. Acquire practical skills in cell & molecular biology, biochemistry, genetics, enzymology These methodologies will provide an extra edge to our students, who wish to undertake higher studies.

PSO4. Understand comparative anatomy and developmental biology of various biological systems; and learning about the organisation, functions, strength and weaknesses of

various systems will let student critically analyse the way evolution has shaped these traits in human body.

PSO5. Skill enhancement course like medical diagnostics will provide them opportunity to work in diagnostic or research laboratory.

PSO6. Students undertaking wild life management courses would gain expertise in identifying key factors of wild life management and be aware about different techniques of estimating, remote sensing and Global positioning of wild life. This course will motivate students to pursue career in the field of wildlife conservation and management.

B.Sc. (Honours) Zoology

Note: 1 credit = 15 hours

1. Theory paper: 6 credits each (4Theory and 2 Practical).

Core Courses (6 credits each)

Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

Semester I

1. Non-Chordates I (Theory)
Non-Chordates I (Practical)
2. Principles of Ecology (Theory)
Principles of Ecology (Practical)

Semester II

3. Non-Chordates II (Theory)
Non-Chordates II (Practical)
4. Cell Biology (Theory)
Cell Biology (Practical)

Semester III

5. Diversity of Chordates (Theory)
Diversity of Chordates (Practical)
6. Physiology: Controlling and Coordinating Systems (Theory)
Physiology: Controlling and Coordinating Systems (Practical)
7. Fundamentals of Biochemistry (Theory)
Fundamentals of Biochemistry (Practical)

Semester IV

8. Comparative Anatomy of Vertebrates (Theory)
Comparative Anatomy of Vertebrates (Practical)

9. Physiology: Life Sustaining Systems (Theory)
Physiology: Life Sustaining Systems (Practical)
10. Biochemistry of Metabolic Processes (Theory)
Biochemistry of Metabolic Processes (Practical)

Semester V

11. Molecular Biology (Theory)
Molecular Biology (Practical)
12. Principles of Genetics (Theory)
Principles of Genetics (Practical)

Semester VI

13. Developmental Biology (Theory)
Developmental Biology (Practical)
14. Evolutionary Biology (Theory)
Evolutionary Biology (Practical)

Generic Elective Papers (GE) (6 credits each)

Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

Semester I

1. Animal Diversity

Semester II

2. Environment and Public Health

Semester III

3. Food Nutrition and Health

Semester IV

4. Insect Vectors and Disease

Discipline Specific Elective (DSE) (6 credits each)

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

Semester V

DSE-1

1. Endocrinology

DSE-2

2. Immunology

Semester VI

DSE-3

- Animal Behaviour and Chronobiology

DSE-4

- Wildlife Conservation and Management

Skill Enhancement Course (SEC)(2Credits)

Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide **value-based and/or skill-based knowledge**.

Semester III

- Inter Religious Studies (Value based)

Semester IV

- Medical Diagnostics

Zoology (Hons.) CBCS Syllabus

Se m.	Core Course (14) <u>6 Credits each</u>	Ability Enhancement Compulsory Course AECC (2) <u>2 Credits each</u>	Skill Enhancement Course SEC (2) <u>2 Credits each</u>	Discipline Specific Elective DSE (4) <u>6 Credits each</u>	Generic Elective GE (4) <u>6 Credits each</u>
I	ZOO CC101: Non-Chordates I	English/ MIL Communication/ Environmental Science			ZOO GE101: Animal Diversity
	ZOO CC102: Principles of Ecology				
II	ZOO CC203: Non-Chordates II	English/ MIL Communication/ Environmental Science			ZOO GE202: Environment and Public Health
	ZOO CC204: Cell Biology				
III	ZOO CC305: Diversity of Chordates		IRS SEC301: Inter-Religious Studies (Value based)		ZOO GE303: Food Nutrition and Health
	ZOO CC306: Physiology: Controlling and Coordinating Systems				
	ZOO CC307: Fundamentals of Biochemistry				
IV	ZOO CC408: Comparative Anatomy of Vertebrates		ZOO SEC402: Medical Diagnostics		ZOO GE404: Insect Vectors and Diseases
	ZOO CC409: Physiology: Life Sustaining Systems				

	ZOO CC410: Biochemistry of Metabolic Processes				
V	ZOO CC511: Molecular Biology			ZOO DSE501: Endocrinology ZOO DSE502: Immunology	
	ZOO CC512: Principles of Genetics				
VI	ZOO CC613: Developmental Biology			ZOO DSE603: Animal Behaviour and Chronobiology ZOO DSE604: Wildlife Conservation and Management	
	ZOO CC614: Evolutionary Biology				

Course Structure for B.Sc. Zoology (Hons.)

<u>Semester –I</u>		<u>Semester –II</u>	
ZOO CC101: Non-Chordates I (Theory) Non-Chordates I (Practical)		ZOO CC203: Non-Chordates II (Theory) Non-Chordates II (Practical)	
ZOO CC102: Principles of Ecology (Theory) Principles of Ecology (Practical)		ZOO CC204: Cell Biology (Theory) Cell Biology (Practical)	
ENG AEC101 : English Communication HIN AEC101 : fgUnh O;kdj.k vkSj IEizs"k.k		EVS AEC202 : Environmental Science	
ZOO GE101: Animal Diversity		ZOO GE202: Environment and Public Health	
<u>Semester –III</u>		<u>Semester –IV</u>	
ZOO CC305: Diversity of Chordates (Theory) Diversity of Chordates (Practical)		ZOO CC408: Comparative Anatomy of Vertebrates (Theory) Comparative Anatomy of Vertebrates (Practical)	
ZOO CC306: Physiology: Controlling and Coordinating Systems (Theory) Physiology: Controlling and Coordinating Systems (Practical)		ZOO CC409: Physiology: Life Sustaining Systems (Theory) Physiology: Life Sustaining Systems (Practical)	
ZOO CC307: Fundamentals of Biochemistry (Theory) Fundamentals of Biochemistry (Practical)		ZOO CC41: Biochemistry of Metabolic Processes (Theory) Biochemistry of Metabolic Processes (Practical)	
IRS SEC301: Inter-Religious Studies (Value Based)		ZOO SEC402: Medical Diagnostics	
ZOO GE303: Food Nutrition and Health		ZOO GE404: Insect Vectors and Diseases	
<u>Semester –V</u>		<u>Semester –VI</u>	

ZOO CC511: Molecular Biology (Theory) Molecular Biology (Practical)	ZOO CC613: Developmental Biology (Theory) Developmental Biology (Practical)
ZOO CC512: Principles of Genetics (Theory) Principles of Genetics (Practical)	ZOO CC614: Evolutionary Biology (Theory) Evolutionary Biology (Practical)
ZOO DSE501: Endocrinology.	ZOO DSE603: Animal Behaviour and Chronobiology
ZOO DSE502: Immunology	ZOO DSE604: Wildlife Conservation and Management

