

# **Scheme and Syllabus**

**For**

**B.Sc. Honours Zoology**

**Under**

**Choice Based Credit System (CBCS)**

**Applicable from Session 2020-2021 to onwards**

**Department of Zoology**

**School of Life Sciences**

**Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)**

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## Under Graduate Programs: B.Sc. (Hon.) Zoology

Offered by the Department of Zoology, School of Life Sciences

1. Name of the program: Bachelor of Science in Zoology

2. Program Specifications:

School of Studies: School of Life Sciences

Department: Zoology

Program: B.Sc. (Zoology) CBCS Scheme

Date of Approval in Board of Studies: 2020

3. Mode of Study:

Full time (Semester system): Class room teaching; tutorials; experiential learning; experimental laboratory training; project assignments.

**Purpose of the course:**

Zoology is one of the most important branches of biology, studied at undergraduate level. It is essential to learn and understand animal diversity to appreciate the variability in relation to their morphology, anatomy and behavior among different animals. Students will learn and know about different human systems, their coordination and control. This course will also provide an opportunity to learn the evolution along with other animals. They will be able to analyze evolutionary parameters using various tools used in modern sciences. This will provide them adequate opportunities to explore different career opportunities. This course will also provide a platform to learn classical genetics to understand distribution of different traits among populations, their inheritance and ethnicity. Student can correlate with contemporary and modern techniques like genomics, metagenomics, genome editing and molecular diagnostic tool. Practical and theoretical skills gained in this course will be helpful in designing different public health strategies for social welfare. Zoology course will also provide a sound knowledge of applied subjects to develop various skills to make a career and become an entrepreneur in the field of biology.

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**Semester-wise Theory Papers/ Practical: B.Sc. Hon's (Zoology)**  
**Department of Zoology, School of Life Science**

<b>SEMESTER I</b>						
Course Opted	Course Code	Name of the course	Credit	Hours /week	Internal Assessment	End Semester Exam.
Core Course-1 Theory	LS/ZOO/CC-101 L	Non Chordates – I (Protista to Pseudocoelomate)	4	4	30 (15+15)	70
Core Course-1 Practical	LS/ZOO/CC-101 P	Lab Course	2	4	30 (15+15)	70
Core Course-2 Theory	LS/ZOO/CC-102 L	Principles of Ecology	4	4	30 (15+15)	70
Core Course-2 Practical	LS/ZOO/CC-102 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-1 Theory	LS/ZOO/GE-101 L	Aquatic Biology	4	4	30 (15+15)	70
Generic Elective-1 Practical	LS/ZOO/GE-101 P	Lab Course	2	4	30 (15+15)	70
Ability Enhancement Compulsory Course-1	LS/ZOO/AE-101/EC	English Communication / Hindi Communication	4*	4	30 (15+15)	70
Extracurricular Activity		Tour/ Field visit/ Industrial training/ NSS/ Swachhta/ Vocational Training/ Sports/ others	2	(2)		
<b>TOTAL</b>			<b>24</b>	<b>28</b>	<b>30</b>	<b>70</b>
<b>SEMESTER II</b>						
Core Course-3 Theory	LS/ZOO/CC-201 L	Non Chordates – II (Coelomates)	4	4	30 (15+15)	70
Core Course-3 Practical	LS/ZOO/CC-201 P	Lab Course	2	4	30 (15+15)	70
Core Course-4 Theory	LS/ZOO/CC-202 L	Cell Biology	4	4	30 (15+15)	70
Core Course-4 Practical	LS/ZOO/CC-202 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-2 Theory	LS/ZOO/GE-201 L	Environment and Public Health	4	4	30 (15+15)	70
Generic Elective-2 Practical	LS/ZOO/GE-201 P	Lab Course	2	4	30 (15+15)	70
Ability Enhancement Compulsory Course-2	LS/ZOO/AE-201/ES	Environmental Science	4*	4	30 (15+15)	70
Extracurricular Activity		Tour/ Field visit/ Industrial training/ NSS/ Swachhta/ Vocational Training/ Sports/ others	2	(2)		
<b>TOTAL</b>			<b>24</b>	<b>28</b>	<b>30</b>	<b>70</b>
<b>Summer Internship: 15 days</b>		Swayam Swachhta / NSS / Industrial/ others	2	6h/day	–	<b>100</b>
<b>SEMESTER III</b>						
Core Course-5 Theory	LS/ZOO/CC-301 L	Diversity of chordates	4	4	30 (15+15)	70
Core Course-5 Practical	LS/ZOO/CC-301 P	Lab Course	2	4	30 (15+15)	70
Core Course-6 Theory	LS/ZOO/CC-302 L	Physiology: Controlling and Coordinating systems	4	4	30 (15+15)	70
Core Course-6 Practical	LS/ZOO/CC-302 P	Lab Course	2	4	30 (15+15)	70
Core Course-7 Theory	LS/ZOO/CC-303 L	Fundamentals of Biochemistry	4	4	30 (15+15)	70

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Core Course-7 Practical	LS/ZOO/CC-303 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-3 Theory	LS/ZOO/GE-301 L	Food Nutrition and Health	4	4	30 (15+15)	70
Generic Elective-3 Practical	LS/ZOO/GE-301 P	Lab Course	2	4	30 (15+15)	70
Skill Enhancement Course-1	LS/ZOO/SEC-301 L	Sericulture	2	2	30 (15+15)	70
Skill Enhancement Course-1	LS/ZOO/SEC-301 P	Lab Course	2	4	30 (15+15)	70
<b>TOTAL</b>			<b>28</b>	<b>34</b>	<b>30</b>	<b>70</b>
<b>SEMESTER IV</b>						
Core Course-8 Theory	LS/ZOO/CC-401 L	Comparative anatomy of vertebrates	4	4	30 (15+15)	70
Core Course-8 Practical	LS/ZOO/CC-401 P	Lab Course	2	4	30 (15+15)	70
Core Course-9 Theory	LS/ZOO/CC-402 L	Physiology: Life Sustaining Systems	4	4	30 (15+15)	70
Core Course-9 Practical	LS/ZOO/CC-402 P	Lab Course	2	4	30 (15+15)	70
Core Course-10 Theory	LS/ZOO/CC-403 L	Biochemistry of Metabolic Processes	4	4	30 (15+15)	70
Core Course-10 Practical	LS/ZOO/CC-403 P	Lab Course	2	4	30 (15+15)	70
Generic Elective-4 Theory	LS/ZOO/GE-401 L	Insect Vectors and Diseases	4	4	30 (15+15)	70
Generic Elective-4 Practical	LS/ZOO/GE-401 P	Lab Course	2	4	30 (15+15)	70
Skill Enhancement Course-2	LS/ZOO/SE-401	Medical Diagnostics	2	2	30 (15+15)	70
Skill Enhancement Course-2	LS/ZOO/SE-401	Lab Course	2	4	30 (15+15)	70
<b>TOTAL</b>			<b>28</b>	<b>34</b>	<b>30</b>	<b>70</b>
<b>Summer Internship: 15 days</b>		Swayam Swachhta / NSS / Industrial/ others	2	6h/day	--	100
<b>SEMESTER V</b>						
Core Course-11 Theory	LS/ZOO/CC-501 L	Molecular Biology	4	4	30 (15+15)	70
Core Course-11 Practical	LS/ZOO/CC-501 P	Lab Course	2	4	30 (15+15)	70
Core Course-12 Theory	LS/ZOO/CC-502 L	Principles of Genetics	4	4	30 (15+15)	70
Core Course-12 Practical	LS/ZOO/CC-502 P	Lab Course	2	4	30 (15+15)	70
Discipline Specific Elective-1 Theory	LS/ZOO/DSE-501(A) L	*A. Biology of Insect (MOOCS)	4	4	30 (15+15)	70
	LS/ZOO/DSE-501(B) L	*B. Immunology (MOOCS)				
Discipline Specific Elective-1 Practical	LS/ZOO/DSE-501(A) P	Lab Course A	2	4	30 (15+15)	70
	LS/ZOO/DSE-501(B) P	Lab Course B				
Discipline Specific Elective-2 Theory	LS/ZOO/DSE-502(A) L	A. Basics of Neuroscience	4	4	30 (15+15)	70
	LS/ZOO/DSE-502(B) L	B. Reproductive Biology				
Discipline Specific Elective-2 Practical	LS/ZOO/DSE-502(A) P	Lab Course A	2	4	30 (15+15)	70
	LS/ZOO/DSE-502(B) P	Lab Course B				
<b>TOTAL</b>			<b>24</b>	<b>32</b>		

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*Praveen*

SEMESTER VI						
Core Course-13 Theory	LS/ZOO/CC-601 L	Developmental Biology	4	4	30 (15+15)	70
Core Course-13 Practical	LS/ZOO/CC-601 P	Lab Course	2	4	30 (15+15)	70
Core Course-14 Theory	LS/ZOO/CC-602 L	Evolutionary Biology	4	4	30 (15+15)	70
Core Course-14 Practical	LS/ZOO/CC-602 P	Lab Course	2	4	30 (15+15)	70
Discipline Specific Elective-3 Theory	LS/ZOO/DSE-601(A) L	A. Endocrinology	4	4	30 (15+15)	70
	LS/ZOO/DSE-601(B) L	B. Fish and Fisheries				
Discipline Specific Elective-3 Practical	LS/ZOO/DSE-601(A) P	Lab Course A	2	4	30 (15+15)	70
	LS/ZOO/DSE-601(B) P	Lab Course B				
Dissertation/ Project work / Academic Visit followed by report submission and seminar	LS/ZOO/DW/PW/AV		5 + 1 = 6	8	30 (15+15)	70
<b>TOTAL</b>			<b>24</b>	<b>32</b>		
<b>TOTAL CREDITS</b>				<b>152 + 4 (SI)</b>		

As per UGC CBCS guidelines, University / departments have liberty to offer GE and SEC courses offered by any department to students of other departments. The No. of GE course is four. One GE course is compulsory in first 4 semesters each. In present scheme it is proposed to have minimum two GE courses (from one subject) in first two semester after which student shall change two GE for another subject in III<sup>rd</sup> and IV<sup>th</sup> semester, so that all the student can have exposure of one additional subject.

