



**ST.PHILOMENA'S COLLEGE (AUTONOMOUS), MYSURU**

***(AFFILIATED TO UNIVERSITY OF MYSORE)***

***REACCREDITED BY NAAC WITH A GRADE***

## **PROGRAMME –B.Sc**

Three-year six semesters Choice Based Credit System (CBCS) with  
**Learning Outcome Based Curriculum framework (LOCF)**  
And Continuous Assessment & Grading Pattern (CAGP) Undergraduate Programme  
Under Autonomous Structure

## **Programme- B.Sc.**

**The academic year 2018-19 onwards**

## DEPARTMENT OF ZOOLOGY

### Syllabus for B.Sc., under Choice Based Credit System, LOCF Scheme, Scheme of Teaching & Examination From the academic year- 2018onwards

Semester	Title of the Paper	TYPE	Course Code	Teaching Hours per Week Theory/ Practical	Credits Theory/ Practical	Exam Duration in Hours Theory/ Practical	Max. Marks Theory/Practical		
							Theory/Practical	I A Theory/Practical	Total Marks
<b>I</b>	<b>Paper I: Animal Diversity I</b>	<b>DSC</b>	<b>MA630</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>50</b>	<b>20</b>	<b>100</b>
	<b>Practical Paper I: Animal Diversity I</b>	<b>DSC</b>	<b>MA632</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>20</b>	<b>10</b>	
<b>II</b>	<b>Paper-II: Animal Diversity II</b>	<b>DSC</b>	<b>MB630</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>50</b>	<b>20</b>	<b>100</b>
	<b>Practical Paper II: Animal Diversity II</b>	<b>DSC</b>	<b>MB632</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>20</b>	<b>10</b>	
<b>III</b>	<b>Paper III: Comparative anatomy and Histology</b>	<b>DSC</b>	<b>MC630</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>50</b>	<b>20</b>	<b>100</b>
	<b>Practical : Comparative anatomy and Histology</b>	<b>DSC</b>	<b>MC632</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>20</b>	<b>10</b>	
<b>IV</b>	<b>Paper IV Biochemistry and Physiology</b>	<b>DSC</b>	<b>MD630</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>50</b>	<b>20</b>	<b>100</b>

	<b>Practical Paper IV Biochemistry and Physiology</b>	<b>DSC</b>	<b>MD632</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>20</b>	<b>10</b>	
<b>V</b>	<b>Paper V Cell and molecular biology</b>	<b>DSC</b>	<b>ME630</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>70</b>	<b>30</b>	<b>300</b>
	<b>Practical Paper V Cell and molecular biology</b>	<b>DSC</b>	<b>ME632</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>35</b>	<b>15</b>	
	<b>Paper VI Developmental biology and endocrinology</b>	<b>DSC</b>	<b>ME634</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>70</b>	<b>30</b>	
	<b>Practical Paper VI Developmental biology and endocrinology</b>	<b>DSC</b>	<b>ME636</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>35</b>	<b>15</b>	
<b>VI</b>	<b>Paper VII Genetics and evolution</b>	<b>DSC</b>	<b>MF630</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>70</b>	<b>30</b>	<b>300</b>
	<b>Practical Paper VII Genetics and evolution</b>	<b>DSC</b>	<b>MF632</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>35</b>	<b>15</b>	
	<b>Paper VIII Environmental biology</b>	<b>DSC</b>	<b>MF634</b>	<b>03</b>	<b>03</b>	<b>03</b>	<b>70</b>	<b>30</b>	
	<b>Practical Paper VIII Environmental biology</b>	<b>DSC</b>	<b>MF636</b>	<b>03</b>	<b>1.5</b>	<b>03</b>	<b>35</b>	<b>15</b>	
		<b>DSE 1</b>		<b>02</b>	<b>02</b>	<b>03</b>	<b>30</b>	<b>20</b>	<b>100</b>
		<b>DSE 2</b>		<b>02</b>	<b>02</b>	<b>03</b>	<b>30</b>	<b>20</b>	
					<b>40</b>	<b>-</b>			<b>1100</b>

### Discipline Specific Elective (DSE) or Soft Core (SC)

SL. No	Title of the Paper	Course Code	TYPE	Semester	Examination Scheme				
					Theo ry	Exam Duration in Hours	Theory Max. Marks	I A Max Marks	Total Marks
<b>1</b>	<b>Tropical Parasitological</b>	M63Y04	<b>DSE</b>	<b>I to VI</b>	<b>2</b>	<b>2</b>	<b>30</b>	<b>20</b>	<b>50</b>
<b>2</b>	<b>Applied Entomology</b>	M63Y06	<b>DSE</b>		<b>2</b>		<b>30</b>	<b>20</b>	<b>50</b>
<b>3</b>	<b>Animal Husbandry</b>	MB63Y01	<b>DSE</b>		<b>2</b>		<b>30</b>	<b>20</b>	<b>50</b>

4	Clinical Science	M63Y07	DSE		2		30	20	50
4	Animal Biotechnology	M63Y05	DSE		2		30	20	50
5	Ethology	M63Y03	DSE		2		30	20	50
6	Economic Zoology	MB63Y02	DSE		2		30	20	50

## VISION AND MISSION OF THE COLLEGE

### VISION:

The college is guided by the visionary zeal of providing value- based education to everyone irrespective of religion, caste, creed or sex by which the character is formed, intellect is explained and one can stand on his/her feet.

### MISSION:

To transform young men and women who come to learn not from books, but also from life and to share the experience of working and playing together, this inculcates life skills to become good citizens with integrity and discipline.

### Programme Educational Objectives (PEO)

PEO1	Graduates will be able to master and display competency and leadership to become successful professionals, employees and entrepreneurs or pursue higher education and research.
PEO2.	Graduates will be able to demonstrate the commitment towards professional ethics, gender sensitivity, preservation of environment and sustainable development.
PEO3	Graduates will continue to learn and advance their careers through activities such as participation in professional organizations, attainment of professional certification and seeking higher education.

### Programme Outcomes (PO):BSc. Programme

PO1	<b>Disciplinary Knowledge:</b> The BSc. graduates will acquire the knowledge with facts and figures related to pure and applied sciences. Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.
PO2	<b>Cognitive and Communicative skills:</b> Students learn two languages along with three major subjects. At the end of the programme, the students would have developed advanced reading, writing, interpretive and composition skills in both languages. They would be able to communicate with others using appropriate media; confidently share one's views and express themselves.
PO3	<b>Research Related Skills:</b> The BSc. students will acquire the skills in handling scientific instruments, planning and performing in laboratory experiments.

PO4	<b>Ethics:</b> The BSc. students will be imbibed ethical, moral and social values in personal and social life leading to highly cultured and civilized personality.
PO5	<b>Problem Solving:</b> The BSc. graduates will develop the ability to analyze and solve Course-related problems and also the ability to evaluate situations and react responsibly to communicate, cooperate and lead a team among peers and others.
PO6	<b>Critical Thinking:</b> The qualities of a science student – observation, precision, analytical mind, logical thinking, clarity of thought and expression, systematic approach, qualitative and quantitative decision making are enhanced.
PO7	<b>Social Interaction:</b> The BSc. graduates shall appreciate the role of science in society; and its personal, social and global importance.
PO8	<b>Analytical Skills:</b> The graduates will master the skills of observations and drawing logical inferences from the scientific experiments. Analyzed the given scientific data critically and systematically and the ability to draw the objective conclusions.
PO9	<b>Environment and Sustainability:</b> Graduates will be able to understand the issues of environment and work towards sustainable development.
PO10	<b>Employability:</b> After completing the of the programme, graduates will have the competency to be employed or to be an entrepreneur.
PO11	<b>Leadership Quality:</b> In the graduation programme students are inculcated moral and ethical values, managerial skills, adoptability, problem solving, taking initiative, decision making, risk taking to make them confident leaders.

### Programme Specific Outcomes (PSO)

PSO-No	After the completion of BSc programme by studying CBZ/BtCZ the students will be able to	Cognitive level
PSO-01	Develop analytical skills and problem solving skills required for the application of <b>chemical principles</b> . They will be able to perform scientific experiments skillfully by application of procedural knowledge.	Apply
PSO-02	Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for <b>Plant Tissue</b> culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.	Apply

PSO-03	Understand the basic concepts of Taxonomy, Physiology, Genetics, Cytology, Histology, Embryology, Ecology and Evolution. Be able to apply their knowledge of classical and applied aspects of <b>Zoology</b> in allied fields like Economic Zoology, Biotechnology, Pathology, Public Health, Environmental Toxicology and Wildlife conservation.	Understand
PSO-04	Able to demonstrate and apply their knowledge of cell biology, biochemistry, microbiology and molecular biology to solve the problems related to the field of <b>Biotechnology</b>	Apply

Mapping of Mission of the College with PEO			
Mission	PEO-1	PEO-2	PEO-3
Mission -1	✓	✓	✓

Mapping of PEOs with Programme Outcomes(PO)											
PEO No.	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
PEO-1		✓	✓		✓					✓	✓
PEO-2	✓			✓					✓		
PEO-3						✓	✓	✓			



## **Preamble**

The Objective of this syllabus is to impart a comprehensive understanding of the classical and applied aspects of zoology. Modern developments in the field of the subject are given sufficient weightage to help the students to be updated with information on these aspects. Certain new topics such as those related to Eco toxicology, human reproduction and impact of modern lifestyle on reproduction etc.; are added to make teaching and learning more interesting and pertinent.

Following the UGC guidelines, using animals for dissections and mountings is removed from the syllabus, which creates a huge void in teaching and learning zoology. However, efforts are taken to make the subject interesting by introducing topics on parasitic and vector biology and it is proposed to make use of modern ICT tools and simulation gadgets (demonstrating dissections and related studies) to compensate for this loss. For each semester a set of clear objectives are mentioned indicating the expected outcome after studying the course material.

Sufficient care is taken to include relevant and interesting practical components that help the students to appreciate the subject and its application in their life.

Salient features should be elaborated while giving general characters of each group. Local examples with common and scientific names and one or two salient features from all the groups to be mentioned. Some of the examples are not found in India can be included because of taxonomic/phylogenetic or other significance.

## **I SEMESTER**

### **PAPER I**

#### **ANIMAL DIVERSITY– I**

**3 Hours/Week x16 = 48 Hrs.MARKS THEORY – 60 + INTERNAL ESSMENT -10 = 70**

#### **Course Objectives:**

1. To explain the basic principles of Systematics and Linnaean classification.
2. To explain the features, classification and diversity of Protista and Porifera.
3. To describe the organization of diploblastic nature of germ layers and phenomenon of Polymorphism with examples from Phyla Cnidaria and Ctenophora.
4. To recognize organ grade of organization, types of coelom, parasites and parasitic adaptations, along with phylum characters, diversity and classification of Helminthes
5. To study the concept of metamerism, discuss the general characters, diversity, classification and economic importance of Annelida with special reference to biomolecules like Hirudin.
6. To explain the concept of connecting links in evolution with example of Phylum Onychophora; general characters, classification, economic importance, metamorphosis and vision in Arthropoda.
7. To describe the general characters, classification, larval forms of phyla Mollusca and Echinodermata; Significance of Water vascular system; Economic importance of Mollusca.