Details of Credits for Courses under B.Sc. Honours

Zoology

Semester	Course	Theory	Practical	Tutorial	Total Credits
I. Core Course (14 Papers) – 06 credits each					
I	1. Non-Chordates I	4	2	-	6
	2. Principles of Ecology	4	2	-	6
II	3. Non-Chordates II	4	2	-	6
	4. Cell Biology	4	2	-	6
III	5. Diversity of Chordates	4	2	-	6
	6. Physiology: Controlling and Coordinating Systems	4	2	-	6
	7. Fundamentals of Biochemistry	4	2	-	6
IV	8. Comparative Anatomy of Vertebrates	4	2	-	6
	9. Physiology: Life Sustaining Systems	4	2	-	6
	10. Biochemistry of Metabolic systems	4	2	-	6
V	11. Molecular Biology	4	2	-	6
	12. Principles of Genetics	4	2	-	6
VI	13. Developmental Biology	4	2	-	6
	14. Evolutionary Biology	4	2	-	6
II. Elective Course – 06 credits each					
A. 1. Discipline Specific Elective- DSE(4 papers)					
V	1. Endocrinology	4	2	-	6
	2. Immunology	4	2	-	6
VI	3. Animal Behaviour and Chronobiology	4	2	-	6
	4. Wildlife Conservation and Management	4	2	-	6
B. 1. Generic Elective / Interdisciplinary (4 papers)					
I	1. Animal Diversity	4	2	-	6
II	2. Environment and Public Health	4	2	-	6

III	3. Food Nutrition and Health	4	2	-	6
IV	4. Insect Vectors and Diseases	4	2	-	6
III. Ability Enhancement Courses – 02 credits each					
1. Ability Enhancement Compulsory (AECC)					
I	English / Hindi Communication	2			2
II	Environmental Science	2			2
II. Skill Enhancement Course (SEC)					
III	1. Inter Religious Studies	2	-	-	2
IV	2. Medical Diagnostics	2	-	-	2
TOTAL					140

Institute should evolve a system/policy about ECA / General Interest / Hobby / Sports / NCC / NSS / related courses on its own.

*wherever there is practical there will be no tutorial and vice-versa.

Zoology (Honours) Details of CBCS Syllabus

Core Courses (6 credits each)

SEMESTER – I

Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

ZOO CC101 : Non-Chordates I : Protists To Pseudocoelomates

(Theory :4 credits + Practical: 2 credits)

Course Outcome:

On completion of the courses students will be able

CO1- To learn & interpret the importance of taxonomy and classify Protista, Parazoa, Metazoa, Porifera, Cnidaria, Platyhelminthes and Nematelminthes.

CO2- To understand and explain the economic importance and describe the life cycle and pathogenecity of *P. vivax*, *E. histolytica*, *Schistosoma haematobium*, *Taenia solium*, *Ascaris lumbricoides* and *Wuchereria bancrofti*;

CO3- To appreciate the diversity and complexities exhibited by non-chordates and familiarize with the morphology, anatomy and functioning of different groups of non-chordates.

CO4- To Critically analyze the organization, complexity and adaptations in parasitic Nematelminthes and Platyhelminthes; affinities and Evolutionary significance of Ctenophora and to enhance collaborative learning through practical sessions, assignments and projects.

Units	Topics to be covered (Theory)	No. of hours
1	Protista, Parazoa and Metazoa: General characteristics & Classification up to orders; Life cycle and pathogenicity of <i>Plasmodium vivax</i> ; Locomotion and Reproduction in Protista	14
2	Porifera: General characteristics and Classification up to orders, Canal system Cnidaria: General characteristics and Classification up to orders; Metagenesis in <i>Obelia</i> ; Ctenophora: General characteristics, affomotoes and Evolutionary significance	17
3	Platyhelminthes: General characteristics and Classification up to orders; Life cycle and pathogenicity of <i>Schistosoma haematobium</i> and <i>Taenia solium</i>	7
4	Nemathelminthes: General characteristics and Classification up to orders; Life cycle, and pathogenicity of <i>Ascaris lumbricoides</i> and <i>Wuchereria bancrofti</i> .	7
	Classification to be followed from Barnes,RD.(1982) Invertebrate Zoology, V Edition	
	Self Learning (SL) life cycle & pathogenicity of <i>E. histolytica</i> Spicules in sponges Polymorphism in Cnidaria; Corals and coral reefs. Parasitic adaptations in Helminthes (Platyhelminthes and Nemathelminthes)	15
	Practicals 1. Study of WM of <i>Paramecium</i> , Binary fission & Conjugation in <i>Paramecium</i> 2. Examination of pond water collected from different places for diversity in protista 3. Study of <i>Sycon</i> (T.S. and L.S.), <i>Hyalonema</i> , <i>Euplectella</i> 4. Study of <i>Obelia</i> , <i>Physalia</i> , <i>Aurelia</i> , <i>Tubipora</i> , <i>Alcyonium</i> , <i>Metridium</i> , <i>Fungia</i> , <i>Meandrina</i> , <i>Madrepora</i> 5. One specimen/slide of any ctenophore 6. Study of adult <i>Schistosoma haematobium</i> , <i>Taenia solium</i> and their life cycles (Slides/microphotographs) 7. Study of adult <i>Ascaris lumbricoides</i> and its life stages (Slides/microphotographs) 8. To submit a Project Report on any related topic on life cycles/coral/coral reef Note: Classification to be followed from “Ruppert and Barnes (2006) <i>Invertebrate Zoology</i> , 8 th edition, Holt Saunders International Edition”	30
	TOTAL	90

Reading List :

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Verma P S, Jordan E L. (2009). *Invertebrate Zoology*. S. Chand publishers
5. Brusca R C (2016). *Invertebrates*. Published by Sinauer Associates, an imprint of Oxford University Press.

SEMESTER – I

ZOO CC102 : Principles of Ecology (Theory :4 credits + Practical: 2 credits) Course Outcome: On completion of the courses students will be able: CO1- To understand and relate the key concepts in ecology with emphasis on historical perspective, role of physical factors and concept of limiting factors. CO2- To understand and explain the population attributes; population growth models and population interactions and to understand and describe the community characteristics and ecological succession CO3- To understand and describe the different ecosystems, food chains, energy flow & efficiency; biogeochemical cycles. CO4- To learn and relate the application of the basic principles of ecology in wildlife conservation and management.		
Units	Topics to be covered (Theory)	No. of hours
1	Introduction to Ecology: Laws of limiting factors, Study of physical factors	4
2	Population: Unique and group attributes of population: life tables; fecundity tables, survivorship curves, Exponential and logistic growth, equation and patterns, r and K strategies Population regulation density-dependent and independent factors; Population interactions, Gause's Principle with laboratory density-dependent and independent factors; Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses	20

3	Community: Community characteristics: species richness, dominance, diversity, abundance vertical stratification, Ecotone and edge effect; Ecological succession general concepts & theories pertaining to climax community	11
4	Ecosystem: Types of ecosystems; Linear and Y-shaped food chains, Energy flow through an ecosystem and Ecological efficiencies; General concepts of Nutrient and biogeochemical cycle.	10
	SELF LEARNING (SL) * History of ecology, Autecology and synecology, Levels of organization Unitary and modular populations, Unique and group attributes of population, Density, Natalty, Mortality, age ratio, sex ratio, dispersal and dispersion * Ecological Succession: Hydrarch succession * Pond ecosystem in detail, Food chains, Food webs, Ecological pyramids, * Nitrogen cycle and Human Modified Ecosystem * Applied Ecology: Ecology in wildlife conservation and management	15
	PRACTICALS Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, determination of pH, and Dissolved Oxygen content (Winkler's method) Report on a visit to National Park/Biodiversity Park/Wild life sanctuary	30
	TOTAL	90

Reading List :

1. Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

SEMESTER – II

ZOO CC203 : Non-chordates II: Coelomates

(Theory :4 credits + Practical: 2 credits)

Course Outcome:

On completion of the courses students will be able:

CO1- To classify and compare phylum Annelida, Arthropoda, Mollusca and Echinodermata.

