Department of P.G. Studies and Research in Zoology
Teaching and Evaluation Scheme (w.e.f-2023)
M. Sc Zoology (CBCS) Semester - I

Course Code	Course Title	Teaching hours/week		Practical/ Project/ Field work L:P	Duration of Examination	CIE Marks	SEE Marks	Total Marks	Credits
		Theory	Practical/ Assignment/ Seminar						
Theory									
22ZOL11	Animal Systematics and Biology of Non-Chordates.	04	-	-	3	50	50	100	04
22ZOL12	Molecular cell Biology and Genetics	04	-	-	3	50	50	100	04
22ZOL13	Biological Tools, Techniques and Biostatistics.	04	-	-	3	50	50	100	04
22ZOLXX	**Elective Paper Theory**	04	-		3	50	50	100	04
Practicals									
22ZOLP15	Practical: Animal Systematics and Biology of Non Chordates	-	04	1:2	3	50	50	100	02
22ZOLP16	Practical: Molecular cell Biology and Genetics.	-	04	1:2	3	50	50	100	02
22ZOLP17	Practical: Biological Tools, Techniques and Biostatistics	-	04	1:2	3	50	50	100	02
22ZOLPXX	**Elective Practical Paper**	-	04	1:2	3	50	50	100	02
		16	**16**					**800**	**24**

Elective Theory Papers :
22ZOL141 : Economic Zoology
22ZOL142 : Parasitology.

Elective Practical Papers :
22ZOLP181 : Practical:Economic Zoology
22ZOLP182 : Practical:Parasitology.

Department of P.G. Studies and Research in Zoology
Teaching and Evaluation Scheme (w.e.f-2023)
M. Sc Zoology (CBCS) Semester – II

Course Code	Course Title	Teaching hours/week		Practical/ Project/ Field work L:P	Duration of Examination	CIE Marks	SEE Marks	Total Marks	Credits
		Theory	Practical/ Assignment/ Seminar						
Theory									
22ZOL21	Origin and Biology of Chordates	04	-	-	3	50	50	100	04
22ZOL22	Applied Endocrinology	04	-	-	3	50	50	100	04
22ZOL23X	**Elective Paper Theory**	04	-	-	3	50	50	100	04
22ZOLXX	**Open Elective Paper Theory**	04	-		3	50	50	100	04
Practicals									
22ZOLP25	Practical : Origin and Biology of Chordates	-	04	1:2	3	50	50	100	02
22ZOLP26	Practical : Applied Endocrinology	-	04	1:2	3	50	50	100	02
22ZOLP27	**Elective Practical Paper**	-	04	1:2	3	50	50	100	02
22ZOLP28	**Project**					50	50	100	02
		16	**16**					**800**	**24**

Elective Theory Papers :
22ZOL231 : Aquatic Biology
22ZOL232 : Animal Biotechnology

Open OET **Elective Theory Papers :**
22ZOL24 : Human Physiology

Elective Practical Papers :
22ZOLL271 : Practical : Aquatic Biology
22ZOLL272 : Practical : Animal Biotechnology

Department of P.G. Studies and Research in Zoology
Teaching and Evaluation Scheme (w.e.f-2023)
M. Sc Zoology (CBCS)
Semester - III

Course Code	Course Title	Teaching hours/week		Practical/ Project/ Field work L:P	Duration of Examination	CIE Marks	SEE Marks	Total Marks	Credits
		Theory	Practical/ Assignment /Seminar						
Theory									
22ZOL31	Animal Physiology	04	-	-	3	50	50	100	04
22ZOL32	Reproductive and Developmental Biology	04	-	-	3	50	50	100	04
22ZOL33X	**Elective Paper Theory**	04	-	-	3	50	50	100	04
22ZOLXX	**Open Elective Paper Theory**	04	-		3	50	50	100	04
Practicals									
22ZOLP35	Practical : Animal Physiology	-	04	1:2	3	50	50	100	02
22ZOLP36	Practical : Reproductive and Developmental Biology	-	04	1:2	3	50	50	100	02
22ZOLP37	**Elective Practical Paper**	-	04	1:2	3	50	50	100	02
22ZOL38	**Practical:** Research methodology and Instrumentation		04			50	50	100	02
		16	**12**					**800**	**24**

Elective Theory Papers :
22ZOL331 : Ethology and Evolutionary Biology
22ZOL332 : Environmental Biology

Open Elective Theory Papers :
OET 22ZOL34 : Applied Zoology

Elective Practical Papers :
22ZOLL371 : Practical : Ethology and Evolutionary Biology
22ZOLL372 : Practical : Environmental Biology

GBReddy

Department of P.G. Studies and Research in Zoology
Teaching and Evaluation Scheme (w.e.f-2023)
M. Sc Zoology (CBCS)
Semester - IV

Course Code	Course Title	Teaching hours per week	Practical/ Project/ Field work L:P	Duration of Examination	CIE Marks	SEE Marks	Total Marks	Credits
22ZOL41	Internship	06	-	03	50	50	100	07
22ZOL42	Project	06	-	03	50	50	100	12
22ZOL43	Study Tour	10 Days	-	-	50	50	100	01
							300	**20**

SHARNBASVA UNIVERSITY
KALABURAGI

M.SC. SYLLABUS FOR

DEPARTMENT OF ZOOLOGY

WITH EFFECT FROM THE ACADEMIC YEAR

2022-23

FIRST SEMESTER

22ZOL11 : ANIMAL SYSTEMATICS AND BIOLOGY OF NON CHORDATES

Module 1 : Advances in Taxonomy:

1.1 : Introduction; Science of Taxonomy, History and stages of Taxonomy, Aims and tasks of taxonomist, Significance of Taxonomy.

