Centenary Celebrated Sharnbasveshwar Vidya Vardhak Sangha's

ಶರಣಬಸವ Sharnbasva KALABURAGI - 585 103

ವಿಶ್ವವಿದ್ಯಾಲಯ University KARNATAKA, India

M.Sc. ZOOLOGY

SYLLABUS

2024-2025 onwards

Department of Post Graduate Studies and Research in Zoology
Sharnbasva University, Kalabuargi- 585105, Karnataka, India.

SCHEME
I Semester

M.Sc. Zoology		I Semester	Academic Year		SCHEME	
2024-26 Batch		Courses Opted by the Students	2024-2025		2024	
Sl No.	Course Code	Course Title	Theory / Practical	Course offered by the following Dept.	Marks	Credit
					CIE / SEE	
01	24ZOL11	Systematics and Life of Non-Chordates	Theory	Zoology	50 / 50	4
02	24ZOL12	Instrumentation, Biotechniques and Biostatistics	Theory	Zoology	50 / 50	4
03	24ZOL13	Molecular Cell Biology	Theory	Zoology	50 / 50	4
04	24ZOLE141	Biodiversity	Theory	Zoology	50 / 50	4
	24ZOLE142	Applied Zoology				
05	24ZOLP15	Systematics and Life of Non-Chordates	Practical	Zoology	50 / 50	2
06	24ZOLP16	Instrumentation, Biotechniques and Biostatistics	Practical	Zoology	50 / 50	2
07	24ZOLP17	Molecular Cell Biology	Practical	Zoology	50 / 50	2
08	24ZOLEP181	Biodiversity	Practical	Zoology	50 / 50	2
	24ZOLEP182	Applied Zoology				
				Total	400 / 400	24

II Semester

M.Sc. Zoology		II Semester	Academic Year				SCHEME
2024-26 Batch		Courses Opted by the Students	2024-2025				2024
Sl No.	Course Code	Course Title	Theory / Practical	Course offered by the following Dept.	Marks		Credits
					CIE	SEE	
01	24ZOL21	Systematics and Life of Chordates	Theory	Zoology	50	50	4
02	24ZOL22	Endocrinology And Biology of Reproduction	Theory	Zoology	50	50	4
03	24ZOLE231	Animal Physiology and Bioenergetics	Theory	Zoology	50	50	4
	24ZOLE232	Aquaculture and Fisheries					
04	24ZOLOE24	Environmental Biology	Theory	Zoology	50	50	4
05	24ZOLP25	Systematics and Life of Chordates	Practical	Zoology	50	50	2
06	24ZOLP26	Endocrinology And Biology of Reproduction	Practical	Zoology	50	50	2
07	24ZOLEP271	Animal Physiology and Bioenergetics	Practical	Zoology	50	50	2
	24ZOLEP272	Aquaculture and Fisheries					
08	24ZOLP28	Field Visit	Practical	Zoology	50	50	2
				Total	**400**	**400**	**24**

III Semester

M.Sc. Zoology		III Semester	Academic Year				SCHEME
2024-26 Batch		Courses Opted by the Students	2024-2025				2024
Sl No.	Course Code	Course Title	Theory / Practical	Course offered by the following Dept.	Marks		Credi
					CIE	SEE	
01	24ZOL31	Animal Behaviour and Wildlife Biology	Theory	Zoology	50	50	4
02	24ZOL32	Environmental Pollution and Ecotoxicology	Theory	Zoology	50	50	4
03	24ZOLE331	Developmental Biology	Theory	Zoology	50	50	4
	24ZOLE332	Genetics and Evolutionary Biology					
04	24ZOLOE34	Public Health and Hygiene	Theory	Zoology	50	50	4
05	24ZOLP35	Animal Behaviour and Wildlife Biology	Practical	Zoology	50	50	2
06	24ZOLP36	Environmental Pollution and Ecotoxicology	Practical	Zoology	50	50	2
07	24ZOLEP371	Developmental Biology	Practical	Zoology	50	50	2
	24ZOLEP372	Genetics and Evolutionary Biology					
08	24ZOLP38	Computer Application in Biology	Practical	Zoology	50	50	2
				Total	400	400	24

IV Semester

M.Sc. Zoology 2024-26 Batch	IV Semester Courses Opted by the Students		Academic Year 2024-2025			SCHEME 2024
Sl No.	Course Code	Course Title	Theory / Practical	Course offered by the following Dept.	Marks		Credits
					CIE	SEE	
01	24ZOL41P	Internship	Practical	Zoology	50	50	8
02	24ZOL42P	Project	Practical	Zoology	50	50	12
				Total	100	100	20

First Semester

SEMESTER-I
SYSTEMATICS AND LIFE OF NON-CHORDATES

Course Code:	**24ZOL11**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives:

This course will enable students to:

1. To understand the taxidermic and other methods of preservation of chordates
2. To identify chordates based on special identifying characters
3. To understand internal an atomy of animals through demo or virtual dissections, thus directing the student for "empathy towards the fellow living beings"
4. To maintain a neat, labeled record of identified museum specimens

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Science of Biosystematics.		
1.1: Concept of biosystematics, Historical review of taxonomic philosophies. 1.2: Stages of taxonomy, Tasks of taxonomist, Problems of taxonomy. 1.3: Systematics as a profession, Significance of taxonomy. 1.4: New trends and approaches in taxonomy.	**09 Hours**	**L1 &L2**
Module–2: Species concept, Taxonomic Collection, Preservation and Identification.		
2.1: Historical prospective of Species concept. 2.2: Kinds of species, Infraspecific groups. 2.3: Taxonomic Collection. 2.4: Taxonomic Preservation and Identification.	**09 Hours**	**L1 &L2**
Module–3: Classification of Non-Chordates.		
3.1: General characters and classification of phylum Protozoa to Platyhelminthes. 3.2: General characters and classification of phylum Aschelminthes to Arthropoda. 3.3: General characters and classification of phylum Mollusca to Hemichordata. 3.4: General characters and classification of minor phyla.	**10 Hours**	**L3 &L4**
Module–4: Coelom, Locomotion, Nutrition and Respiration.		
4.1: Origin and importance of coelom. Protostomia and Duterostomia. 4.2: Locomotion in protozoa and other non-chordates. 4.3: Nutrition in protozoa and in lower metazoans. 4.4: Organs of Respiration in Non-chordates.	**10 Hours**	**L4 &L5**
Module–5: Excretion, Nervous system and Reproduction.		
5.1: Organs of excretion in non-chordates. 5.2: Primitive Nervous System and Advanced Nervous System. 5.3: Patterns of Reproduction in Non-chordates. 5.4: Larval forms and their Evolutionary significance.	**10 Hours**	**L5 &L6**

Course out comes: After completion of this course students are able to:

- Understand the different species concepts, trends and approaches of taxonomy.
- Study different collection, preservation and identification methods in animal science.
- Understand the evolution of body plan and design in invertebrates.
- Learn the morphological adaptations with respect to different physiological functions in invertebrates.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Principles of Systematic Zoology, Mayr, E.& P. D. Ashlock (1991) 2nd Edition, McGraw-Hill, In
2. Principles of animal taxonomy- G.G.Simpson-Columbia University Press, New York 1961.
3. Theory and Practice of Animal Taxonomy - V C Kapoor, SOxfod IBH Co. Pvt. Ltd. New Delhi, I
4. Collection & Preservation of Animals by Jairajpuri M.S. Zoological Survey of India 1990.
5. Biodiversity: Principles & Consevation Kumar & AsijaAgobios (India) 2000.
6. Barnes, R.D.1968. Invertebrate Zoology.IIEd. Saunders, Philadelphia.
7. Barrington, E.J.W.1967. Invertebrate Structure and Function, Nelson, London.
8. Marshall, A. J., and Williams, W. D. (Eds.). Text book of Zoology Invertebrates. VII Ed., Vol. I, S Publishers and Distributors, 1995.

PRACTICAL
SYSTEMATICS AND LIFE OF NON-CHORDATES

Course Code:	**24ZOLP15**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 02

1. Identification and systematic position of selected species of phylum Protozoans to Platyhelminthe
2. Identification and systematic position of selected species of phylum Aschelminthes to Arthropoda
3. Identification and systematic position of selected species of phylum Mollusca to Hemichordata.
4. Animal Preservation Techniques.
5. Construction of phylogenetic trees by taking suitable examples.
6. Study of Earthworm:
   a. Study of External Features.
   b. Study of Digestive System.
   c. Study of Nervous System.
7. Study of starfish:
   a. External features of starfish
   b. Oral and aboral view of starfish.
   c. Water vascular system of starfish
8. Mounting and Locomotory organelles:
   a. Setae
   b. Tube feet
   c. Appendages of Cockroach.
9. Any other practical depending on feasibility.

SEMESTER-I
INSTRUMENTATION, BIOTECHNIQUES AND BIOSTATISTICS

Course Code:	**24ZOL12**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives:

This course will enable students to:

- This knowledge helps in finding placement opportunities in research labs, and also in R&D departments of various biological fields.
- A skill-oriented course where students equip themselves with new methods and techniques for microscopy, chromatography, ultracentrifuge, SEM, TEM etc., which will help in studying fine structure and composition of various organisms.
- To learn about the basics of most often used tools, techniques, methodologies and methods of analysis used in biological research.
- To know about the basic statistics, variables, primary and secondary data, different kinds of data, presentation of data in the form of diagrams and various types of statistical applications.