CO2 To understand and describe Excretion in Annelida; Vision and Respiration in Arthropoda; Metamorphosis in Insects; Social life in bees and termites.

CO3- To understand and describe Respiration in Mollusca; Torsion and detorsion in Gastropoda; Pearl formation in bivalves.

CO4- To understand and describe the Water-vascular system in Asteroidea; Larval forms in Echinodermata.

Units	Topics to be covered (Theory)	No. of hours
1	Annelida : General characteristics and Classification up to orders Excretion in Annelida	10
2	Arthropoda : General characteristics and Classification up to orders Vision and Respiration in Arthropoda; Metamorphosis in Insects	13
3	Mollusca : General characteristics and Classification up to orders; Respiration in Mollusca; Torsion and detorsion in Gastropoda;	12
4	Echinodermata: General characteristics and Classification up to orders; Water-vascular system in Asteroidea; Larval forms in Echinodermata;	10

	<i>Classification to be followed from “Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition”</i>	
	SELF LEARNING (SL) * Introduction to coelomates: Evolution of coelom and metamerism * Social life in bees and termites * Onychophora: General characteristics and Evolutionary significance * Pearl formation in bivalves; Evolutionary significance of trochophore larva	15
	Practical 1. Study of following specimens: Annelids - <i>Aphrodite, Nereis, Heteronereis, Pheretima, Hirudinaria</i> Arthropods - <i>Limulus, Palamnaeus, Palaemon, Daphnia, Megalopa, Nauplius, Cyclops, Zoea, Mysis, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta</i> , termites and honey bees Onychophora - <i>Peripatus</i> Molluscs - <i>Chiton, Dentalium, Pila, Doris, Unio, Mytilus, Sepia, Loligo, Octopus, Nautilus</i> Echinodermates - <i>Pentaceros/Asterias, Ophiocoma, Echinus, Cucumaria</i> and <i>Antedon</i> 2. T.S. through pharynx, gizzard of earthworm 3. To submit a Project Report on any topic related to larval forms (crustacean, mollusc and echinoderm)	30
	TOTAL	90

Classification to be followed from “Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition”

Reading List :

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition
2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Verma P S, Jordan E L. (2009). *Invertebrate Zoology*. S. Chand publishers

5. Brusca R C (2016). Invertebrates. Published by Sinauer Associates, an imprint of Oxford University Press.
6. Ganguli et al (2018). Biology of Animals. NCBA Publications.

SEMESTER – II

ZOO CC204 : Cell Biology		
(Theory :4 credits + Practical: 2 credits)		
Course outcome:		
On completion of the courses students will be able to:		
CO 1- To understand the structures and purposes of basic components of Prokaryotic and Eukaryotic cells.		
CO 2- To understand the structures and functions of Plasma Membrane, Endomembrane System and Cytoskeleton.		
CO 3- To understand the detailed structure of Mitochondria and how energy is produced by it through the Respiratory chain.		
CO 4- To understand the detailed structure of Nucleus and its associated structures, Cell Division, Cell Cycle and Cell Signaling.		
Units	Topics to be covered (Theory)	No. of hours
1	Overview of Cells : Prokaryotic and Eukaryotic cells	2
2	Plasma Membrane : Various models of plasma membrane structure; Transport across membranes: Active and Passive transport, Facilitated transport Endomembrane System : Structure & Functions: Endoplasmic Reticulum, Golgi Apparatus, lysosomes	21

	Cytoskeleton : Structure and Functions: Microtubules, Microfilaments and Intermediate filaments	
3	Mitochondria: Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis; Mitochondrial Respiratory Chain, Oxidative phosphorylation with respect to Chemi-osmotic hypothesis	7
4	Nucleus: Nuclear envelope and Nuclear pore complex, Nucleolus, Chromatin packaging (nucleosome model) Cell cycle and its regulation (Role of CDK-cycli complex) Cell Signaling : Receptors and Signaling molecules, GPCR and Role of second messenger (cAMP)	15
	SELF LEARNING (SL) * Virus, Viroids, Mycoplasma, Prions * Cell junctions: Tight Junctions, Desmosomes, Gap junctions * Chromatin: Euchromatin and Heterochromatin * Peroxisomes * Mitosis, Meiosis	15
	Practical : Preparation of temporary stained squash of onion root tip to study various stages of mitosis Study of various stages of meiosis in grasshopper testis Preparation of temporary slide to show the presence of Barr body in human female blood cells/cheek cells Histochemical demonstration of DNA by Feulgen reaction	30
	TOTAL	90

Reading List :

1. Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). *Molecular Biology of the Cell*, V Edition, Garland publishing Inc., New York and London.

Generic Elective Papers (GE) (6 credits each)

SEMESTER – I

Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

ZOO GE101 : Animal Diversity

(Theory :4 credits + Practical: 2 credits)

On completion of the courses students will be able:

CO1- To understand and describe the features of Protista, Porifera, Radiata, Acoelomates and Pseudocoelomates.

CO2 - To understand and describe the features of Arthropoda, Mollusca and coelomate deuterostomes.

CO3- To understand and describe the features of Protochordates, Pisces and Amphibia.

CO4- To understand and describe the features of Reptiles, Aves and Mammalia.

Units	Topics to be covered	No. of hours
1	Protista General characters of Protozoa; Life cycle of Plasmodium Porifera General characters and canal system in Porifera	22

	<p>Radiata General characters of Cnidarians and polymorphism</p> <p>Aceolomates General characters of Helminthes; Life cycle of <i>Taenia solium</i></p> <p>Pseudocoelomates General characters of Nemethehelminthes; Parasitic adaptations in Nematodes</p> <p>Coelomate Protostomes General characters of Annelida ; Metamerism.</p>	
2	<p>Arthropoda General characters. Social life in insects with respect to honey bees and termites</p> <p>Mollusca General characters of mollusca; Pearl Formation</p> <p>Coelomate Deuterostomes General characters of Echinodermata, Water Vascular system in Starfish.</p>	10
3	<p>Protochordata Salient features</p> <p>Pisces General Characters, Migration of Fishes, Parental Care</p> <p>Amphibia General characters, Adaptations for terrestrial life, Parental care in Amphibia.</p>	10
4	<p>Reptiles General Characters, Origin of reptiles</p> <p>Aves: General Characters, the origin of birds; Flight adaptations</p> <p>Mammalia General Characters, early evolution of mammals; Dentition in mammals.</p>	18
	Total	60
	<p>Practical :</p> <p>1. Study of following specimens: Non Chordates: <i>Euglena, Noctiluca, Paramecium, Sycon,, Physalia, Tubipora, Metridium, Taenia, Ascaris, Nereis, Aphrodite, Leech, Peripatus, Limulus, , Hermitcrab Daphnia, Millipede, Centipede, Beetle, Chiton, Octopus, Asterias, and Antedon.</i> Chordates: <i>Balanoglossus, Amphioxus, Petromyzon Hippocampus, Labeo, Ichthyophis Salamander, Draco, Uromastix, Naja, Viper, model of Archaeopteryx, any three common birds-(Psittacula, Hen, Sparrow), Squirrel and Bat.</i></p> <p>2. Study of following Permanent Slides: Cross section of Sycon, <i>Ascaris</i>(male and female). T. S. of Earthworm passing through pharynx, gizzard. Bipinnaria and Pluteus larva</p> <p>3. Temporary mounts of</p> <ul style="list-style-type: none"> <input type="checkbox"/> Septal & pharyngeal nephridia of earthworm. <input type="checkbox"/> Stained mounts of Placoid, cycloid and ctenoid scales. 	30
	TOTAL	90

Reading List :

1. Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
2. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
3. Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
4. Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
5. Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

SEMESTER – II

ZOO GE202 : Environment and Public Health

(Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO 1- To acquire knowledge about various sources of environmental hazards, their risk assessment, fate of toxic and persistent substances in the environment.