#### **Course Learning Outcome:**

<b>CO</b>	<b>After the completion of this course, the student will be able to</b>	<b>Cognitive level</b>
CO-01	State Biological species concept and give outline classification of animal kingdom	Understand
CO-02	Differentiate between Parazoa and Metazoa and protoplasmic and cellular level of body organization Comprehend the significance of water vascular system in Porifera.	Analyse
CO-03	Describe polymorphism and compare the organization of germ layers in different animals.	Understand Analyse
CO-04	Define coelomic conditions and describe parasitic adaptations.	Remember



CO-05	Distinguish between metameric and ametameric condition and discuss the economic importance of Annelids	Analyse
CO-06	Apply the knowledge of metamorphosis in Arthropods.	Apply
CO-07	Identify the larval forms of Mollusca and Echinodermata. Compare canal system in Porifera and water vascular system on Echinodermata.	Remember  Analyse

<b>Unit 1</b>	<b>Systematics:</b>	<b>2 hrs</b>
<b>1.1</b>	Systematics - Contributions of Carolus Linnaeus, Linnaean hierarchy, binomial nomenclature, the concept of species, outline classification of the animal kingdom.	
<b>Unit 2</b>	<b>Animal kingdom</b>	
<b>2.1</b>	<b>Protista – Protozoa</b>	
	General characters & classification up to classes with suitable examples. <i>Paramecium</i> -Externals and internal structure. Reproduction - Fission & conjugation (in <i>Paramecium</i> ).	<b>4hrs</b>
<b>2.2</b>	<b>Porifera</b>	
	General characters & classification up to classes with examples. Sycon: Externals and larval forms <i>Parenchymula</i> and <i>Amphiblastula</i> . Canal System – Asconoid, syconoid, and it's significance. Economic importance of sponges.	<b>5hrs</b>
<b>Unit 3</b>	<b>Cnidaria and Acnidaria</b>	
<b>3.1</b>	Cnidaria-General characters & classification up to classes with examples. <i>Obelia</i> – Externals, the structure of zooids (Polyp, Blastostyle, Medusa). Polymorphism with reference to <i>Physalia</i> . Structure of corallite, coral reefs.	<b>6hrs</b>
<b>3.2</b>	Acnidaria-Salient features and systematic position of Ctenophora with <i>Pleurobranchia</i> as an example.	<b>2 hrs</b>
<b>Unit 4</b>	<b>Helminths</b>	
<b>4.1</b>	<b>Platyhelminthes</b>	
	General characters & classification up to classes with examples. Tapeworm – Externals, Scolex in tapeworm.	<b>3 hrs</b>
<b>4.2</b>	<b>Aschelminthes</b>	
	General characters with examples. Morphology, transmission, pathogenicity and preventive measures of <i>Ascaris</i> and parasitic adaptation.	<b>3 hrs</b>
<b>Unit 5</b>	<b>Annelida</b>	

<b>5.1</b>	Annelida- General characters and classification up to classes with examples. Metamerism and its significance. <b><i>Pheretima</i></b> : Externals, digestive system, nervous system. <b><i>Trochophore larva</i></b> . Economic importance of Annelida.	<b>6 hrs</b>
<b>Unit 6</b>	<b>Onychophora and Arthropoda</b>	
<b>6.1</b>	Onychophora-Salient features of <i>Peripatus</i> & systematic position of Onychophora.	<b>2 hrs</b>
<b>6.2</b>	Arthropoda-General characters and classification up to classes with examples. Vision in Arthropoda-Compound eye and simple eye. Metamorphosis in insects – Types, hormonal control of metamorphosis.Economic importance of Arthropoda.	<b>5 hrs</b>
<b>Unit 7</b>	<b>Mollusca and Echinodermata</b>	
<b>7.1</b>	Mollusca- General characters & classification up to classes with examples. Unio type study – Externals, digestive system, and <i>Glochidium larva</i> . Economic importance of Mollusca.	<b>5 hrs</b>
<b>7.2</b>	Echinodermata -General characters & classification up to classes with examples. Type study – Asterias - externals. Water vascular system and its significance.	<b>5 hrs</b>

## References

- a. Barnes, R.D, (1968) Invertebrate Zoology, W.B. Saunders Co.
- b. Barrington E.J.W. ( 1981) Invertebrate Structure and Function, ELBS
- c. Borradaile L.A.Potts E.A and Kerkut G.A(1977) The Invertebrates, Cambridge Uni.Press
- d. EkambaranathaAyyar M and Anantakrishnan T.N. (1990) A Manual of Zoology Vol. I Invertebrata (Part I & II), S.VishwanathanPvt.Ltd.
- e. Hegner R.W. and Engelmann J.G. (1960) Invertebrate Zoology, Mac Millan Co.
- f. Hyman L.H. (1941) The Invertebrates (Vols. I to VII) McGraw Hill, N.Y.
- g. Jordon E L and Verma P.S (1976) Invertebrate Zoology, S.Chand& Co.
- h. Kotpal R.L. (1993) Protozoa – Echinodermata (All volumes), Rastogi Publications.
- i. Majupuria T.C. (1980) Invertebrate Zoology, R.K.Jain Publ.
- j. Mayr E (1980) Principles of Systematic Zoology, Tata-McGraw Hill
- k. Parker T.J. and Haswell W.A (1972) A text book of Zoology – Vol-I, Mac Millan Press Ltd.
- l. Prasad S.N (1980) Life of Invertebrates, Vikas Publishing House.
- m. Sedgwick A, (1966) Student's textbook of Zoology, Vol.I& III Central Book Depot, and Allahabad.
- n. Soper R (1998) Biological Science, Cambridge Univ. Press.
- o. Vidyarthi R.D (1984) A textbook of Zoology, S.Chand& Co.

**b) SEMESTER II**  
**PAPER-II**  
**ANIMAL DIVERSITY II**  
**3Hours/week.16 weeks = 48 Hrs.**  
**MARKS THEORY – 60 + INTERNAL ASSESSMENT -10 = 70**

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**Course Objectives**

1. To describe the salient features of Hemichordata; salient features and classification of Protochordata and Vertebrata.
2. To study the salient features and classification of Cyclostomata, Pisces and Amphibia; parental care in Fish and Amphibia and type study of Shark and Frog.
3. To explain general characters and classification of Reptilia; Evolutionary significance of Arcades and fossae in skull; Importance of venom, Identification of snakes.
4. To enlighten students on salient features, classification and flight adaptation of Aves.
5. To understand salient features of Mammalia and give an outline classification upto orders.

**Course Learning Outcome.**

CO	After the completion of this course the student will be able to	Cognitive level
CO-01	Differentiate between Hemichordata, Protochordata and Vertebrata.	Analyse
CO-02	Explain the salient features of Cyclostomata, Pisces and Amphibia , Vital organ systems in Frog. Appreciate parental care in Amphibia.	Understand Evaluate
CO-03	Describe the salient features of Reptilia. Analyse the evolutionary significance of Arcades and fossae. Identify poisonous and nonpoisonous snakes. Apply the knowledge of snake venoms	Remember Analyse
CO-04	Describe the salient features and classification of Aves and summarize flight adaptations.	Understanding
CO-05	Explain the salient features and classification of Mammalia upto orders with examples.	Understanding

<b>UNIT 1</b>	<b>Hemichordata, Chordata, Protochordata, Cephalochordata</b>	
<b>1.1&amp;1.2</b>	Hemichordata- <i>Balanoglossus</i> :Externals, Proboscis complex, <i>Tornaria larva</i> . Affinities of Hemichordate (with Annelida, Echinodermata and Chordata). Chordata- General characters and classification up to classes with examples.	<b>3 hrs</b>
<b>1.3</b>	Protochordata-Urochordata: <i>Ascidia</i> : Externals and internal anatomy of <i>Ascidia</i> , it's larva and retrogressive metamorphosis.	<b>3 hrs</b>
<b>1.4</b>	Cephalochordata- <i>Amphioxus</i> : Externals.	<b>1 hrs</b>
<b>Unit 2</b>	<b>Cyclostomata, Pisces, Amphibia</b>	
<b>2.1</b>	Cyclostomata- Salient features of Petromyzon, <i>Ammocoetes larve</i> and its significance, comparison of <i>Petromyzon</i> and <i>Myxine</i> .	<b>3 hrs</b>
<b>2.2</b>	Pisces- General characters of Pisces. Differences between Chondrichthyes and Osteichthyes with examples. Salient features and discontinuous distribution of <i>Dipnoi</i> . <i>Scoliodon</i> –Externals, lateral line sense organ. Parental care in fish – <i>Hippocampus</i> , <i>Tilapia</i> , <i>Syngnathus</i> , Shark, Three Spined Stickle back.	<b>7 hrs</b>
<b>2.3</b>	Amphibia-General characters and classification of living Amphibian orders with examples. Parental care in Amphibia – <i>Ichthyophis</i> , <i>Salamandra</i> , <i>Alytes</i> (Midwife toad), <i>Surinam toad</i> , <i>Hyla goldeii</i> . Type study – Frog: Externals, digestive system, respiratory system, circulatory system and urino-genital system.	<b>7 hrs</b>
<b>Unit 3</b>	<b>Reptilia</b>	
<b>3.1</b>	General characters & classification up to orders with distinctive features of living reptiles with examples. Evolutionary significance of Arcades and fossae in the skull. Poisonous and non-poisonous snakes of India, key for the identification of poisonous snakes, poison apparatus, types and importance of snake venom.	<b>6 hrs</b>
<b>Unit 4</b>	<b>Aves</b>	
<b>4.1</b>	General characters and classification up to sub-classes with examples. Morphological, anatomical and physiological flight adaptations in birds. Distinctive features of Archaeornithes and Neornithes (Paleognathae, Impennae and Neognathae).	<b>6 hrs</b>
<b>Unit 5</b>	<b>Mammalia</b>	
<b>5.1</b>	General characters of Mammalia and classification up to subclasses with examples. Distinctive features and distribution of Prototheria, Metatheria. Distinctive features of Perissodactyla, Artiodactyla, Carnivora, Chiroptera, Rodentia, Proboscidae, Cetaceae, and Primata.	<b>12 hrs</b>

## References

- a) Agarwal V.P & Dalela (1975) Textbook of Vertebrate Zoology, Jai Prakashnath & co.
- b) Dhami P.S & Dhami J.K. (1952) Chordate Zoology, S.Chand & Co.
- c) Ekambaranatha Ayyar M and Anantakrishnan T.N. (1990) A Manual of Zoology Vol. II Chordata, S.Vishwanathan Pvt.Ltd.
- d) Joprdan E.L. and Verma P.S. (1978) Chordate Zoology & animal Physiology, S.Chand & Co.
- e) Mayr E (1980) Principles of Systematic Zoology, Tata-McGraw Hill
- f) Parker T.J. and Haswell W.A (1972) a Text book of Zoology – Vol II, Mac Millan press Ltd.
- g) Prasad S.N (1980) a textbook of vertebrate Zoology, Vikas Publishing House.
- h) Romer A.S and Parson E (1978) The Vertebrate Body, W.B.Saunders Co.
- i) Sedgwick A, (1966) Student's textbook of Zoology, Vol.I & III Central Book Depot, and Allahabad.
- j) Soper R (1998) Biological Science, Cambridge Univ. Press.
- k) Vidyarthi R.D (1984) A textbook of Zoology, S.Chand & Co.
- l) Young J.Z. (1981) The Life of Vertebrates, Clarendon Press, N.Y.

**SEMESTER III**  
**PAPER III**  
**Comparative anatomy and Histology.**  
**3Hours/Week x16 = 48 Hrs.**  
**MARKS THEORY – 60 + INTERNAL ASSESSMENT -10 = 70**

**Course Objectives:**

1. To describe the exoskeletal structures with respect to different Vertebrates.
2. To study the comparative account of circulatory system in Vertebrates and its evolutionary significance.
3. To elaborate the evolution of Kidneys from lower to higher Vertebrates and comparative account of Nervous coordination.
4. To understand the concept of tissues and histological details of different organs in Frog.
5. To explain the histological details of different organs in Mammals.

**Course Learning Outcome:**

CO	After the completion of this course the student will be able to	Cognitive level
CO-01	Explain the types of exoskeletal structures in different classes of Vertebrates and co-relate it their habitats.	Analyse
CO-02	Give a comparative account of heart, venous system and aortic arches of different vertebrate classes.	Understand
CO-03	Appreciate the evolution of kidneys and nervous co-ordination in Vertebrates.	Evaluate
CO-04	List and compare different tissues in Animals and describe histological aspects in different organs of Frog.	Analyse Understand
CO-05	Explain histological aspects in different organs of Mammals.	Understand

<b>Unit 1</b>	<b>Comparative anatomy</b>	
<b>1.1</b>	<b>Exoskeletal structure-</b> Epidermal scales, dermal scales, structure of hair, claws, nails, hooves, horns and structure of feathers.	<b>5hrs</b>
<b>Unit 2</b>	<b>Comparative anatomy</b>	
<b>2.1</b>	Circulatory system: Comparative account of heart: Fish (Shark and <i>Dipnoi</i> ), Amphibia (Frog), Reptilia (lizard), Aves (Pigeon) and Mammalia (Man).	<b>5hrs</b>
<b>2.2</b>	Venous system: Comparative account of venous system in Shark, <i>Dipnoi</i> and Frog.	<b>5hrs</b>
<b>2.3</b>	The evolutionary account of aortic arches (general plan): Fish, Amphibia, Reptilia, Aves and Mammalia.	<b>5hrs</b>
<b>Unit 3</b>	<b>Comparative anatomy</b>	

<b>3.1</b>	Urino-genital system: Evolution of kidneys in vertebrates: Pronephros, Mesonephros and Metanephros.	<b>4hr</b>
<b>3.2</b>	Nervous system comparative account of the brain in fish Amphibia, Reptilia, Aves and Mammals.	<b>6hr</b>
<b>Unit 4</b>	<b>Histology</b> A brief account of different types of tissues.	<b>2 hrs</b>
<b>4.1</b>	Detailed Study of histological aspects in different organs of frog- Tongue, Lung, Stomach, Intestine, Liver, Pancreas, Kidney, Ovary and Testis.	<b>8hrs</b>
<b>Unit 5</b> <b>5.1</b>	Detailed Study of histological aspects in different organs of Rat- Tongue, Lung, Stomach, Intestine, Liver, Pancreas, Kidney, Ovary and Testis.	<b>8hrs</b>

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**IV SEMESTER**  
**PAPER IV**  
**BIOCHEMISTRY and PHYSIOLOGY**  
**3Hours/Week x16 = 48 Hrs.**  
**MARKS THEORY – 60 + INTERNAL ASSESSMENT -10 = 70**

**Course Objectives:**

1. To learn the structure and biological significance of biomolecules- Carbohydrates, Proteins and Lipids.
2. To describe homeostasis, thermoregulation and osmoregulation in different animals and regulation of blood glucose level.
3. To elaborate the processes of digestion, respiration, transport of gases and energy generation.
4. To learn the processes of circulation and excretion.
5. To explain the mechanism of nervous co-ordination and muscle contraction.