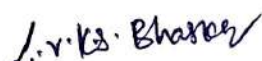
**(Subject to approval by the competent authority)**

\*These two courses will be offered to students depending upon the availability and commencement in the respective semester in MOOCS and syllabus of MOOCS will be followed. In case of unavailability of these two courses, the same will be taught as usual DSE courses.

  
Prof. S K Prasad  
(External Expert)

  
Dr. Rohit Seth  
(Member)

  
Dr. S K Verma  
(Member)

  
Prof. LVKS Bhaskar  
(HOD)

**Under Graduate Programs: B.Sc. (Hon.) Zoology**

**Offered by the Department of Zoology, School of Life Sciences**

**1. Name of the program:** Bachelor of Science in Zoology

**2. Program Specifications:**

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Department: Zoology

Program: B.Sc. (Zoology) CBCS Scheme

Date of Approval in Board of Studies: 2020

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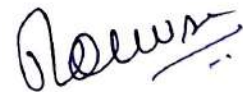
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Zoology is one of the most important branches of biology, studied at undergraduate level. It is essential to learn and understand animal diversity to appreciate the variability in relation to their morphology, anatomy and behavior among different animals. Students will learn and know about different human systems, their coordination and control. This course will also provide an opportunity to learn the evolution along with other animals. They will be able to analyze evolutionary parameters using various tools used in modern sciences. This will provide them adequate opportunities to explore different career opportunities. This course will also provide a platform to learn classical genetics to understand distribution of different traits among populations, their inheritance and ethnicity. Student can correlate with contemporary and modern techniques like genomics, metagenomics, genome editing and molecular diagnostic tool. Practical and theoretical skills gained in this course will be helpful in designing different public health strategies for social welfare. Zoology course will also provide a sound knowledge of applied subjects to develop various skills to make a career and become an entrepreneur in the field of biology.



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**CORE COURSE I**

LS/ZOO/CC-101 L

**NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATA**

**THEORY**

(Credits 4)

- Unit 1: Protista, Parazoa and Metazoa** 19  
General characteristics and classification up to classes; Study of *Euglena*, *Amoeba* and *Paramecium*; Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica*; Locomotion and Reproduction in Protista; Types of symmetry.
- Unit 2: Porifera** 7  
General characteristics and classification up to classes; Type study of *Sycon*; Canal system and spicules in sponges.
- Unit 3: Cnidaria** 12  
General characteristics and classification up to classes; Type study of *Obelia*; Polymorphism in Cnidaria; Corals and coral reefs.
- Unit 4: Ctenophora** 4  
General characteristics and Evolutionary significance.
- Unit 5: Platyhelminthes** 10  
General characteristics and classification up to classes; Type study, larval forms and pathogenicity of *Fasciola hepatica*.
- Unit 6: Nematelminthes** 8  
General characteristics and classification up to classes; Type study of *Ascaris lumbricoides*; Life cycle and pathogenicity of *Wuchereria bancrofti*; Parasitic adaptations in helminthes.

**Course Objectives:**

Core course Protista to Pseudocoelomate will help to understand the behavior, structure and evolution of animals. To make the graduate students aware with the importance of Plant-like protista and organisms belong to invertebrate animal whose body cavity is a *pseudocoel* rather than a true coelom.

**Course Outcomes:**

These courses and their practical exercises will help the students to apply their knowledge in future course of their career development in higher education and research. Therefore, this study will help in Identify the two groups of pseudocoelomates, their general characteristics and the human impacts of nematodes.

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**CORE COURSE I**

**LS/ZOO/CC-101 P**

**NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATA**

**PRACTICALS**

**(Credits 2)**

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramecium*, Binary fission and Conjugation in *Paramecium*
2. Examination of pond water collected from different places for diversity in Protista
3. Study of *Sycon* (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla*
4. Study of *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Metridium*, *Pennatula*, *Fungia*, *Meandrina*, *Madrepora*
5. One specimen/slide of any ctenophore
6. Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/microphotographs)
7. Study of adult *Ascaris lumbricoides* and its life stages (slides/microphotographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

**SUGGESTED READINGS**

- Ruppert and Barnes (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JI (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.
- Barrington EJW (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson.

  
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**CORE COURSE II**

**LS/ZOO/CC-102 L**

**PRINCIPLES OF ECOLOGY**

**THEORY**

**(Credits 4)**

- Unit 1: Introduction to Ecology** **6**  
History of ecology; Autecology and synecology; Levels of organization; Laws of limiting factors-Liebig's law of minimum and Shelford's law of tolerance; Study of physical factors-Temperature and Light.
- Unit 2: Ecosystem** **12**  
Types of ecosystems with one example in detail; Trophic levels; Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains; Food web; Energy flow through ecosystem; Ecological pyramids and Ecological efficiencies; Nutrient and biogeochemical cycle (nitrogen cycle); Human modified ecosystem.
- Unit 3: Population** **18**  
Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age and sex ratio, dispersal and dispersion, Exponential and logistic growth, equation and patterns, r and k strategies; Population regulation-density-dependent and independent factors; Population interactions.
- Unit 4: Community** **10**  
Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological Succession, Types of Succession, Theories pertaining to climax community.
- Unit 5: Human impact on environment** **06**  
Environmental Pollution: Air, water and noise pollution; Greenhouse effect, Acid rain, Global Warming, Ozone depletion.
- Unit 6: Biodiversity and Wildlife Conservation** **08**  
Ecology in Wildlife Conservation and Management, Biodiversity; types, importance and threats. Protected areas; National parks, Bio reserves and Sanctuaries. Restoration ecology.

**Course Objectives:**

To bring physical environment and living organisms together in a single framework.  
To develop an appreciation of the modern scope of the scientific study in the field of ecology. To understand different types of ecosystem, extinction of species consumption, human impact on the environment.

**Course Outcomes:**

Develop knowledge base covering all attributes of the environment and ecology.  
Illustrate the flow of energy through ecosystems with reference to trophic levels and ecological efficiency. Describe population structures and growth.



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**CORE COURSE II**

**LS/ZOO/CC-102 P PRINCIPLES OF ECOLOGY**

**PRACTICALS**

**(Credits 2)**

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided.
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community.
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO<sub>2</sub>.
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary.

**SUGGESTED READINGS**

- Colinvaux P A (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs C J (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum EP (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole.
- Robert Leo Smith, Ecology and field biology Harper and Row publisher.
- Ricklefs RE (2000). Ecology. V Edition. Chiron Press.

  
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**CORE COURSE III**

**LS/ZOO/CC-201 L**

**NON-CHORDATES II: COELOMATA**

**THEORY**

**(Credits 4)**

**Unit 1: Introduction to Coelomates** 2  
Evolution of coelom and metamerism.

**Unit 2: Annelida** 10  
General characteristics and Classification up to classes; Type study of *Pheretima*; Metamerism in Annelids.

**Unit 3: Arthropoda** 17  
General characteristics and Classification up to classes; Type study of *Periplaneta*; Vision and Respiration in Arthropoda; Larval forms in Arthropoda; Metamorphosis in Insects; Social life in bees.

**Unit 4: Onychophora** 4  
General characteristics and Evolutionary significance with special reference to *Peripatus*.

**Unit 5: Mollusca** 15  
General characteristics and Classification up to classes; Type study of *Pila*; Respiration in Mollusca; Torsion and detorsion in Gastropoda; Pearl formation in bivalves; Evolutionary significance of trochophore larva.

**Unit 6: Echinodermata** 12  
General characteristics and Classification up to classes; Type study of *Asterias*; Water-vascular system in Asteroidea; Larval forms in Echinodermata; Affinities with Chordates.

**Course Objectives:**

To discuss representative lineages of the protostome coelomates, including molluscs, annelids and arthropods. Students will know how are these groups of animals similar? What morphological and developmental patterns do they have in common? How do they differ?

They will know the importance of segmentation in the annelids. Students will come to know why the animals in Phylum Arthropods are thought to be so successful.

**Course Outcomes:**

Compare the two groups (Acoelomate and Coelomates) of animals with true coeloms, the protostomes and deuterostomes, including the differences in development seen in these two groups.

Explain the characteristics of arthropods that have made them successful.

Review the diversity of arthropod groups, including trends in arthropod evolution.

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**CORE COURSE III**

**LS/ZOO/CC-201 P**

**NON-CHORDATES II: COELOMATA**

**PRACTICALS**

**(Credits 2)**

1. Study of following specimens:  
**Annelids** - *Aphrodite*, *Nereis*, *Heteronereis*, *Sabella*, *Serpula*, *Chaetopterus*, *Pheretima*, *Hirudinaria* etc.  
**Arthropods** - *Limulus*, *Palamnaeus*, *Palaemon*, *Daphnia*, *Balanus*, *Sacculina*, *Cancer*, *Eupagurus*, *Scolopendra*, *Julus*, *Bombyx*, *Periplaneta*, termites and honey bees etc.  
**Onychophora** - *Peripatus*  
**Molluscs** - *Chiton*, *Dentalium*, *Pila*, *Doris*, *Helix*, *Unio*, *Ostrea*, *Pinctada*, *Sepia*, *Octopus*, *Nautilus* etc.  
**Echinodermates** - *Pentaceros/Asterias*, *Ophiura*, *Clypeaster*, *Echinus*, *Cucumaria* and *Antedon* etc.
2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
3. T. S. through pharynx, gizzard, and typhlosolar intestine of earthworm
4. Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta*
5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)

**SUGGESTED READINGS**

- Ruppert and Barnes (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JI (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.
- Barrington EJW (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson.
- Nigam (1997). Biology of Chordates, S. Chand.
- Kotpal, Modern text book of Zoology: Vertebrates, Rastogi Publication.