CO 2- To understand the factors of Climate change like Greenhouse gases, Global warming, Acid rain, Ozone layer destruction and Effect of Climate change on public health.

CO 3- To know about the sources and effects of Air, Water and Noise Pollution and their control methods, Waste Management Technologies, Bhopal Gas Tragedy, Chernobyl Disaster, Seveso Disaster and Three Mile Island Accident and their aftermath.

CO 4- To understand the causes, symptoms and control of Diseases like- Tuberculosis, Asthma, Silicosis, Asbestosis, Cholera, Minamata, Arsenicosis and Fluorosis.

Units	Topics to be covered	No. of hours
1	Introduction Sources of Environmental hazards, hazard identification and risk assessment, fate of toxic and persistent substances in the environment, dose response evaluation	16

2	Climate Change Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health Pollution Air, water, noise pollution sources and effects, Pollution control	16
3	Waste Management Technologies Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath.	24
4	Diseases Causes, symptoms and control of tuberculosis, Asthma, Silicosis, Astestosis, Cholera, Minamata, Arsenocosis, Fluorosis	4
	Total	60
	Practical 1. To determine pH, Cl, SO ₄ , NO ₃ in soil and water samples from different locations. 2. DO in water sample	30
	TOTAL	90

Reading List :

1. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
3. Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V.N. University Press, New York, 2003.
5. Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.

SEMESTER – III

Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

ZOO CC305 : Diversity of Chordates

(Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO1- To understand the General Characteristics and Classification of Hemichordata, Urochordata and Cephalochordata, the Larval forms of Protochordata and Retrogressive Metamorphosis in Urochordata.

CO2- To acquire knowledge about the General Characters and Classification of Agnatha, Pisces and Amphibia.

CO3- To understand the General Characteristics and Classification of Reptilia, Aves and Mammals, Biting Mechanism in Snakes, Flight Adaptations in Birds and Migration in Birds.

CO4- To know about the Zoogeographical Realms and Characteristic Fauna.

Units	Topics to be covered (Theory)	No. of hours
1	Introduction to Chordates :General characteristics and outline classification	9

	Protochordata: General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata	
2	Agnatha : General characteristics and classification of cyclostomes up to order Pisces: General characteristics of Chondrichthyes and Osteichthyes, classification up to order; Amphibia: General characteristics and classification up to order; Origin of <i>Tetrapoda</i> (Evolution of terrestrial ectotherms);	12
3	Reptilia: General characteristics and classification up to order; Poison apparatus and Biting mechanism in snakes Aves : General characteristics and classification up to order <i>Archaeopteryx</i> -- a connecting link; Flight adaptations and Migration in birds Mammals: General characters and classification up to order; Affinities of Prototheria;	18
4	Z:ooogeography : Zoogeographical realms and Characteristic fauna, Theories pertaining to distribution of animals	6
	SELF LEARNING (SL) Parental care in fishes, Migration in Fishes Parental care in amphibians Affinities of Sphenodon Mammals: Adaptive radiation with reference to locomotory appendages Zoogeography: Plate tectonic and continental drift theory	15
	Practical : 1. Protochordata <i>Balanoglossus, Herdmania, Branchiostoma</i> , Sections of <i>Amphioxus</i> through pharyngeal, intestinal and caudal regions. 2. Agnatha <i>Petromyzon</i> 3. Fishes <i>Scoliodon, Torpedo, Labeo, Exocoetus, Hippocampus</i> (male and female) <i>Tetrodon, Anabas, Pleuronectes</i> 4. Amphibia <i>Ichthyophis, Necturus, Bufo, Hyla, Alytes, Ambystoma</i> 5. Reptilia <i>Kachuga, Trionyx, Hemidactylus, Varanus, Draco, Bungarus, Vipera, Naja, Zamenis, Crocodylus</i> Key for Identification of poisonous and non-poisonous snakes 6. Aves Study of four common birds (<i>Passer, Columba, Gallus, Psittacula</i>) from different orders. Types of beaks and claws 7. Mammalia <i>Cynopterus</i> (Bat), <i>Funambulus</i> ; 8. Temporary mount of Squamous epithelium	30
	TOTAL	90

Reading List :

1. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
2. Pough H. *Vertebrate life*, VIII Edition, Pearson International.
3. Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.
5. Classification from Young, J. Z. (2004) to be followed .

SEMESTER – III

ZOO CC306 : Animal Physiology: Controlling and Coordinating Systems (Theory :4 credits + Practical: 2 credits)		
Course outcome:		
On completion of the courses students will be able to:		
CO1- To know about different types of Tissues, Bone and Cartilage, Muscles and physiology of Muscle Contraction.		
CO2- To acquire knowledge about the structure and function of Nervous System.		
CO3- To understand the Histology and physiology of Male and Female Reproductive System.		
CO4- To learn about the Histology and Physiology of human Endocrine System and Associated Diseases.		
Units	Topics to be covered (Theory)	No. of hours
1	Tissues: Structure, location, classification and functions of epithelial tissue, connective tissue Bone and Cartilage: Structure & types of bones & cartilages Muscle: Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction	15
2	Nervous System : Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc	7

3	Reproductive System : Histology of testis & ovary; Physiology: male & female reproduction; Puberty .	8
4	Endocrine System: Histology of endocrine glands - pineal, pituitary, parathyroid, pancreas, adrenal; hormones secreted by them and their functions and associated diseases; Classification of hormones; Regulation of their secretion; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones	15
	SELF LEARNING(SL) * Structure, location, classification and function of Muscular tissue and Nervous tissue * Physiology of hearing and vision. * Histology of thyroid and adrenal gland; hormones secreted by them and their mechanism of action	15
	Practical : ● Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex) ● Preparation of temporary mounts: Striated muscle fibres ● Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Pancreas, Testis, Ovary, Adrenal and Thyroid.	30
	TOTAL	90

Reading List :

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Herculat Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
4. Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
5. Geetha N. (2014). Textbook of Medical Physiology. Paras Medical Publisher.

SEMESTER – III

ZOO CC307 : Fundamentals of Biochemistry

(Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO1- To understand the Structure, Classification and Importance of Carbohydrates and Proteins.

CO2- To understand the Structure and Significance of physiologically important Lipids.

CO3- To understand the Basic Structure and Types of DNA and RNA, Base pairing, Denaturation and Renaturation of DNA.

CO4- To understand the Types of Enzymes, Mechanism of Enzyme Action and Enzyme Kinetics.

Units	Topics to be covered (Theory)	No. of hours
1	Carbohydrates: Structure and importance of Monosaccharides, Disaccharides, Polysaccharides and glycoconjugates Proteins: Amino acids: Structure, Classification	14
2	Lipids : Structure and Significance: Physiologically important saturated and unsaturated fatty acids Tri-acylglycerols, Phospholipids, Glycolipids, Steroids	7

3	Nucleic Acids: Basic structure of DNA and RNA; Types of DNA and RNA; Cot Curves: Base pairing, Denaturation and Renaturation of DNA	9
4	Enzymes : Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation; Enzyme inhibition; Allosteric enzymes and their kinetics	15
	SELF LEARNING (SL) Proteins: General properties of alpha aminoacids; physiological importance of essential and non- essential alpha amino acids Nucleic acids: Structure of Purines, pyrimidines, nucleosides, nucleotides, nucleic acids Nomenclature and classification of enzymes	15
	Practical : 1. Qualitative tests for carbohydrates, proteins and lipids. 2. Paper chromatography of amino acids. 3. Action of salivary amylase under optimum conditions. 4. Effect of pH and temperature on the action of salivary amylase.	30
	TOTAL	90

Reading List :

1. Cox, M.M and Nelson, D.L. (2008). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.

SEMESTER – IV

ZOO CC408 : Comparative Anatomy of vertebrates (Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO 1- To describe the function and derivative of integument

CO 2- To explain the Evolution of heart and aortic arches

CO 3- To compare structure and function of the Alimentary canal and associated glands

CO 4- To evaluate the techniques relating to the nervous system and how they within the body respond to challenges.