1.2: Species concept; Historical perspective of species concept, types of species and subspecies.

1.3: Taxonomic collection- collection of animals; preservation, curating, cataloging and identification.

1.4: Recent trends in systematic taxonomy: morphological, embryological, Cytogenetic, Numerical, molecular.

Module 2 : Zoological Classification and Nomenclature:

2.1 : Components of classification; Linnaean hierarchy; phylogenetic lineages

2.2 : Methods of phylogenetic analysis; Phenetic and Cladistic

2.3: History and Objectives of ICZN; Principles of ICZN

2.4: Rules of Zoological nomenclature; Biocode; Phylocode.

Module 3 : General characters and classification of Non-chordates and Chordates:

3.1: Classification of Non-chordates upto classes with suitable examples.

3.2 : Minor phyla – Rotifer, Ctenophore, Acanthocephala, Phoronida and Onychophora with suitable examples.

3.3: Classification of Chordates upto orders with suitable examples.

3.4: Phylogenetic interrelationships between protochordates and chordates..

Module 4 : Coelom, Locomotion and Nutrition:

4.1: Origin and importance of coelom – Acoelomates, Pseudocoelomate, Eucoelomates, Protostomia and Duterostomia.

4.2 : Locomotion in protozoa and Hydrostatic movements in Coelenterates, Annelida and Echinodermata.

4.3 : Nutrition in Protozoans and in lower metazoans,

4.4 : Filter feeding in Polychaeta, Mollusca and Echinodermata; Feeding patterns in Insects.

Module 5 : Respiration, Excretion, Nervous system and Reproduction:

5.1 : Organs of respiration in Non-Chordates – Gills, Book lungs and Trachea.

5.2 : Organs of excretion in Non-Chordates – Coelomoducts, Nephridia and Malpighian tubules.

5.3 : Primitive nervous system – Coelenterate and Echinodermata. Advanced nervous system – Annelida, Arthropods and Mollusca.

5.4 : Pattern of reproduction in Non-Chordates; Larval forms and their evolutionary significance in Non-Chordates.

Practicals:

1. Identification and systematic position of selected species of Non-chordate phylums from Protozoans to Hemichordates.
2. Identification and systematic position of species of Chordate from Protochordates to Mammalia.
3. Morphometric measurements of some locally available fishes
4. Animal preservation techniques (Physical and chemical methods)
5. Construction of phylogenetic trees by taking suitable examples
6. Study of starfish:
    a. External features of starfish
    b. Oral and aboral view of starfish.
    c. Water vascular system of starfish
7. Study of Earthworm:
    a. Study of External Features.
    b. Study of Digestive System.
    c. Study of Nervous System.
    d. Mounting of Setae, Ovary and Nephridia.
8. Locomotion :
    a. Setae, b. Tube feet and legs of Cockroach.
9. Nutrition:
    a. Tubular feeding in hydra
    b. Eversible pharynx in Planaria
    c. Filter feeding in Sponge, Terebella, Sabella and Unio
10. Study of Non-chordate larval forms.
11. Any other practical depending on feasibility.

References :

1. Principles of Systematic Zoology, Mayr, E.& P. D. Ashlock (1991) 2nd Edition, McGraw-Hill, Inc.
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, 1998.
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.AI.T. B. S Publishers and Distributors, 1995.

22ZOL12 : MOLECULAR CELL BIOLOGY AND GENETICS

Module 1: Overview of Molecular Cell Biology:

1.1: Scope of modern cell biology; Prokaryotes and Eukaryotes

1.2: Molecular Structure and functions of Plasma membrane, Cell junction: Types and Functions

1.3: Molecular organization and functions of cell organelles: Endoplasmic reticulum, Golgi complex, Mitochondria, Ribosome.

1.4: Cytoskeleton- Molecular organization of microfilaments, Intermediate filaments and microtubules and their role in cell architecture and functioning

Module 2: Biomolecules of Cell and Nucleus:

2.1:Amino acids :Structure, Classification and peptide bond formation. Protein Structure: Primary, Secondary and tertiary.

2.2:Carbohydrates - Complex polysaccharides; Protein modifications - Glycoproteins, Proteoglycans and Lipoproteins; Lipids – Triglycerides and compound lipids.

2.3:Ultra structure of nucleus: Molecular structure of chromosomes ; Euchromatin and Heterochromatin.

2.4: Role of histones in Packaging DNA; Non-histone proteins.

Module 3: Cell Cycle and Cancer Biology :

3.1: Cell Cycle: Phases and Molecular events of cell cycle

3.2: Cyclins and Cyclin Dependent Kinases (CDK).

3.3: Apoptosis: Mechanism and significance.

3.4: Cancer Biology - Benign and Malignant tumors; Characteristics and properties of cancer, carcinogens, oncogenes, diagnosis, treatment of cancer.

Module 4: DNA and Gene regulation:

4.1: Concept of gene; DNA as hereditary material; Watson and Crick model.