**CORE COURSE IV**

**LS/ZOO/CC-202 L**

**CELL BIOLOGY**

**THEORY**

**(Credits 4)**

- Unit 1: Overview of Cells** **8**  
Prokaryotic and Eukaryotic cells, Cell Theory, Virus, Viroids, Prions.
- Unit 2: Plasma Membrane** **12**  
Various models of plasma membrane, Structure and Function of Plasma Membrane. Transport across membranes: Active and Passive transport, Facilitated transport; Cell junctions: Tight junctions, Gap junctions.
- Unit 3: Cellular Organelles and Endomembrane System** **12**  
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Peroxisomes, Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis.
- Unit 4: Cytoskeleton** **8**  
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments.
- Unit 5: Nucleus** **10**  
Structure of and function of Nucleus. Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome). Giant Chromosomes: Polytene and Lampbrush.
- Unit 6: Cell division and Signaling** **10**  
Mitosis, Meiosis, Cell cycle and its regulation. Cell signaling through GPCR and Role of second messenger (cAMP); Protein kinases.

**Course Objective:**

Course is designed to provide fundamentals understanding of structure and functions of prokaryotic and eukaryotic cells, especially plasma membrane, cell organelles, cytoskeleton and nucleus. Student will understand how these organelles work together to produce and utilize the energy for maintaining the cell functions. How cellular components are performing the cell division, inheritance and cell signaling.

**Course Outcomes:**

Students will apply the knowledge of cell biology to understand the mechanism of individual metabolism and physiology, and also changes occur during the environmental interaction.

  
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**CORE COURSE IV**

**LS/ZOO/CC-202 P**

**CELL BIOLOGY**

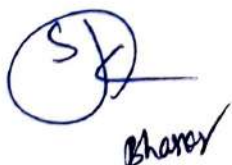
**PRACTICALS**

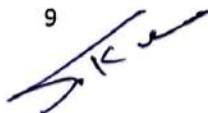
**(Credits 2)**

1. Familiarization with the student's Light and dissecting Microscope.
2. Staining of cell and different organelles (nucleus, mitochondria and chromosomes).
3. Permeability of Plasma membrane - effect of isotonic, hypertonic solution.
4. Mitosis in onion root tips and permanent slide and chart.
5. Meiosis in grasshopper testis (from slides/photographs provided) and permanent slide.
6. Study of Polytene chromosomes in *Chironomous* larva.
7. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.

**SUGGESTED READINGS**

- Karp (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition, John Wiley and Sons Inc.
- De Robertis EDP and De Robertis EMF (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper GM and Hausman RE (2009). The Cell: A Molecular Approach. V Edition; ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009). The World of the Cell, VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Albert B, Dennis B, Julian L, Martin R, Keith R and James W (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
- Lodish et al (2008). Molecular Cell Biology, Freeman.

  
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**CORE COURSE V**

LS/ZOO/CC-301 L

**DIVERSITY OF CHORDATA**

**THEORY**

(Credits 4)

**Unit 1: Introduction and origin of Chordates**

5

General characteristics and outline classification, Dipleurula concept and the Echinoderm theory of origin of chordates, Advanced features of vertebrates over protochordates.

**Unit 2: Zoogeography**

8

Zoogeological time scale, Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, Distribution of vertebrates in different realms.

**Unit 3: Protochordata**

8

General characteristics of Hemichordata, Urochordata and Cephalochordata, Study of larval forms in Protochordates, Retrogressive metamorphosis in Urochordata.

**Unit 4: Agnatha and Pisces**

10

General characteristics and classification of cyclostomes up to orders; General characteristics of Chondrichthyes and Osteichthyes and Classification up to orders, Skin and Scales, Migration, Osmoregulation and Parental care in fishes.

**Unit 5: Amphibia and Reptilia**

13

Origin of *Tetrapoda* (Evolution of terrestrial ectotherms), General characteristics and classification of Amphibia up to orders, Parental care in Amphibians; General characteristics and classification of Reptilia up to orders, Affinities of *Sphenodon*, Poisonous and non-poisonous snakes, Poison apparatus and biting mechanism.

**Unit 6: Aves and Mammalia**

16

General characteristics and classification of Aves up to orders, *Archaeopteryx*- a connecting link; Principles and aerodynamics of flight, Flight adaptations, Migration in birds; General characters and classification of Mammalia up to orders, Affinities of Prototheria, Metatheria, Adaptive radiation in mammals: locomotory appendages.

**Course Objective:**

- To get information about the diversity of chordates
- To have awareness about the beneficial and harmful chordates
- To know about the endangered species of chordates
- To know about the management of chordates

**Course Outcomes:**

By the study of diversity of chordates, it would be easy to know about the species of chordates surviving in different ecological areas of world. It would also be very useful that how these species may be harmful or useful for mankind.



**CORE COURSE V**

**LS/ZOO/CC-301 P**

**DIVERSITY OF CHORDATA**

**PRACTICALS**

**(Credits 2)**

**1. Protochordata**

*Balanoglossus*, *Herdmania*, *Branchiostoma*, Colonial Urochordata, Sections of *Balanoglossus* through proboscis and branchiogenital regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions, Permanent slide of *Herdmania* spicules.

**1. Agnatha and Fishes**

*Petromyzon*, *Myxine*, *Scoliodon*, *Sphyrna*, *Pristis*, *Torpedo*, *Chimaera*, *Mystus*, *Heteropneustes*, *Labeo*, *Catla*, *Cirrhinus*, *Exocoetus*, *Echeneis*, *Anguilla*, *Hippocampus*, *Tetrodon*, *Diodon*, *Anabas*, Flat fish.

**2. Amphibia and Reptilia**

*Ichthyophis*, *Necturus*, *Rana*, *Bufo*, *Hyla*, *Alytes*, *Salamandra*, *Chelone*, *Trionyx*, *Hemidactylus*, *Varanus*, *Uromastix*, *Chamaeleon*, *Ophiosaurus*, *Draco*, *Bungarus*, *Vipera*, *Naja*, *Hydrophis*, *Zamenis*, *Crocodylus*, Key for Identification of poisonous and non-poisonous snakes.

**3. Aves and Mammalia**

Study of common birds from different orders, Types of beaks and claws, *Sorex*, Bat (Insectivorous and Frugivorous), *Rattus*, *Funambulus*, *Loris*, *Herpestes*, *Erinaceous*, Internal ear of scoliodon/Mount of weberian ossicles of *Mystus*/ pecten from Fowl head/Power point/ Study of afferent and efferent arteries of fish (scoliodon).

**SUGGESTED READINGS**

- Young JZ (2004). The Life of Vertebrates. III Edition. Oxford university press.
- Darlington PJ. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
- Hall BK and Hallgrimsson B (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
- Dorit, Walker and Barnes (1991). Zoology. Brooks Cole; 1 Edition.
- Nigam (1997). Biology of Chordates, S. Chand.
- Kotpal : Modern text book of Zoology: Vertebrates, Rastogi Publication.









**CORE COURSE VI**

**LS/ZOO/CC-302 L**

**ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS**

**THEORY**

**(Credits 4)**

- Unit 1: Tissues** 6  
Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue.
- Unit 2: Bone and Cartilage** 4  
Structure and types of bones and cartilages, Ossification, bone growth and resorption.
- Unit 3: Muscle** 12  
Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus.
- Unit 4: Nervous System** 10  
Structure and classification 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; Physiology of hearing and vision.
- Unit 5: Endocrine System** 18  
Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones.
- Unit 6: Reproductive System** 10  
Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female.

**Course Objective:**

To familiarize students with the principles and basic facts of animal physiology. Emphasis will be placed on control and coordination of tissues, bone and cartilage, muscle, nervous, endocrine and reproductive system.

**Course Outcomes:**

To understand fundamental principles of animal physiology and how these principles are incorporated into the adaptations of different animal groups.

To understand control and coordination of various organ systems in animals i.e. tissues, bone and cartilage, muscle, nervous, endocrine and reproductive system in animals. To gain experience in discussing, and answering questions about animal physiology.

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**CORE COURSE VI**

**LS/ZOO/CC-302 P**

**ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS**

**PRACTICALS**

**(Credits 2)**

1. Recording of simple muscle twitch with electrical stimulation (or Virtual)
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
5. Microtomy: Preparation of permanent slide of mammalian tissues
6. Study of eggs and tadpoles of frogs.
7. Study of whole mount preparation of chick embryo.

**SUGGESTED BOOKS**

- Guyton AC and Hall JE (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora GJ and Grabowski S (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P Eroschenko (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

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**CORE COURSE VII**

LS/ZOO/CC-303 L

**FUNDAMENTALS OF BIOCHEMISTRY**

**THEORY**

**(Credits 4)**

**Unit 1: Biomolecules**

**4**

Chemistry of Living system: Scope and importance; Biomolecules: Organizational principle, Configuration and confirmation; Water as a biological solvent.

**Unit 2: Carbohydrates**

**8**

Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates. Aldose, ketose, chiral centre, polarized light and Fischer's nomenclature, cyclization reaction of glucose, anomers, pyranose, furanose, glycosidic linkage, reducing and non-reducing sugars.

**Unit 3: Lipids**

**8**

Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids.

**Unit 4: Proteins**

**14**

Amino acids: Structure, Classification and General properties of  $\alpha$ -amino acids; Physiological importance of essential and non-essential  $\alpha$ -amino acids Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins.

**Unit 5: Enzymes**

**14**

Nomenclature and classification; Cofactors; Specificity of enzyme action; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of  $K_m$  and  $V_{max}$ , Lineweaver-Burk plot; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action.

**Unit 6: Nucleic Acids**

**12**

Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids, Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA.