Units	Topics to be covered (Theory)	No. of hours
1	Integumentary System: functions and derivatives of integument Skeletal System : Jaw suspensorium	12
2	Digestive System : Alimentary canal and associated glands, Respiratory System : Lungs and air sacs.	12
3	Circulatory System : Evolution of heart and aortic arches Urinogenital System : Succession of kidney, Evolution of urinogenital ducts,	11
4	Nervous System : Comparative account of brain	10

	SELF LEARNING (SL) * Structure of integumentary system * Dentition in mammals * Respiratory system: Skin, Gills * General Plan of Circulation * Spinal cord, cranial nerves in mammals * Classification of receptors	15
	Practical : 1.Study of placoid, cycloid and ctenoid scales through permanent slides. 2.Disarticulated skeleton of Frog, <i>Varanus</i> , Fowl, Rabbit 3.Carapace and plastron of turtle /tortoise 4.Mammalian skulls: One herbivorous and one carnivorous animal 5.Study of structure of any two organs based on models (heart, lung, kidney, eye and ear l) 6.Project on skeletal modifications in the forelimbs and hindlimbs of vertebrates	30
	TOTAL	90

Reading List :

1. Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education
2. Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of Vertebrates*. IX Edition. The McGraw-Hill Companies
3. Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons
4. Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House
5. Saxena R K (2008). *Comparative Anatomy of Vertebrates*. Viva Books Private Limited

SEMESTER – IV

ZOO CC409 : Animal Physiology: Life Sustaining Systems **(Theory :4 credits + Practical: 2 credits)**

Course outcome:

On completion of the courses students will be able to:

CO 1- To compare the mechanical and chemical digestion of food

CO 2- To remember and understand hormonal control of secretion of enzymes in gastrointestinal tract

CO 3- To acquire knowledge of mechanism of breathing, Pulmonary ventilation and its control and to understand the concept of hemostasis and blood clotting system.

CO 4- To explain origin and conduction of cardiac impulses and cardiac cycles.

Units	Topics to be covered (Theory)	No. of hours
1	Physiology of Digestion Mechanical and chemical digestion of food; Hormonal control of secretion of enzymes in Gastrointestinal tract	11
2	Physiology of Respiration :Mechanism of breathing, Pulmonary ventilation and its control Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it	09
3	Renal Physiology Kidney: functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance	07
4	Blood: Haemostasis: Blood clotting system.	18

	Physiology of Heart: Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses; Cardiac cycle	
	SELF LEARNING (SL) Structural organization and functions of gastrointestinal tract and associated glands Respiratory volumes and capacities Carbon monoxide poisoning Components of blood and their functions: structure and function of haemoglobin, Blood groups: Rh factor, ABO, MN Structure of mammalian heart; coronary circulation, electrocardiogram	15
	PRACTICAL 1. Determination of ABO Blood group 2. Estimation of haemoglobin using Sahli's haemoglobinometer 3. Preparation of haemin crystals 4. Recording of blood pressure using a sphygmomanometer 5. Examination of sections of mammalian stomach, ileum, liver, lung, kidney	30
	TOTAL	90

Reading List :

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Herculat Asia PTE Ltd. W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
4. Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
5. Geetha N. (2014). Textbook of Medical Physiology. Paras Medical Publisher.

SEMESTER – IV

ZOO CC410 : Biochemistry of Metabolic Processes **(Theory :4 credits + Practical: 2 credits)**

Course outcome:

ZOCC 410: Biochemistry of Metabolic Processes

On completion of the courses students will be able to:

CO 1- To compare catabolism Vs Anabolism, Compartmentalization of metabolic pathways and membrane transporters

CO 2- To construct a flowchart for the steps involved in sequence of reactions of glycolysis, citric acid and pentose phosphate pathway

CO 3- To acquire a comprehensive knowledge of β – oxidation of saturated fatty acids

CO 4-To understand the transamination and determination.

Units	Topics to be covered	No. of hours
1	Overview of Metabolism : Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, shuttle systems and membrane transporters	10

2	Carbohydrate Metabolism: Sequence of reactions of glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis.	16
3	Lipid Metabolism: β -oxidation of saturated fatty acids with even and odd number of carbon atoms	12
4	Protein Metabolism: Catabolism of amino acids: Transamination, Deamination, Urea cycle;	7
	SELF LEARNING (SL) * Intermediary metabolism * ATP and another energy rich compounds * Fate of C-skeleton of Glucogenic and Ketogenic amino acids * Gluconeogenesis, Glycogenolysis and Glycogenesis	15
	Practical 1. Estimation of total protein in given solutions by Lowry's method 2. Detection of SGOT and SGPT or GST and GSH in serum/ tissue 3. Estimation of glycogen in goat liver 4. To perform the Acid and Alkaline phosphatase assay from serum/ tissue. 5. Project on Metabolic pathways.	30
	TOTAL	90

Reading List :

1. Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. Vasudevan D M. (2016). *Textbook of Biochemistry for Medical Students*. Publisher: Jaypee brothers

SEMESTER – V

ZOO CC511 : Molecular Biology

(Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO 1- To understand Central dogma of molecular biology. Explain and distinguish mechanism of replication, transcription and translation in prokaryotes and eukaryotes.

CO 2- To understand and explain the post transcriptional modifications in eukaryotes .

CO 3- To explain and differentiate the mechanism of gene expression and regulation in prokaryotes and eukaryotes

CO 4- To describe the concept of regulatory RNAs, Ribo-switches and RNA interference and to enhance skill in molecular biology through relevant experiments.

Units	Topics to be covered	No. of hours
1	DNA Replication : DNA Replication in prokaryotes and brief account of mechanism in eukaryotes	18

	Transcription: RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes , Synthesis of mRNA in eukaryotes, transcription factors	
2	Translation : Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation	10
3	Post Transcriptional Modifications and Processing of Eukaryotic RNA Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism	6
4	Gene Regulation Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon; trp operon Transcription regulation of eukaryotes; Activators, Repressors, Enhancers, silencer elements Regulatory RNAs Ribo-switches, RNA interference	11
	SELF LEARNING (SL) Salient features of DNA, RNA; Watson and Crick model of DNA Ribosome structure and assembly in prokaryotes Gene silencing, Genome imprinting miRNA, SiRNA, PiRNA	15
	Practical : 1. Study of Polytene chromosomes from Chironomous / Drosophila larvae 2. Preparation of liquid culture medium (LB) and raise culture of <i>E. coli</i> 3. Estimation of the growth kinetics of <i>E. coli</i> by turbidity method 4. Preparation of solid culture medium (LB) and growth of <i>E. coli</i> by spreading and streaking 5. Demonstration of antibiotic sensitivity/resistance of <i>E. coli</i> to antibiotic pressure and interpretation of results 6. Study and interpretation of electron micrographs/ photograph showing a. DNA replication b. Split genes	30
	TOTAL	90

Reading List :

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IV Edition.