To characterize and manage the different types of biological data.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Separation Techniques		
1.1: Centrifugation: Principle, types and applications. 1.2: Chromatography: Principle, Paper, TLC, Column. 1.3: Blotting techniques 1.4: Electrophoresis: Principle, structural components and applications.	**09 Hours**	**L1 &L2**
Module–2: Biomolecular Techniques		
2.1: Polymerase Chain reaction. 2.2: Cryopreservation techniques 2.3: Spectrophotometer: Principle and applications 2.3: ELISA techniques.	**09 Hours**	**L1 &L2**
Module–3: Animal Handling and Maintenance		
3.1: Laboratory animal housing and environment enrichment. 3.2: Laboratory animal handling techniques: safe and ethical practice. 3.3: Committee for Control & supervision on Experiments on Animals (CCSEA). 3.4: Institutional Animal Ethics Committee (IAEC).	**10 Hours**	**L3 &L4**
Module–4: Microscopy and Histological Techniques		
4.1: Light Microscopy and Phase Contrast Microscopy. 4.2: Electron Microscopy: TEM and SEM. 4.3: Microtome: Types and Applications. 4.4: Histological techniques and microphotography: Fixation, Sectioning, Staining and imaging of tissue samples.	**10 Hours**	**L4 &L5**
Module–5: Biological Data and Quantification		
5.1: Types of biological data on ratio, interval, ordinal and nominal scale. 5.2: Measures of central tendency. 5.3: Testes of statistical significance & their applications. 5.4: Analysis of Variance (ANOVA)	**10 Hours**	**L5 &L6**

Course out comes: After completion of this course students are able to:

- The students will be able to gain a comprehensive knowledge on techniques widely used in biologica research and clinical understanding.
- Learn principles, mechanism and applications of instruments used in biological science.
- Gain knowledge on application of statistical tools.
- Utilize the databases that provide information on biomolecules.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. *Arora P.N and Malhan P.K., 2007. Biostatistics – Himalaya publishers House, Mumbai. India.*
2. *Bioinformatics-Sequence and Genome Analysis- CSHL Press, USA.*
3. *Gurumani, N. 2005. An Introduction to Biostatistics 2nd Ed., MJP Publishers, Chennai, India*
4. *Lehninger A. L. Biochemistry 2nd Edition., Kalyani publishers, New Delhi, India.*
5. *Sharma, A.K., 2005. Text book of Biostatistics, Discovery Publishers House, New Delhi, India.*
6. *Upadhay and Upadhay, 2009. Biophysical chemistry- principles and techniques.*
7. *Himalaya publishing House. India. 8. Wilson and Walker.2001.*
8. *Practical biochemistry- Cambridge University Press, Low Price Edition. India 9. Zar. 2014.*
9. *Introduction to instrumental analysis-Robert Braun-McGraw Hill.*
10. *A biologist Guide to principles and Techniques of Practical Biochemistry-K, Wilson*
11. *Clark &Swizer. Experimental Biochemistry. Freeman, 2000.*
12. *Principles and Practice of Bioanalysis, R F Venn, Taylor and Francis, 2003.*
13. *Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983*
14. *Boyer. Modern Experimental Biochemistry. Benjamin, 1993*
15. *Freifelder. Physical Biochemistry. Freeman, 1982.*
16. *John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.*
17. *Robert Braun. Introduction to instrumental analysis. McGraw Hill*

PRACTICAL
INSTRUMENTATION, BIOTECHNIQUES AND BIOSTATISTICS

Course Code:	**24ZOLP16**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	48	**Exam Hours:**	**03**

Credits: 02

1. Separation of selected Amino acids by Paper Chromatography.
2. Separation of selected Amino acids by thin layer Chromatography.
3. Separation of selected different color compound using column Chromatography
4. Electrophoresis separation of serum protein (Demonstration).
5. Separation of selected molecules using centrifuge.
6. Estimation of Protein by lowry's method.
7. Care and handling of laboratory animals.
8. Microtome technique: Preparation permanent histological slides.
9. Usage of statistical package- SPSS or Graph Pad Prism.
10. Calculate the mean, median, mode for given data.

SEMESTER-I
MOLECULAR CELL BIOLOGY

Course Code:	**24ZOL13**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives:

1. To understand the origin of cell and distinguish between prokaryotic and eukaryotic cell
2. To understand the role of different cell organelles in maintenance of life activities
3. To provide the history and basic concepts of heredity, variations and gene interaction
4. To enable the students, distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance.
5. To acquaint student with basic concepts of molecular biology as to how characters are expressed with a coordinated functioning of replication, transcription and translation in all living beings

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Introduction to the Cell		
1.1: The origin and evolution of cell. 1.2: Discovery and basic properties of cell. 1.3: The central dogma of molecular biology. 1.4: The scope of modern cell biology.	**09 Hours**	**L1 &L2**
Module–2: Biochemistry of Cell		
2.1: Amino acids and proteins: Structure and classification. 2.2: Carbohydrates: Classification and significance. 2.3: Lipids: Classification and significance. 2.4: Nucleic acids, DNA and RNA: Types and structure.	**09 Hours**	**L1 &L2**
Module–3: Molecular Organization of Biomembranes		
3.1: History and basic structure of plasma membrane. 3.2: Fluid mosaic model. 3.3: Movement of substance across cell membranes- passive transport, active transport, membrane pumps, pinocytosis, phagocytosis, receptor mediated endocytosis and transcytosis. 3.4: Cell junction: Types and functions.	**10 Hours**	**L3 &L4**
Module–4: Structural Organization and Functions of Cell Organelles		
4.1: Endoplasmic reticulum (SER, RER), Golgi complex and Centrioles. 4.2: Ribosomes, polysomes, free ribosomes and membrane associated ribosomes. 4.3: Mitochondria and Peroxisomes. 4.4: Endosomes and Lysosomes. 4.5: Cytoskeleton: Microfilaments and microtubules.	**10 Hours**	**L4 &L5**
Module–5: Nucleus, Cell Cycle, Apoptosis and Cancer Biology		
5.1: Nucleus: Molecular structure and functions. 5.2: Chromosomes: Molecular structure, types and functions. 5.3: Cell cycle, regulation and checkpoints of cell cycle. 5.4: Apoptosis: Mechanism and significance. 5.5: Cancer Biology: Types, causes, characteristics, diagnosis and treatment.	**10 Hours**	**L5 &L6**

Course out comes: After completion of this course students are able to:

1. To understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.

2. Describe fine structure and function of plasma membrane and different cell organelles of eukary
3. To understand the history of origin of branch of genetics, gain knowledge e on heredity, interacti genes, various types of inheritance patterns existing in animals
4. Acquiring in-depth knowledge on various of aspects of genetics involved in sex determination, h karyo typing and mutations of chromosomes resulting in various disorders
5. Understand the central dogma of molecular biology and flow of genetic information from DNA t proteins.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Alberts,B., Bray Dennis, Lewis Julian, Raff Martin, Roberts.K and Watson, J.D. Molecular Biology o Cell. Garland Publishing Inc. New York, 1994.

2. Cellis, J.E. Cell Biology: a Laboratory Handbook Vol. I and II. Academic Press, 1998.

3. Lodish, H., Berk,A., Zipuosky, L.S., Matsudaira, P. , Baltimore,D& Darnell, J. Molecular Cell Biolog W.H. Freeman & Co. 2001.

4. Malacinski, G.M &Freifelder, D. Essentials of Molecular Biology III Ed. Jones & Bartlett Publishers,

5. Molecular Biology of Cell. Alberts B. Johnson A. Lewis J. Raff M. Robert K & Walter P.

6. Molecular Cell Biology.Lodish. Berk. Kaiser. Kringer, Scott Bretscher, Ploegh, Matsudaira. 6th Editi Freeman Publication

7. The Cell: A Molecular Approach 2nd Edition AMS Press Washington 2000

8. De Robertis EDP & De Robertis EMI. Cell and Molecular Biology 7th Edition

9. Cell and Molecular Biology Gerald Karp

10. Abbas A.K. Lichtman A.H. &Pober J.S. Cellular and Molecular Immunology

PRACTICAL
MOLECULAR CELL BIOLOGY

Course Code:	**24ZOLP17**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	48	**Exam Hours:**	**03**

Credits: 02

1. Study of epithelial tissues: Squamous, Ciliated and Columnar, etc.,
2. Study of nervous tissue: Myelinated and Non myelinated Nerve cells.
3. Study of muscular tissue: Smooth Muscles, Striated Muscles and Cardiac Muscle.
4. Study of connective tissues: Bone and cartilage; Blood Cells – Neutrophils, Basophils, Eosinophil Lymphocytes and monocytes.
5. Estimation of DNA by Discrete Diphenylamine (DPA) Method.
6. Estimation of RNA by Orcinol Method.
7. Study of Mitosis by observing permanent slides.
8. Study of stages of Mitosis in Onion Root Tips.
9. Study of Meiosis by observing permanent slides.
10. Study of stages of Meiosis in Grasshopper testis.
11. Histopathological Examination (HPE) of Normal and Malignant cells.
12. Preparation of Stains and Fixatives.
13. Observation of Lacto bacillus from the curd sample.
14. Study of Eukaryotes from Rectal parasite of Frog.
15. Any other Practical depending upon feasibility.