**Course Objective:**

Course is aimed to provide molecular structure of biological macromolecules (Carbohydrates, protein, lipids and nucleic acids) and their significance in living system. How enzymes work to perform biochemical reaction during metabolism.

**Course Outcomes:**

Students will be able to analyses and understand the basic concept of chemical reaction occur in living system that enables them to explore the applied science beneficial for mankind.

 S. K. Sharma

 S. K. Sharma

 S. K. Sharma

**CORE COURSE VII**

**LS/ZOO/CC-303 P**

**FUNDAMENTALS OF BIOCHEMISTRY**

**PRACTICALS**

**(Credits 2)**

1. Qualitative tests of functional groups in carbohydrates: Benedict's test for reducing sugars, Iodine test for starch
2. Qualitative tests of proteins
3. Qualitative tests of lipids.
4. Paper chromatography of amino acids.
5. Action of salivary amylase under optimum conditions.
6. Effect of pH, temperature and inhibitors on the action of salivary amylase.
7. Structural study of DNA and RNA through models.
8. Preparation and roles of phosphate and bicarbonate buffers

**SUGGESTED READING**

- Cox MM and Nelson DL (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Berg JM, Tymoczko JL and Stryer L (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- Murray RK, Bender DA, Botham KM, Kennelly PJ, Rodwell VW and Well PA (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Hames BD and Hooper NM (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

 *Bhaskar*  
*S.K. W*  
*Dewar*

**CORE COURSE VIII**

LS/ZOO/CC-401 L

**COMPARATIVE ANATOMY OF VERTEBRATES**

**THEORY**

**(Credits 4)**

- Unit 1: Integumentary and Skeletal System** 14  
Structure, functions and derivatives of integument, functions of skin; Overview of axial and appendicular skeleton; Jaw suspensorium; Visceral arches; Vertebrae.
- Unit 2: Digestive and Respiratory System** 14  
Alimentary canal and associated glands; dentition; Skin, Gills, Lungs and air sacs; Accessory respiratory organs.
- Unit 3: Circulatory System** 8  
General plan of circulation; Evolution of heart and aortic arches.
- Unit 4: Urinogenital System** 8  
Succession of kidney; Evolution of urinogenital ducts; General plan of gonads; Accessory reproductive organs; Types of mammalian uteri.
- Unit 5: Nervous System** 8  
Comparative account of brain; Autonomic nervous system; Spinal cord; Cranial nerves in mammals.
- Unit 6: Sense Organs** 8  
Classification of receptors, Brief account of visual and auditory receptors in human.

**Course Objectives:**

To learn the basic of vertebrates anatomy to understand how different anatomies function have evolved and develop.

To learn the basic morphological features of representative chordates system.

**Course Outcomes:**

Describe the major architectural features of the integumentary skeletal nervous muscular digestive respiratory circulatory excretory and reproductive systems.

Develop an understanding of the application of comparative anatomy in current scientific method /literature.

 *Sharma* *S.K. Sinha* *Ramesh*

**CORE COURSE VIII**

**LS/ZOO/CC-401 P**

**COMPARATIVE ANATOMY OF VERTEBRATES**

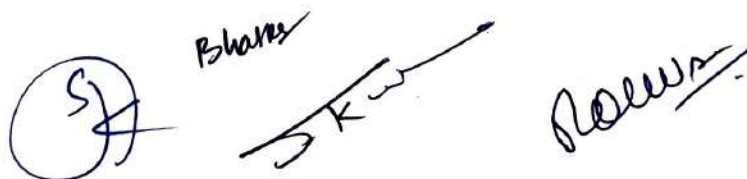
**PRACTICALS**

**(Credits 2)**

1. Study of different types of feathers in birds.
2. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
3. Histological slides of different tissues and organs of vertebrates (Skin, Stomach,
4. Pancreas, Duodenum, Liver, Lungs, Ovary, Testes).
5. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit
6. Carapace and plastron of turtle /tortoise
7. Mammalian skulls: One herbivorous and one carnivorous animal
8. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
9. Project on skeletal modifications/GI tract/Respiratory organs in vertebrates.
10. Study of digestive, circulatory and urinogenital system of frog/rat through videos on dissection or through virtual dissection.

**SUGGESTED READINGS**

- Kardong KV (2005). Vertebrates' Comparative Anatomy, Function and Evolution IV Edition. McGraw-Hill Higher Education
- Kent GC and Carr RK (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
- Hilderbrand M and Gaslow GE. Analysis of Vertebrate Structure , John Wiley and Sons
- Walter HE and Sayles LP, Biology of Vertebrates, Khosla Publishing House

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**CORE COURSE IX**

**LS/ZOO/CC-402 L**

**ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS**

**THEORY**

**(Credits 4)**

**Unit 1: Integumentary system**

**6**

Cell junction, epithelial and connective tissue, structure, type and function of skin, accessory structure of skin

**Unit 2: Digestion**

**14**

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

**Unit 3: Respiration**

**10**

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Carbon monoxide poisoning; Control of respiration

**Unit 4: Renal Physiology**

**12**

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

**Unit 5: Blood**

**8**

Components of blood and their functions; Structure and functions of haemoglobin Haemostasis: Blood clotting system, Complement system and fibrinolytic system, Haemopoiesis Blood groups: Rh factor, ABO and MN

**Unit 6: Physiology of Heart**

**10**

Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

**Course Objective:**

To acquaint students with the principles and basic facts of animal physiology in relation with integumentary system, digestion, respiration, renal physiology, blood and physiology of heart to promote student understanding.

**Course Outcomes:**

To Understand fundamental principles of animal physiology and life sustaining systems.

To understand the processes involved in formation and functioning of integumentary system, digestion, respiration, renal physiology, blood and physiology of heart in animals.

To gain experience in discussing and answering questions about animal physiology.

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**CORE COURSE IX**

**LS/ZOO/CC-402 P**

**ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS**

**PRACTICALS**

**(Credits 2)**

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Recording of frog's heart beat under *in situ* and perfused conditions\*
6. Recording of blood pressure using a sphygmomanometer
7. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney through permanent slides.

**SUGGESTED READINGS**

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

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**CORE COURSE X**

**LS/ZOO/CC-403 L**

**BIOCHEMISTRY OF METABOLIC PROCESSES**

**THEORY**

**(Credits 4)**

**Unit 1: Bioenergetics**

**4**

ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors.

**Unit 2: Overview of Metabolism**

**6**

Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; Intermediary metabolism and regulatory mechanisms.

**Unit 3: Carbohydrate Metabolism**

**16**

Sequence of reactions and regulation of glycolysis, Citric acid cycle, Pentose Phosphate pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis.

**Unit 4: Lipid Metabolism**

**14**

$\beta$ -oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis.

**Unit 5: Protein Metabolism**

**10**

Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids.

**Unit 6: Oxidative Phosphorylation**

**10**

Redox systems; Review of mitochondrial respiratory chain, Electron carriers, sites of ATP production, Inhibitors and un-couplers of Electron Transport System, Structure of ATPase complex, chemiosmotic hypothesis.

**Course Objective:**

To learn the basic elements of bioenergetics and energy metabolism.

To make the student learn and understand the basics of carbohydrate, protein and lipid metabolisms.

To make the students understand oxidative Phosphorylation

**Course Outcomes:**

At the end of the course, the students will acquire basic knowledge of bioenergetics and energy metabolism. The students will acquire knowledge about various biomolecules that constitute the living organisms. Students will understand composition and metabolism of carbohydrate, protein and lipids.

  
S. K. Sharma

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**CORE COURSE X**

**LS/ZOO/CC-403 P**

**BIOCHEMISTRY OF METABOLIC PROCESSES**

**PRACTICALS**

**(Credits 2)**

1. Estimation of total protein in given solutions by Lowry's method.
2. Estimation of carbohydrate by toluene method.
3. Detection of SGOT and SGPT or GST and GSH in serum/ tissue
4. Detection of GSH in serum/ tissue
5. To study the enzymatic activity of Trypsin and Lipase /SOD and Catalase
6. Study of biological oxidation (LPO) [Rat liver]
7. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.
8. To estimate the bilirubin by clinical method and to know the physiological significance of the bilirubin.

**SUGGESTED READINGS**

- Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- 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.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.



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**CORE COURSE XI**

**LS/ZOO/CC-501 L**

**MOLECULAR BIOLOGY**

**THEORY**

**(Credits 4)**

**Unit 1: Nucleic Acids**

**8**

Salient features of DNA and RNA Watson and Crick model of DNA; Ribo-switches, Different types of RNAs

**Unit 2: DNA Replication**

**12**

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear *ds*-DNA, replication of telomeres, Concept of DNA repairing

**Unit 3: Transcription**

**10**

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

**Unit 4: Translation**

**12**

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference in prokaryotic and eukaryotic translation

**Unit 5: Post Transcriptional Modifications and Processing of RNA**

**8**

Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, Processing of tRNA

**Unit 6: Gene Regulation**

**10**

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon and *trp* operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting; RNA interference.

**Course Objective:**

Course is designed to understand the life process at sub-cellular and molecular level. Define the molecular mechanisms by which DNA controls development, growth or morphological characteristics of cell and organisms.

**Course Outcomes:**

Students will be able to understand the molecular mechanism of living system that enables them to designed knowledge in applied science.

  
S. K. Singh

  
S. K. Singh

  
S. K. Singh

**CORE COURSE XI**

**LS/ZOO/CC-501 P**

**MOLECULAR BIOLOGY**

**PRACTICALS**

**(Credits 2)**

1. Study the structure of nucleotides, DNA and RNA through model/ charts.
2. Study of Polytene chromosomes from Chironomous / Drosophila larvae
3. Preparation of agar culture plate and raise culture of bacteria (*E. coli*)
4. Preparation of liquid culture medium
5. Demonstration of DNA extraction process
6. Demonstration of RNA extraction process
7. Study and interpretation of electron micrographs/ photograph showing
  - (a) DNA replication
  - (b) Transcription
  - (c) Split genes

**SUGGESTED READINGS**

- 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.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IV Edition.
- Cooper G. M. and Robert E. Hausman R. E. *The Cell: A Molecular Approach*, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). *Gene XI*, Jones and Bartlett.
- McLennan A., Bates A., Turner, P. and White M. (2015). *Molecular Biology* IV Edition. GS, Taylor and Francis Group, New York and London.