3. Cooper G. M. and Robert E. Hausman R. E. *The Cell: A Molecular Approach*, V Edition, ASM Press and Sinauer Associates.
4. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
5. Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.

SEMESTER – V

<p><u>ZOO CC512 : Principles of Genetics</u> (Theory :4 credits + Practical: 2 credits)</p> <p>Course outcome: On completion of the courses students will be able to:</p> <p>CO 1- To explain and discuss the genetic variation through linkage and crossing over.</p> <p>CO 2- To describe sex-linked, sex limited and sex influenced inheritance.</p> <p>CO 3- To understand the Concept behind genetic disorder, gene mutations and molecular basis of mutations and to explain the criteria for extra-chromosomal inheritance.</p> <p>CO 4- To describe the molecular mechanisms of recombination in bacteria and to explain and distinguish the concept of transposable genetic elements in prokaryotes and eukaryotes. Solve genetic based problems.</p>		
Units	Topics to be covered	No. of hours
1	Sex-linked , sex limited and sex influenced inheritance. Linkage, Crossing Over and Chromosomal Mapping : Linkage and crossing over, Cytological basis of crossing over, Molecular	16

	mechanisms of recombination including different models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence	
2	Mutations : Types of gene mutations (classification) Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached X method.	8
3	Extra-chromosomal Inheritance : Criteria for extra-chromosomal inheritance, Antibiotic resistance in <i>Chlamydomonas</i> , Maternal effects	6
4	Recombination in Bacteria: Transformation, Transduction, Conjugation in Bacteria ,Molecular mechanisms of recombination including different models of recombination Transposable Genetic Elements : Transposons in bacteria, Ac-Ds elements in maize and P elements in <i>Drosophila</i> ,	15
	SELF LEARNING (SL) Principles of inheritance, incomplete dominance and co-dominance; multiple alleles, lethal alleles, Epistasis, Pleiotropy Types of chromosomal aberrations (Classification, figures and with one suitable example each Chromosomal Mechanism of sex determination in <i>Drosophila</i> and man	15
	Practical : 1. To study the Mendelian laws and gene interactions. 2. Chi-square analyses using seeds/beads/ <i>Drosophila</i> . 3. Linkage maps based on data from <i>Drosophila</i> crosses 4. Study of human karyotype (normal and abnormal) based on photographs 5. Pedigree analysis of some human inherited traits	30
	TOTAL	90

Reading List :

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India
2. Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc

3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings
4. Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings
5. Fletcher H. and Hickey I. (2015). *Genetics*. IV Edition. GS, Taylor and Francis Group, New York and London.

SEMESTER – VI

ZOO CC613 : Developmental Biology

(Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO 1- To describe the mechanism of gametogenesis, fertilization and blocks to polyspermy.

CO 2- To explain early embryonic development in frog and chick.

CO 3- To understand the concepts of late embryonic development in model organisms.

CO4 - To describe post embryonic development such as metamorphosis and regeneration with suitable examples and apply important experiments and project work.

Units	Topics to be covered	No. of hours
1	Gametogenesis : Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal) ,Blocks to polyspermy	10

2	Early Embryonic Development : Planes and patterns of cleavage; Fate maps; Early development of frog and chick up to gastrulation; Embryonic induction and organizers	14
3	Late Embryonic Development : Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans,	5
4	Post Embryonic Development : Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis , morphallaxis and compensatory regeneration(with one example each)	16
	SELF LEARNING (SL) Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants . Placenta (structure, types and functions of placenta)	15
	Practical : 1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, tadpole (external and internal gill stages) 2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages) 3. Study of the developmental stages and life cycle of <i>Drosophila</i> from stock culture 4. Study of different placenta types (models) 5. Project report on <i>Drosophila</i> culture/chick embryo development	30
	TOTAL	90

Reading List :

1. Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
2. Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
3. Carlson, R. F. Patten's Foundations of Embryology

4. Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers
5. Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press

SEMESTER – VI

ZOO CC614 : Evolutionary Biology

(Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO 1- To understand the basis of origin of life such as: chemogeny, RNA world, biogeny and evolution of eukaryotes.

CO 2- To obtain the various evolutionary concepts and heritable variation and to understand concept of species, isolating mechanisms, modes of speciation and adaptive radiation.

CO 3- To explain and different types of fossils, geological time scale, climatic conditions, hominid characteristics, primate phylogeny and evolution of horse and man.

CO 4- To understand Hardy-Weinberg principle of genetic equilibrium and its destabilizing forces such as Natural selection, Mutation, Migration and genetic drift .

Units	Topics to be covered	No. of hours
1	Origin of life: Chemogeny, RNA world, Biogeny, Evolution of eukaryotes	5
2	Evolutionary concepts: Lamarckism, Darwinism, Neo-Darwinism Heritable variations: sources and their role in evolution Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches)	17
3	Evidences of Evolution, types of fossils, geological time scale and climatic conditions and their fauna, evolution of horse Origin and evolution of man; Unique hominid characteristics contrasted with primate characteristics, primate phylogeny from <i>Dryopithecus</i> leading to <i>Homo sapiens</i>	12
4	Population genetics: Hardy-Weinberg Law (statement and derivation of equation, Evolutionary forces upsetting H-W equilibrium; Natural selection (concept of fitness, types of selection, kin selection), Genetic Drift (mechanism, founder's effect, bottleneck phenomenon)	11
	SELF LEARNING (SL) * Product of evolution: micro-evolutionary changes (inter-population variations, clines, races) * Extinctions, Back ground mass extinctions (causes and effects), detailed eg. of K-T extinction * Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees	15
	Practical : 1. Study of fossils from models/ pictures 2. Study of homology and analogy from suitable specimens 3. Study and verification of Hardy-Weinberg Law by chi square analysis 4. Study of role of natural selection and genetic drift in changing allele frequencies using data 5. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.	30

	6. Construction of cladogram	
	TOTAL	90

Reading List :

1. Ridley, M. (2004). Evolution III Edition Blackwell publishing
2. Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers.
3. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
4. Snustad. S Principles of Genetics.
5. Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley-Blackwell

Generic Elective Papers (GE) (6 credits each)

SEMESTER – III

Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

<u>ZOO GE303 : Food, Nutrition and Health</u> (Theory :4 credits + Practical: 2 credits)		
Course outcome:		
On completion of the courses students will be able to:		
CO 1- To explain the concept of balanced diet		
CO 2- To compare nutrient needs and dietary pattern for various groups – adults, pregnant and nursing mothers.		
CO 3- To understand the concept of Carbohydrate, lipids and proteins.		
CO 4- To apply the knowledge of potable water and apply to methods of purification at domestic level.		
Units	Topics to be covered	No. of hours
1	Basic concept of food and nutrition Concept of a balanced diet, nutrient needs and dietary pattern for various groups- adults, pregnant and nursing mothers, infants, school children, adolescents and elderly	10
2	Nutritional Biochemistry: Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role Vitamins- Fat-soluble and Water-soluble vitamins- their dietary source and importance Minerals- Iron, calcium, phosphorus, iodine, selenium and zinc: their biological functions	20
3	Health Introduction to health- Definition and concept of health Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin A deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders- their causes, symptoms, treatment, prevention and government programmes, if any. Life style related diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention through dietary and lifestyle modifications Social health problems- smoking,	15