SEMESTER-I
BIODIVERSITY

Course Code:	**24ZOLE141**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives:

1. To create environmental awareness among learners.
2. To enlighten the importance of bio diversity
3. To provide information regarding the status of environment, the depletion of its resources, the loss of biodiversity and the remedial measures undertaken
4. To create awareness about sustainable development

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Introduction to Biodiversity and Bio-geographic Realms		
1.1: Biodiversity: Concept and definition. 1.2: Scope of Biodiversity. 1.3: Values of Biodiversity 1.4: Bio-geographic Realms	**09 Hours**	**L1 &L2**
Module–2: Types of Biodiversity		
2.1: Genetic Diversity: Origin and Measurement of Genetic Diversity, and Bio-Geographic Realms 2.2: Species Diversity: Origin and Measures of Species Diversity. 2.3: Ecosystem Diversity: Nature and Classification of Ecosystem Diversity of India. 2.4: Agro Biodiversity: Origin and Evolution of Cultivated Species Diversity and Diversity in Domesticated Animal Species.	**09 Hours**	**L1 &L2**
Module–3: Biodiversity Hotspots and Mega Diversity		
3.1: Biodiversity at Global, National and Local Levels. 3.2: Hotspots of Biodiversity. 3.3: India as a Mega Diversity Nation. 3.4: Endemic and Exotic Species.	**10 Hours**	**L3 &L4**
Module–4: Conservation and threats to Biodiversity		
4.1: Threats to Biodiversity: Deforestation and Habitat Destruction, Hunting and Over exploitation. 4.2: Endangered, Vulnerable, rare and Threatened Species. 4.3: Conservation of Biodiversity: In-situ and Ex-situ Conservation. 4.4: Role of Educational Institution and NGO's, Biodiversity awareness Programmes.	**10 Hours**	**L4 &L5**
Module–5: International Convention and Treaties for Conservation of Biodiversity		
5.1: Kyoto Protocol and framework Convention on Climate Change (UNFCCC) of 1987. 5.2: International Convention for the Regulation of Whaling (ICRW) of 1946. 5.3: Convention for the Conservation of Antarctic Seals (CCAS) and Convention on International Trade on Endangered Species (CITES) of 1975. 5.4: Migratory Bird Treaty Act (MBTA) of 1918.	**10 Hours**	**L5 &L6**

Course out comes: After completion of this course students are able to:

- To introduce basic concepts and significance of biodiversity and distribution of world.
- To analyze Hierarchical components of biodiversity, values and losses.
- Create awareness about systematics and species identification scientifically.
- Create knowledge about biodiversity management; in-situ and ex-situ conservation through tech aspects.
- Develop understanding for the environment which is largely degraded in the current scenario.
- Learn about the judicious utilization of natural resources

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Andrew S. Pullin, Conservation Biology. 2002., Cambridge University Press, UK.
2. Chapman, J.L. and Reiss, M.J. (1999). Ecology: Principles and applications (2nd edition) Cambridge University Press.
3. Fred Van Dyke, 2008, Conservation Biology: Foundations, Concepts, Applications. McGraw-Hill Science/Engineering/Math, New York, USA.
4. Ghosh, S.K. and Singh, R. (2003). Social forestry and Forest Management. Global Vision Pub.
5. Joseph, B. (2008) Environmental studies, Tata McGraw Hill.
6. Martha J. Groom, Gary K. Meffe, C. Ronald Carroll, 2012, Principles of Conservation Biology, Sina Associates. Oxford University Press, USA.
7. Miller, G.T. (2002). Sustaining the earth, an integrated approach. (5th edition) Books/Cole, Thomps Learning, Inc.
8. Richard B. Primack, 2016, An Introduction to Conservation Biology, Sinauer Associates. Oxford Un Press, USA.
9. Wagher, R.H. (1974) Environment and Man. (Second Edition), Norton, New York.
10. Wilson, E.O. (1986) Biodiversity, Academic press Washington

PRACTICAL
BIODIVERSITY

Course Code:	**24ZOLP181**	**CIE Marks:**	
Contact Hours/Week:	**04**	**SEE Marks:**	
Total Hours:	**49**	**Exam Hours:**	

Credits: 02

1. Importance and Scope of Biodiversity
2. Study of Biogeographical Realms
3. Biodiversity Hotspots of the world
4. Wildlife Sanctuaries of India
5. National Parks of India
6. Wildlife Sanctuaries of Karnataka
7. National Parks of Karnataka
8. Wetlands of India
9. Methods of biodiversity study
10. Endangered species of India
11. Extinct species of world
12. Extinct species of India

13. One day field visit: Collection of specimens
14. Any other Practical depending upon feasibility.

SEMESTER-I
APPLIED ZOOLOGY

Course Code:	**24ZOLE142**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives:

1. To study the scope, status and economic importance of sericulture in India.
2. To discuss about apiculture, methods of bee keeping, byproducts of honey bees and its economic impo
3. To study about Vermiculture and compost technologies.
4. To understand the basic concepts of Economics of poultry keeping and Dairy farm management.

Modules	Teaching Hours	R Bl Ta (L
Module – 1: Vermiculture 1.1: Introduction and importance of vermiculture. 1.2: Types of earthworms; Collection methods of earthworms; 1.3: Vermiculture technique, vermicompost as biofertilizer for sustainable development. 1.4: Production of Vermiwash, Vermicompost and Vermiprotein and their importance.	**09 Hours**	L
Module – 2: Sericulture 2.1: Origin, history, Indian Scenario and importance of Sericulture. 2.2: Classification of silkworms based on moultinism, voltinism and geographical distribution. 2.3: Life cycle of Silkworm, Bombyx mori; Diseases and pests of silkworms. 2.4: Silkworm rearing technique and silk worm rearing Appliances and their uses.	**09 Hours**	L
Module – 3: Apiculture 3.1: Introduction and scope of apiculture. 3.2: Bee keeping practices in India and colony organization in honeybees. 3.3: Management of bee keeping and types of bees 3.4: Uses of honey and its adulterations and Bee products.	**10 Hours**	L
Module – 4: Poultry Farming 4.1: Importance and Scope of poultry. 4.2: Poultry Breeds: Indigenous and Exotic breeds 4.3: Poultry diseases- Vaccination and control of disease 4.4: Poultry products and their importance	**10 Hours**	L
Module – 5: Dairy Technology 5.1: Importance and scope of Dairy. 5.2: Dairy breeds- Indigenous and Exotic breeds. 5.3: Dairy diseases- Vaccination and control of diseases, Techniques of Artificial Insemination. 5.4: Dairy products and their importance	**10 Hours**	L

Course out comes: After completion of this course students are able to:

- Explain the origin, history, rearing method and importance of sericulture. Study the life cycle and Pathology of Silkworm
- Discuss the different species of honey bees and bee keeping management. Explain the scope of A and bee products, by products and their uses
- Explain the process of vermiwash, vermicompost and importance of vermiculture. Apply the acq knowledge for establishment of vermiculture unit and identify the types of earthworms.

- Discuss the importance and scope of diary, dairy breeds, breeding methods and their management.
- Explain the Dairy Diseases and processing and preservation of dairy products
- Explain the importance, scope and Diseases of poultry. Discuss the methods and techniques of breeding and poultry products

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Hickling, C.E. 1962. Fish and fish culture. Faber and Faber, London.
2. Jhingran, V.G. 1977. Fish and Fisheries of India. Hindustan Publ., New Delhi.
3. Scnmitz, R.J. 1996. Introduction to Freshwater Biology. Gulf Publishing Company, New Delhi.
4. Srivastava., 1979. Applied Entomology.Vol II.
5. Singh.S., 1962. Beekeeping in India. ICAR. New Delhi. India.
6. Snodgrass,R.E. 1956. Anatomy of the Honeybee.Cornell Univ. Press. Ithaca. New York.
7. Winston, M. 1984. The Biology of the Honeybee. Harvard. Uni. Press. London. UK.
8. Tazima. Y. 1958. Silkworm egg. CSB Publication, Bombay.
9. Yashimoro Tanaka. 1964. Sericology, CSB Publication, Bombay.
11. Tazima, Y. 1978. The silkworm an important laboratory tool. Kodnasha Ltd., Tokyo.
12. Govindan, R., Narayanswamy, T.K. and Devaiah,M.C. 1998. Principles of silkworm pathology. Ser scientific Publishers, Bangalore.
13. Earthworm Ecology by Edwards CA
14. Sathe T.V. Vermiculture& Organic farming, Dya publishing house, Delhi 2004
15. Gupta P.K Vermicomposting for sustainable agriculture, agrobios (India)2004

PRACTICAL
APPLIED ZOOLOGY

Course Code:	**24ZOLP182**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	48	**Exam Hours:**	**03**