  
S. K. Sharma





**CORE COURSE XII**

**LS/ZOO/CC-502 L**

**PRINCIPLES OF GENETICS**

**THEORY**

**(Credits 4)**

- Unit 1: Mendelian Genetics and its Extension** **8**  
Principles of inheritance (Mendel's Laws), Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance, concept of gene.
- Unit 2: Linkage, Crossing Over and Chromosomal Mapping** **16**  
Linkage and crossing over, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence; Introduction to conjugation, transformation and transduction
- Unit 3: Mutations** **12**  
Types of gene mutations (Classification) and causes, Chromosomal aberrations, Molecular basis of mutations in relation to UV light and chemical mutagens;
- Unit 4: Sex Determination and Extra-chromosomal Inheritance** **12**  
Chromosomal mechanisms of sex determination in *Drosophila* and Man, Extra-chromosomal inheritance with suitable example, Mitochondrial DNA
- Unit 5: Polygenic Inheritance** **4**  
Polygenic inheritance with suitable examples; numericals based on it.
- Unit 6: Transposable Genetic Elements** **8**  
Transposition; Transposons in bacteria, P elements in *Drosophila*, Transposons in humans, Transposons as mutagens.

**Course Objective:**


- To study the structure and function of gene.
- To study how gene is hereditary material.
- To study how is gene contribute to an organism's wellbeing.

**Course Outcomes:**

- Develop in-depth knowledge of gene function and development.
- Students will develop understanding about how gene inherits from generation to generation.
- Students will develop understanding about how gene related disease can alter the life of an organism.



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**CORE COURSE XII**

**LS/ZOO/CC-502 P**

**PRINCIPLES OF GENETICS**

**PRACTICALS**

**(Credits 2)**

1. To study the Mendelian laws with suitable examples.
2. Chi-square analyses using seeds/beads/*Drosophila*.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. *Drosophila* biology: Sexual dimorphism, Life cycle and different mutant's types.
5. Linkage maps based on data from *Drosophila* crosses.
6. Study of human karyotype (normal and abnormal).
7. Pedigree analysis of some human inherited traits.

**SUGGESTED READINGS**

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings
- Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co
- Fletcher H. and Hickey I. (2015). *Genetics*. IV Edition. GS, Taylor and Francis Group, New York and London.



Bhargava



**CORE COURSE XIII**

**LS/ZOO/CC-601 L**

**DEVELOPMENTAL BIOLOGY**

**THEORY**

**(Credits 4)**

**Unit 1: Introduction**

**12**

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation (Axis formation in *Drosophila*), Differential gene expression, Cytoplasmic determinants and asymmetric cell division; Basic concept of induction, competence, specification and differentiation.

**Unit 2: Gamete Biology and Fertilization**

**10**

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Sperm egg interaction; Changes in gametes, Blocks to polyspermy

**Unit 3: Early Embryonic Development**

**10**

Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers

**Unit 4: Late Embryonic Development**

**8**

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)

**Unit 5: Post Embryonic Development**

**12**

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphic regeneration of Salamander limbs, morphallactic regeneration in *Hydra* and compensatory regeneration in mammalian liver; Ageing: concept and theories.

**Unit 6: Implications of Developmental Biology**

**8**

Teratogenesis: Teratogenic agents and their effects on embryonic development; *In vitro* fertilization, Stem cell (ESC), Amniocentesis

**Course objective**

The main aim of the paper on Developmental Biology is to provide an in-depth knowledge on the embryonic and post embryonic developmental processes. The course explains the basic principles and concepts underlying the developmental processes at the cellular and molecular level. By understanding the developmental processes the students can relate to errors occurring in during development leading to congenital disorder and human diseases. The paper also addresses the problem of infertility in humans and how to overcome this

**Course Outcomes**

Students will be able to understand the fundamentals of developing process. Knowledge regarding embryonic and post embryonic developments will be imparted to students.

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**CORE COURSE XIII**

**LS/ZOO/CC-601 P**

**DEVELOPMENTAL BIOLOGY**

**PRACTICALS**

**(Credits 2)**

1. Collection, preparation and Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, 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. Window preparation to study chick embryo development
4. Study of the developmental stages and life cycle of *Drosophila* from stock culture
5. Study of different sections of placenta (photomicrograph/ slides)
6. Project report on *Drosophila* culture/chick embryo development
7. A visit to Poultry farm/IVF centre

**SUGGESTED READINGS**

- Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
- Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
- Carlson, R. F. Patten's Foundations of Embryology
- Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw- Hill Publishers
- Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press



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**CORE COURSE XIV**

**LS/ZOO/CC-602 L**

**EVOLUTIONARY BIOLOGY ,**

**THEORY**

**(Credits 4)**

<b>Unit 1: Origin of Life</b> Chemogeny and Biogeny, RNA world.	<b>4</b>
<b>Unit 2: Historical Review of Evolutionary Concept</b> Lamarckism, Darwinism, Neo-Darwinism.	<b>10</b>
<b>Unit 3: Evidences of Evolution:</b> Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesizing machinery, neutral theory of molecular evolution, molecular clock, example of globin gene family, rRNA/cyt c, role of heritable variations in evolution.	<b>16</b>
<b>Unit 4: Population Genetics:</b> Hardy-Weinberg Law; Natural selection (concept of fitness, selection coefficient, types of selection, genetic drift (mechanism, founder's effect, bottleneck phenomenon; Role of Migration and Mutation in changing allele frequencies.	<b>12</b>
<b>Unit 5: Product of Evolution</b> Micro evolutionary changes (inter-population variations, clines, races, species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees.	<b>8</b>
<b>Unit 6: Species Concepts and Species Attribute</b> The "Modern Synthesis". The nature of evolutionary units; Species concepts, The Biological Species concept.	<b>10</b>

**Course Objective:**

The course aims to provide students with a deeper insight into the evolutionary processes - both selective and random which can explain the genetic composition of populations, form, behavior and distribution of organisms, and to teach students the basic methods of analyzing the evolutionary relationships between species.

**Course Outcome:**

A student who has completed the course should have solid knowledge of: natural selection as key to understanding the natural world; how natural selection produces adaptation; the origins of genetic variation; population genetic consequences of selection, mutation, migration (gene flow), inbreeding; genetic drift, an important evolutionary force; evolution of social behavior and kin selection; sexual selection; evolution of life history characters.

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**CORE COURSE XIV**

**LS/ZOO/CC-602 P**

**EVOLUTIONARY BIOLOGY**

**PRACTICALS**

**(Credits 2)**

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. Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies
5. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.
6. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.
7. Construction of cladograms based on morphological characters.

**SUGGESTED READINGS**

- Ridley, M (2004) Evolution III Edition Blackwell publishing
- Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett, Publishers.
- Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin Cummings.
- Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
- Snustad. S. Principles of Genetics.
- Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley Blackwell

  
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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-501(A) L**

**IMMUNOLOGY\***

**THEORY**

**(Credits 4)**

- Unit 1: Overview of Immune System** **10**  
Historical perspective of Immunology, Early theories of Immunology, Cells and organs of the Immune system, Haematopoiesis
- Unit 2: Innate and Adaptive Immunity** **10**  
Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, primary and secondary lymphoid organs; Adaptive immunity, Passive: Artificial and natural Immunity, Active: Artificial and natural Immunity, Immune tolerance
- Unit 3: Antigens and Antibody** **14**  
Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, Structure and functions of different classes of immunoglobulins, Antigen antibody interactions, Immunoassays (ELISA and RIA), Hybridoma technology: Monoclonal antibodies in therapeutics and diagnosis
- Unit 4: Major Histocompatibility complex** **8**  
Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation; Immune dysfunctions (brief account of autoimmunity with reference to Rheumatoid Arthritis and tolerance, AIDS).
- Unit 5: Cytokines and complement system** **8**  
Properties and functions of cytokines, Therapeutics Cytokines; Components and pathways of complement activation.
- Unit 6: Hypersensitivity and vaccines** **8**  
Gell and Coombs' classification and brief description of various types of Hypersensitivities; Various types of vaccines.

**Course Objectives:**

The aim of the course in immunology is to get the student acquainted with the working of the immune system in normal health and how it fights the disease and may sometimes contribute to disease. The immune system is incredibly complicated. This course is designed to enable understanding the molecular and cellular basis of the development of the immune functions and identification of its biological, clinical and therapeutic implications.

**Course Outcome:**

Describe the basic mechanisms and functional interplay of innate/adaptive immunity  
Define the cellular/molecular pathways of humoral/cell-mediated responses.  
Understand the molecular basis of complex, humoral (Cytokines, Complement) and cellular processes involved in inflammation and immunity.  
Describe basic and state-of-the-art experimental methods and technologies.

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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-501(A) P**

**IMMUNOLOGY\***

**PRACTICALS**

**(Credits 2)**

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.
5. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
6. Demonstration of
  - a. ELISA/ RIA
  - b. Immunoelectrophoresis/ Immunohistochemistry

**SUGGESTED READINGS**

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lichtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

\*This course will be offered to students depending upon the availability and commencement in the respective semester in MOOCS and syllabus of MOOCS will be followed. In case of unavailability of this course, the same will be taught as usual DSE courses and the given syllabus will be followed.

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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-501(B) L**

**BIOLOGY OF INSECTA\***

**THEORY**

**(Credits 4)**

**Unit I: Introduction and Insect Taxonomy**

**8**

General Features of Insects, Distribution and Success of Insects on the Earth; Basis of insect classification, Classification of insects up to orders.