4.2: Replication: initiation, elongation and termination; models of replication

4.3: Protein synthesis: Genetic code, Transcription, post-transcriptional modification. Translation: post- translational modification.

4.4: Regulation of Gene Expression in Prokaryotes and Eukaryotes.

4.5: Molecular basis of gene Mutation; Effect of Mutations; Linkage and Crossing over.

Module 5: Chromosomal Abnormalities and Genetic Disorders:

5.1: Human chromosome and Karyotype.

5.2: Autosomal and sex chromosomal abnomalities

5.3: Genetic diseases.

5.4: Genomics and Proteomics.

Practicals:

1. Study of mitosis by observing permanent slides.
2. Study of meiosis by observing permanent slides.
3. Study of stages of mitosis in onion root tips.
4. Study of cell organelles and tissues- Epithelial, Muscular, Nervous and Connective tissue.
5. Fixative and stains.
6. Estimation of DNA by Diphenylamine (DPA) method
7. Estimation of RNA by Orcinol method
   Study of stages of meiosis in grasshopper testis.
8. Study of Polytene chromosomes in Chiranamous / Drosophila larva.
9. Study of genetics of blood group in man.
10. Study of Drosophila mutants.
    a. Study of Normal male and Normal female.
    b. Study of sex comb and genital plate.
    c. Study of Vestigial wings and curly wings.
11. Study of X-Chromatin or barr body in cells of humans (female) buccal smear.
12. Observation of Lactobacillus from the curd sample
13. Study of eukaryotes from rectal parasite of frog.
14. Human Karyotype analysis: a. Normal male b. Normal female
    b. Human Karyotype analysis: a. Down syndrome;
    b.Cri-du-chat syndrome c.Klinefelter syndrome.
    D.Turner syndrome e.Translocation
15. Any other practical depending on feasibility.

References:

1. Alberts,B., Bray Dennis, Lewis Julian, Raff Martin, Roberts.K and Watson, J.D. Molecular Biology of the 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 Biology IV Ed. W.H. Freeman & Co. 2001.
4. Malacinski, G.M &Freifelder, D. Essentials of Molecular Biology III Ed. Jones & Bartlett Publishers, 1998.
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 Edition. 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

22ZOL13 : BIOLOGICAL TOOLS, TECHNIQUES AND BIOSTATISTICS

Module 1: Separation Techniques:

1.1: Chromatography : Principles of Chromatography- Paper, TLC, Column.

1.2: Centrifugation Techniques : Basic Principles of sedimentation . Types of centrifuge rotors and their uses. Differential centrifugation, density gradient centrifugation.

1.3: Electrophoresis: Principles and structural components and application.

1.4: Spectroscopy techniques: Principles and applications of UV, fluorescence and visible spectroscopy.

Module 2: Molecular Technique:

2.1: DNA Finger printing : Principle ,Steps and Applications.

2.2: Blotting Techniques : Western ,Southern , Northern.

2.3: PCR: Principle , Methods and Applications.

2.4: Cryopreservation Techniques.

Module 3: Breeding and Maintenance of Laboratory animals :

3.1: Committee for the purpose of Control and supervision on experiments on Animals (CPCSEA) Guidelines.

3.2: Institutional Animal Ethics Committee (IAEC) : Guidelines and rules

3.3: Institutional Human Ethics Committee (IHEC) Guidelines and rules.

3.4: Laboratory animal handling techniques.

Module 4: Microscopic and Histological Techniques:

4.1: Light Microscopy and Phase Contrast Microscopy.

4.2: Electron Microscopy : Transmission Electron Microscope (TEM) Scanning Electron Microscope (SEM).

4.3: Microtome : Types and Applications.

4.4: Fixation , Dehydration, Cleaning, Embedding, Sectioning, Staining, Mounting and Labeling.

Module 5: Biostatistics and Computer Application :

5.1: Mean, Median, Mode, Standard Deviation and Standard Error.

5.2: ANOVA and its Significance in Research and Co-relation co-efficient.

5.3: M.S Office : MS Word , MS Excel ,MS Power point.

5.4: Computer Networking: LAN, MAN, PAN, WAN.

Practicals:

1. Chromatography-
    a. Thin layer chromatography.
    b. Column chromatography.
    c. Paper chromatography.
2. Spectrophotometery:
3. Centrifugation Technique.
4. Protein estimation by Lowry's Method.
5. Demonstration of agarose gel electrophoresis and SDS Page.
6. Microtomy method of histological slide preparation.
7. Care and handling of laboratory animals.
8. MS Office , MS Word , MS Excel, PPT Preparation for Presentation.
9. Calculation of Significant difference using ANOVA.
10. Estimation of DNA and RNA from Animal tissue.
11. Any other practical depending upon feasibility.

Referecnes:

1. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
2. A biologist Guide to principles and Techniques of Practical Biochemistry-K, Wilson and K.H. GouldingElBSEdn.
3. Essentials of Biophysics, P Narayanan, New Age Int. Pub. New Delhi. 2000.
4. Clark &Swizer. Experimental Biochemistry. Freeman, 2000.
5. Principles and Practice of Bioanalysis, R F Venn, Taylor and Francis, 2003.
6. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
7. Boyer. Modern Experimental Biochemistry. Benjamin, 1993
8. Freifelder. Physical Biochemistry. Freeman, 1982.
9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.
10. Robert Braun. Introduction to instrumental analysis. McGraw Hill
11. David W. Mount's "Bioinformatics" [Cold Spring Harbor Press; ISBN 0879697121].
12. James Tisdall. Beginning Perl for Bioinformatics An Introduction to Perl for Biologists. Publisher: O'Reilly Media. October 2001.