**Course Learning Outcome:**

CO	After the completion of this course the student will be able to	Cognitive level
CO-01	Identify the biomolecules, describe their structure and appreciate their biological significance.	Understand Evaluate
CO-02	Explain the concept of homeostasis and compare the thermoregulatory and osmoregulatory mechanisms in different animals.	Understand Analyse
CO-03	Give an outline of digestive and respiratory physiology and illustrate the energy budget of cellular respiration.	Understand Analyse
CO-04	Compare the different types of circulation, hearts and describe the regulation of heart. Apply the knowledge of the mechanism of blood clotting. Differentiate animals on the basis of nitrogenous waste products and appreciate the counter current mechanism of urine formation.	Apply, Analyse and Evaluate.
CO-05	Compare the structure of different muscle fibres and neurons; explain the ultra structure of muscle fibre, multipolar neuron and mechanism of muscle contraction, appreciate the relation between nervous co-ordination and muscle contraction.	Understand Analyse



<b>Unit 1</b>	<b>Biochemistry</b>	<b>9hrs</b>
<b>1.1</b>	Carbohydrates-Definition and classification, Biological importance of common carbohydrates (monosaccharides, disaccharides and polysaccharides).	
<b>1.2</b>	Proteins-Elementary classification of amino acids. Primary, secondary, simple and conjugated proteins, fibrous (keratin) and globular (globulin) proteins, Biological importance of proteins.	
<b>1.3</b>	Lipids-Classification and biological importance of lipids. Saturated and unsaturated fatty acids with examples. Clinical importance of lipids – Lipid profile of blood. Enzymes-Classification, properties, and biological importance of enzymes, mechanism of enzyme action, Induced fit theory.	
<b>Unit 2</b>	<b>Physiology</b>	
<b>2.1</b>	Homeostasis Concept-Osmoregulation- water and salt balance, Osmoconformers, Osmoregulators, osmoregulation in shark, marine and freshwater teleosts, terrestrial mammals (kangaroo rat and camel). Glucose balance – Role of liver and pancreas, Diabetes mellitus.	<b>4hrs</b>
<b>2.2</b>	Thermoregulation-Ectotherms, Endotherms, Heterotherms, Poikilotherms and Homeotherms. Thermogenesis and its regulation, Adaptive changes in animals for cold and warm environments. A note on Aestivation and Hibernation.	<b>4hrs</b>
<b>Unit 3</b>	<b>Physiology</b>	
<b>3.1</b>	Digestion-Physiology of digestion in the oral cavity, salivary glands, physiology of digestion in stomach, intestine and absorption of glucose. Role of hormones in digestion.	<b>6hrs</b>
<b>3.2</b>	Respiration-Physiology of respiration – Exchange of gases, transport of oxygen, oxygen dissociation curves – Bohr's effect, transport of carbon dioxide – Chloride shift, Respiratory Quotient. Cellular respiration: Glycolysis, Krebs cycle, Oxidative phosphorylation, energy budget, Respiratory pigments.	<b>6hrs</b>
<b>Unit 4</b>	<b>Physiology</b>	
<b>4.1</b>	Circulation- Open and closed type of circulation, the composition of blood, structure of human heart, complete double circulation, conduction of heart (heartbeat, cardiac cycle, pulse, heart sounds), Types of hearts: - Neurogenic, Myogenic. Blood pressure, blood clotting, chemical and nervous regulation of the heart.	<b>5hrs</b>

<b>4.2</b>	Nitrogen Excretion: Nitrogen excretion, Ammonotelism, Ureotelism and Uricotelism with examples. Ornithine cycle, structure of nephron. Physiology of urine formation in man, counter-current multiplier system. Regulation of urine formation.	<b>5hrs</b>
<b>Unit 5</b>	<b>Physiology</b>	
<b>5.1</b>	Muscle Contraction-Types of muscles, ultrastructure of striated muscle fibre, Contractile and regulatory proteins, neuro-muscular junction. Mechanism of muscle contraction and relaxation- sliding filament theory.	<b>5hrs</b>
<b>5.2</b>	Nervous Co-ordination-Ultrastructure of a multipolar neuron. Morphological types of neurosynapse. Axonic & synaptic transmission of nerve impulse.	<b>4hrs</b>

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- l. Harper H.A. Illustrated Biochemistry 29<sup>th</sup> Edition
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**V SEMESTER**  
**PAPER V**  
**CELL AND MOLECULAR BIOLOGY**  
**3Hours/Week x16 = 48 Hrs.**  
**MARKS THEORY – 80 + INTERNAL ASSESSMENT -20 = 100**

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### Course Objectives

1. To learn the structure of Animal cell, ultra structure and functions of Plasma membrane, Endoplasmic reticulum and Golgi complex.
2. To study the structure and functions of Mitochondria, Ribosomes, Lysosomes, Nucleus and Nucleic acids.
3. To describe structure and types of Chromosome, chromosomal aberrations and chromosomal changes during Mitosis.
3. To explain the behaviour of cancerous cells and jumping genes, chromosomal changes during Meiosis and regulation of gene expression.
4. To learn genetic code and protein synthesis.

### Course Learning Outcome:

CO	After the completion of this course the student will be able to	Cognitive level
CO-01	Compare the ultra structure of Plant and Animal cells. To explain the Fluid Mosaic model of Plasma membrane; structure and functions of Golgi complex and Endoplasmic Reticulum.	Analyse & Understand
CO-02	Elaborate the occurrence, structure and functions of Mitochondria, Ribosomes, Lysosomes and Nucleus and compare the types of nucleic acids.	Understand & Analyse
CO-03	Summarize the types of chromosomes and chromosomal aberrations and the behaviour of chromosomes during Mitosis.	Create
CO-04	Differentiate between the characteristics of normal and cancerous cells and compare the behaviour of chromosomes during the different stages of Mitosis and Meiosis. Illustrate the mechanism of gene regulation.	Analyse
CO-05	Appreciate the Central Dogma of Molecular Biology.	Evaluate

<b>Unit 1</b>	<b>Cell Organelles</b>	<b>8 hrs</b>
<b>1.1</b>	<b>The Cell-</b> Ultra structure of an Animal cell.	
<b>1.2</b>	<b>Plasma membrane</b> -Ultra structure – Fluid mosaic model, differentiation of cell surface, functions.	
<b>1.3</b>	<b>Endoplasmic reticulum</b> - Ultra structure, types, origin and functions.	
<b>1.4</b>	<b>Golgi complex:</b> Occurrence, morphology, origin and functions.	
<b>Unit 2</b>	<b>Cell organelles</b>	
<b>2.1</b>	<b>Mitochondria</b> - Morphology, distribution, ultra structure and functions. <b>Ribosomes</b> - Occurrence, structure, distribution, types, chemical composition. <b>Lysosomes</b> - Occurrence, structure, enzymes, polymorphism, functions	<b>6 hrs</b>
<b>2.2</b>	<b>Nucleus</b> - Ultra structure of the nucleus, nuclear membrane, nucleoplasm and chromatin fibres. Ultra structure and functions of <b>Nucleolus</b> . Structure of <b>Nucleic acid</b> - DNA Watson and Crick model, types of DNA. RNA- types of rRNA, Cloverleaf model of t-RNA.	<b>5 hrs</b>
<b>Unit 3</b>	<b>Chromosome and its anomalies</b>	
<b>3.1</b>	<b>Chromosome</b> -Chromosome number, types, size. Morphology, chemical composition, Ultra structure – nucleosome model. Giant chromosomes – Polytenes and lampbrush chromosomes. Chromosomal aberrations –numerical & structural deletion, duplication, inversion and translocation.	<b>6 hrs.</b>
<b>3.2</b>	Mitosis- Cell cycle, Mitotic stages, ultra structure of centriole, spindle fibre and its role in chromosome movements, the significance of mitosis, mitotic inhibitors.	<b>3 hrs</b>
<b>Unit 4</b>	<b>Cell division</b>	
<b>4.1</b>	Cancer Biology-Types of cancer, characteristics of cancer cell, oncogenes, tumours. Carcinogenic agents (physical, chemical and biological). Cancer therapy.	<b>4 hrs</b>
<b>4.2</b>	Meiosis- Stages of meiosis, synaptonemal complex, crossing over and chiasma formation, mechanism of crossing over, Significance of meiosis. Jumping genes Barbara McClintock's work on maize, control of gene expression: Lac operon.	<b>7 hrs</b>
<b>Unit 5</b>	<b>Gene and protein synthesis</b>	
<b>5.1</b>	Gene code- Properties of genetic code, transcription in prokaryotes-RNA polymerase, binding, initiation, elongation and termination. Post-transcriptional modification of mRNA. mRNA-Addition of cap, tail, and RNA- splicing-introns, exons, ribozymes. Translation in prokaryotes- Aminoacylation of t-RNA, elongation and	<b>8 hrs</b>

	termination.	
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**PAPER VI**  
**DEVELOPMENTAL BIOLOGY AND ENDOCRINOLOGY**

**3Hours/Week x16 = 48 Hrs.**

**MARKS THEORY – 80 + INTERNAL ASSESSMENT -20 = 100**

**Course Objectives**

1. To study the types of eggs and process of gamete formation and fertilization.
2. To learn the embryonic development in Frog and Chick; Cytological concept of parthenogenesis.
3. To learn the structure of placenta and foetal membranes.
4. To explain human development, modern trends in reproduction and sexually transmitted diseases.
5. To describe endocrine system, role of hormones in reproduction, population explosion and contraceptive methods.

**Course Learning Outcome.**

CO	After the completion of this course the student will be able to	Cognitive level
CO-01	Compare spermatogenesis and oogenesis. Describe the types of eggs and egg membranes with examples; mechanism of fertilization and it's significance.	Analyse  Understand
CO-02	Explain the embryological stages in the development of Frog and Chick upto gastrulation; concept of organizer and differentiation and cytological basis of Parthenogenesis.	Understand
CO-03	Describe the histological details of placenta and foetal membranes.	Remember
CO-04	Elaborate different stages of human development and apply their knowledge of sexually transmitted diseases and modern trends in reproduction.	Understand  Apply
CO-05	Describe the structure, functions and disease condition associated with endocrine system. Apply the knowledge of hormonal control in human reproduction. Create awareness on population explosion and contraceptive strategies.	Remember  Apply  Create

<b>Unit 1</b>	<b>Gametes and fertilization</b>	
<b>1.1</b>	<b>Gametogenesis:</b> Spermatogenesis – Formation of spermatids, spermiogenesis. Oogenesis, comparison between Oogenesis & spermatogenesis. .	<b>4 hrs</b>

<b>1.2</b>	<b>Structure of egg:</b> Types of eggs – Based on the quantity and distribution of yolk with examples. Egg membranes.	<b>2 hrs</b>
<b>1.3</b>	<b>Fertilization:</b> Details of the process with reference to sea urchin – Approach of gametes, gametes and its role, activation, penetration, reaction of the egg and amphimixis, monospermy and polyspermy (physiological and pathological), the significance of fertilization.	<b>4 hrs</b>
<b>Unit 2</b>	<b>Cleavage and development</b>	
<b>2.1</b>	Parthenogenesis- Cytology of natural parthenogenesis – Arrhenotoky, thelytoky (amictic and apomictic) and cyclical parthenogenesis with examples. Artificial parthenogenesis – Loeb's and Battalion's experiment. Significance of parthenogenesis.	<b>3hrs</b>
<b>2.2</b>	Cleavage and development:-Types of cleavage – holoblastic, meroblastic, radial, spiral and superficial types with examples. Planes of cleavage – meridional, vertical, equatorial and latitudinal.	<b>3 hrs</b>
<b>2.3</b>	Detailed account of development in frog and chick up to gastrulation. Concepts of organizer. Experiment of Spemann and Mangold, differentiation: process and importance. Morphogens and their role in development.	<b>7 hrs</b>
<b>Unit 3</b>	<b>Extra embryonic membrane</b>	
<b>3.1</b>	Foetal Membranes- Development, structure and functions of amnion, chorion, yolk sac and allantois.	<b>3 hrs</b>
	Placenta- Histological and morphological classification with examples, placental hormones. Significance of placenta.	<b>4 hrs</b>
<b>Unit 4</b>	<b>Human development</b>	<b>7 hrs</b>
<b>4.1</b>	Structure of mature Spermatozoan, Graafian follicle, and ovulation. A brief account of the stages of human development.	
<b>4.2</b>	Modern trends in reproduction: artificial insemination, sperm and egg banks, ET, GIFT, ICSI, cloning, stem cells and its applications. Advantages and disadvantages.	
<b>4.3</b>	Sexually transmitted diseases: types, symptoms, control measures of Gonorrhea, Syphilis and AIDS.	
<b>Unit 5</b>	<b>Human endocrine and hormones</b>	