**Unit II: General Morphology of Insects**

**8**

External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits, Thorax- Wings and wing articulation, Types of Legs adapted to diverse habitat, Abdomen- Abdominal appendages and genitalia.

**Unit III: Physiology of Insects**

**28**

Structure and physiology of Insect body systems - Integumentary, digestive, circulatory, respiratory, excretory, endocrine, nervous and reproductive system; Sensory receptors, Growth and metamorphosis

**Unit IV: Insect Society**

**6**

Group of social insects and their social life, Social organization and social behaviour of honey bee/ant/termite.

**Unit V: Insect Plant Interaction**

**4**

Theory of co-evolution, role of allelochemicals in host plant mediation, Host-plant selection by phytophagous insects, Insects as plant pests.

**Unit VI: Insects as Vectors**

**6**

Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors.

**Course Objective:**

- To know about the great diversity of insects
- To know about the beneficial and harmful insects
- To get knowledge of importance of insects in food chain
- To promote the industries based on beneficial Insects like apiculture, sericulture, lac culture, etc.

**Course Outcomes:**

Class Insecta is the largest group of animal kingdom. This group includes both harmful, causing various diseases to animals and plants, and beneficial animals, providing us silk, lac, honey, etc. Therefore, it is important to know about how they could manage to get maximum benefit and minimum harm.



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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-501(B) P**

**BIOLOGY OF INSECTA\***

**PRACTICALS**

**(Credits 2)**

1. Study of one specimen from each insect order.
2. Study of different kinds of antennae, legs and mouth parts of insects.
3. Study of head and sclerites of any one insect. 4. Study of insect wings and their venation.
5. Study of insect spiracles.
6. Methodology of collection, preservation and identification of insects.
7. Morphological studies of various castes of *Apis*, *Camponotus* (ant) and *Odontotermes* ( termite)
8. Study of any three insect pests and their damages. 9. Study of any three beneficial insects and their products.
9. Field study of insects and submission of a project report on the insect diversity.

**SUGGESTED READINGS**

- Imms , A. D. (1977). A general text book of entomology. Chapman & Hall, UK.
- Chapman, R. F.(1998). The Insects: Structure and function. Cambridge University Press, UK.
- Snodgrass, R. E. Principles of Insect Morphology. Cornell Univ. Press, USA.
- Borror, D. J., Triplehorn, C. A., and Johnson, N. F. Introduction to the study of insects. M Saunders College Publication, USA.
- Wilson, E. O. The Insect Societies. Harward Univ. Press, UK.
- Bernays, E. A., and Chapman, R. F. Host Selection by Phytophagous insects. Chapman and Hall, New York, USA.
- Klowden, M. J., Physiological system in Insects. Academic Press, USA.
- Gullan, P. J., and Cranston, P. S. The Insects, An outline of Entomology. Wiley Blackwell, UK.
- Nation, J. L. Insect Physiology and Biochemistry. CRC Press, USA.

\*This course will be offered to students depending upon the availability and commencement in the respective semester in MOOCS and syllabus of MOOCS will be followed. In case of unavailability of this course, the same will be taught as usual DSE courses and the given syllabus will be followed.

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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-502(A) L**

**BASICS OF NEUROSCIENCE**

**THEORY**

**(Credits 4)**

**Unit 1: An Introduction to Neuroscience** **8**

Classification of nervous system; Brain compartments and function; Development and anatomical organization of the Nervous System: Neural tube induction and embryonic brain development; Blood Brain Barrier, Cranial nerves; Spinal cord; Overview of peripheral nervous system (PNS).

**Unit 2: Structure and Function of Nervous system** **10**

Cellular components: Neurons; Neuroglia; axons and dendrites as unique structural components of neurons. Action potential: Generation, conduction and properties of the action potential.

**Unit 3: Cellular and Molecular Neurobiology** **12**

Synaptic transmission, Types of synapses; synaptic function; Principles of chemical synaptic transmission; Principles of synaptic integration; EPSPs and IPSPs. Ion channels, Neural transmission.

**Unit 4: Neurotransmitters and Brain Rhythms** **10**

Classification and function of neurotransmitters; Hypothalamic regulation of biological rhythm; Stress; Sleep; Temperature; Thirst and drinking; Hunger and feeding; Electroencephalogram (EEG).

**Unit 5: Neurobiology of neurodegenerative diseases:** **12**

Addiction, Depression, Schizophrenia, Alzheimer's disease, Parkinson disease, Huntington's disease; Brain imaging techniques: PET, CT, and MRI.

**Course Objective:**

Neuroscience cuts across traditional fields in the biological and behavioral sciences. This is a foundational course that will inculcate the basic understanding about functioning of brain. This course will introduce students to basic concepts and the variety of topics in the field of neuroscience, including neuroanatomical (gross and cellular), physiology, neural basis of behavior, malfunctions due to disease and injury, and methods used to study these areas; laying a foundation for advanced coursework in neuroscience.

**Course Outcomes:**

Students will get the knowledge of the organization of the nervous system, cellular events that underlie emotions, learning, and behavior, and awareness of classical and modern methods for advancing the field.



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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-502(A) P**

**BASICS OF NEUROSCIENCE**

**PRACTICALS**

**(Credits 2)**

1. Dissection and study of *Drosophila* nervous system.
2. Study of neurons and/ or myelin by Nissl, Giemsa or Luxol Fast Blue staining.
3. Study of olfaction in *Drosophila*.
4. Study of novelty, anxiety and spatial learning in mice.
5. Study of anatomy of mammalian brain by using brain models (plastic or clay medical anatomical teaching models, graphics, videos etc.).
6. Dissection of a goat brain
7. Study of pituitary and pineal cell types through prepared slides.
8. Some important behavioural techniques in neuroscience:
  - (a). Morris water maze
  - (b). 8 Arm radial maze or T – Maze
  - (c). Rotarod for studying behaviour in rats.

**SUGGESTED READINGS**

- Neuroscience: Exploring the brain by Mark F. Baer; Barry W. Connors. 2015
- Principles of Neural Science-4th Edn-Eds. Kandel, Schwartz and Jessell- Mc Graw Hill Companies-2000
- Nerve Cells and Animal Behaviour-2nd Ed-Peter J Simmons and David Young CUP-2003
- Essential Psychopharmacology-Neuroscientific Basis and Practical Applications- 2nd Edn.-Stephan M. Stahl-CUP-2000
- Richard F. Thompson: The Brain – A Neuroscience Primer (2<sup>nd</sup> Ed. 1993, W. H. Freeman & Company)
- The Human Brain Book - Rita Carter-2009
- Fundamental Neuroscience (3rd Edition), Squire, Elsevier, 2008
- Elements of Molecular Neurobiology. Smith, John Wiley & Sons, Ltd. 2002

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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-502(B) L**

**REPRODUCTIVE BIOLOGY**

**THEORY**

**(Credits 4)**

**Unit 1: Functional anatomy of male reproduction**

**12**

Outline and histology of male reproductive system in human; Testis: Cellular functions, germ cell; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract.

**Unit 2: Functional anatomy of female reproduction**

**12**

Reproductive cycles (rat and human) and their regulation, changes in the female tract; Outline and histological of female reproductive system in human; Ovary: folliculogenesis ovulation, corpus luteum formation and regression; secretion of ovarian hormones.

**Unit 3: Gametogenesis**

**12**

Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Oogenesis, Hormonal regulation of Oogenesis, Steroidogenesis Pathway and regulation, StAR, SRBPE.

**Unit 4:12**

Hormonal regulation of gestation, pregnancy diagnosis, foeto- maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation.

**Unit 5: Reproductive Endocrinology**

**12**

Mechanism of action of Gonadal hormone, steroids, glycoprotein hormones, prostaglandins, hypothalamo - hypophyseal - gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

**Unit 6: Reproductive Health**

**12**

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning.

**Course Objective:**

Aims to understand the scientific principles that govern reproduction in humans and other mammals.

**Course Outcomes:**

Advances in this field provided the knowledge for assisted conception and revolutionized reproductive medicine and veterinary practice.



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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-502(B) P**

**REPRODUCTIVE BIOLOGY**

**PRACTICALS**

**(Credits 2)**

1. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Surgical techniques: principles of surgery in endocrinology. Ovariectomy, hysterectomy, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat
7. Study of modern contraceptive devices
8. Mini projects involving survey, data collection, statistical analysis, and submission of a project report on reproductive health of a small human population.

**SUGGESTED READINGS**

- Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
- Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.







**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-601(A) L**

**ENDOCRINOLOGY**

**THEORY**

**(Credits 4)**

**Unit 1: Introduction to Endocrinology**

**08**

History of endocrinology, Classification, Characteristic and Transport of Hormones, Neurosecretions and Neurohormone.

**Unit 2: Epiphysis Hypothalamus**

**12**

Structure of pineal gland and its evolutionary significance, Secretions and their functions in biological rhythms and reproduction; Structure of hypothalamus, Hypothalamic nuclei and their functions, Regulation of neuroendocrine glands.

**Unit 3: Hypophysis**

**10**

Structure of pituitary gland, Hormones and their functions, Hypothalamohypophysial portal system, Feedback mechanisms, Disorders of pituitary gland.

**Unit 4: Peripheral Endocrine Glands**

**10**

Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis, Hormones in homeostasis, Disorders of endocrine glands.

**Unit 5: Control of Hormone Secretion**

**10**

Synthesis, Processing and sorting of preprohormone precursor, sequential stages of the regulated secretory pathway; Dense-core granule: Exocytosis, Regulation of exocytosis by calcium and protein kinase C

**Unit 6: Molecular Endocrinology**

**10**

Mechanism of Hormone action: Hormone receptors, Steroid hormone receptor family transduction and regulation, Hormone action at Molecular level: Molecular mediators, Genetic control of hormone action

**Course Objective:**

To explain the roles of the endocrine system in maintaining homeostasis, integrating growth and development, responding to environmental insults and promoting successful reproduction.