Credits: 02

1. Study of morphology and life cycle of silk worm, Bombyx mori.
2. Dissect and display of digestive system of silk worm.
3. Mounting of silk glands.
4. Study of silkworm rearing appliances.
5. Study of bee keeping apparatus.
6. Mounting of, mouth parts, stinging apparatus and venom gland, wax gland, pollen brush and basket in honey bee.
7. Study of of earthworm
8. Study of different types of economically important freshwater and marines' fishes.
9. Study of dairy breeds and their common diseases.
10. Study of poultry breeds and their common diseases.
11. Visit to Reeling Centers and Grainage Unit.
12. Any other experiments depending on feasibility

Second Semester

SEMESTER-II

SYSTEMATICS AND LIFE OF CHORDATES

Course Code:	24ZOL21	CIE Marks:	50
Contact Hours/Week:	04	SEE Marks:	50
Total Hours:	48	Exam Hours:	03

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To enlighten the principle and practice of taxonomy and systematics of chordates
2. To comprehend the origin and diversity of protochordates and vertebrates.
3. To learn the salient features, evolution, comparative anatomy and adaptations of vertebrates

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Diversity and Evolution of Chordates		
1.1 : Origin of Protochordates and Chordates – Theories, Systematic position and Phylogeny. 1.2 : General characters and classification of Protochordates and chordates. 1.3: Silurian and Devonian Ostracoderms and their evolutionary position. 1.4: Origin of Jaws Structural Peculiarities of Cyclostomata.	**09 Hours**	**L1 &L2**
Module–2: Origin and Evolution of Pisces and Amphibians		
2.1: Fossil history of Chondrichthyes, tendencies in Elasmobranch evolution. 2.2: Actinopterygii Origin and evolution, Adaptive radiation of bony fishes. 2.3: Amphibia: Origin and evolution of Amphibia. 2.4: Adaptive radiation in Amphibians.	**09 Hours**	**L1 &L2**
Module–3: Origin and evolution of Reptiles and Aves		
3.1: Origin and Evolution of Reptilia, Saurischian and Ornithischian Dinosaurs Rhyncocephalia. 3.2: Adaptive radiation in Reptiles. 3.3: Origin and evolution of Birds, Fossil history of birds, Palate in Birds. 3.4: Adaptive radiation in birds	**10 Hours**	**L3 &L4**
Module–4: Origin and evolution of Mammals		
4.1 Origin and Evolution of Mammals. 4.2 Structural Peculiarities of Prototheria, Metatheria and Eutheria. 4.3 Dentition in mammals. 4.4 Adaptive radiation in Mammals (Marsupials, Human skin color)	**10 Hours**	**L4 &L5**
Module–5: Comparative Anatomy and Osteology		
5.1 Integuments and its derivatives. 5.2 Dermal and Epidermal derivatives. 5.3 Comparative anatomy of Heart, Aortic arches, Brain and Kidney in vertebrates. 5.4 Osteology: Axial and Appendicular skeletal system (Frog and Rat)	**10 Hours**	**L5 &L6**

Course out comes:

- Describe general taxonomic rules on animal classification of chordates.
- Classify Protochordata to Mammalia with taxonomic keys.
- Understand Mammals with specific structural adaptations.
- Understand the significance of dentition and evolutionary significance.

- Understand the origin and evolutionary relationship of different phyla from Prochordata to Mammalia.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Marshall, A.J and Williams. W.D (Ed). Textbook of Zoology: Vertebrates-VII Ed. Vol. II. AITBS Publishers and distributors, 1995.
2. Young, J.Z. The Life of Vertebrates, III rd Ed Clarendon Press Oxford,1981.
3. William N McFarland, F and Harvey PoughTom.J.C and Heiser, J.B. Vertebrate Life. Collier-Macmillan Publishers, London, 1979.
4. Romer, W.B. The Vertebrate Body. Saunders, Philadelphia, 1956.
5. Vertebrate Zoology – E L Jordan; P S Verma
6. A text book of Zoology vol.II – P S Dhami J K Dhami
7. A text book of Vertebrate Zoology – R L Kotpal.
8. Alexander, R.M. 1998. The Chordates – Cambridge University press, London.
9. Arnold G.K and Frye.B.E. 1977. Chordate Structure and Function. Second edition. Macmillan Pub Co. UK.
10. Ekambaranatha Ayyer and Ananthakrishnan. 2008. Manual of Zoology - Chordata. Volume II. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai
11. John Zachary Young, 2001. The Life of Vertebrates, Oxford University Press, New Delhi,
12. Weischert, C.K., 1965. Anatomy of Chordates, McGraw Hill Book Co., Inc., NewYork.

PRACTICAL
SYSTEMATICS AND LIFE OF CHORDATES

Course Code:	**24ZOLP25**	**CIE Marks:**	5
Contact Hours/Week:	**04**	**SEE Marks:**	5
Total Hours:	**48**	**Exam Hours:**	0

Credits: 02

1. Study of Cephalochordates and Urochordates with suitable example.
2. Study of classes of vertebrates with 3-4 suitable examples each.
3. **Biology of locally available fish**
   a. Study of External Features
   b. Study of Digestive System
   c. Study of Male Urogenital system
   d. Study of Female Urogenital system
   e. Study of Cranial Nerves
   f. Mounting of Brain
4. **Biology of Rat**
   a. Study of External features.
   b. Study of male reproductive system
   c. Study of female reproductive system, digestive system.
   d. Study of Digestive System.
   e. Mounting of rat Brain

5. **Mounting of scales from bony and cartilaginous fishes**
6. Comparative anatomy of heart, brain, integument & its derivatives, aortic arches, urogenital system in vertebrates.
7. Study of Osteology of Frog and Rat
8. Field visit to study different types of local variety of fishes nearby Kalaburagi
9. Any other experiments depending upon feasibility

SEMESTER-II

ENDOCRINOLOGY AND BIOLOGY OF REPRODUCTION

Course Code:	**24ZOL22**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To introduce the basic concepts about biosynthesis of hormones and the factors influencing the secretions.
2. To understand the Hormones as messengers and the evolution of essential endocrine glands and their structure.
3. Analyzing the evolution of structural and functional organization of thyroid hormone action in different phylum.
4. To discuss about the Evolution, Synthesis and structural diversity of steroid hormones on human health. To understand the growth, development and reproductive regulation of hormones.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Foundations of Endocrinology		
1.1: Introduction of Endocrinology, Definition, History and importance. 1.2: Classification Hormones: Peptides, Steroids and amines. 1.3: Homeostasis - Positive and Negative Feedback Mechanism. 1.4: Types of Endocrines Signaling: Autocrine, Paracrine, Endocrine.	**09 Hours**	**L1 &L2**
Module–2: Structural Organization and Biological Roles of Endocrine Glands		
2.1: Structural and functional aspects of Hypothalamus, Pituitary and Pineal gland. 2.2: Structural and functional aspects of Thyroid and Parathyroid gland. 2.3: Structural and functional aspects of Pancreas and adrenal gland. 2.4: Endocrine disorders of Thyroid and Pancreas.	**09 Hours**	**L1 &L2**
Module–3: Mode of Hormonal Action and Biosynthesis		
3.1: Types of receptors, General mechanism of peptide hormone action. 3.2: General mechanism of steroid hormone action and Secondary messengers 3.3: Biosynthesis and secretion of Insulin. 3.4: Biosynthesis and secretion of Steroid hormone and Catecholamines.	**10 Hours**	**L3 &L4**
Module–4: Female Reproductive System		
4.1: Female Reproductive system: Anatomy, Endocrine, Physiology and structural aspects of ovary. 4.2: Hormonal regulation of oogenesis. 4.3: Implantation, Placentation, Gestation, Parturition 4.4: Reproductive Endocrine disorders: PCOD, PCOS, Ectopic pregnancy, Endometriosis.	**10 Hours**	**L4 &L5**
Module–5: Male Reproductive System		
5.1: Male Reproductive system: Anatomy, Endocrine, Physiology and structural aspects of testis and Hormonal regulation of spermatogenesis 5.2: Fertility control in male 5.3: Infertility- Assisted Reproductive techniques (ART'S) 5.4: Reproductive Endocrine disorders: Hypogonadism, Cryptorchidism.	**10 Hours**	**L5 &L6**

Course out comes:

- Explain the concepts of endocrine systems, homeostasis and their physiological actions of various hormones.
- Understand metabolic pathways of hormones biosynthesis and mechanism of actions
- Understand how these systems produce physiological responses.
- Appreciate the system of control and coordination of animals
- Acquire knowledge about the chemical co-ordination of life

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Bentley, P.J.1994: Comparative vertebrate endocrinology –III Ed. Cambridge Univ. Press (NY)
2. Chandra. S. Nagi: Introduction to Endocrinology PHI (New Delhi)
3. Degroot. L.J. and Neill, J.D. 2001: Endocrinology-IV Ed, Vol. I-III. W.B. Saunders company (Ed)
4. Gorbman and Beru .1962: A text book of Comparative Endocrinology\
5. Highman and Hill 1972: Comparative Endocrinology of Invertebrates
6. Machodley Prentree.1996: Comparative endocrinology and reproduction (Narosa publication house; New Delhi)
7. Nelson. R.J. 1995: An Introduction to behavioural endocrinology Sinauer Associates, Inc.
8. Nooris. D.O. 1996: Vertebrate endocrinology IIIrd Ed., Academic Press
9. Saidapur.S.K.1989: (Ed) Reproductive cycles of Indian vertebrates. Allied Publishers Ltd, New Delhi
10. Turner. C.D. and Bugnara.J.T 1976: General Endocrinology., W.B. Saunders
11. Zarrow M.X and Mc Carthy. J.L 1964: Experimental endocrinology (Academic Press;New York).
12. Adiyodi and Adiyodi 1977: Reproductive Biology of invertebrates (IBH; New Delhi) Adler. N.T. 1981: Neuroendocrinology of Reproduction.
13. Austin C.R & Short. R.V 1972: Reproduction in mammals (Cambridge University Press; London)
14. Balin. H and Glasser. S, 1976: Reproductive Biology (Experia Medica Amsterdam) 26 Birkhead. R.T. David J.H and Pitnick S, 2009: Sperm Biology-An evolutionary perspective (Elsevier/Academic press).