22ZOL141 : ECONOMIC ZOOLOGY

Module 1 : Sericulture :

1.1 : Origin, history and importance of Sericulture.
1.2 : Classification of silkworms based on moultinism, voltinism and geographical distribution.
1.3 : Lifecycle of Silkworm, *Bombyx mori;* Diseases and pests of silkworms.
1.4 : Silkworm rearing technique and silk worm rearing Appliances and their uses.

Module 2 : Apiculture :

2.1: Introduction and scope of apiculture, Bee keeping practices in India.
2.2: Different species of honeybees, foraging and colony organization in honeybees.
2.3: Management of bee keeping.
2.4: Composition and uses of honey and Bee products.

Module 3 : Vermiculture :

3.1: Introduction and importance of vermiculture.
3.2 :Types of earthworms; Collection of earthworms; Life cycle of earthworm
3.3 : Vermiculture technique, Earthworms as tools for organic waste management.
3.4 : Production of Vermiwash, Vermicompost and Vermiprotein.

Module 4 : Pisciculture:

4.1: Importance and scope of Fisheries .
4.2: Freshwater, brackish and marine fishes of India and its importance.
4.3: Culture of Exotic fishes; Composite fish culture; Induced breeding.
4.4: Preservation and processing of fish and fish by-products.

Module 5 : Dairy Technology and Poultry Farming :

5.1: Importance and scope of Dairy.
5.2: Dairy breeds- Indigenous and Exotic breeds; Dairy products; Dairy diseases- Vaccination and control of diseases.
5.3: Importance and Scope of poultry.
5.4: Indigenous and Exotic Poultry breeds. Techniques and methods of breeding; Poultry products; Poultry diseases- Vaccination and control of diseases.

Practicals:

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 Morphology and digestive system of earthworm: Mounting of Setae, Spermatheca and Ovary 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

References:

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

22ZOL142 : PARASITOLOGY

Module 1: Introduction to Parasitology:

1.1: Scope and importance of parasitology.
1.2: Origin and Evolution of Parasites.
1.3: Types and classification of Parasites.
1.4: Host-parasite interactions with examples.

Module 2: Epidemiology of parasitic diseases: Etiology, Life Cycle, Mode of Transmission, Pathogenisity and Control of:

2.1: Protozoan Parasites: Leishmania, Trypanosoma, Plasmodium and Entomeoba histolytica.
2.2 – Nematoda Parasites - Ascaris, Anchylostoma, Wucheria.
2.3 – Trematoda Parasites - Schistosoma, Fasciola hepatica.
2.4 – Cestoda Parasites - Taenia solium, Echinococcus.

Module 3: Ectoparasites :

3.1 - Habitat, Life Cycle, Pathogenecity and Prevention of Fleas
3.2 - Habitat, Life Cycle, Pathogenecity and Prevention of Mites and Ticks
3.3 - Habitat, Life Cycle, Pathogenecity and Prevention of Lice and Housefly
3.4 - Habitat, Life Cycle, Pathogenecity and Prevention of Mosquito

Module 4. Host - Parasitic relationship and Parasitoids:

4.1 - Cellular, Physiological and Immunological Aspects
4.2 - Molecular, Social and Behavioural Aspects
4.3 - Larval Migrants
4.4 - Characters, Classification of Parasitoids, Importance of Parasitoids in Insect Management, Importance and Limitations.

Module 5. Bacterial and Viral Infections:

5.1 - Bacterial Infections -Cholera, Tuberculosis, Diphtheria, Anthrax
5.2 - Thyroid, Tetanus, Leprosy
5.3 - Viral Infections - Rabies, Dengue fever, Japanese Encephalitis,
5.4 - KFD, Hepatitis, Poliomyelitis

Practicals:

1. Study of Protozoan Parasites of Human and Domestic Animals: *Leishmania, Trypanosoma, Plasmodium* and *Entomeoba histolytica.*
2. Collection of specimen for the study of Parasites.
3. Study of Intestinal Parasites of frog and insects.
4. Study of vectors and their mouth parts
    a. Mosquito
    b. Flea
    c. Ticks
    d. Housefly
    e. Cockroach
5. Study of Ectoparasites - Lice, Leech, Ticks and Mites.
6. Study of Helminthes parasites - *Taenia, Wucheria, Fasciola, Ascaris, Ancylostoma .*
7. Slides and Specimens: Pathogens of Malaria, Filariasis, Leishmaniasis, Trypanosomiasis, Ascariasis. Diseases of Liver fluke, Tapeworm, etc
8. Study of pathogens of bacterial and viral dieseases
9. Any other practical depending upon feasibility

REFERENCES

1. Smyth, J.D 2000. Animal Parasitology, Cambridge low Edition.U.K.
2. Arira, D.R. And Arora,B. 2001. Medical parasitology. 1st Edition. Satishkumarjain for CBS Publisher ad Distributors, New Delhi.
3. Chatterjee, K.D. 2001. Parasitology (Protozoology and Helminthology). 12th Edition. Chatterjee Medical Publishers, Calcutta.
4. Thomas C. Cheng. 1999. General Parasitology. 2nd Edition. Acdemic Press, California.
5. Sobti,R.C.1999. Medical Zoology. ShobanLalNagin Chand & Co. Jalandhar. India.
6. Roberts L.S. and Janovy J. Foundations of Parasitology, McGraw-Hill Publishers, New York, USA.
7. Modern Parasitology: A Textbook of Parasitology, FEG Cox., Wiley-Blackwell, U. K.