To discuss the definition of a hormone in terms of its general properties.

**Course Outcomes:**

The curricula for this program is expected to include learning experiences that offer opportunities for higher studies and research at reputed laboratories. Students will be able to understand the basics of endocrine glands, hormones and mechanism of action.

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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-601(A) P**

**ENDOCRINOLOGY**

**PRACTICALS**

**(Credits 2)**

1. Dissect and display of Endocrine glands in laboratory bred rat.
2. Study of the permanent slides of all the endocrine glands.
3. Compensatory ovarian/ adrenal hypertrophy *in vivo* bioassay in laboratory bred rat.
4. Demonstration of Castration/ ovariectomy in laboratory bred rat.
5. Estimation of plasma level of any hormone using ELISA.
6. Paper chromatographic separation of steroid hormones.
7. Survey based project on any prevalent endocrine disorder.

**SUGGESTED READINGS**

- General Endocrinology C. Donnell Turner Pub- Saunders Toppan
- Endocrinology: An Integrated Approach; Stephen Nussey and Saffron Whitehead.
- Oxford: BIOS Scientific Publishers; 2001.
- Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice Hall, Pearson Education Inc., New Jersey.
- Vertebrate Endocrinology by David O. Norris

  
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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-601(B) L**

**FISH AND FISHERIES**

**THEORY**

**(Credits 4)**

**Unit 1: Introduction and Classification**

**6**

General characters of fish; Account of systematic classification of fishes (upto classes); Classification based on feeding habit, habitat and manner of reproduction. Ornamental and weed fishes; Fin formula.

**Unit 2: Morphology and Physiology**

**16**

Different types of fins and scales; Use of scales in classification and determination of age of fish; Gills and gas exchange; Swim Bladder: types and role in respiration, buoyancy; Osmoregulation and ionic balance in fishes; Reproductive strategies (special reference to Indian fishes); Electric organs; Bioluminescence; Schooling; Parental care; Migration.

**Unit 3: Fisheries**

**10**

Inland Fisheries; Marine Fisheries; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations.

**Unit 4: Aquaculture**

**16**

Sustainable Aquaculture; Qualities of culturable species of fishes; Types of pond in a fish farm; Pen and cage culture; Integrated fish farming; Composite fish culture; Brood stock management; Induced breeding of fish; Hatchery, Preparation of compound diets for fish; Role of water quality in aquaculture; Fish by-products.

**Unit 5: Fish Pathology and Cure**

**8**

Sign of sickness in fishes, defensive devices in fishes against diseases, diseases of fishes: Nutritional diseases, bacterial disease (Infectious dropsy, Tail rot or fin rot), Fungal diseases (Dermatomycoses, Branchiomycosus) and protozoan diseases (Ichthyophthiriusiasis, Costiasis).

**Unit 6: Fish in research**

**4**

Transgenic fish, Zebra fish as a model organism in research.

**Course Objectives:**

To know about the diversity of fishes

To know about the edible and non-edible fish

To fulfill the great demands of nutritious food

To promote the fish industry basically based on fish byproducts

**Course Outcomes:**

Class Pisces is the largest group of the vertebrates. This group provides us highly nutritious food at the low cost. Fish byproducts are also used for various purposes. Therefore, it is utmost need in the present era to involve more and more people in the fish industry.



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**DISCIPLINE SPECIFIC ELECTIVE COURSE**

**LS/ZOO/DSE-601(B) P**

**FISH AND FISHERIES**

**PRACTICALS**

**(Credits 2)**

1. Morphometric and meristic characters of fishes
2. Study of *Petromyzon*, *Myxine*, *Pristis*, *Chimaera*, *Exocoetus*, *Hippocampus*, *Gambusia*, *Labeo*, *Heteropneustes*, *Anabas*
3. Study of different types of scales (through permanent slides/ photographs).
4. Study of crafts and gears used in Fisheries
5. Study of air breathing organs in *Channa*, *Heteropneustes*, *Anabas* and *Clarias*
6. Study of ventilation rate of an air-breathing fish under different experimental conditions.
7. Determination of gonadosomatic index
8. Demonstration of induced breeding in Fishes (video)
9. Demonstration of parental care in fishes (video)
10. Project Report on a visit to any fish farm/ pisciculture unit/Zebrafish rearing Lab.

**SUGGESTED READINGS**

- Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
- D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK von der Emde, R.J. Mogdans and B.G. Kapoor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
- C.B.L. Srivastava, Fish Biology, Narendra Publishing House
- J.R. Norman, A history of Fishes, Hill and Wang Publishers
- S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House

  
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**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-101 L**

**AQUATIC BIOLOGY**

**THEORY**

**(Credits 4)**

**Unit 1: Aquatic Biomes**

Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

**Unit 2: Freshwater Biology**

**Lakes:** Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.

**Streams:** Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.

**Unit 3: Marine Biology**

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Sea weeds.

**Unit 4: Management of Aquatic Resources**

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD.


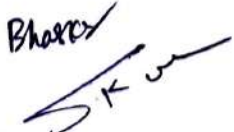

**Course Objective**

This program helps students to study about aquatic life and equip students with skills that can later lead into a profession in aquatic biology. Aquatic biology at undergraduate level works as an entry point for future aquatic biologist. Two major aspects of Aquatic biology are study of the organisms in the freshwater (Limnology) and saline waters (Marine biology). This paper focuses on research and explains processes, structures and pathways in most aquatic and wet ecosystems. Geographically, we cover aquatic ecosystems in temperate, tropical and arctic regions, and we work with both basic and applied science.

**Course Outcomes**

They learn about adaptations exhibited by organisms to survive in these typical conditions. Learn about the laws governing the use of freshwater systems, as well as the local, state, federal, and international agencies. Students understand how Human activities influence the physicochemical environment of water bodies, what devastating impact it has on aquatic organisms. Understand and apply relevant scientific principle in the area of aquatic biology and educate others or work to conserve our natural resources.

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**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-101 P**

**AQUATIC BIOLOGY**

**PRACTICALS**

**(Credits 2)**

1. Determine the area of a lake using graphimetric and gravimetric method.
2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant/Marine bioreserve/ Fisheries Institutes.

**SUGGESTED READINGS**

- Anathkrishnan : Bioresources Ecology 3rd Edition
- Goldman : Limnology, 2nd Edition
- Odum and Barrett : Fundamentals of Ecology, 5th Edition
- Pawlowski: Physicochemical Methods for Water and Wastewater Treatment, 1<sup>st</sup> Edition
- Wetzel : Limnology, 3rd edition
- Trivedi and Goyal : Chemical and biological methods for water pollution studies
- Welch : Limnology Vols. I-II



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**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-201 L**

**ENVIRONMENT AND PUBLIC HEALTH**

**THEORY**

**(Credits 4)**

**Unit 1: Introduction**

Sources of Environmental hazards, hazard identification and accounting, fate of toxic and persistent substances in the environment, dose Response Evaluation, exposure Assessment.

**Unit 2: Climate Change**

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health.

**Unit 3: Pollution**

Air, water, noise pollution sources and effects, Pollution control.

**Unit 4: 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.

**Unit 5: Diseases**

Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid

**Course Objective:**

To understand the direct and indirect human, ecological and safety affects of major environmental and occupational agents.

Attain knowledge about genetic, physiologic and psychosocial factors that affect susceptibility to adverse health outcomes following exposure to environmental hazards.

Specify approaches for assessing, preventing and controlling environmental hazards that pose risks to human health and safety.

To understand various waste management techniques and risks involved in event of poor management.

Understand the outbreak of certain communicable and non-communicable diseases.

**Course Outcomes:**

Acquire skills in the application of epidemiologic methods to environmental health problems

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**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-201 P**

**ENVIRONMENT AND PUBLIC HEALTH**

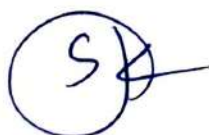
**PRACTICALS**

**(Credits 2)**


1. To determine Ph in soil and water samples from different locations.
2. To determine Cl in soil and water samples from different Locations
3. To determine SO<sub>4</sub> in soil and water samples from different Locations
4. To determine NO<sub>3</sub> in soil and water samples from different Locations
5. To determine BOD in water samples from different locations

**SUGGESTED BOOKS**

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



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**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-301 L**

**FOOD, NUTRITION AND HEALTH**

**THEORY**

**(Credits 4)**

**Unit 1: Basic concept of food and nutrition**

**5**

Food Components and food-nutrients Concept of a balanced diet, nutrient needs and dietary pattern for various groups.

**Unit 2: Nutritional Biochemistry**

**15**

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.

**Unit 3: Health-I**

**10**

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.

**Unit 4: Health-II**

**10**

Life style related diseases- hypertension, diabetes mellitus and obesity- their causes and prevention through dietary and lifestyle modifications. Social health problems- smoking, alcoholism, drug dependence and Acquired Immuno Deficiency Syndrome (AIDS) - their causes, treatment and prevention Common ailments- cold, cough, and fevers, their causes and treatment.

**Unit 5: Food Hygiene-I**

**10**

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.

**Unit 6: Food Hygiene-II**

**10**

Protozoan infection: amoebiasis, giardiasis; Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention Brief account of food spoilage: Causes of food spoilage and their preventive measures

**Course Objective:**

To make students aware of food, nutrition and health needs.

To evaluate the effectiveness of nutrition interventions when dealing with certain health problems.

Apply educational theory, research and experiential knowledge in nutrition education and counseling activities.

**Course Outcomes:**

Curriculum outlined in this paper will prepare students to understand the nutritional demands and also make them aware of certain health conditions that occur due to nutritional deficiencies.