PRACTICAL
ENDOCRINOLOGY AND BIOLOGY OF REPRODUCTION

Course Code:	24ZOLP26	**CIE Marks:**	
Contact Hours/Week:	04	**SEE Marks:**	
Total Hours:	48	**Exam Hours:**	

Credits: 02

1. Dissection and exposure of major endocrine glands in an experimental rat.
2. Study of surgical procedure of bilateral orchiectomy and ovariectomy in rat.
3. Study of microscopic slides of endocrine and related structure-
   a. T.S. of Pituitary
   b. T.S. of Thyroid
   c. T.S. of Parathyroid
   d. T.S. of Pancreas
   e. T.S. of Adrenal
   f. T.S. of Testis,
   g. T.S. of Epididymis,
   h. T.S. of Seminal Vesicles, vasa deference
   i. T.S. of Prostate
   j. T.S. of Ovary
   k. T.S. of Fallopian Tube, Uterus
4. Study of Estrous Cycle in rat.
5. Study Sperm count and sperm motility in rat.
6. Study of abnormal Sperms.
7. Study of different contraceptive methods.
8. Reproductive disorders – PCOD, PCOS, Hypogonadism, Cryptorchidism, prostate cancer.
7. Visit to veterinary institute to learn breeding techniques.

ANIMAL PHYSIOLOGY AND BIOENERGETICS

Course Code:	**24ZOLE231**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To know about physiology of animals.
2. To study the functioning of organ systems across the animal world
3. To understand nutrition, respiration, circulation, excretion and neural coordination of animals with reference to human

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Digestion and Respiration.		
1.1: Functional anatomy of digestive system. 1.2: Digestion and absorption of carbohydrates, proteins and lipids. 1.3: Functional anatomy of respiratory system. 1.4: Physiology of respiration and respiratory pigments.	**09 Hours**	**L1 &L2**
Module–2: Circulation.		
2.1: Circulatory system. 2.2: Structure, functions and regulation of heart beat. 2.3: Composition of blood. 2.4: Blood coagulation.	**09 Hours**	**L1 &L2**
Module–3: Neuromuscular physiology		
3.1: Structure and function of different types of muscles. 3.2: Mechanism of muscle contraction and relaxation. 3.3: Structure and functions of neurons. 3.4: Neuromuscular junction and neurotransmitters.	**10 Hours**	**L3 &L4**
Module–4: Excretion and Immunity.		
4.1: Functional anatomy of mammalian kidney. 4.2: Physiology of urine formation. 4.3: Innate and acquired immunity. 4.4: Structure and functions of immune cells, tissues and organs.	**10 Hours**	**L4 &L5**
Module–5: Metabolism		
5.1: Metabolism of carbohydrates, lipids and proteins. 5.2: Glycolysis, Citric acid cycle, gluconeogenesis, glycogenolysis and glycogenesis. 5.3: β-oxidation of saturated fatty acids. 5.4: Catabolism of amino acids.	**10 Hours**	**L5 &L6**

Course outcomes:

- Understand the various aspects of the Physiology of digestion and absorption, Physiology of respiration Learn various aspects of the physiology of the cardiovascular and circulatory system.
- Explain the physiology of excretion and its regulation.
- Understand the various aspects of the physiology of the Nervous system, Neuromuscular physiology, and Photochemistry of vision.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Animal Physiology ----- Samson & Writy
2. Animal Physiology ----- Nelsion & Nelsion
3. Animal Physiology ----- Medical Physiology-Guiton
4. Text book of Animal Physiology ----- Nagbhushan
5. Text book of Animal Physiology -----Guize
6. Text book of Animal Physiology ----- A.K. Berry.
7. Essentials of Animal Physiology------S.C. Rastogi.
8. Animal Physiology and Biochemistry-----R.A. Agarwal.
9. Text book of Physiology Vol. 1 & 2 ------A.K. Jain.
10. Animal Physiology and Biochemistry-----K.V. Sastry.
11. Animal Physiology ----P.S. Verma.

PRACTICAL
ANIMAL PHYSIOLOGY AND BIOENERGETICS

Course Code:	24ZOLP271	**CIE Marks:**	50
Contact Hours/Week:	04	**SEE Marks:**	50
Total Hours:	48	**Exam Hours:**	03

Credits: 02

1. Qualitative tests for the detection of carbohydrates, proteins and fats.
2. Detection of abnormal excretion of glucose and albumin in mammalian urine.
3. Blood smear preparations, staining and study of mammalian blood.
4. Total count of red blood corpuscles of mammalian blood.
5. Total count of white blood corpuscles of mammalian blood.
6. Estimation of hemoglobin content in mammalian blood.
7. Preparation of hematin crystal from mammalian blood.
8. Determination of bleeding and clotting time of mammalian blood.
9. Determination of Salivary amylase activates.
10. Quantitative estimation of protein / glycogen / amino acids.
11. Any other practical depending upon feasibility.

SEMESTER-II
AQUACULTURE AND FISHERIES

Course Code:	**24ZOLE232**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To provide fundamental knowledge about the principles and practices of aquaculture, cultivable species, aquatic resources and various types of culture practices
2. To understand the concepts of different types of cultures, techniques of induced breeding and management of carp culture ponds
3. To acquire knowledge on the culture of air-breathing fishes, brackish water fishes and freshwater prawns
4. To describe the culture practices of shrimp, pearl oysters and sea weeds of commercial importance.
5. To explain the ornamental fish culture and for understanding various biotechnological approaches for the improvement of fish stocks and advanced culture techniques for higher and profitable yields.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module–1: Aquatic Environment		
1.1: Classification of freshwater habitats - Lotic and lentic ecosystems. 1.2: Structure of aquatic ecosystems - lake and river. 1.3: Physical factors (light and temperature) and Chemical factors (pH, DO, Salinity) 1.4: Biological zonation	**09 Hours**	**L1 &L2**
Module–2: Aquatic Community and Fish Diversity		
2.1: Plankton-Classification, distribution and migration 2.2: Management of lakes – Eutrophication. 2.3: River management and restoration 2.4: Distribution of freshwater fishes of India.	**09 Hours**	**L1 &L2**
Module–3: Pearl Culture		
3.1: Introduction and scope of pearl culture 3.2: Importance and status of pearl culture 3.3: Pond management, Implantation Technique 3.4: Post -operation care and Marketing	**10 Hours**	**L3 &L4**
Module–4: Fish Culture Practices		
4.1: Fish culture techniques. 4.2: Freshwater carps (Indian major and minor) 4.3: Lacustrine, ornamental fish culture. 4.4: Recent advances in fish culture techniques and their importance.	**10 Hours**	**L4 &L5**
Module–5: Fisheries in India		
5.1: Methods of fish preservation 5.2: Fishing gears and crafts of India 5.3: Fishing industry in India; Fishery economics 5.4: Fishery Research Institutes in India	**10 Hours**	**L5 &L6**

Course out comes:

- Acquire the basic knowledge about the biology, morphometry and meristic characters of fishes.
- Learn the status of the culture and capture fisheries of India
- Learn the modern culture techniques and diseases management
- Become entrepreneurs and create employments

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Beaven C R1998 Handbook of the freshwater fishes of India (Narendra Publishing House)
2. Biswas K P 1996 A Text Book of Fish, Fisheries and Technology, 2nd ed. (Narendra Publishing House)
3. Brown E and Margret 1957 Physiology of Fishes Vol I & II (Academic Press, Inc. Publishers)
4. Daniels R J R 2002 Freshwater fishes of Peninsular India (Universities press)
5. Jhingran V 1982 Fish and Fisheries of India 2nd Ed (Hind Publication Comp.)
6. Jobling M 1995 Environmental Biology of Fishes (Chapmen and Hall)
7. Kumar S and Thembre M 1996 Anatomy and Physiology of Fishes (Vikas Publishing House)
8. Lagler K F, Bardach J E, Miller R R and Passino D R 1977 Ichthyology (John Wiley & Sons)
9. Nikolsky G V 1999 Ecology of Fishes (Allied Scientific Publishers)
10. Pillay T V S 1990 Aquaculture – Principles and practices (Fishing News Books Oxford)
11. Selvamani B.R & Mahadevan R.K 2008 Freshwater fish farming (Campus Books International)
12. B.B.Hosetti and A.Kumar:2006: A text book of applied aquatic biology. Daya publishing house, Delhi.