<b>5.1</b>	Human Endocrine System- Anatomical structure and hormones of pituitary, thyroid, parathyroid, adrenals and pineal glands – Their physiological roles and conditions resulting due to hypo and hypersecretion. Neurohormones – Hypothalamic releasing and inhibiting factors and their actions.	<b>7 hrs</b>
<b>5.2</b>	Hormonal Control of Reproduction- Human menstrual cycle, Role of hormones in menstrual cycle. Role of male (testosterone) and female gonadal hormones (estrogen and progesterone) in reproduction. A Brief account of the early onset of puberty v/s food and lifestyle in both sexes.	<b>3 hrs</b>
<b>5.3</b>	Family Planning: Population explosion – Meaning and causes, need for birth control in India, contraceptive strategies – Rhythm method, pills, diaphragm, IUD, condoms, coitus interrupts, Sterilization.	<b>1 hrs</b>

## References

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**VI SEMESTER**  
**PAPER VII**  
**GENETICS AND EVOLUTION**

**3Hours/Week x16 = 48 Hrs.**

**MARKS THEORY – 80 + INTERNAL ASSESSMENT -20 = 100**

**Course Objectives:**

1. To learn the role of nature and nurture in inheritance and state Mendelism.
2. To study the interaction of genes.
3. To understand the mechanism and significance of linkage, crossing over, sex linked inheritance, sex determination; Construction of genetic maps.
4. To explain the types, causes and disorders associated with gene mutations.
5. To appreciate the concept of organic evolution; Describe Hardy Weinberg Law and types of speciation and isolation.

**Course Learning Outcome:**

CO	After the completion of this course the student will be able to	Cognitive level
CO-01	Define and describe the common terminologies used in Genetics; Appreciate the common concept of nature and nurture; Solve the problems on Mendelism.	Remember Evaluate
CO-02	To demonstrate with examples the different types of gene interactions. Apply their knowledge on multiple allelism. Solve problems on interaction of genes.	Apply
CO-03	Describe mechanism of linkage, crossing over and sex determination. Analyse the information and construct the genetic maps. Solve problems related to sex linked inheritance	Understand Analyse
CO-04	Differentiate the types of gene mutation and apply their knowledge on inborn errors of metabolism.	Analyse  Apply
CO-05	Appreciate organic evolution and their evidences. Solve problems on Hardy Weinberg Law. Explain the role of isolating mechanisms in speciation.	Evaluate  Understand

<b>Unit 1</b>	<b>Nature and Nurture</b>	<b>6 hrs</b>
<b>1.1</b>	Definition. Experiments on <i>Potentilla glandulosa</i> , Himalayan albino rabbit human twins. Definition of the norm of reaction, genetic homeostasis, phenocopy, penetrance and expressivity with examples – Huntington's chorea, PTC.	
<b>1.2</b>	Mendel's laws, Mono and dihybrid crosses. Incomplete dominance – Flower colour inheritance in <i>Mirabilis jalapa</i> .	
<b>Unit 2</b>	<b>Gene interplay</b>	
<b>2.1</b>	Interaction of genes: Supplementary factors – 9:3:3:1 – comb pattern in fowls. Dominant epistasis – 13:3 – plumage colour in Leghorn and Wyandotte. Complementary factors – 9:7 – flower colour in sweet peas. Multiple factors / polygenic inheritance – skin colour in man. Lethal genes – yellow coat colour in mice. Multiple alleles: Inheritance of ABO blood groups in Man, Rh factor, Erythroblastosis foetalis, Amniocentesis, Pleiotropism with examples.	<b>7 hrs</b>
<b>Unit 3</b>	<b>Linkage and sex determination</b>	
<b>3.1</b>	Linkage and crossing over- Coupling and repulsion, complete and incomplete linkage in <i>Drosophila</i> (grey body and vestigial wing). Significance of crossing over.	<b>4 hrs</b>
<b>3.2</b>	Genetic maps of chromosomes- Construction of chromosome maps, two-point and three-point test cross in <i>Drosophila</i> (sc ec cv), ymf.	<b>3 hrs</b>
<b>3.3</b>	Sex-Linked inheritance- Sex linked inheritance in <i>Drosophila</i> , man, & bird. Haemophilia and colour blindness in man. Y-linked genes.	<b>3 hrs</b>
<b>3.4</b>	Sex determination- Chromosomal basis of sex determination. Non-disjunction – primary and secondary. Genic balance theory. Gynandromorphs and intersexes in <i>Drosophila</i> . Environmental effect (Bonellia) and hormonal effects (Free Martin in cattle) on determination of sex. Human sex anomalies XO, XXY.	<b>5 hrs</b>
<b>Unit 4</b>	<b>Gene mutation</b>	
<b>4.1</b>	Kinds of mutation, classification - Point mutation and gross mutation. Gross mutation- classification according to origin – spontaneous and induced mutation, classification according to direction and magnitude of Phenotypic effect. Spontaneous mutation-Oenothera lamarckiana, Induced mutation-physical mutagens, chemical mutagens. Muller's CIB technique, disorders due to mutant genes-Brachydactyl, Sickle cell anaemia, Thalassemia, Inborn errors of metabolism-PKU, AKU & albinism.	<b>6 hrs</b>
<b>Unit 5</b>	<b>Organic Evolution &amp; Population Genetics:</b>	

<b>5.1</b>	Evidences for organic evolution: Indirect evidences from comparative anatomy, connecting links (Archaeopteryx) homology (vertebrate forelimb skeleton), analogy (wings of insect and bird), vestigial organs (human examples), physiology and biochemistry – Enzyme, excretory product analysis and embryological evidences. Direct evidences from palaeontology – Nature and types of fossils. A brief account of Brontosaurus, Stegosaurus, Geological time scale (GTS).	<b>5 hrs</b>
<b>5.2</b>	Mendelian population, gene pool and gene frequency. Hardy-Weinberg law – Genetic equilibrium, destabilizing forces of genetic equilibrium- Random genetic drift, natural selection, meiotic drive, mutation, migration, founder principle, bottleneck phenomenon.	<b>4 hrs</b>
<b>5.3</b>	Speciation: Definition, types – instantaneous – through mutation, chromosomal aberrations through polyploidy. Gradual speciation – Allopatric and Sympatric speciation. Isolation: types –Geographical and reproductive isolations, role of isolating mechanism in speciation.	<b>5 hrs</b>

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**PAPER VIII**  
**ENVIRONMENTAL BIOLOGY**  
**3Hours/Week x16 = 48 Hrs.**  
**MARKS THEORY – 80 + INTERNAL ASSESSMENT -20 = 100**

**Course Objectives**

1. To define the concepts of Ecology and describe its scope and components of environment.
2. To explain the physico- chemical properties of different ecosystems, concepts of demography and mechanisms of animal associations.
3. To state the laws of limiting factors and describe concepts of ecosystem energetics, ecological succession and biogeochemical cycles.
4. To understand the causes, effects and control measures of environmental issues and impact of xenobiotics.
5. To describe the types, values and threats to biodiversity and conservation methods.

**Course Learning Outcome:**

CO	After the completion of this course the student will be able to	Cognitive level
CO-01	Differentiate between autecology and synecology. Summarize the structure and significance of different components of environment.	Analyse Create
CO-02	Analyze different factors affecting demography. Summarize the structure of different ecosystems. Appreciate animal associations.	Analyse Create
CO-03	State the laws of limiting factors. Illustrate ecological pyramids, ecological succession and biogeochemical cycles. Interpret the consequences of unsustainable development.	Remember Evaluate
CO-04	Realize the impacts of pollution, global warming, ozone depletion and nuclear winter. Appreciate the significance of environment management tools. Apply their knowledge of ecotoxicology.	Analyse Evaluate Apply
CO-05	To appreciate biodiversity hotspots in India, conservation projects and role of NGOs in conservation. Create awareness on different conservation strategies.	Evaluate Create

	<b>Ecology</b>	
<b>Unit 1</b> <b>1.1</b>	<b>Introduction to ecology</b> -Definition, autecology, synecology, the scope of ecology.	<b>2hrs</b>
<b>1.2</b>	<b>Environment:</b> Different components: Atmosphere -Structure of atmosphere, composition of air. <b>Hydrosphere</b> - Importance of water, life supporting properties of water. <b>Lithosphere</b> – Pedogenesis, soil types & soil profile.	<b>5hrs</b>
<b>Unit 2</b>	<b>Ecosystem and ecology</b>	
<b>2.1</b>	Ecosystem- Structure of ecosystem, abiotic and biotic components of an ecosystem, types of ecosystem. <b>Freshwater ecosystem</b> - Pysico-chemical properties of freshwater ecosystem, fresh water biota(flora and fauna), zonation of the pond. <b>Marine ecosystem</b> -Pysico-chemical properties of marine water ecosystem, marine biota, zonation of the sea, communities of marine environment. <b>Terrestrial ecosystem</b> - Pysico-chemical properties of terrestrial ecosystem, classification of the terrestrial ecosystem.	<b>3hrs</b>
<b>2.2</b>	<b>Population ecology</b> - Definition of population, distribution, density, natality, growth, mortality, survivorship curve and age distribution.	<b>3hrs</b>
<b>2.3</b>	<b>Community ecology</b> - Definition of community, animal association- interspecific- positive interactions (mutualism, commensalism, proto cooperation), Negative interactions (parasitism, predation and competition) with relevant, examples, Gause's principle.	<b>4hrs</b>
<b>Unit 3</b>	<b>Environmental factors</b>	
<b>3.1</b>	<b>Limiting factors</b> - Liebig-Blackman's law of limiting factors, Shelford's law of tolerance, <b>Ecosystem energetics</b> -Food chains, food web, trophic levels(Ecological pyramids), Ecotone and edge effect, ecological succession: primary and secondary succession.	<b>6hrs</b> •
<b>3.2</b>	<b>Biogeochemical cycles</b> (Gaia hypothesis)- Definition, importance; carbon cycle, Nitrogen and Phosphorus cycles, Effective utilization of renewable and nonrenewable natural resources; <b>Renewable resources</b> –Solar, Wind, electrical, tidal, geothermal, <b>Nonrenewable resources</b> –Fossil fuels, Sustainable development.	<b>5hrs</b> •
<b>Unit 4</b>	<b>Impact of human activities on the environment</b>	
<b>4.1</b>	<b>Pollution</b> - Definition, types- Air, Water, Noise, Soil; causes, consequences and control measures with examples. Urbanization and desertification, Global environmental issues: greenhouse effect, ozone thinning, nuclear winter, Patents, GATT, EIA and ecological auditing.	<b>5 hrs</b>

<b>4.2</b>	<b>Ecotoxicology</b> -Scope, the toxicity of pesticides-organochlorides-DDT, organophosphates (malathion), heavy, metals (mercury), plants (parthenium), Impact of xenobiotics - bioaccumulation and bio magnifications, Resistance e development in mosquitoes. LD50, LD100, bioassay and it's importance.	<b>6hrs</b>
<b>Unit 5</b>	<b>Biodiversity and Wildlife</b>	
<b>5.1</b>	<b>Biodiversity</b> -Definition, types, values, biodiversity at the local level, hot spots of India. Wildlife management- Indian wildlife, causes for depletion, conservation strategies: <i>ex-situ</i> and <i>in-situ</i> conservation, WWF India, BNHS, IBCN, NGOs in the conservation of wildlife. Wildlife protection act, red data book, ecological status of a species (rare, vulnerable, endangered, threatened, extinct data insufficient data unknown). Human wildlife conflict, Conservation project and trade in wildlife, species conservation project-project tiger, project lion.	<b>9hrs</b>

## References

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- e. Kotpal R.L. (1991) The Birds, Rastogi Publications.
- f. Krebs J.R. and N.B.Davies (1993) Anintorudction to Behavioural Ecology, Backwell Scientific Publishing Co.
- g. Kumar H.D (1986) Modern Concepts of Ecology, Vikas Publishing House.
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- m. Singh H.R. (1989) Introduction to Animal Ecology & Environmental Biology, S.Chand& Co.
- n. Trivedi P.R. and Gurudeep Raj ( 1992) Environmental Biology.
- o. Odum E.P (1974) Basic Ecology.