SECOND SEMESTER

22ZOL21 ORIGIN AND BIOLOGY OF CHORDATES

Module 1 :Origin of Pisces:

1.1 : General organization and life cycle of Ascidia, Amphioxus; Retrogressive metamorphosis.
1.2 : Origin and evolution of Agnatha –Extinct (conodonts,ostracoderms) and Living(myxinoidea, petromyzontiformes)
1.3 : Origin and evolution of Gnathostomata : Placodermi & chondrichthyes.
1.4 : Origin and evolution of Teleostomi (Acanthodi), Actinopterygie and Sarcoptergie.

Module 2 : Origin of Amphibians and Reptiles:

2.1 : Origin and evolution of Amphibians and Reptiles.
2.2 : Adaptive radiation in Amphibians.
2.3 : Adaptive radiation in Reptiles.
2.4 : Phylogenetic relationship between amphibians and reptiles.

Module 3 : Origin and Evolution of Birds:

3.1 : Origin and evolution of Birds.
3.2 : Aerial adaptations and mechanism of flight in birds.
3.3 : Aquatic/amphibious birds & flightless birds.
3.4 : Phylogenetic relationship of reptiles with birds.

Module 4 : Origin and Evolution of Mammals:

4.1 : Origin and evolution of Mammals.
4.2 : Structural peculiarities of Prtotheria, Metatheria & Eutheria.
4.3 : Dentition in Mammals.
4.4 : Phylogenetic relationship of reptiles with mammals.

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 in mammals – frog and rat.

Practicals:

1. Study of Cephalochordates with suitable example.
2. Study of Urochordates with suitable example.
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. Study of ampulla of lorenzini
   g. Mounting of Brain
   h. Study of membranous labyrinth
4. Biology of Rat
   a. Study of External features
   b. Study of circulatory system
   c. Study of male reproductive system
   d. Study of female reproductive 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 classes of vertebrates with 3-4 suitable examples each.
8. Osteology of Frog and Rat
9. Field visit to study different types of local variety of fishes and amphibians nearby Kalaburagi
10. Identification and documentation of birds of Kalaburagi
11. Any other experiments depending upon feasibility

References:

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.

22ZOL22 : APPLIED ENDOCRINOLOGY

Module 1: Basic Concepts of Endocrinology:

1.1 : Pioneers in Endocrinology - Discovery of Hormones.
1.2 Types of Hormones.
1.3 : Autocrine, Paracrine and Endocrine secretion.
1.4 : Concept of Homeostasis - Positive and Negative Feedback Mechanism.

Module 2 : Structure and Functions of Endocrine Glands:

2.1 : Structure and functions of Hypothalamus and Pituitary gland: Hypothalamo-hypophysial portal system.
2.2 : Structure and function of Pineal gland, Thyroid gland and Parathyroid gland.
2.3 : Structure and function of Adrenal gland and Pancreas.
2.4 : GI hormones and Secondary endocrine glands.

Module 3 : Mechanism of Hormone Action:

3.1 : Hormone receptors – types and structure.
3.2 : Mechanism of hormone action - Peptide hormone.
3.3 : Mechanism of hormone action- Steroid hormone, Calmodulin.
3.4: Other secondary messengers, G-Protein, Protein Kinase-C, Phospholipas-C, Cyclic-AMP.

Module 4 : Biosynthesis of Hormones and Pathophysiology:

4.1 : Biosynthesis and transport of Peptide hormone – Insulin.
4.2: Biosynthesis and transport of Steroid hormone - Corticosteroid and sex steroid.
4.3: Biosynthesis and transport of Catecholamines.
4.4: Pathophysiology of Pitutary,Thyroid, Adrenal and Pancreas.

Module 5 : Growth Factors & Clinical Endocrinology:

5.1 : Growth Factors- Neurotropic Growth Factor; Hematopoietic Growth Factors, Epidermal Growth Factors.
5.2 : Hormones of IVF, Pregnancy, testing and Amniocentesis.
5.3 : Clinical disorders of male and female gonads.
5.4 : Hormones in sexual behavior and application.

Practicals:

1) Study of procedure for unilateral and bilateral orchiectomy and ovariectomy in rats.
2) Mounting of pituitary gland in rat/mice/fish.
3) Histological slides of Endocrine glands - Pituitary, Thyroid, Parathyroid, Thymus, Adrenal, Pancreas, Testes and Ovary.
4) In-situ demonstration of Rat.
5) In-situ demonstration of Fish.
6) In-situ demonstration of Rabbit.
7) Hormonal assays and working principle of RIA & ELISA.
8) Identification of Gonadotrophin in human urine samples.
9) Effect of Insulin & Adrenaline on blood glucose levels in the Rats.
10) Any other practical's depending on the feasibility.

References :

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).

22ZOL231 : AQUATIC BIOLOGY

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).
1.4: Chemical factors. Biological zonation

Module 2: Aquatic Community:

2.1: Plankton - Classification, distribution and migration
2.2 : Benthos – Animal communities in lakes, stream and reservoir
2.3: Management of lakes - Eutrophication,
2.4: River management and restoration, Conservation of wetlands.