PRACTICAL
AQUACULTURE AND FISHERIES

Course Code:	**24ZOLP272**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 02

1. Morphometry of fishes; Determination of length-weight analysis in fishes.
2. Determination of absolute and relative fecundity in fishes.
3. Identification of Cartilaginous and bony fishes
4. Identification of apparatus used in Pisciculture.
5. Identification of important fish parasites (external and internal).
6. Identification of fishing gears
7. Study of different fish by products.
8. Identification of fish food organisms (phytoplankton and zooplankton, benthic invertebrates)
9. Study about different species used in pearl culture
10. Any other practical depending on feasibility

SEMESTER-II
ENVIRONMENTAL BIOLOGY

se Code:	24ZOLOE24	CIE Marks:	50
act Hours/Week:	04	SEE Marks:	50
l Hours:	48	Exam Hours:	03

Credits: 04

se Learning Objectives: This course will enable students to:

1. To introduce the basic concepts about Classification and Characteristics of Fresh water and marine water and terrestrial region.
2. To understand the concept of Ecological Energetics and productivity of ecosystems and Impact of environmental factors on Energy flow.
3. To discuss about Air pollution, water pollution and environmental health hazards.
4. To study about the concept of Biomonitoring, Environmental Impact Assessment and natural calamities and disaster management.
5. To discuss about the concept of Bioaccumulation, Biomagnification, Bioremediation and Environmental laws in India.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
odule–1: Introduction to Environment		
1 Environmental Components: Atmosphere, Hydrosphere, Lithosphere, Biosphere. .2 Abiotic and Biotic Interactions .3 Energy Flow .4 Food chain and Food Web	**09 Hours**	**L1 &L2**
Module–2: Natural Resources		
2.1 . Renewable and non-renewable energy sources. 2.2 Forest Resources: Importance, Use and over-exploitation, Deforestation, Timber Extraction, Mining, Dams and their effects on forest and tribal people. 2.3 Water resources: Importance, use and over-exploitation of surface water and ground water, floods, drought conflicts over water, dam's benefits and problems. 2.4 Mineral, Food and Energy Resources: Importance, Use and Exploitation, Environmental Effects of Extracting and using mineral resources. World food Problems, changes caused by agriculture and overgrazing, effects of modern agriculture.	**09 Hours**	**L1 &L2**
Module–3: Ecosystem and Biodiversity		
3.1 Concept, Structure and Function of Ecosystem. 3.2 Food chain, Food webs and ecological Pyramids. 3.3 Types of Ecosystems: Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem. 3.4 Concept of Biodiversity, Biodiversity at Global, National and Local levels.	**10 Hours**	**L3 &L4**
Module–4: Environmental Pollution		
4.1 Air Pollution: Causes, Effects and Control measures 4.2 Water Pollution: Causes, Effects and Control measures 4.3 Soil Pollution: Causes, Effects and Control measures. 4.4 Thermal and Radioactive pollution: Causes, Effects and Control measures.	**10 Hours**	**L4 &L5**

Module–5: Environmental Laws		
5.1 Environment Protection Act. 5.2 Wild life Protection Act. 5.3 Air (Prevention and Control of Pollution) Act. 5.4 Water (Prevention and Control of Pollution) Act.	**10 Hours**	**L5 &L6**

Course out comes:

- Understand the concept of environmental biology, its multidisciplinary nature, scope, and its components.
- Knowledge about the terrestrial biomes of the world their characteristics and major biota
- Know the Island biogeography
- Understand the Population cycles and fluctuations
- Analyze the Concept of biological indicators
- Understand the Biological control.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Fundamentals of Ecology. E.P.Odum, G W Barrett.
2. Environmental Science. Willam .P.CunninshamBarborawoodworthsaigo.
3. The use of Earthworms in waste disposal by. Edward, C.A.
4. Introduction to Environmental Engineering & Science Gilbert M. Masters.
5. Essential of Ecology by colin R. Townsend Michael BegonJohn.L.Harper.
6. Environmental Biology -- A.G.Agarwal.
7. Environmental Science by G.Tyler Miller.
8. Toxicology -- Y.K.Lahir.
9. Environmental Studies-Dr. Shanta Satyanarayan, Dr. Suresh Zade, Dr. Shashikant Sitre and Dr. Pravi Meshram.
10. Environmental Studies -Dr. N. Nandini, Dr. N. Sunitha, Mrs, Sucharita Tandon.

Third Semester

SEMESTER III
ANIMAL BEHAVIOUR AND WILDLIFE BIOLOGY

Course Code:	24ZOL31	**CIE Marks:**	50
Contact Hours/Week:	04	**SEE Marks:**	50
Total Hours:	48	**Exam Hours:**	03

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To impart knowledge about animal responses to external stimuli
2. To emphasize on different behavioral mechanisms (classical and recent concepts).
3. To explain development of behavior with suitable examples of animals.
4. To understand role of genetic and neuro-physiology in behavioral development.

Modules	Teaching Hours	R B Ta
Module I: Introduction to animal behavior		
1.1: Introduction, Historical perspectives and Ethology. 1.2: Diversity and Unity in the study of behavior and complex behavior. 1.3: Significance of study of animal behavior. 1.4: Proximate and ultimate causes of behaviour.	**09 Hours**	I
Module II: Types of animal behavior.		
2.1: Types of behavior: Innate and acquired behavior. 2.2: Stereotyped behavior: Kinesis, taxis, orientation & reflexes. 2.3: Neural and hormonal control of behavior. 2.4: Social organization in insects.	**09 Hours**	I
Module III: Communication		
3.1 Drive and their types. 3.2 Migration and Homing with special reference to birds. 3.3 Chemical, Visual, Tactile and audible communication. Functions of communication. 3.4 Application of pheromones and their biological actions in invertebrates and vertebrates.	**10 Hours**	I
Module IV: Ecology and Behavior:		
4.1: Ecological aspects of behavior - Habitat selection, food selection, Aggression, territoriality 4.2: Host-parasite relations, anti - predator defense mechanism. 4.3: Parental care and mating, courtship behavior. 4.4: Social organizations in primates.	**10 Hours**	I
Module V: Wildlife Biology		
5.1 Scope and importance of wildlife 5.2: Wildlife and significance of its conservation 5.3: Wildlife protection act-1972 5.4: IUCN Red data List and CITES	**10 Hours**	I

Course out comes:

- Learn the baseline information and knowledge for animal behavior.
- Associate the likely role of external and internal stimuli on various animals during the day, season and year.
- Relate daily behavioral rhythms in diurnal and nocturnal periodicities.
- Predict and anticipate variety of animal actions (costs and benefits) as assessed by innate and learned behaviour; displays.
- Integrate the animal behaviour as balanced mechanism to develop animal personality.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Dngatkin, L. A. 2012. Principles of Animal Behavior. W.W. Nortan and Co.New York.
2. Alcock, J. 2010. Animal behavior, an evolutionary approach. 9th Edition. Sinauer Publishers.
3. Scott, G. 2009. Essential Animal Behavior. Wiley publishers
4. Scott, G. 2005.Essential Animal Behavior. Blackwell Pub. New York.
5. Goodenough, J., McGuire, B., Wallace, R.A. 2001. Perspective on Animal Behavior. John Wiley & Sons, New York.
6. Aubrey Manning and Marian. S. Dawkins. An Introduction to Animal Behaviour. Cambridge University Press, 1995.
7. McFarland. D. The Oxford Companion to Animal Behaviour.
8. McFarland.D. Animal Behavior Psychology, Ethology and Evolution. Pitman Publications 1985.
9. Slater.P.J.B. Essentials of Animal Behaviour. Cambridge University Press, 1999.
10. Krebs J.R and Davies, N.B.An Introduction to behavioral Ecology-III (Ed). Blackwell Science Ltd, 1993.

PRACTICAL
ANIMAL BEHAVIOUR AND WILDLIFE BIOLOGY

Course Code:	**24ZOLP35**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 02

I. Animal behaviour

1. Habituation
2. Imprinting.
3. Insight learning.
4. Classical Conditioning.
4. Operant Conditioning.
5. Courtship Behavior:
   a. Andean Flamingo
   b. Lesser Flamingo
   c. Peacock.
   d. Mallard Duck
   e. Stickle Back Fish
   f. Giraffe
6. Insight Behavior /Learning:
   a. Chimpanzee tool use
   b. Orangutan in rain

7. Stereotyped Behavior:
   a. Graylag goose /Imprinting.
   b. Stickleback fish.
   c. Herring gull.
8. Territorial Behavior:
   a. Common black bird.
   b. Wood pecker.
9. Nesting Behavior:
   a. Bower bird.
   b. Baya bird.
   c. Tailor bird.
10. Honey bee Communication;
   a. Round dance.
   b. Waggle dance.