	alcoholism, drug dependence and Acquired Immuno Deficiency Syndrome (AIDS)-their causes, treatment and prevention Common ailments- cold, cough, and fevers, their causes and treatment	
4	Food hygiene: Potable water- sources and methods of purification at domestic level Food and Water borne infections: Bacterial infection Cholera, typhoid fever, dysentery; Viral infection: Hepatitis, Poliomyelitis, Protozoan infection: amoebiasis, giardiasis; Parasitic infection: ascariasis, its transmission, causative agent, sources of infection, symptoms and prevention Brief account of food spoilage: Causes of food spoilage and their preventive measures	15
	Total	60
	Practical 1. To detect adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric 2. Estimation of Lactose in milk 3. Ascorbic acid estimation in food by titrimetry 4. Estimation of Calcium in foods by titrimetry 5. Study of the stored grain pests from slides/ photograph(<i>Sitophilus oryzae</i> , <i>Trogoderma granarium</i> , <i>Callosobruchus chinensis</i> and <i>Tribolium castaneum</i>): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests. 6. Project- Prepare diet chart for different age groups. OR Identify nutrient rich sources of foods (fruits and vegetables), their seasonal availability and price- Prepare chart OR Study of nutrition labelling on selected foods	30
	TOTAL	90

Reading List :

1. Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2007; New Age International Publishers
2. Srilakshmi B. Food Science; Fourth Ed; 2007; New Age International (P) Ltd.
3. Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.

4. Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd.
5. Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence.

SEMESTER – IV

ZOO GE404 : Insect Vectors and Diseases

(Theory :4 credits + Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO 1- To understand and describe the morphological features of insects

CO 2- To understand the exemplify the important insect Vectors- mosquitoes, Sand fly and houseflies

CO 3- To understand and Explain mosquito-borne diseases live Malaria, Dengue, Chikungunya, Viral encephalitis

CO 4- To understand and describe the Hemipteran disease vectors

Units	Topics to be covered	No. of hours
1	Introduction to Insects General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits	7
2	Concept of Vectors Brief introduction of Carrier and Vectors (mechanical and biological vector),Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity Insects as Vectors Insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera	15
3	Dipteran as Disease Vectors Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly	24
4	Siphonaptera as Disease Vectors Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas Hemiptera as Disease Vectors Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures	14

	Total	60
	Practical 1. Study of different kinds of mouth parts of insects 2. Study of following insect vectors through permanent slides/ photographs: <i>Aedes, Culex, Anopheles, Musca domestica</i> , through permanent slides/ photographs 3. Study of different diseases transmitted by above insect vectors Submission of a project report on any one of the insect vectors and disease transmitted	30
	TOTAL	90

Reading List :

1. Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
2. Chapman, R.F. (1998). *The Insects: Structure and Function*. IV Edition, Cambridge University Press, UK
3. Pedigo L.P. (2002). *Entomology and Pest Management*. Prentice Hall Publication
4. Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell
5. Peterson P G (2017). *Insect Ecology*. Meditech publication

Discipline Specific Elective (DSE) (6 credits each)

SEMESTER – V

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

ZOO DSE501 : Endocrinology		
(Theory :4 credits+ Practical: 2 credits)		
Course outcome:		
On completion of the courses students will be able to:		
CO 1- Describe and of types of endocrine glands, classify hormones and explain their features.		
CO 2- Explain structure ,functions and regulation of peripheral endocrine glands and associate function of neuroendocrine system, epiphysis, and hypothalamo-hypophysial axis.		
CO 3- Understand the mechanism of regulation of hormone action hormone action at cellular level and gain the knowledge of hormone receptors.		
CO 4- Apply the knowledge by performing biochemical assays to detect level of hormones in plasma and visualize cross sections of endocrine glands.		
Unit	Topics to be covered	No. of hours
1	Introduction to Endocrinology Types of endocrine glands, classification of hormones	06
2	Epiphysis, Hypothalamo-hypophysial Axis : Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction. Structure of hypothalamus, Hypothalamic nuclei and their functions, Regulation of neuroendocrine glands, Feedback mechanisms. Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophysial portal system.	15
3	Peripheral Endocrine Glands : Structure, Hormones, Functions and Regulation of Thyroid gland, Adrenal, Pancreas, Ovary and Testis	14
4	Regulation of Hormone Action Hormone action at Cellular level: Hormone receptors	10
	SELF LEARNING (SL) Characteristic and Transport of Hormones, Neurosecretions and Neurohormones Disorders of Pituitary Parathyroid Hormones in homeostasis, Disorders of endocrine glands	15
	Practical : 1. Dissect and display of Endocrine glands in laboratory bred 2.Study of the permanent slides of all the endocrine glands 3.Estimation of plasma level of any hormone using ELISA T ₃ , T ₄ , TSH	30

	TOTAL	90
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Reading List :

1. General Endocrinology C. Donnell Turner Pub- Saunders Toppan
2. Endocrinology: An Integrated Approach; Stephen Nussey and Saffron Whitehead. Oxford: BIOS Scientific Publishers; 2001.
3. Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice-Hall, Pearson Education Inc., New Jersey.
4. Vertebrate Endocrinology by David O. Norris
5. Melmed S, Polonsky K , Larsen P R , Kronenberg H M (2016). Williams Textbook of Endocrinology

SEMESTER – V

ZOO DSE502 : Immunology **(Theory :4 credits+ Practical: 2 credits)**

Course outcome:

On completion of the courses students will be able to:

CO 1- To explain cells and organs of the immune system, innate and adaptive immunity.

CO 2- To describe autoimmunity with reference to rheumatoid arthritis and tolerance and AIDS.

CO 3- To understand antigens and its type, structure and functions of immunoglobulins, antigen-antibody interactions and immunoassays (such as ELISA and RIA).

CO 4- To explain structure and functions major histocompatibility complex, know the concept of hypersensitivity and vaccines.

Unit	Topics to be covered	No. of hours
1	Overview of Immune System: , Cells and organs of the Immune system Innate and Adaptive Immunity Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral), Passive: Artificial and natural Immunity, Active: Artificial and natural Immunity, Immune dysfunctions (brief account of autoimmunity with reference to Rheumatoid Arthritis and tolerance, AIDS)	16
2	Antigens Antigenicity and immunogenicity, Factors influencing immunogenicity	03
3	Immunoglobulins: Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Major Histocompatibility Complex: Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation	14
4	Complement System: Components and pathways of complement activation. Hypersensitivity Gell and Coombs' classification and brief description of various types of hypersensitivities Vaccines Various types of vaccines	12
	SELF LEARNING (SL) Historical perspective of Immunology, Early theories of immunology Immunogens, adjuvants and haptens	15

	Polyclonal sera Cytokines: properties and functions of cytokines, therapeutics Cytokines	
	Practical : 1*. Demonstration of lymphoid organs. 2. Histological study of spleen, thymus and lymph nodes through slides/ photographs 3. Preparation of stained blood film to study various types of blood cells. 4. ABO blood group determination. Project : Different types of immunoglobulins.	30
	TOTAL	90

Reading List :

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Publication.
2. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Edition. Saunders Publication.
3. Abbas, K. Abul and Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V
4. Owen J A, Punt J, Stanford S A (2013). *Kuby Immunology* W H Freeman & Co;
5. Wood P. (2007). *Basic Immunology*. Pearson publication

SEMESTER – VI

ZOO DSE603 : Animal Behavior and Chronobiology

(Theory :4 credits+ Practical: 2 credits)

Course outcome:

On completion of the courses students will be able to:

CO 1- To understand various pattern of animal behaviours such as stereotyped, instinct, learnt, associative behaviour along with operant conditioning and habituation imprinting and to explain the concept of social and sexual behaviour.