Module 3 : Fish Diversity and Body Design:

3.1: Distribution of freshwater fishes of India.
3.2 : Distribution of marine fishes of India.
3.3 : Gas exchange and swimming –Air breathing organs
3.4 : Reproduction- reproductive behaviour, parental care, Pheromones.

Module 4 : Fish Culture Practices:

4.1 : Morphometry- Definition, Principles and applications
4.2 : Freshwater carps (Indian major and minor)
4.3 : Lacustrine fish culture (ornamental).
4.4 : Mariculture – Finfish and shellfish culture.

Module 5 : Induced Breeding in India:

5.1 : Hybridization and cryopreservation
5.2 : Fishing gears and crafts
5.3 : Fishing industry in India; Fishery economics
5.4 : Fishery Research Institutes in India

Practicals:

Hydrobiology

1. Use of limnological equipments such as Secchi's disk, Sedgewick rafter counting cell, Ekman's dredge (grab). Water sampling bottle and Plankton net.
2. Determination of total alkalinity.
3. Determination of total hardness, calcium and magnesium, hardness
4. pH, Electrical conductivity, Primary productivity, zooplanktonic analysis.

Fisheries

1. Determination of length-weight analysis in fishes.
2. Identification of important fish parasites (external and internal).
3. Identification of fishing gears
4. Study of different fish byproducts.
5. Identification of fish food organisms (phytoplankton and zooplankton, benthic invertebrates)
6. Any other practical depending on feasibility

Refereences:

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.

22ZOL232 : ANIMAL BIOTECHNOLOGY

Module 1: Introduction to Biotechnology:

1.1 : Concept, Scope, Importance and Applications of Biotechnology.

1.2: Cell Culture - Types, applications and Importance of cell culture, cell lines and storage.

1.3: Culture Media - Types of culture media (Solid and Liquid Media).

1.4: Stem cell -Types, difference, advantages and disadvantages of stem cell.

Module 2 : Gene and Animal Cloning:

2.1: Gene Cloning: Methods and procedure. Enzymes used in gene cloning. Cloning Vectors: Plasmid, Cosmids, Bacteriophage, Phagemids, Artificial Chromosomes (YAC, BAC & HAC).

2.2 : Gene transfer techniques: Transformation, micro injection, electrophoration, lipofection & retrovirus.

2.3: Cloning strategies: Construction of genomic & cDNA library.

2.4: Animal Cloning: Somatic Cell Nuclear Transfer(SCNT) with special reference to Dolly. Advantages and disadvantages.

Module 3 : Transgenic Animals & Gene therapy:

3.1: rDNA Technology.

3.2 : Genetically Modified Organisms (GMO's) & their applications.

3.3 : Gene targeting: Gene knock out & knock in technology, Gene silencing.

3.4 : Gene therapy methods and applications (Somatic and Germplasm).

Module 4 : Applications of Biotechnology:

4.1: Hybridoma technology: Production and application of Monoclonal antibodies.

4.2: Application of Biotechnology in Aquaculture.

4.3: Production of Regulatory proteins (insulin, somatostatin).

4.4: Recombinant Vaccines; DNA vaccines, DNA probes, Biochips.

Module 5 :Techniques in Nanobiotechnology:

5.1: DNA fingerprinting: Methods and applications.

5.2 : PCR: Methods and applications.

5.3 :Nanoparticles: Properties and synthesis.

5.4 : Characterization and applications of nanobiotechnology.

Practicals:

1. General requirements of animal biotechnology laboratory.
2. Demonstrations and working principles of instruments used in animal Biotechnology.
3. Sterilization Techniques – Physical, Chemical & Radiation.
4. Identification of bacteria's through Gram's staining method.
5. Cell viability test by using trypan blue.
6. Extraction of DNA and RNA from animal tissues.
7. Isolation of Casein, Lactose, and Albumin from Milk.
8. Isolation and characterization of microbes useful in Fermentation.
9. Methods of cultivating Bacteria and Fungi.
10. Protozoan's culture in laboratory as a model for cell culture preparation of different types of media and preparation of buffers.
11. Demonstration and principle of PCR.
12. Demonstration of instruments used in Animal Biotechnology.
13. Any other practical depending upon feasibility.

References:

1. Recombinant DNA: Genes and Genomics – A short course, Watson et al., W. H. Freeman and Company, New York, USA
2. Principles of Gene Manipulation and Genomics, Primrose, S. B. and Twyman,R.M.,(7th Ed. 2006),
3. Molecular Biotechnology: Principles and Application of recombinant DNA, Bernard R. and Jack, ASM Press, Herndon, U
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA 4th Edition By Bernard Glick, Jack Pasternick& Cheryl Patten
5. Gene Cloning and DNA Analysis 6th Edition. Willey – Blackwell Publications. T.A. Brown.
6. Alberts et al. Mowelecular Biology of Cell: Garland Science
7. Principles of Genetics Simon & Snustad,2003
8. Principles and Techniques in Biochemistry & Molecular Biology. KenithWelson and John Walker Cambridge University Press
9. Chirikjian, J.C. *Biotechnology: Theory and Techniques* Vol. I-II. Jones and Bartlett, 1995

22ZOL24 HUMAN PHYSIOLOGY

Module 1 : Digestion:

1.1 : Functional anatomy of digestive system.
1.2 : Mechanical and Chemical digestion.
1.3 : Digestion and Absorption of Proteins, Carbohydrates and Lipids.
1.4 : Role of gastrointestinal hormones in digestion.