## **PRACTICALS**

Importance should be given to student participation in the observation of identifying morphological characters/conduction of experiments. Students should complete the record work before the next practical class, and it has to be signed by the teacher and later submission should be entered in their record. Students who are absent for a particular practical class can be allowed to complete the record only when they make the observation in the next practical class, failing which, such records remain incomplete. Students should submit the certified practical record and filed the report, if any at the time of the practical examination. They will not be allowed to take the Practical Examination without the certified record and filed report. When a student submits his record sheets, it should be valued for 10 marks by the concerned teacher on the same day. The marks scored by each student should be added together at the end of the Semester and then divided by the total number of classes held. The marks thus scored will form the marks for Internal Assessment. Wherever there is submission/field report, they also shall form part of Internal Assessment along with class records.

### **SEMESTER-I**

**3 Hours/Week (3x16=48 hrs.)**

**MARKS THEORY – 20 + INTERNAL ASSESSMENT -10 = 30**  
**PRACTICAL – I**

### **ANIMAL DIVERSITY I**

#### **Course Objectives:**

1. To identify and learn the characters of Protozoans and mount them.
2. To identify the various specimens of Porifera and their exoskeleton and uniqueness of Cnidaria
3. To learn the endo-parasitic nature of Helminthes and their interaction with the host.
4. To identify, classify the Annelidan and Arthropodan specimens.
5. To gain the knowledge of different larval and adult forms of Mollusca and Echinodermata

#### **Course Learning Outcome:**

<b>CO</b>	<b>After the completion of this course the student will be able to</b>	<b>Cognitive level</b>
CO-01	Develop the skill of mounting and identifying Protozoans.	Apply
CO-02	Understand and apply the skills of identifying and mounting of Poriferans and Cnidarians.	Apply
CO-03	To differentiate between endo-parasite of Helminthes and their host.	Analyze
CO-04	Recognize and learn about different species of Annelidan and Arthropodans.	Remember
CO-05	Identify, classify the specimens of Mollusca and Echinodermata and their larval forms,	Remember

1 & 2	Study of permanent slides: <i>Amoeba</i> , <i>Entamoeba</i> , <i>Polystomella</i> , <i>Euglena</i> , <i>Paramoecium</i> , <i>Balantidium</i> , <i>Vorticella</i> .
3	Mounting of Foraminiferan shel.
4	Preparation of Protozoan culture – Hay infusion and observation of the Protozoan culture.
5	Porifera: <i>Sycon</i> , <i>Spongilla</i> , <i>Euspongia</i> .
6	Sponge Gemmule (marine & F.W), spicules (monaxon) / mounting of spicules.
7	Cnidaria: <i>Hydra</i> , <i>Obelia</i> , <i>Physalia</i> , <i>Ephyra larva</i> , <i>Pennatula</i> , <i>Fungia</i> , <i>Favia</i> .
8	Helminthes: <i>Planaria</i> , <i>Taenia</i> , Scolex of tapeworm, Liver fluke, <i>Ascaris</i> and <i>Ancylostoma</i> (male & female).
9	Annelida: <i>Pheretima</i> , <i>Chaetopterus</i> , <i>Nereies</i> , <i>Leech</i> .
10 & 11	Arthropoda: <i>Penaeus</i> , <i>Sacculina</i> on crab, Butterfly, Silkworm, Praying mantis, Grasshopper, <i>Julus</i> , <i>Scolopendra</i> , <i>Palamnaeus</i> , <i>Aranea</i> , <i>Mysis larva</i> .
12 &13	Mollusca: <i>Unio</i> , <i>Slug</i> , <i>Sepia</i> , Cuttlebone, <i>Nautilus</i> , <i>Pila</i> , <i>Aplysia</i> , <i>Chiton</i> , <i>Octopus</i> , <i>Ostrea</i> , <i>Mytilus</i> , <i>Glochidium larva</i> .
14	Echinodermata: Starfish, <i>Ophiothrix</i> , <i>Sea urchin</i> , <i>Antedon</i> , <i>Pluteus larva</i> , <i>Bipinnaria larva</i> .

### SCHEME OF PRACTICAL EXAMINATION

**Time: 3 hrs.**

**Max.Marks: 20**

Identify with reasons the specimen in the culture provided / Isolate and identify with reasons the specimen from the material provided. Write the procedure/mount the material and identify by giving reasons (by lots). (Protozoan culture, Foraminiferan shell, mounting of spicules).  
**5x1=5**

Identify with reasons spots A and B and C.

**3x3=9**

Identify with reasons spots D (parasitic form) and E (larval forms).

**3x2=6**



## SCHEME OF VALUATION FOR PRACTICAL I

Identification – 1, Procedure -1, Reason -2, Diagram- 1

Identification- 1 , Classification – ½ , Diagram + Reasons – 1½

Identification -1, diagram – 1, comment – 1

## II SEMESTER

3 Hours/Week (3x16=48 hrs.)

MARKS THEORY – 20 + INTERNAL ASSESSMENT -10 = 30

## PRACTICAL II

## ANIMAL DIVERSITY II

### Course Objectives

1. Learn different organisms/ specimens and their internal morphology through T.S.
2. Identify different specimens of Pisces their respiratory behaviour and their food value. Demonstrate the scales.
3. To understand and classify amphibian and reptilian along with identification of venomous and non-venomous snakes.
4. Concept of beak and feet modification in birds. Classify mammals; acquire the knowledge of dental formula.

### Course Learning Outcome:

At the end of the course the student will be able to

CO	At the end of the course the student will be able	Cognitive level
CO-01	Identify and describe the internal structure.	Understand
CO-02	Differentiate between respiratory organs and fresh and marine water food fishes of Karnataka. Identify different types of scales.	Remember
CO-03	Describe different amphibian according to orders and also identify the snakes.	Understand
CO-04	Apply the knowledge of feet and beak, dental formula.	Apply

1	Hemichordata – <i>Balanoglossus</i> , T.S through collar, T.S through proboscis, T.S thorough branchio-genital region.
2	Urochordata – <i>Ascidia</i> . Cephalochordata – <i>Amphioxus</i> , T.S through pharynx, T.S through intestine and T.S through caudal region.
3	Cyclostomata: <i>Petromyzon</i> , <i>Ammocoetes larva</i> , <i>Myxine</i> .
4	Pisces: <i>Scoliodon</i> , <i>Zygaena</i> , <i>Pristis</i> , <i>Trygon</i> .
5	<i>Echeneis</i> , <i>Hippocampus</i> , <i>Anguilla</i> .
6	Accessory respiratory organs – <i>Clarias</i> , <i>Ophiocephalus</i> , <i>Saccobranhus</i> .
7	Food fish of Karnataka – 3 Marine, 3 Fresh water fishes.
8	Permanent slide preparation – Placoid, Cycloid, Ctenoid scales.
9	Amphibia – <i>Rana</i> , <i>Salamandra</i> , <i>Axolotl</i> , <i>Ichthyophis</i> .
10	Reptilia: <i>Varanus</i> , <i>Chelone</i> , <i>Najana</i> , <i>Viper</i> , <i>Bungarus</i> , <i>Enhydrina</i> .
11 &12	Aves: (Based on beak and feet modification) Kingfisher, Parakeet, Woodpecker, Crow, Owl, duck, hen, and kite.
13	Mammalia: Rabbit, Rat, Bat, Loris.
14	Types of teeth and their identification and dental formulae in Cat, Dog Elephant, Horse, Monkey, Man.

#### SCHEME OF PRACTICAL EXAMINATION

**Time: 3 hrs.**

**Max.Marks: 20**

Mount, identify the given fish scale (Cycloid, Ctenoid).

**3x1=3**

Identify with reasons the spots A, B & C

**3x3=9**

An (Accessory respiratory organ), B (Bird-beak/feet modification), C (Dental formula).

Identify and comment on spot D&E (Any two specimen)

**2x2=4**

Identify and comment on spot F (From practical 7)

**4x1=4**

#### SCHEME OF VALUATION FROM PRACTICAL II

Mounting -2, Identification – 1.

Identification - 1 Diagram – 1, comment-1

Identification – ½, Comment- 1½

Identification and Classification – 1, Reasons – 1½, Diagram 1½,

**III SEMESTER**  
**3 Hours/Week (3x16=48 hrs.)**  
**MARKS THEORY – 20 + INTERNAL ASSESSMENT -10 = 30**

**PRACTICAL III**  
**OSTEOLOGY, COMPARATIVE ANATOMY AND HISTOLOGY**

**Course Objectives:**

1. To understand the concept of endoskeleton in different types of vertebrates.
2. To collate the study of aortic arches in brain and hearts in vertebrates.
3. Study of histological details of Frog organs.
4. Study of histological details of Mammalian organs.

**Course Learning Outcome:**

CO	At the end of the course the student will be able to	Cognitive level
CO-01	Identify and describe axial and appendicular skeleton in different vertebrates	Remember
CO-02	Compare and differentiate between heart, brain and aortic arches in Vertebrates.	Analyze
CO-03	Distinguish the histological details of Frog organs.	Analyze
CO-04	Apply the knowledge on histology of Mammalian organs.	Apply

<b>1</b>	Shark- Skull, Pectoral and pelvic girdles with fins. Vertebrae- Thoracic and caudal.
<b>2</b>	Frog- Skull, Pectoral and pelvic girdles, Fore limb and hind limb skeleton. Vertebrae- Atlas, Procoelus, Amphicoelous, Sacral, Urostyle.
<b>3</b>	Crocodile (Skull), Chelone (Carapace and Plastron).
<b>4</b>	Pigeon – Skull. Pectoral girdles with keel, synsacrum, fore limb, hind limb skeleton, heterocoelous vertebra.
<b>5</b>	Rabbit – Skull, Pectoral and pelvic girdles, fore limb, hind limb skeleton. Vertebrae-Atlas, Axis, Thoracic vertebra.
<b>6</b>	Aortic arches- Comparative study (pictures or models).
<b>7</b>	Comparative study of brain (pictures or models).

<b>8</b>	Comparative study of hearts (pictures or models).
<b>9</b>	Histology- Study of histological slides of Tongue and Lung in <b>frog</b> .
<b>10</b>	Histology- Study of histological slides of Stomach and Intestine in Mammal.
<b>11</b>	Histology- Study of histological slides of Liver and Pancreas in Mammal.
<b>12</b>	Histology- Study of histological slides of Kidney and Adrenal in Mammal.
<b>13</b>	Histology- Study of histological slides of Ovary and Testis in Mammal.
<b>14</b>	Histology-Study of histological slides of Thyroid in Mammal.

### **SCHEME OF PRACTICAL EXAMINATION**

**Time: 3 hrs.**

**Max.Marks: 20**

Compare and comment on aortic arches/ hearts/brain.	<b>4x1=4</b>
Compare and comment on spot A (Appendicular skeleton).	<b>4x1=4</b>
Identify spots C(Skull) and D(Vertebrae) with a neat diagram.	<b>2x2=4</b>
Identify spots E and F (Histology).	<b>2x4=8</b>

### **SCHEME OF VALUATION FOR PRACTICAL III**

Diagram – 2, Comment– 2

Diagram – 2, comment – 2

Identification – 1, Diagram – 1

Identification – 1, Diagram & comment – 3

## IV SEMESTER

3 Hours/Week (3x16=48 hrs.)

MARKS THEORY – 20 + INTERNAL ASSESSMENT -10 = 30

### PRACTICAL – IV

### BIOCHEMISTRY AND PHYSIOLOGY

#### Course Objectives:

1. To detect the presence and absence of bio-molecule in given sample.
2. To determine the enzymatic activity in given sample.
3. To gain the knowledge of different types of nitrogenous waste products and observe the abnormalities in it.
4. To perform serological test to identify the blood groups and demonstrate haematin crystals.
5. Demonstration of blood smears preparation and identification of WBC, osmotic changes in earthworm and benefits of vitamins.

#### Course Learning Outcome:

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Perform and evaluate the presence and absence of Carbohydrates, proteins and lipids.	Evaluate
CO-2	Demonstrate and analyze the different types of enzymes.	Analyze
CO-3	Compare the types of nitrogenous waste products in different class of vertebrates and evaluate the abnormal excretion in Man.	Evaluate
CO-4	Apply their knowledge of blood typing and haematin crystals in medico-legal cases and creates awareness in transfusion.	Create
CO-5	Differentiate between blood cells and vitamins sources.	Analyse

1	Qualitative tests to detect carbohydrates in the given test samples – Molisch's test, Iodine test, Fehling's test and Picric acid test.
2	Qualitative tests to detect proteins in the given test samples – Biuret test, Ninhydrin test, Million's test and Xanthoproteic test.
3	Qualitative tests to detect lipids in the given test samples – Acrolein test, Salkowsky test.
4	Salivary amylase activity on starch.
5	Dehydrogenase activity in milk.