II. Wildlife Biology:

11. Study of Wildlife animals
   - Elephant
   - Tigar
   - Lion
   - Rihno
12. Mapping of national parks and wild life sanctuaries in India with a note of important wild life fau
13. Any other Practical depending upon feasibility.

SEMESTER III
ENVIRONMENTAL POLLUTION AND ECOTOXICOLOGY

Course Code:	24ZOL32	CIE Marks:	50
Contact Hours/Week:	04	SEE Marks:	50
Total Hours:	48	Exam Hours:	03

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To understand the fundamental issues of environment.
2. To analyse different sources of environmental problems and methods of measurement of pollution.
3. To evaluate the economy of quality of life.
4. To learn the management of pollution and environmental laws

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module 1: Environment		
1.1 Atmosphere, Hydrosphere and Lithosphere. 1.2 Abiotic and Biotic interactions. 1.3 Energy flow, food chain and food web. 1.4 Biogeochemical cycles and Water cycle.	09 Hours	L1 &L2
Module 2: Pollution and Management		
2.1: Natural Resources and their Management -Renewable and Non-Renewable resources. 2.2: Pollution: Types Sources, Effects and control measures (Water, Air, Soil, Noise, Thermal) 2.3 Disaster Management: Floods, Earth quake, Cyclone and Landslides. 2.4 Resettlement and Rehabilitation of people, wasteland reclamation.	09 Hours	L1 &L2
Module 3: Waste Treatment Technology		
3.1 Solid waste management. 3.2 Sewage and waste water treatment. 3.3 Bio medical waste management. 3.4 Bio remediation: Advantages and Disadvantages.	10 Hours	L3 &L4
Module 4: Environmental laws and social issues		
4.1 Environmental Protection Act 1986. 4.2 Air (Prevention & Control of Pollution) Act 1981. 4.3 Water (Prevention & Control of Pollution) Act 1974. 4.4 Environmental Protection activities by common peoples.	10 Hours	L4 &L5
Module 5: Ecotoxicology and Climate Change		
5.1 Toxic Pollutants and their impact on Flora, Fauna and Humans 5.2 Biomagnifications, Biodegradation, Biotransformation, Bioaccumulation of toxicants. 5.3 Greenhouse effect, Ozone layer depletion, Acid Rain and Nuclear winter. 5.4 Biological indicators and monitoring GIS.	10 Hours	L5 &L6

Course out comes: After completion of this course students are able to:

- Explain the scientific basis of the global environmental issues.
- Discuss on various measures of pollution mitigation
- Realize the laws and acts of environment in India

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Fundamentals of Ecology. E.P.Odum, G W Barrett.
2. Environmental Science. Willam. P.CunninshamBarborawoodworthsaigo.
3. The use of Earthworms in waste disposal by. Edward, C.A.
4. Introduction to Environmental Engineering & Science Gilbert M. Masters.
5. Essential of Ecology by colin R. Townsend Michael BegonJohn.L.Harper.
6. Environmental Biology -- A.G.Agarwal.
7. Environmental Science by G.Tyler Miller.
8. Toxicology -- Y.K.Lahir.
9. Environmental Studies--------Dr. Shanta Satyanarayan, Dr. Suresh Zade, Dr. Shashikant Sitre and Meshram.
10. Environmental Studies --------Dr. N. Nandini, Dr. N. Sunitha, Mrs, Sucharita Tandon.

PRACTICAL
ENVIRONMENTAL POLLUTION AND ECOTOXICOLOGY

Course Code:	24ZOLP36	**CIE Marks:**	50
Contact Hours/Week:	04	**SEE Marks:**	50
Total Hours:	48	**Exam Hours:**	03

Credits: 02

1. Collection and identification of animal biodiversity of selected ecosystem.
2. Physical analysis of soil; water, pH, moisture, temperature, humidity.
3. Estimation of soil organic matter.
4. Air monitoring for particulate matter.
5. Physicochemical parameters of different water samples:
   a. Dissolved oxygen
   b. Carban Dio -oxide (CO_2)
   c. Biological Oxygen Demand (BOD)
   d. Chemical Oxygen Demand
   e. Chlorides
   f. Total Hardness, Ca, Mg.
6. Bio remediation of waste water using soil microorganisms.
7. Bioconversion of solid and municipal waste by vermi-composting and composting.
7. Collection, preservation and estimation of zooplanktons.
8. Visit to solid waste treatment plant.
10. Visit to drinking water treatment plant.
12. Compulsory study tour and submission of report
11. Any other Practical depending upon feasibility.

SEMESTER III
DEVELOPMENTAL BIOLOGY

Course Code:	**24ZOLE331**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To study the structure, development and maturation of germ cells.
2. To understand the process of fertilization and development of embryo.
3. To introduce the concepts and process in developmental biology
4. To understand about the genetic mechanisms of organogenesis and to learn about the post embryonic development.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
MODULE: 1- INTRODUCTION		
1.1 History and scope of developmental biology. 1.2 Basic concept of development. 1.3 Stages of animal development. 1.4 Anatomical and experimental approach to developmental biology.	**09 Hours**	**L1 &L2**
MODULE: 2- GAMETOGENESIS, FERTILIZATION AND EARLY DEVELOPMENT		
2.1 Spermatogenesis and oogenesis. 2.2 Fertilization, Cleavage, Blastulation and gastrulation. 2.3 The early development of sea urchin, frog and chick. 2.4 Structure of mature egg and its membranes; Types of eggs.	**09 Hours**	**L1 &L2**
MODULE: 3- METAMORPHOSIS, REGENERATION AND SENESCENCE		
3.1 Morphological and biochemical changes during amphibian metamorphosis. 3.2 Morphological and biochemical changes during insect metamorphosis. 3.3 Regeneration in planaria and salamander. 3.4 Ageing mechanism and concept.	**10 Hours**	**L3 &L4**
MODULE: 4- GENES AND DEVELOPMENT		
4.1 Embryological origin of gene theory. 4.2 Evidence of genomic equivalence. 4.3 Nuclear transplantation experiment in frog. 4.4 Cloning in Dolly, Stem cell potency.	**10 Hours**	**L4 &L5**
MODULE: 5- CONTROL OF DEVELOPMENT		
5.1 Fundamental processes in development (brief idea) – Gene activation, determination and induction. 5.2 Differentiation, morphogenesis, intercellular communication, cell movements and cell death. 5.3 History and causes of abnormal development. 5.4 Teratogenic agents and their effects on embryonic development.	**10 Hours**	**L5 &L6**

Course out comes: After completion of this course students are able to:

- Understand the biological process involved in the development.
- Understand the intricate process of fertilization.
- Appreciate the events involved in the interaction of gametes and embryogenesis
- Understand the embryonic induction, development and post embryonic changes.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Balinsky B.I.2012. An Introduction to Embryology, W.B. Saunders Co,Philadelphia
2. Berrill, N.J. 1986, Developmental Biology, TATA McGraw-Hill Publishing Company Ltd, N India
3. Fred H. Wilt and Sarah C. Hake, 2001. Principles of Developmental Biology, W.W. Norton & (New York.
4. Lewis Wolpert, 2012. Principles of Development, Oxford Univ. Press, US
5. Mary S. Tyler, 2000. Developmental Biology: A guide for experimental study, 2nd Edition, Sina Inc. Sunderland, MA.
6. Richard M. Twyman, 2001. Instant notes on Developmental Biology, Springer Verlag, BIOS England.
7. Scott F. Gilbert. 2017. Developmental Biology, 11th Edition, Sinauer Assoc. Inc. Sunderland, M
8. Slack J. M.W. 1992. 2nd Edition. From Egg to Embryo, Cambridge.
9. Slack J. M.W. 2003, Essential Developmental Biology, Blackwell, US.
10. Subramanian T, 2013. Molecular Developmental Biology. Narosa publishing House. New Delhi

PRACTICAL
DEVELOPMENTAL BIOLOGY

Course Code:	**24ZOLP371**	**CIE Marks:**	50
Contact Hours/Week:	**04**	**SEE Marks:**	50
Total Hours:	**48**	**Exam Hours:**	03

Credits: 02

1. Types of eggs (Insect egg, Fish egg, Frog egg, Snake egg, Chick egg and Mammalian egg).
2. Development of Frog egg (Ovary, Cleavage, Late cleavage, Blastula, Gastrula Tadpole Larva).
3. Metamorphosis in Frog.
4. Metamorphosis in insects.
5. Preparation of Whole mount of Chick Embryo.
6. Observation of permanent slides of Chick Embryo (18Hrs, 24Hrs, 36Hrs, 48Hrs and 72 Hrs).
7. Gosner stages of frog development.
8. Study of Embryos (Frog, Snake, Chick Rat, Pig, and Sheep).
9. Development of Insects (Honey Bee and Silk moth).
10. Any other practical depending upon feasibility.