Module 2 : Respiration:

2.1 : Functional anatomy of respiratory system.
2.2 : Physiology of respiration.
2.3 : Nervous and Chemical control of respiration.
2.4 : Respiratory pigments. Artificial respiration.

Module 3 : Circulation and Excretion:

3.1 : Structure, function of heart.
3.2 : Circulatory system, composition of blood.
3.3 : Functional anatomy of mammalian kidney.
3.4 : Physiology of urine formation and counter current mechanism.

Module 4 : Muscule Contraction and Nervous Regulation:

4.1: Structure and functions of different types of muscles.
4.2 : Mechanism of muscle contraction and relaxation - the sliding filament theory.
4.3 : Structure and functions of neurons; Synaptic transmission, Neuromuscular junction and neurotransmitters.
4.5 : Structure and functions of sense organs: Vision, hearing and tactile response.

Module 5 :Reproductive System:

5.1: Structure and function of gonads.
5.2: Male and female accessory reproductive structures.
5.3: Menstrual cycle.
5.4: Infertilization and fertilization control.

References:

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.

THIRD SEMESTER

22ZOL31 : ANIMAL PHYSIOLOGY

Module 1: Digestive System:

1.1: Digestive tract & associated glands and their secretions.
1.2: Mechanism & Stages of Digestion.
1.3 : Absorption of Carbohydrates, Proteins and Lipids.
1.4 : Digestive System diseases, symptoms & treatments.

Module 2 : Respiratory System:

2.1 : Functional anatomy of Respiratory system.
2.2 : Mechanism Of Respiration.
2.3 : Neural and Chemical regulations of respiration.
2.4 : Respiratory System diseases, symptoms and treatments.

Module 3 : Circulatory System:

3.1 : Functional anatomy of Circulatory system.
3.2 : Blood Group and Blood coagulation.
3.3 : Cardiac cycle, ECG - principle and significance.
3.4 : Circulatory System diseases, symptoms and treatments.

Module 4 : Excretory System:

4.1: Functional anatomy of Mammalian kidney.
4.2 : Physiology of Urine formation.
4.3 : Counter current mechanism. Krebs Urea cycle.
4.4: Excretory System diseases, symptoms & treatments.

Module 5 : Neuromuscular physiology:

5.1: Neuron - structure, types and functions.
5.2 : Molecular mechanism of synaptic transmission, Neurotransmitters.
5.3 : Types of Muscles. Ultra structure and functions of Muscles.
5.4 : Neuromuscular diseases, symptoms and treatments.

Practicals:

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 heamoglobin content in mammalian blood.
7. Preparation of hematin crystal from mammalian blood.
8. Determination of bleeding and clotting time of mammalian blood.
9. Salivary amylase activates.
10. Quantitative estimation of protein / glycogen / amino acids.
11. Any other practical depending upon feasibility.

References:

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.

22ZOL331 ETHOLOGY AND EVOLUTIONARY BIOLOGY

Module I: Introduction to animal behavior:

1.1. Introduction, Definition & history (Lorenz, Tinbergen, Karl von Frisch)
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.

Module II: Types of animal behavior:

2.1 Types of behavior: Innate and acquired behavior.
2.2 Neural and hormonal control of behavior.
2.3 Stereotyped behavior: Kinesis, taxis, orientation & reflexes.
2.4 Social organization in insects.

Module III: Motivation and Communication:

3.1 Motivation and models of motivation. Drive and their types.
3.2 Migration and Homing with special reference to birds.
3.3 Chemical, Visual, tactile and audible communication. Communication, Functions of communication.
3.4 Application of pheromones and their biological actions in invertebrates and vertebrates.

Module IV: Ecology and Behavior:

4.1 : Ecological aspects of behavior – Habitat selection, food selection, anti – predator defense mechanism.
4.2 : Aggression, territoriality, Host-parasite relations.
4.3 : Parental care and mating, courtship behavior systems.
4.4 : Social organizations in primates.

Module V: Evolution of life:

5.1: Theories of Evolution: Lamarckism, Darwinism, and Neo-Darwinism.
5.2: Natural selection and adaptation: Mutation and its types.
5.3: Speciation – Reproductive isolation (pre-zygotic & post-zygotic). Models of speciation.
5.4: Patterns of Evolution - sequential, divergent, convergent and gradual.

Practicals:

1. Imprinting.
2. Insight learning.
3. 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 c. Orangutan roof preparation.
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.
11. To study the geotaxis, photo taxis, chemo taxis and hydro taxi of earthworm.

Evolutionary Biology:

12. Evidence for principle of Evolution;
    a. Homologous Organs.
    b. Analogous Organs.
    c. Serial Homology.
    d. Vestigial Organs.
13. Study of fossils.
14. Any other experiments depending on feasibility.