CO 2- To provide the concept of biological rhythm, photoperiod and regulation of seasonal reproduction of vertebrates and role of melatonin.

CO 3- To understand the relevance of biological clock in terms of chronopharmacology, chronomedicine and chronotherapy.

CO 4- To develop the skill in this course by performing practical works such as studying nest and nesting habitat of birds and social insects and other significant experiments.

Unit	Topics to be covered	No. of hours
1	Patterns of Behaviour Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.	10
2	Social and Sexual Behaviour Social and Sexual Behaviour Social Behaviour: Concept of Society; Communication and the senses; Altruism; Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.	15
3	Biological Rhythm Concept of synchronization and masking; Photic and non-photic zeitgebers; Circannual rhythms; Photoperiod and regulation seasonal reproduction of vertebrates; Role of melatonin.	10
4	Biological Clocks Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy. Adaptive significance of biological clocks.	10
	SELF LEARNING (SL)	15

	<ol style="list-style-type: none"> 1. Comparison of instinct vs learnt behaviour 2. Insects' society with Honey bee as example; Foraging in honey bee significance of the bee dance. 3. Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms 	
	<p>Practical :</p> <ol style="list-style-type: none"> 1. To study nests and nesting habits of the birds and social insects. 2. To study the behavioural responses of wood lice to dry and humid conditions. 3. To study geotaxis behaviour in earthworm/ <i>Drosophila</i> 4. To study the phototaxis/ chemotaxis behaviour in insect larvae. 5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report. 6. Study of circadian functions in humans (daily eating, sleep and temperature patterns). 	30
	TOTAL	90

Reading List :

1. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
3. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
4. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
5. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

SEMESTER – VI

**ZOO DSE604 : Wild Life Conservation and Management
(Theory :4 credits+ Practical: 2 credits)**

Course outcome:

On completion of the courses students will be able to:

CO 1- To understand different physical and biological parameters for evaluation and management of wild life.

CO 2- To get the knowledge of Grazing logging, cover construction, preservation of genetic diversity and restoration of degraded habitats under management of habitats.

CO 3- To estimate Population density, Natality, Birth rate, Mortality and fertility schedules.

CO 4- To get the concept of climax persistence, Rescue and rehabilitation, Quarantine, Common disease of wild animal and Man – Animal conflict and to enhance exposure through visit to Wild life Sanctuary, Biodiversity Park and Zoological Parks .

Unit	Topics to be covered	No. of hours
1	Evaluation and management of wild life: Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.	12
2	Management of habitats: Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats	12
3	Population estimation Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation;	12
4	Management planning of wild life: Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbation, Rescue and rehabilitation Bio- telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal, Man-Animal conflict	9
	SELF LEARNING	15

	<p>Values of wild life : positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; Conservation strategies.</p> <p>Protected Areas: National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.</p> <p>Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.</p>	
	<p>Practical :</p> <ol style="list-style-type: none"> 1. Identification of mammalian fauna, avian fauna, herpeto-fauna 2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Global Positioning System, Various types of Cameras and lenses) 3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc. 4. PCQ, Ten tree method, Circular, Square & rectangular plots, ground cover assessment, Tree canopy cover assessment, Shrub cover assessment. 5. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences) 	30
	TOTAL	90

Reading List :

1. Caughley, G., and Sinclair, A.R.E. (1994). *Wildlife Ecology and Management*. Blackwell Science.
2. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). *People and Wildlife, Conflict or Co-existence?* Cambridge University.
3. Bookhout, T.A. (1996). *Research and Management Techniques for Wildlife and Habitats*, 5 th edition. The Wildlife Society, Allen Press.
4. Sutherland, W.J. (2000). *The Conservation Handbook: Research, Management and Policy*. Blackwell Sciences
5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). *Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory*. Blackwell Publishing.

Skill Enhancement Course (SEC) (2Credits)

SEMESTER – III

Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide **value-based and/or skill-based knowledge**.

<u>IRS SEC301 : Inter-Religious Studies (Value Based) (02credits)</u>		
Unit	Topics to be covered	No. of hours
1	Nature and Need of Inter-Religious study, Scope of Comparative Religion.	05
2	Salient Features of Hinduism, Jainism and Buddhism, Salient Features of Christianity, Islam and Sikhism.	10
3	Similarities and Differences among Religions, Conflicting Truth claims of different religions and inter-religious Harmony.	10
4	Religious Tolerance, Secularism.	05
	TOTAL	30

Reading List :

1. Chaudhary, C. Neeraj (1979). "Hinduism", B.I. Publication, New Delhi.
2. Devraj, N.K., (1917)- "Hinduism and Christianity" Asian Publishing House.
3. Gordh, George, - "Christian Faith and its Cultural Expression", Printed in USA.
4. Hick, John, - "Philosophy of Religion", Prentice Hall of India.
5. Hopfe, M. Lewis (1983)- "Religion of the World", Macmillan Publishing Co. Inc, New York
6. Masih, Y. (1990)- "Comparative study of Religion", Motilal Banarasi Dass.
7. Sethi, S. Arijit, Pummer, Reinhard, (1979)- "Comparative Religion", Vikas Publishing House pvt. Ltd, Delhi.
8. Singh, B.N., (1994)- "Vishwa Dharma Darshan ki Samasyain", Ratna Printing Works.
9. Tiwari, Nath Kedar, (1983)- "Comparative Religion", Motilal Banarasi Dass.
10. Ward, CHS (1998) – "Early Buddhism", Caxton Publication, Delhi.

SEMESTER – IV

ZOO SEC402 : Medical Diagnostics (2 credits)		
Course Outcome: On completion of the courses students will be able to:		
CO 1- To explain medical diagnostics and its importance.		
CO 2- To concept of diagnostics methods used for analysis of blood and urine.		
CO 3- To describe distinguish infectious diseases and non-infectious diseases, its causes, types, symptoms, complications, diagnosis and preventions.		
CO 4- To describe and distinguish tumour, its types. Explain methods of detection such as medical imaging: X-ray of bone fracture, PET, MRI and CT Scan (using photographs).		
Unit	Topics to be covered	No. of hours
1	Introduction to Medical Diagnostics and its Importance	02
2	Diagnostics Methods Used for Analysis of Blood : Blood composition, Preparation of blood smear and Differential Leukocyte Count (D.L.C) using Leishman’s stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.) Diagnostic Methods Used for Urine Analysis : Urine Analysis: Physical characteristics; Abnormal constituents	16
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 Infectious Diseases : Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis	09
4	Tumours : Type (Benign/Malignant), Detection and metastasis; Medical imaging: X-ray of Bone fracture, PET, MRI and CT Scan (using photographs).	03
	TOTAL	30

Reading List :

1. Leeuwen AMV, Bladh ML (2017). Davis's Comprehensive Handbook of Laboratory and Diagnostic Tests With Nursing Implications. F.A. Davis Company; 7 edition
2. Buckingham L (2011). Molecular Diagnostics: Fundamentals, Methods and Clinical Applications. F.A. Davis Company; 2 edition
3. Merck Editor (2011). The Merck Manual of Diagnosis and Therapy. Elsevier Health Sciences

4. Captain C, Banerjee P. (2014). Common Laboratory Tests Used by TCM Practitioners : When to Refer Patients for Lab Tests and How to Read and Interpret the Results. Jessica Kingsley Publishers.
5. Andersson D, Creations M (2018). Lab Values: Everything You Need to Know about Laboratory Medicine and its Importance in the Diagnosis of Diseases.