**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-301 P**

**FOOD, NUTRITION AND HEALTH**

**PRACTICALS**

**(Credits 2)**

1. To detect adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric
3. Estimation of Lactose in milk
4. Ascorbic acid estimation in food by titrimetry
5. Estimation of Calcium in foods by titrimetry
6. Study of the stored grain pests from slides/ photograph (*Sitophilus oryzae*, *Trogoderma granarium*, *Callosobruchus chinensis* and *Tribolium castaneum*): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.
7. Project- Undertake computer aided diet analysis and nutrition counseling for different age groups.

OR

Identify nutrient rich sources of foods (**fruits and vegetables**), their seasonal availability and price

OR

Study of nutrition labeling on selected foods

**SUGGESTED BOOKS**

- Mudambi, SR and Rajagopal, MV. (2007) Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; New Age International Publishers
- Srilakshmi B. (2002) Nutrition Science; New Age International (P) Ltd.
- Srilakshmi B. (2007) Food Science; Fourth Ed; New Age International (P) Ltd.
- Swaminathan M. (1986) Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
- Bamji MS, Rao NP, and Reddy V. (2009) Text Book of Human Nutrition; Oxford & IBH Publishing Co. Pvt Ltd.
- Wardlaw GM, Hampl JS. (2007) Perspectives in Nutrition; Seventh Ed; McGraw Hill.
- Lakra P, Singh MD. (2008) Textbook of Nutrition and Health; First Ed; Academic Excellence.
- Manay MS, Shadaksharaswamy. (1998) Food-Facts and Principles; New Age International (P) Ltd.
- Gibney et al. (2004) Public Health Nutrition; 2004; Blackwell Publishing





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**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-401 L**

**INSECT VECTORS AND DISEASES**

**THEORY**

**(Credits 4)**

**Unit I: Introduction to Insects**

**6**

General Features of Insects, Morphological features, Head – Structure and orientation of Head, Eyes, Types of antennae, Mouth parts w.r.t. feeding habits. Outline classification of insects up to orders, detailed features of orders with insects as vectors– Diptera, Siphonaptera, Siphunculata, Hemiptera.

**Unit II: Insect Vectors**

**14**

Brief introduction of Carrier and Vectors (mechanical and biological vectors), Reservoirs, Host-pathogen interaction and relationship.

**Unit III: Diptera as Disease Vectors**

**24**

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Filariasis; Control of mosquitoes; Study of sand fly-borne diseases – Visceral Leishmaniasis, Phlebotomus fever; Control of Sand fly; Study of house fly as important mechanical vector, Myiasis, Control of house fly.

**Unit IV: Siphonaptera as Disease Vectors**

**6**

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas.

**Unit V: Siphunculata as Disease Vectors**

**4**

Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Trench fever, Vagabond's disease, Control of human louse.

**Unit VI: Hemiptera as Disease Vectors**

**6**

Bugs as insect vectors; Blood-sucking bugs; *Cimex* Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures.

**Course Objective:**

Insect vectors cause many diseases which lead to millions of deaths across the world especially in developing countries. The rate of pathogen spread by insects is increasing at an alarming pace posing a growing threat to the human population. Disease transmission by these insects can be prevented only by studying their biology, modes of transmission of pathogens by them, evaluation of associated risk factors, devise effective methods to control these insects and resolve the challenges posed.

**Course outcomes**

Describe the host-pathogen relationships and the role of the host reservoir on transmission of parasite. Explain control methods of insect vector diseases including preventing their spread, spreading awareness on public health programs and mitigating insect borne diseases. Employ the use of advanced management strategies in disease control with respect to parasite evolution.



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**GENERIC ELECTIVE COURSES**

**LS/ZOO/GE-401 P**

**INSECT VECTORS AND DISEASES**

**PRACTICALS**

**(Credits 2)**

1. Study of different kinds of mouth parts of insects.
2. Study of different kinds of legs of insects.
3. Study of following insect vectors through permanent slides/ photographs: *Aedes*, *Culex*, *Anopheles*, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phthirus pubis*, *Xenopsylla cheopis*, *Cimex lectularius*, *Phlebotomus argentipes*, *Musca domestica*, through permanent slides/ photographs.
4. Study of different diseases transmitted by above insect vectors through charts/models.

**SUGGESTED READINGS**

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

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**SKILL ENHANCEMENT COURSES**

**LS/ZOO/SEC-301 L**

**SERICULTURE**

**THEORY**

**(Credits 4)**

**Unit 1: Introduction**

**5**

Sericulture: Definition, history and present status of sericulture; Types of silkworms: Exotic and indigenous species. Mulberry and non-mulberry sericulture.

**Unit 2: Biology of Silkworm**

**10**

Types of silkworms: Exotic and indigenous species. Mulberry and non-mulberry; Sericulture, Life cycle of *Bombyx mori*; Structure of silk gland and secretion of silk.

**Unit 3: Rearing of Silkworms**

**15**

Selection of mulberry variety, propagation and establishment of mulberry garden; Rearing house and rearing appliances. Disinfectants: Formalin, bleaching powder, RKO. Silkworm rearing technology: Early age and Late age rearing, Mounting Types of mountages, Spinning, harvesting and storage of cocoons.

**Unit 4: Post harvesting management and Processing**

**10**

Quality and storage of cocoons, stifling and reeling

**Unit 5: Pests and Diseases**

**10**

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates. Protozoan, viral, fungal and bacterial diseases. Control and prevention of pests and diseases.

**Unit 6: Entrepreneurship in Sericulture**

**10**

Prospects of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.

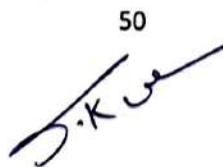
**Course Objectives:**

- To know about importance of sericulture in the rural development
- To increase the economy of rural people and country
- To fulfill the demand of precious silk threads to the textile industry
- To gain more and more foreign currency
- To provide employment to the rural people

**Course Outcomes:**

Sericulture is mainly women labor based rural industry which is playing a significant role to upgrade the life style of rural people. It is also one of the industries which is earning foreign exchange in great amount. It provides employment about 15% to the rural people.

  
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**SKILL ENHANCEMENT COURSES**

**LS/ZOO/SEC-301 P**

**SERICULTURE**

**PRACTICALS**

**(Credits 2)**

1. Study of different specimen and cocoons.
2. Study of mouth parts and silk gland.
3. Study of insect wings and their venation in adult worm.
4. Study of various diseases.
5. Study of any three beneficial insects and their products.

**SUGGESTED READINGS**

- Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

**SUGGESTED ACTIVITY**

Visit to local sericulture units.

  
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**SKILL ENHANCEMENT COURSES**

**LS/ZOO/SEC-401 L**

**MEDICAL DIAGNOSTICS**

**THEORY**

**(Credits 4)**

**Unit 1: Introduction to Medical Diagnostics and its Importance 10**  
Functional components of Chemical Laboratories, Identification of common equipment, principle and care of laboratory instruments. Basic needs of clinical laboratory technician, awareness of soft skills. NABL and SOP. Basic causes of accidents in laboratories.

**Unit 2: Collection of Specimen and Disposal of waste 10**  
General principles, containers, rejection. Samples-Urine, Faeces, Sputum, Pus, Body Fluids, Swab, Blood. Importance of biomedical waste. Disposal of laboratory/hospital waste. Non-infectious waste, infected sharp waste disposal, infected non-sharp waste disposal.

**Unit 3: Basic Haematological Techniques 10**  
Preparation of blood collection-Basic steps for drawing blood by vein, capillary and artery puncture. Complications during and after blood collection. Specimen rejection criteria for blood. Anticoagulants-types and concentration. Transport of blood sample. Effect of storage on blood cell morphology. Universal precautions.

**Unit 4: Diagnostic Methods Used for Analysis of Blood 10**  
Blood composition, Preparation of blood smear and Differential Leukocyte Count using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate, Packed Cell Volume .

**Unit 5: Diagnostic Methods Used for Urine Analysis 10**  
Urine analysis: Physical characteristics; Abnormal constituents, Urine culture. Urinary tract infection, Kidney Disease and diabetes

**Unit 6: Clinical Microbiology, Culture and Staining 10**  
Culture media: Definition, uses, basic requirements, classification, Agar, Peptone; Transport, Sugar and Anaerobic media, Containers and forms of media. Staining methods: Simple, Gram staining, Zeihl-Neelsen staining or AFB staining, Negative impregnation, Antibiotic sensitivity test

**Course Objective:**

To impart adequate knowledge on the diagnostics methods used for analysis of blood and urine. To understand the fundamental principles and applications of medical imaging using X-Ray, PET, MRI and CT Scan

**Course Outcomes:**

Students will learn how doctors diagnose patients using diagnostic tools and resources. Students will be aware of different methods and machines doctors use every day to diagnose patients.

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**SKILL ENHANCEMENT COURSES**

**LS/ZOO/SEC-401 P**

**MEDICAL DIAGNOSTICS**

**PRACTICAL**

**(Credits 2)**

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Haemoglobin electrophoresis
5. Blood urea estimation
6. Total cholesterol estimation
7. Platelet count using haemocytometer, Erythrocyte
8. Serum bilirubin total and Bilirubin direct estimation
9. Serum amylase estimation
10. Serum SGOT (AST) and SGPT (ALT) estimation
11. Recording of blood pressure using a sphygmomanometer

**SUGGESTED READINGS**

- Park, K. (2007), *Preventive and Social Medicine*, B.B. Publishers
- Godkar P.B. and Godkar D.P. *Textbook of Medical Laboratory Technology*, II Edition, Bhalani Publishing House
- Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses*
- Guyton A.C. and Hall J.E. *Textbook of Medical Physiology*, Saunders
- Robbins and Cortan, *Pathologic Basis of Disease*, VIII Edition, Saunders
- Prakash, G. (2012), *Lab Manual on Blood Analysis and Medical Diagnostics*, S. Chand and Co. Ltd.

**SUGGESTED ACTIVITY**

Visit to local hospital units.