<b>6</b>	Detection of nitrogenous excretory wastes in the given samples. Ammonia – Nessler’s reagent test, Urea – Urease test and Uric Acid – Folin’s reagent test.
<b>7</b>	Detection of abnormal excretion of glucose, albumin and creatinine in human urine. Glucose – Benedict’s test, albumin – Heller’s ring test, Creatinine – Jaffe’s test.
<b>8</b>	Blood typing – A, B, AB, O and Rh factors in given human blood samples using antisera.
<b>9</b>	Preparation of haematin crystals in human blood.
<b>10</b>	Preparation and staining of human blood smear & differentiating of WBC (Leishmann stain).
<b>11</b>	Osmotic relations in earthworm with reference to weight changes (demonstration).
<b>12&amp;13</b>	Identification of the sources of different fat soluble and water soluble vitamins – Their role and deficiency diseases – (Sources have to be specified, avoiding overlapping ones).Assignment- a chart to be prepared.

## **SCHEME OF PRACTICAL EXAMINATION**

**Time: 3 hrs.**

**Max. Marks: 20**

Demonstrate the presence or absence of proteins/carbohydrates/ lipids conducting two tests. Show the results and write the procedure (by lots from Pr.1 to 3).

**5marks**

Physiology experiment (by lots from Pr. 4 – 9),conduct two experiments.

**6+6 marks**

Comment on the vitamin present, its role and deficiency diseases of Spot A (Pr.12&13).

**3marks**

## **SCHEME OF VALUATION FOR PRACTICAL IV**

Procedure – 2 and experiment & result – 3

Procedure – 2, result and performance –4

Vitamin identification – 1, Physiological role – 1 and deficiency diseases – 1

## V SEMESTER

2 Hours/Week (2x16=32 hrs.)

Pract exam – 40 + INTERNAL ASSESSMENT -10 = 50

### PRACTICAL – V

### CELL AND MOLECULAR BIOLOGY

#### Course Objectives:

1. To measure cell and nuclear dimension.
2. Study and prepare the different stages of mitosis and meiosis in material provided.
3. Study of cytological permanent slides.
4. Preparation of karyotypes.
5. Colorimetric test to estimate DNA and RNA in the given sample.

#### Course Learning Outcome

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Measure and calibrate microscopic cell	Apply
CO-2	Demonstrate the skills in squash preparation.	Apply
CO-3	Identify and differentiate the different stages of mitosis and meiosis and Identify the giant chromosome.	Remember
CO-4	Identify the chromosome and construct the karyotype.	Create
CO-5	Utilize the equipments like spectrophotometer, colorimeter and micropepites.	Apply

1 & 2	Micrometry: Use of ocular and stage micrometres to measure cell & nuclear dimensions.
3 & 4	Study of permanent slides of onion root tip to study stages of mitosis. Squash preparation of onion root tip to study stages of mitosis.
5 & 6	Study of permanent slides of grasshopper testis to study various stages of meiosis.
7 & 8	Squash preparation of grasshopper testis or pollen grain to study stages of meiosis.
9	Study of permanent slide of salivary gland chromosomes of Drosophila.
10	Study of permanent slide/karyotype and ideogram of Rat and Man.
11	Preparation of karyotype from the given metaphase plate of Drosophila / Grasshopper.



<b>12</b>	Isolation of DNA from animal/plant tissues (Mulberry leaf / Coconut endosperm) - demonstration.
<b>13</b>	Estimation of RNA by Orcinol method.
<b>14</b>	Estimation of DNA.

### **SCHEME OF PRACTICAL EXAMINATION**

Time: 3 hrs.

Max. Marks: 40

Make a temporary squash preparation of the given material and Demonstrate a stage of cell division. Write the procedure and comment on the stage with a diagram(Onion root tip).

**8 marks**

Estimate the DNA / estimate the RNA from the given sample and write the procedure(by lots).

**10 marks**

Prepare the karyotype of the given metaphase plate of Grasshopper / Drosophila or identify and comment on the karyotype given (rat or man).

**4 marks**

Measure the cell or nuclear diameter of the given material in the slide and report.

**6**

**marks**

Identify with reasons the slides A to D (from mitosis, meiosis & Salivary gland chromosome any order.).

**4x3=12**

### **SCHEME OF VALUATION FROM PRACTICAL V**

Procedure – 2, preparation – 4 and report – 2

Procedure – 4, Preparation – 6

Karyotype arrangement – 3, neatness /identification – 1,

Procedure - 4, report – 2

Identification 1, diagram – 1 and reasons – 1

**SEMESTER- V**  
**2 Hours/Week (2x16=32 hrs.)**  
**Pract exam – 40 + INTERNAL ASSESSMENT -10 = 50**

**PRACTICAL – VI**

**DEVELOPMENTAL BIOLOGY AND ENDOCRINOLOGY**

**Course Objectives:**

1. To identify and describe the types of eggs, learn the developmental stages in different animals.
2. To analyze of population data and learn principle of contraceptive devices.
3. To study of mammalian endocrine gland cells.
4. To mount, prepare and identify the material provided.

**Course Learning Outcome:**

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Appreciate the embryological changes in different animals.	Evaluate
CO-2	Analyze, interpret and sketch graphs from the given population data and apply the principles of contraception.	Apply Create
CO-3	Identify and describe endocrine glands and their function.	Understand
CO-4	Acquire expertise in permanent slide preparation.	Apply

- 1 Study of different types of eggs – Graafian follicle, Egg of insect, frog, hen. Study of Grasshoppers, Frogs and mammalian sperms.
- 2 Frog: cleavage stages, blastula (section), gastrula (yolk plug stage) and neurula (sections).
- 3 Chick embryo: 18 hrs and 24 hrs (WM and sections).
- 4 Chick embryo: 36 hrs and 48 hrs (WM).
- 5 Study of development in Hen's egg – window technique (only demonstration).

- 6 Developmental studies in Drosophila – egg, larva and pupa.
- 7 Indian population data: based on census record & plotting a graph to show growth rate.
- 8 Identification of various family planning methods and their principles- condom, oral pill & copper-T.
- 9&10 Study of Permanent slides of mammalian endocrine glands – thyroid, adrenal, pancreas, testis and ovary.
- 11,12&13 Preparation of permanent whole mount slides and submission (any three).
- 14 Gross structure of placenta- man, sheep/goat, rat (V.S of placenta).

### SCHEME OF PRACTIAL EXAMINATION

**Time: 3 hrs.**

**Max.Marks 40**

Prepare a line graph / bar graph / histogram using the population data given.(Practical 7)

**3 marks**

Identify with reasons the slide A to C(Pr 1 to 4).

**3x3=9**

Identify with reasons D, E and F ( Pr.6,8, &14).

**3x3=9**

Identify and comment on G, H (Pr.9&10).

**3x3=9**

Stain, mount and identify with reasons the material provided.

**10 marks**

**Students have to submit minimum of 3 whole mount slides at the time of examination.**

### SCHEME OF VALUATION FOR PRACTICAL V

3 marks

Identification – 1, diagram – 1 and reasons – 1

Identification – 1, diagram – 1 and reasons – 1

Identification – 1, diagram – 2 and reasons – 1

Preparation – 8, Identification – 1, reasons – 1

## VI SEMESTER

2 Hours/Week (2x16=32 hrs.)

Pract Exam – 40 + INTERNAL ASSESSMENT -10 = 50

### PRACTICAL – VII

### GENETICS AND EVOLUTION

#### Course Objectives:

1. To Solving genetic problems identify the abnormal karyotypes in humans.
2. To study of general morphology, mounting and identifying mutants.
3. To study of tetrad and allele frequency.
4. To identify morphological and anatomical structures, connecting link and fossils in reference to evolution.

#### Course Learning Objectives:

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Analyze, workout and interpret the genetic problems given.	Analyze
CO-2	Mount and identify wild and mutants.	Create
CO-3	Think analytically and interpret the given data.	Analyze
CO-4	Appreciate the process of evolution.	Evaluate

1	Genetic problems: Monohybrid inheritance – 1 plant and 1 animal (Drosophila) examples. Dihybrid inheritance – 1 plant and 1 animal (Drosophila) example.
2	Complementary genes – Flower colour in Sweet pea. Supplementary genes – Comb pattern in Fowls. Epistatic (inhibitory) genes – Plumage colour in Fowls. Multiple genes – Skin colour in Man.
3	Multiple alleles – ABO blood group in Humans (2 problems) Sex-linked inheritance in Drosophila (2) and in humans (2).
4	Chromosomal abnormalities in Humans – Turner's, Klinefelter's and Down's syndrome (Chromosomal complements and photos).

<b>5</b>	Construction of 3 point test cross-linkage map (2 problems).
<b>6</b>	General morphology of <i>Drosophila</i> and mounting of sex comb and wing.
<b>7&amp; 8</b>	Identification of wild (male & female) and different types of mutants in <i>Drosophila</i> – white eye, bar eye, sepia eye, vestigial wing and yellow body.
<b>9</b>	<i>Neurospora</i> – Tetrad analysis.
<b>10</b>	Calculation of Allele frequency- tongue rolling, attached ear lobes in humans, ABO blood groups in human.
<b>11 &amp; 12</b>	Homologous and Analogous organs – serial homology – appendages of Prawn, structural homology – forelimb and hind limb skeleton of vertebrates. Analogy – wing of insect, bat, bird.
<b>13 &amp; 14</b>	Connecting links and fossils – peripatus (picture), Archaeopteryx (model), Lungfish (specimen). Fossils – Brontosaurus, Stegosaurus, Trilobite (models).

### SCHEME OF PRACTICAL EXAMINATION

**Time: 3 hrs.**

**Max.Marks:40**

Genetic problems – 2 problems (Pr.1,2,3) and 1 syndrome (Pr 4).

**4x3=12**

Construct the linkage map from data provided. (Pr 5) / *Neurospora*( Pr 9).

**4 marks**

Mounting of the first thoracic leg (mentioning the absence or presence of sex comb) / wing in *Drosophila*.

**4 marks**

Identify with reasons spot A and B(Pr.7&8).

**4x2=8**

Identify and comment on B & C (Pr11 &12).

**4x2=8**

Identify and comment on spot D (Pr 13 & 14).

**4 marks**

### SCHEME OF VALUATION

Genetic problem/ syndrome -3

Linkage map / *Neurospora* -4

Mounting – 3, Comment - 1

Identification – 1, comment – 2, diagram – 1

Identification – 1, comment 3

Identification – 1, comment - 3

## PRACTICAL – VIII

2 Hours/Week (2x16=32 hrs.)

Pract Exam – 40 + INTERNAL ASSESSMENT -10 = 50

### Course Objectives:

1. To estimate water sample for presence of carbon-dioxide, oxygen, chloride, hardness and TDS.
2. To gain the knowledge of different types of animal association.
3. To estimate and demonstrate the amount of copper and protein in the given samples in reference to eco-toxicology
4. To learn the morphological and ecological peculiarities in different animals.

### Course Learning Objectives

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Perform volumetric analysis and analyze the results.	Analyze
CO-2	Appreciate the association between same and different animals.	Evaluate
CO-3	Perform volumetric analysis and analyze the toxic results and predict the impact of toxins in the given sample.	Evaluate
CO-4	Appreciate the significance of adaptations.	Understand

Visit to nearby water bodies- polluted & non-polluted to study the physical parameters such as colours temperature, pH, turbidity, conductivity. (Submission of a report.)

Records + field report 5+5

- 1 Estimation of dissolved oxygen in two water samples. BOD (Biological oxygen demand)-demonstration.
- 2 Estimation of dissolved carbon dioxide in two water samples
- 3 Estimation of chloride content in two water samples
- 4 Estimation of hardness in two water samples.
- 5 TDS-Total Dissolved Solids.
- 6 Water holding capacity of different types of soil.

- 7**     Animal associations: Mutualism – Termite & Trichonympha. Commensalism – Echeneis & Shark, Proto co-operation – Hermit crab & Sea anemone. Animal associations: Parasitism – Head louse, Bed bug, Female mosquito, Ticks & mites. Predation – Snake and Frog.
- 8**     Estimation of amount of copper in the given sample (Ecotoxicology).
- 9**     Estimation of total protein in the given sample.
- 10**    LD 50 and LD100 values (Demonstration).
- 11**    Coloration and mimicry- Chamaeleon, Leaf insect, Hippocampus, Stick insect, Geometrid caterpillar, Fire salamander.
- 12 & 13**   Adaptations – (Morphological and Ecological peculiarities)  
Gryllotalpa, Hermit crab, Periopthalmus, Angler fish, Cypsilurus, Turtle, Duck, Crocodile, Phrynosoma, Ichthyophis, Bat, Owl, Bird and Draco.
- 14**    Visit to Zoo / Wild life sanctuary /National Park to study ecology and behavior of animals and submission of a report.