SEMESTER-III
GENETICS AND EVOLUTIONARY BIOLOGY

Course Code:	**24ZOLE332**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To understand basic concepts and mechanisms of evolution
2. To provide fundamental knowledge in Mendelian principles.
3. To evaluate human genome project quantitative and qualitative traits of human beings.
4. Remembering the concepts of evolution, and hardy- Weinberg law of equilibrium.
5. Elucidate the mega evolution and models of speciation.
6. Analyze the convergent and divergent evolution and adaptive radiation in vertebrates.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
MODULE: 1- INTRODUCTION		
1.1 History and scope of genetics. 1.2 Pre-Mendelian experiments and Mendel's Laws of Inheritance. 1.3 DNA as the hereditary material- experiments. 1.4 Concept of gene and Watson – Crick model.	**09 Hours**	**L1 &L2**
MODULE: 2- INTERACTION OF GENES AND GENE MAPPING		
2.1 Epistasis-Dominant and Recessive epistasis. 2.2 Supplementary, Complementary, lethal gene and Multiple alleles. 2.3 Linkage maps, Coupling and repulsion hypothesis. 2.4 Crossing over and recombination.	**09 Hours**	**L1 &L2**
MODULE: 3- REPLICATION, REGULATION OF GENE EXPRESSION AND MUTATION		
3.1 Replication in prokaryotes and eukaryotes. 3.2 Regulation of gene express in prokaryotes. 3.3 Regulation of gene express in eukaryotes. 3.4 Molecular basis of gene mutation.	**10 Hours**	**L3 &L4**
MODULE: 4- PROTEIN SYNTHESIS AND CYTOGENETICS		
4.1 Transcription: Prokaryotic and Eukaryotic transcription. 4.2 Translation: Prokaryotic and Eukaryotic Translation. 4.3 Human chromosome and Karyotypes. Autosomal and sex chromosomal anamolies. 4.4 Prenatal diagnosis	**10 Hours**	**L4 &L5**
MODULE: 5- EVOLUTION		
5.1 Theories of Evolution: Lamarkism, Darwinism and Neodarwinism. 5.2 Speciation- Reproductive isolation. Models of speciation. 5.3 Patterns of Evolution – sequential, divergent, convergent and gradual. 5.4. Evolution of horse and humans.	**10 Hours**	**L5 &L6**

Course out comes: After completion of this course students are able to:

- Realize the complexity of evolutionary processes, speciation
- To understand the history of origin of branch of genetics, gain knowledge on heredity, interaction of genes, various types of inheritance patterns existing in animals
- Acquiring in-depth knowledge on various of aspects of genetics involved in sex determination, human karyo typing and mutations of chromosomes resulting in various disorders

- Understand the central dogma of molecular biology and flow of genetic information from DNA to prote
- Understand the principles and forces of evolution of life on earth, the process of evolution of new speci and apply the same to develop new and advanced varieties of animals for the benefit of the society.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Burns GW. 1972. The Science of Genetics. An Introduction to Heredity. Mac Millan Publ.Co.Inc.
2. Gardner EF. 1975. Principles of Genetics. John Wiley & Sons, Inc. NewYork.
3. Harth and Jones EW. 1998. Genetics – Principles and Analysis. Jones and Bar Hett Publ.Boston.
4. Levine L. 1969. Biology of the Gene.Toppan.
5. Pedder IJ. 1972. Genetics as a Basic Guide. W. Norton & Company, Inc.
6. Rastogi VB. 1991. A Text Book of Genetics. Kedar Nath Ram Nath Publications, Meerut, Uttar Pra India.
7. Rastogi VB. 1991. Organic Evolution. Kedar Nath Ram Nath Publications, Meerut, UttarPradesh, Ind
8. Stahl FW. 1965. Mechanics of Inheritance. Prentice-Hall.
9. White MJD. 1973. Animal Cytology and Evolution. Cambridge Univ.Press.

PRACTICAL
GENETICS AND EVOLUTIONARY BIOLOGY

Course Code:	24ZOLP372	**CIE Marks:**	50
Contact Hours/Week:	04	**SEE Marks:**	50
Total Hours:	48	**Exam Hours:**	03

Credits: 02

1. Study of Polytene Chromosomes in Chironomous larva.
2. Study of Polytene Chromosomes in Drosophila larva.
3. Study of Genetics of RBC antigen.
4. Study of X- Chromatin or Barr body in buccal smear by Aceto orcin.
5. Human chromosome analysis / Karyotype analysis.
   a) Normal male b) Normal female
6. Numerical abnormalities
   a) Down's syndrome b) Monosomy 21
   c) Klinefelter syndrome d) Turners syndrome
7. Structural Abnormalities
   a) Translocation b) Cri- Du- Chat syndrome
8. Genetic problems – Monohybrid, dihybrid and blood group.
9. Sex linked inheritance

Evolutionary Biology:

10. Evidence for principle of Evolution:
    a) Homologous Organs.
    b) Analogous Organs.
    c) Serial Homology.
    d) Vestigial Organs.
11. Study of fossils.
12. Any other practical's depending on the feasibility.

SEMESTER III
PUBLIC HEALTH AND HYGIENE

Course Code:	**24ZOLOE34**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 04

Course Learning Objectives: This course will enable students to:

1. To understand the importance of health 3 Credits
2. To understand the transmission of diseases and loss of health.
3. To study various diseases, causes, mode of transmission, symptoms of diseases and their control.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Levels
Module I Introduction Public Health		
1.1: Scope of Public Health and Hygiene 1.2: Nutrition and health - classification of foods - Balanced Diet 1.3: Malnutrition - Nutritional deficiencies - Vitamin deficiencies. 1.4: Nutritional requirements of special groups.	**09 Hours**	**L1 &L2**
Module–2: Environmental and Health hazards		
2.1: Environmental Degradation - pollution and associated health Hazards 2.2: Health problems due to industrializations - Hospital waste management. 2.3: Municipal hazardous waste 2.4: Occupational Hazards	**09 Hours**	**L1 &L2**
Module–3: Communicable Diseases		
3.1: Communicable diseases and their control measures Measles, Polio. 3.2: Communicable diseases and their control measures Chikungunya, Malaria, Rabies, 3.3: Communicable diseases and their control measures TB, Leprosy 3.4: Contagious Diseases -Covid, AIDS, Hepatitis, Influenza.	**10 Hours**	**L3 &L4**
Module–4: Non-Communicable Diseases		
4.1: Non - communicable diseases and their preventive measures Hypertension. 4.2: Non - communicable diseases and their preventive measures Coronary Heart Diseases, Stroke. 4.3: Non - communicable diseases and their preventive measures Diabetes, Obesity. 4.4: Non - communicable diseases and their preventive measures Mental ill - Health. Alcoholism and drug dependence.	**10 Hours**	**L4 &L5**
Module–5: Health Education		
5.1: Health Education and Health programmes in India. 5.2: WHO programmes - their health service. 5.3: Public Awareness through Digital Media - An Introduction to Mobile Apps of Government of India: NHP, Swasth Bharat, No More Tension. Pradhan Mantri Surakshit Mantritva Abhiyan (PM Suman Yojana). 5.4: Swachh Bharat Mission, Basel Convention, e-waste regulations	**10 Hours**	**L5 &L6**

Course out comes: After completion of this course students are able to:

- Acquire knowledge of the diseases outbreak
- Acquire knowledge on communicable and non-communicable diseases of man
- Understand the seriousness of disease outbreaks
- Learn about good living and occupational hazards

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be Two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer Five full questions, selecting one full question from each module.

Reference Books:

1. Charles M. D. Porter, 2016, Elements of Hygiene and Public Health a Textbook for Studen Practitioners of Medicine, Wentworth Press
2. Dunn, CL and D. D. Pandya, 2013. Indian Hygiene and Public Health Butterworth and Company.
3. George Moses Price, 2017, Hygiene and Public Health (Classic Reprint), Fb&c Limited.
4. Modi, J.P. 2015, Elements of Hygiene and Public health, Butterworth and Company.
5. Park M. Park's Textbook of Preventive and Social Medicine, 2015, M/s Banarsi Das Bhanot Publish
6. Roger. Detels 2009. Oxford Textbook of Public Health, Oxford University Press. UK
7. William Hallock 1863 – 1939 Park Public, Health and Hygiene (English, Paperback) Wentworth Pre
8. William Hobson, 2006. Theory and practice of Public Health. Oxford Medical Publishers. UK
9. William Hobson, 2006. Theory and Practice of Public Health. Oxford Medical Publishers. UK

PRACTICAL
COMPUTER APPLICATION IN BIOLOGY

Course Code:	**24ZOLP38**	**CIE Marks:**	**50**
Contact Hours/Week:	**04**	**SEE Marks:**	**50**
Total Hours:	**48**	**Exam Hours:**	**03**

Credits: 02

1. Word Processing (MS Word/Google Docs): Create a research report with headers, footers, table of contents, and references.
2. Spreadsheet Applications (MS Excel/Google Sheets): Perform data entry, use formulas, and create basic charts.
3. Presentation Tools (MS PowerPoint/Google Slides): Design a professional presentation with animations and transitions.
4. Data Analysis Tools: SPSS, Graph Pad Prism Provide hands-on experience with data analysis software.
5. Access to internet
    a. E-Mail
    b. Creating an E-Mail Account
    c. Internet Browsing
    d. Search Engines
6. Artificial Intelligence (AI)Tools in Resrech

Fourth Semester

01	24ZOL41	Internship
02	24ZOL42	Project