## SCHEME OF PRACTICAL EXAMINATION

**Time: 3 hrs.**

**Max.Marks: 40**

Estimate the dissolved oxygen / carbon dioxide/chloride/hardness in the given Sample(by lots)  
9 marks

Estimate the copper/protein in the given sample. (by lots) **9 marks**

Identify and comment on adaptation of spots A and B

(Colouration and mimicry) **3x2=6**

Identify and comment on the Animal association in C & D **4x2=8**

Identify and comment on morphological and ecological peculiarities of spot E and F **4x2=8**

## SCHEME OF VALUATION

1. Procedure + Principle – 4, result – 5
2. Procedure + Principle – 4, result – 5
3. Identification – 1, Comment- 2
4. Identification & diagram – 2, comment -2
5. Identification diagram - 2, comment -2

## DISCIPLINE SPECIFIC ELECTIVE- DSE

**DSE-1**

**ZSC I**

**Tropical Parasitology**

**2 Hrs. /week x 16 = 32 hrs.**

### Course Objectives:

1. To study different types animal association.
2. To study different parasitic Protozoans.
3. To study different parasitic Nematodes.
4. To study different parasitic Cestodes

### Course Learning Objectives:

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Appreciate animal association and apply the knowledge to prevent	Apply



	Zoonotic disease.	
CO-2	Describe the structure, life cycle, disease caused by parasitic protozoan.	Understand
CO-3	Differentiate between sexes, describe its function, pathogenesis and control measures.	Analyze
CO-4	Describe the structure, life cycle, disease caused by parasitic cestodes.	Understand

<b>Unit 1</b>	<b>Host-parasite relationship</b>	
<b>1.1</b>	Introduction – Host-parasite relationship- definitive and intermediate ecto& endo parasitism, symbiosis, commensalism, zoonosis.	<b>3hrs</b>
<b>Unit 2</b>	<b>Pathogenic protozoans</b>	
<b>2.1</b>	<i>Entamoeba histolytica</i> - Structure and differentiation of different amoeba, mAoebiasis.	<b>3hrs</b>
<b>2.2</b>	<i>Trypanosoma gambiense</i> – Structure, life cycle of, Trypanosmiasis.	<b>3hrs</b>
<b>2.3</b>	<i>Plasmodium vivax</i> – Structure, life cycle of Plasmodium.	<b>3hrs</b>
<b>2.4</b>	Leishmaniasis- Structure, life cycle and Leishmaniasis.	<b>2hrs</b>
<b>Unit 3</b>	<b>Pathogenic nematodes</b>	
<b>3.1</b>	<i>Ascaris</i> - Pathogenesis, diagnosis, prevention and control measures of <i>Ascaris</i> . Their structure & sexual dimorphism.	<b>3hrs</b>
<b>3.2</b>	<i>Ancylostoma duodenale</i> (hookworm)-Their structure & sexual dimorphism.	<b>3hrs</b>
<b>3.3</b>	<i>Enterobius vermicularis</i> (Pin worm)-Their structure & sexual dimorphism.	<b>3hrs</b>
<b>3.4</b>	<i>Wuchereria bancrofti</i> (filarial worm)- Their structure & sexual dimorphism.	<b>3hrs</b>
<b>Unit 4</b>	<b>Pathogenic Cestodes</b>	
<b>4.1</b>	<i>Taenia solium</i> -Pathogenesis, diagnosis, prevention and control measures of <i>Taeniasolium</i>	<b>3hrs</b>
<b>4.2</b>	<i>Fasciola hepatica</i> (Liver fluke)-Their structure & life cycle.	<b>3hrs</b>

#### References:

- Hoare C.A (1950) Handbook of medical protozoology London: Baltimore, Tindall and cox.
- Levine. N.D. (1973) Protozoan parasites of domestic animals and man. 2<sup>nd</sup> Ed. Minncapolis: Burgers.
- Noble E.R and Nolsse.G.A. (1961)Parasitology.The biology of animal Parasites.LondonKimpton.

- d) Richards W. and Devis R.G (1971) Imm's general textbook of Entomology, 10<sup>th</sup> Ed. London Chapman and hall.
- e) Smith K.G.V (1973), Insects and other arthropods of medical importance. London: British Museum of Natural History.

## DSE-2

### ZSC II Applied Entomology

**2 Hrs. /week x 16 = 32 hrs.**

**Objectives:** Entomology, the study of insects provides knowledge about intimacy between insect and environment and familiarize the students with insect identification and it helps students appreciate the impact that insects have on humans and society.

<b>Unit 1</b>	<b>Introduction to entomology</b>	
<b>1.1</b>	Introduction to entomology-Classification of insect, morphology of head & eyes of insects, types of antennae.	<b>4hrs</b>
<b>1.2</b>	Introduction to entomology-Trophic insects with reference to feeding habits of (cockroach, mosquito (male & female), housefly, honey bee, butterfly.	<b>5hrs</b>
<b>Unit 2</b>	<b>Concept of vectors</b>	
<b>2.1</b>	Brief introduction of carrier and vectors (mechanical and biological vectors).	<b>3hrs</b>
<b>2.2</b>	Adaptations of vectors.	<b>1hrs</b>
<b>2.3</b>	Host specificity.	<b>1hrs</b>
<b>Unit 3</b>	<b>Insects as vectors</b>	<b>8 hrs</b>
<b>3.1</b>	Insects orders as vectors – Diptera, Siphonaptera, Siphumelata, Hemiptera with examples.	
<b>3.2</b>	Kinds of vectors – Bloodsucking – Diphtheria mosquito- dengue, chikungunya, malaria, filarial – Control of mosquitoes.	
<b>3.3</b>	Mechanical vector & its control measures- Housefly, Bed bugs	
<b>Unit 4</b>	<b>Beneficial insects</b>	
<b>4.1</b>	Silkmoth, honey bee, lac insects – brief note on them.	<b>2hrs</b>

<b>4.2</b>	<p>Useful insects</p> <p>Medicine - Sting of the honey bee – <i>E. antheridium</i>.  Food – For animals &amp; man.  Scientific research – <i>Drosophila</i> &amp; mosquitoes – genetic &amp; toxicological studies.</p> <p>Helpful insects – Parasites – Live &amp; feed on harmful insects. predators  pollinators  weed killers  soil builders</p> <p>Scavengers Household &amp; disease-carrying insects.</p>	<b>8hrs</b>
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#### References:-

- Ramakrishna Ayar. T.V., (1963) Handbook of Economics Entomology for south India Government Press, Chennai.
- Metacalf C.L and W.P Flint, (1967) Destructive and useful insects. Their habits and control. Tata-McGraw Hill, New Delhi.
- Nayar K.K, T.N. Ananthakrishnan and B.N David, (1976) General and applied entomology Tata Mc-Graw Hill.
- Vasantharaj David B, (2000) Elements of Economic Entomology popular book Depot, Chennai.

### **DSE-3**

### **ZSC III**

### **Animal Husbandry**

**2 Hrs. /week x 16 = 32 hours**

#### **Course Objectives:**

1. Elaborate the modern technique, and scopes in poultry.
2. To learn the principle of cattle breeding and dairy management.
3. To learn disease caused in dairy.

#### **Course Learning Objectives:**

<b>CO</b>	<b>At the end of the course the student will be able to</b>	<b>Cognitive level</b>
CO-1	Analyze different technique in poultry and apply knowledge to create job opportunity.	Create
CO-2	Identify cattle breeds and apply their knowledge and generate revenue.	Create
CO-3	Apply the knowledge and control the disease related to dairy.	Apply

<b>Unit 1</b>	<b>Poultry</b>	
<b>1.1</b>	<b>Poultry-</b> Introduction, scope and its importance, modern techniques in animal husbandry, History of poultry in India, Importance and scope of poultry Poultry Breeds-Principle techniques and methods of breeding.	<b>4hrs</b>
<b>1.2</b>	Commercial poultry farming, poultry housing and equipment location of poultry farm, the nutritive value of egg and meat. poultry products and their uses - feathers, excreta.	<b>5hrs</b>
<b>Unit 2</b>	<b>Dairy</b>	
<b>2.1</b>	<b>Dairy-</b> Cattle breeds and management, Cattle breeds- Milk breeds, Drought breeds and exotic breeds, buffalo breeds- Swap and Riverine.	<b>5hrs</b>
<b>2.2</b>	Principle and methods of breeding-Inbreeding, outbreeding and cross-breeding. Artificial insemination.	<b>3hrs</b>
<b>Unit 3</b>	<b>Dairy cattle management</b>	
<b>3.1</b>	Dairy cattle management- General principle, housing, water supply, caretaking during pregnancy, care of newborn calf.	<b>2hrs</b>
<b>3.2</b>	Cattle nutrition –feeds and fodders, feeding standards, composition of milk, testing of milk for adulteration, processing of milk.	<b>2hrs</b>
<b>3.3</b>	Preparation of milk products- Cream, Butter, Ghee, curds and buttermilk.	<b>2hrs</b>
<b>3.4</b>	Milk hygiene- Cleaning of dairy utensils.	<b>1hrs</b>
<b>3.5</b>	Visit to dairy submission of project report.	<b>1hrs</b>
<b>Unit 4</b>	<b>Dairy pathology</b>	
<b>4.1</b>	Dairy pathology- Viral, bacterial, parasites (ecto and endo) and Vaccination programs.	<b>5hrs</b>
<b>4.2</b>	Visit to dairy submission of project report.	<b>2hrs</b>

#### References:-

- ICAR, Handbook of animal husbandry-The Indian council of agriculture research, New Delhi.
- Jeergenson .E.M and W.P. Mortenson, Approved practices in dairying.
- Sukumar. D.E.-Outline of diary technology.
- Revives.P.M. and Henderson, Dairy cattle feeding and management.
- Eckles C.H and E.L. Anthony, Dairy cattle and milk production.
- Gopalkrishna. C.A and G. Murley Mohan Lal (1997) Livestock and poultry enterprises for rural development, Vikash, New Delhi.

- g) Gnaanamani. M.R., (1998) Modern aspects of commercial poultry keeping, Giri.
- h) Chauhan H.V.S and S.Roy, (1996) Poultry diseases diagnosis and treatment, new age International.

**DSE-4**  
**ZSC IV**  
**Clinical Science**

**2 Hrs. /week x 16 = 32 hrs.**

**Course Objectives:**

1. To learn blood and its properties and disorders.
2. To elaborate basic principle, auto-immune disease, prevention of post-natal disease and vaccines.

**Course Learning Objectives:**

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Pursue lab technician course.	Create
CO-2	Apply the knowledge of immunological concept and identify the disorder.	Analyze

<b>Unit 1</b>	<b>Haematology</b>	
<b>1.1</b>	Introduction to haematology-scope uses and advantages, blood composition and function of blood.	<b>4hrs</b>
<b>2.2</b>	Blood coagulation, anti-coagulation, blood groups, blood transfusion, blood banks, Inheritance of blood groups, Rh factor and amniocentesis and their detection.	<b>5hrs</b>
<b>Unit 2</b>	<b>Haematology</b>	
<b>2.1</b>	Blood associated disorders and their detection -Anaemia, leucopaenia, leucocytosis, leukemia and haemophilia.	<b>5hrs</b>
<b>Unit 3</b>	<b>Immunoglobulin</b>	<b>9 hrs.</b>
<b>3.1</b>	Immunoglobulin- Classification and significance, natural and artificial immunity, humoral and cell mediated immunity.	
<b>3.2</b>	B lymphocytes and immune response- precipitation of soluble antigens, agglutination, complement fixation, Clonal selection theory.	
<b>3.3</b>	Lymphoid organs- Location, structure and role: Bone marrow, Thymus, bursa of fabricus, lymph node, spleen, Payer's patches and kuffer cells.	

<b>Unit 4</b>	<b>Immunoglobulin</b>	<b>9 hrs</b>
<b>4.1</b>	Immunological memory and Auto immune diseases- Sedormid purpura, systemic leupus erythromatosis (SLE), Rheumatoid arthritis (RA), Major histo-compatibility complexes (MHC).	
<b>4.2</b>	T lymphocytes and immune response.	
<b>4.3</b>	Clinical Immunology- Vaccines –types and uses, Immunization schedule for children.	
<b>4.4</b>	Prevention of postnatal diseases- Tetanus, diphtheria, whooping cough, cholera, yellow fever, measles and AIDS and their detection.	

## References

- Fatima D and Arumugam, (1994), Immunology sarasNagercoil India.
- Ranganathan T.K and S. Karunakaran, Immunology Prints and proofs.
- Roitt, I.M (2000). Essentials of Immunology, Baekwell Scientific, London.

## DSE-5

## ZSC V

## Animal biotechnology

**2 Hrs. /week x 16 = 32 hrs.**

## Course Objectives

- Scope and tools in biotechnology and recombinant DNA technology.
- To study the technique in DNA finger printing and gene therapy.
- To learn stem cell culture and transgenic animals.

## Course Learning Objectives

CO	At the end of the course the student will be able to	Cognitive level
CLO-1	Appreciate and apply the knowledge of recombinant DNA technology.	Evaluate
CO-2	Appreciate the application DNA finger printing and gene therapy.	Evaluate
CO-3	To compare merits and demerits of transgenic animals and apply their knowledge in genetic engineering in areas of agriculture, health care and environment.	Analyze and Apply

**Objective:** Main objectives is to reduce the environmental impact of livestock farming. A transgenic animal is being created to improve the use of dietary phosphorous to lessen the environmental impact of animal manure, it is useful in biomedical purposes like gene therapy disease management. Biotechnology is a science that uses the method and process for transformation of natural raw materials into useful products by the application of living organisms in the industrial process.

<b>Unit 1</b>	<b>Genetic engineering</b>	
<b>1.1</b>	Introduction, scope of biotechnology, Industrial biotechnology and their importance.	<b>2hrs</b>
<b>1.2</b>	Genetic engineering- tools used in genetic engineering –restriction endonucleases, DNA ligases.	
<b>1.2</b>	Genetic engineering- tools used in genetic engineering –restriction endonucleases, DNA ligases. Cloning vehicles or vectors- Plasmids, bio-reactors.	<b>3hrs</b>
<b>Unit 2</b>	<b>Recombinant DNA technology</b>	
<b>2.2</b>	Recombinant DNA technology and its applications	<b>2hrs</b>
<b>2.1</b>	Steps involved in rDNA technology- Insulin made from rDNA technology	<b>2hrs</b>
<b>Unit 3</b>	<b>DNA finger printing</b>	<b>5hrs</b>
<b>3.1</b>	DNA finger printing	
<b>3.2</b>	Basis of DNA finger printing and steps involved in DNA finger printing - Application of DNA finger printing	
<b>Unit 4</b>	<b>Gene therapy</b>	<b>4hrs</b>
<b>4.1</b>	Gene therapy- Types, diseases treated, gene delivery, hybridising techniques- Northern, Southern, Western blotting.	
<b>Unit 5</b>	<b>Stem cell culture</b>	
<b>5.1</b>	Stem cell- Culture Embryonic and adult stem cells, Adult stem cells and their potential, Potential uses of stem cells, Transgenic or genetically modified animals.	
<b>5.2</b>	Hazards and safeguards of genetic engineering. Application in areas of agriculture health care and environment.	

**References:**

- Trehan.k. –Applications of biotechnology.
- Old and Primerose, Gene manipulation technique.
- Ignacimuthu S. Basic biotechnology.

**DSE-6**  
**ZSCVI**  
**Ethology**  
**2 Hrs. /week x 16 = 32 hrs.**

**Course Objectives**

1. To study the types animal behaviour and methodology.
2. Learn the role of endocrine system in animal behaviour.
3. To explain different types of physiological, biochemical and social communication in animals with examples.

**Course Learning Objectives:**

CO	At the end of the course the student will be able to	Cognitive level
CO-1	Compare innate and learned behaviour; appreciate the significance of migration and biological clock.	Analyze and Evaluate
CO-2	Evaluate the role of hormones in aggressive, maternal and courtship behaviour.	Analyze Evaluate
CO-3	Differentiate and identify animal behaviour like bio-luminance, pheromones, auditory and social communication.  Appreciate the evolutionary significance of animal behavior.	Analyze Evaluate

<b>Unit 1</b>	<b>Introduction to ethology</b>	
<b>1.1</b>	Introduction to ethology Branches, methods of studying ethology.	<b>2hrs</b>
<b>Unit 2</b>	<b>Animal behaviour</b>	
<b>2.1</b>	Types of animal behaviour: - Innate and learned behaviours with examples	<b>2hrs</b>
<b>2.2</b>	Migration in fish (catadromous and anadromous with suitable examples).	<b>3hrs</b>
<b>2.3</b>	Migration in Bird (Morphological, Anatomical, Physiological flight adaptation in birds).	<b>3hrs</b>
<b>2.4</b>	Biological Clock: Circadian, circalunar and circannual rhythms with an example for each.	<b>6hrs</b>
<b>Unit 3</b>	<b>Hormones and behaviour</b>	
<b>3.1</b>	Hormones and behaviour -Hormones of Gonads, adrenal gland, pituitary. Hormonal effects on different behavioural patterns- Aggressive behaviour, maternal behaviour, courtship behaviour.	<b>6hrs</b>
<b>Unit 4</b>	<b>Bioluminescence in animals and Pheromones</b>	
<b>4.1</b>	Bioluminescence in animals- occurrence, physiological bases and it's importance.	<b>2hrs</b>



<b>4.2</b>	Pheromones- Functions and importance, scent marking in vertebrates and it's importance.	<b>2hrs</b>
<b>Unit 5</b>	<b>Auditory Communication and Social organization</b>	<b>6hrs</b>
<b>5.1</b>	Auditory Communication -in Gryllid insect. Social organization-mating groups and advantages of being social, societies of lions, monkeys and deer. Orientation-types, eco-location, the language of honey bees.	

#### References:

- Aubrey Manning and Marian.S. Dawkins. (1995)An introduction to animal behaviour. Cambridge University Press.
- McFarland .D, the oxford companion to animal behaviour.
- McFarland D., (1985) Animal behaviour, Psychology, Ethology and Evolution.Pitman Publication.
- Slater P.J.B., (1999) Essentials of Animal Behaviour Cambridge University Press.
- Krebs .J.R and Davies N.B., An Introduction to behavior ecology- III ed. Blackwell Science Ltd.1993.
- Reena Mathur-Animal Behaviour

### **DSE-7**

### **ZSC VII**

### **ECONOMIC ZOOLOGY**

**2 Hrs. /week x 16 = 32 hrs**

#### **Course Objectives:**

- Learn aquaculture and their importance.
- To study the techniques of Vermiculture.
- Explain economic importance of insects with examples.

#### **Course Learning Objectives**

<b>CO</b>	<b>At the end of the course the student will be able to</b>	<b>Cognitive level</b>
CO-1	Identify the different types of food fishes and apply their knowledge on aquaculture to generate revenue from fishes, prawns, sponge and pearl culture.	Create
CO-2	Apply the knowledge to decompose organic waste and produce bio-fertilizer like vermicompost.	Create

CO-3	To initiate small scale industry like apiculture, sericulture and lac culture.	Create
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<b>Unit 1</b>	<b>Aquaculture, Spongeculture, Prawn culture</b>	
<b>1.1</b>	Aquaculture – scope & economic importance, inland and marine. Culture techniques, the food value of fish, food fish of Karnataka - marine, freshwater and brackish water fish. Sponge culture: - technique used to culture both marine and freshwater sponge & it's economic importance.	<b>9hrs</b>
<b>1.2</b>	Pearl culture: - Fresh water pearl culture, economic importance, natural marine pearls. Oyster farming – methods & their significance.  Prawn culture – scope and importance of prawn culture, different species of prawn.	<b>6hrs</b>
<b>Unit 2</b>	<b>Vermiculture</b>	
<b>2.1</b>	Vermiculture- Scope & it's importance, species of earth-worm used, process, the composition of vermicompost, vermiwash, earthworm as farmers friend. Visit to the zoo to gain knowledge about practical vermicomposting.	<b>3hrs</b>
<b>Unit 3</b>	<b>Apiculture</b>	
<b>3.1</b>	Apiculture -social organization in honey bees, species of honey bees used for apiculture, the morphology of honey bee, structural modifications, bee venom, apitherapy, bees in pollination, production, composition, medicinal and nutritional importance of honey.	<b>5hrs</b>
<b>Unit 4</b>	<b>Sericulture</b>	
	Sericulture- Races of the silk worm, mulberry and non-mulberry silk-worms & their larval host plants. Voltinism and Renditta value in cocoons. Morphology and life cycle of <i>B.mori</i> , rearing techniques, global & natural silk production. Importance of by-products of sericulture.	<b>5hrs</b>
<b>Unit 5</b>	<b>Lac Culture</b>	
<b>5.1</b>	Lac Culture-Morphology and life cycle of lac insect. Composition of lac, strains of lac insect, cultivation of lac host plants, in brief process of lac & uses of lac.	<b>4hrs</b>

## References

- Recent advances in aquaculture IV- James. F Muir and Ronald.J.Roberts,(VOLII)- by the same author.
- Handbook on fisheries and aquaculture Technology by NIIR of consultants and engineers.
- Hirobe, T.1968 evolution, differentiation and breeding of silkworm.
- Handbook of silkworm rearing. Japan, Fuji publishing co.ltd. ByongHeeChoe 1973.

- e) Lac culture – springer link-<http://link.springer.com>
- f) Lac culture.pdf-nsdl.niscair.res.in>jspui>bitstream> by R.Singh.
- g) Sericulture –by P.Venkatanarasaiah.
- h) Sericulture Extension- Principles and management – by Tirbhuwan Singh, Madam Mohan Bhat, Mohammad Ashraf Khan.
- i) Honey bee diversity, Role in pollination and beekeeping scenario in south Ruttner, F.Year 1988. Publication springer verlagBodin. Title: Honeybees and their management in India.
- j) Honey bees in mountain agriculture, Verma L.R.1992 Publication west view press.
- k) Perspectus in Indian Apiculture.Mishra.R.C and Gang.R.1998, Publication:AgroBotanica.
- l) Asian bees and Beekeeping: Progress of research and development.MatsukaM.Verma, L.R., Wongsiri, S., Shrestha, K.K., and Pratapu-2000, Publication Oxford and IBH publishing company Ltd., NewDehli, India.
- m) Essentials of beekeeping and pollination, Atwal, A.S.2000, Kalyani Publishers.
- n) Fundamentals of Bee Keeping, Sathe, T.V.2006, Daya Books, Dehli, India.

### BLUE PRINT OF QUESTION PAPER I to IV( DSC)

<b>Semester: I to IV</b>		<b>Subject: ZOOLOGY</b>
<b>Title:</b>		<b>QP Code:</b>
<b>Time: 3 Hours</b>		<b>Max Marks: 60</b>
<b>Instructions to the Candidates: Draw diagram wherever necessary.</b>		
<b>PART A</b>		
I	Answer any FIVE of the following.	<b>5X2=10</b>
1		
2		
3		
4		
5		
6		
7		
<b>PART-B</b>		
II	Answer any FIVE of the following.	<b>5X6=30</b>
8		

9		
10		
11		
12		
13		
14		
<b>PART- C</b>		
III	Write in detail on any TWO of the following.	<b>2X10=20</b>
15		
16		
17		
18		

**BLUE PRINT OF QUESTION PAPER V to VIII ( DSC)**

<b>Semester : V to VIII</b>		<b>Subject: ZOOLOGY</b>
<b>Title:</b>		<b>QP Code:</b>
<b>Time: 3 Hours</b>		<b>Max Marks:70</b>
<b>Instructions to the Candidates: Draw diagram wherever necessary.</b>		
<b>PART A</b>		
I	Answer any FIVE of the following.	<b>5X3=15</b>
1		
2		
3		
4		
5		
6		
7		
<b>PART-B</b>		
II	Write an explanatory note on any FIVE of the following.	<b>5X7=35</b>
8		
9		
10		
11		

12		
13		
<b>PART- C</b>		
III	Write in detail on any TWO of the following.	<b>2X10=20</b>
14		
15		
16		

**BLUE PRINT OF QUESTION PAPER ( DSE)**

<b>St. Philomena's College (Autonomous), Mysore</b>		
<b>Semester:II/V</b>		<b>Subject: ZOOLOGY</b>
<b>Title:</b>		<b>QP Code:</b>
<b>Time:2 HOURS</b>		<b>MaxMarks:30</b>
<b>Instructions to the Candidates: Draw diagram wherever necessary.</b>		
<b>PART A</b>		
I	Answer <b>ALL</b> of the following.	<b>10X1=10</b>
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
<b>PART-B</b>		
II	Answer any <b>TWO</b> of the following.	<b>2X5=10</b>
11		
12		
13		

**PART- C**

<b>III</b>	Write explanatory notes on any <b>ONE</b> of the following.	<b>1X10=10</b>
14		
15		