References:-

1. Aubrey Manning and Marian. S. Dawkins. An Introduction to Animal Behaviour.Cambridge University Press, 1995.
2. McFarland. D. The Oxford Companion to Animal Behaviour.
3. McFarland.D. Animal Behavior Psychology, Ethology and Evolution.Pitman Publications,1985.
4. Slater.P.J.B. Essentials of Animal Behaviour.Cambridge University Press, 1999.
5. Krebs J.R and Davies, N.B.An Introduction to behavioural Ecology-III (Ed). Blackwell Science Ltd, 1993.
6. Evolution by Dobzhansky, Ayala, Stebbins, Valentine.

22ZOL32 REPRODUCTIVE AND DEVELOPMENTAL BIOLOGY

Module 1 : Reproductive Biology:

1.1 Histoarchitecture of testis, Spermatogenesis and its hormonal regulation.
1.2 : Histoarchitecture of ovary, Oogenesis and its hormonal regulation.
1.3 : Fertilization, Implantation and Placenta.
1.4 : Fertility control in male and female

Module 2 : Basic Concepts of Developmental Biology:

2.1: Concept of Potency: Totipotency, Pluripotency, Multipotency, oligopotency and Unipotency.
2.2: Cleavage : Definition , Planes ,Types of Cleavage , Importance of Cleavage in Embryonic Pattern
2.3 : Programme of Animal Development.
2.4 : Scope and Branches of Embryology.

Module 3 : Early Development:

3.1 : Early development in Drosophila.
3.2 : Early development in Sea urchin.
3.3 : Early development in Frog.
3.4 : Early development in Chick.

Module 4 : Post Embryonic Development and Teratology:

4.1 :. Metamorphosis in Insect: Types events and hormonal regulation.
4.2 : Metamorphosis in Amphibia: Ecological, morphological, physiological and biochemical changes and hormonal regulation.
4.3 : Regeneration in Hydra, Planaria and Salamander
4.4 : Teratology: Causes of abnormal development, Experimental studies and teratogens.

Module 5 : Experimental Embryology:

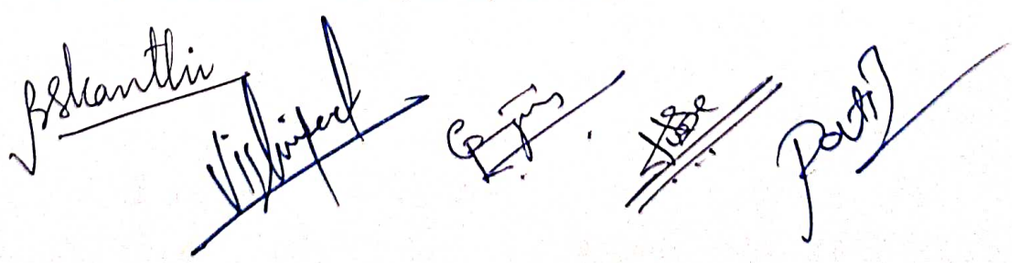
5.1 : Nuclear transplantation experiment in Frog.
5.2 : In vitro fertilization, Embryo transplantation experiment in man.
5.3 : Animal cloning experiment in mammals (Dolly).
5.4 : Stem cell concept: Types, stem cell culture and applications.

Practicals:

1) Study of male and female reproductive system in Rat.
2) Study of histo-architecture of mammalian testis, epidydimus, vas deferens, seminal vesicle, prostate gland, cowper's gland.
3) Study of histo architecture of ovary ,Fallopian tube, Uterus.
4) Contraceptive methods : IUD, Hormonal pill.
5) Development of frog egg (Cleavage, Late cleavage, Blastula, Gastrula Tadpole Larva).
6) Metamorphosis in Frog (Gosnear stages) – Charts.
7) Preparation of whole mounts of Chick embryo (18Hrs, 24Hrs, 36Hrs, 48Hrs and 72 Hrs).
8) Observation of permanent slides of whole mount of Chick embryo (18Hrs, 24Hrs, 36Hrs, 48Hrs and 72 Hrs).
9) Observation of permanent slides of Transverse section of Chick Embryo (36Hrs, 48Hrs)
10) Developmental stages of insects (Honey bee and Mosquito).
11) Observation of normal and abnormal male gametes.
12) Any other Practical depending upon feasibility.

References:

1. Gilbert, S.F. Developmental Biology. 10th Edition, Sinauer Associated Inc., Massachusetts
2. Balinsky, B.I. Introduction to Embryology. Saunders, Philedelphia.
3. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
4. Hamburger V and Hamilton HL. Handbook of chick developmental stages. Saunders Publications. 1965.
5. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
6. Embryology-An Introduction to Developmental Biology—Stanley Shostak
7. Muthukaruppan and Pitchappan. Animal development – a laboratory guide.CoSIP-ULP Publicatiions, India. First Edition, 1979.
8. Subramanian , T. Developmental Biology, Narosa Publishing House, 2002.
9. Wolpert L. and C. Tickle. 2011. *Principles of Development*.(4thedn). Oxford University Press, Oxford,UK.
10. Rao.K.V. Developmental Biology. A Modern Synthesis. Oxford & IBH Publishing co. Pvt. Ltd, 1993.
11. Adiyodi and Adiyodi 1977: Reproductive Biology of invertebrates (IBH; New Delhi)
Adler. N.T. 1981: Neuroendocrinology of Reproduction.



22ZOL332 ENVIRONMENTAL BIOLOGY

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.

Module 2: Community and Population Ecology

2.1 Types of Community.
2.2 Types of interactions - predation, parasitism, commensalism, Co operation, mutualism, Competition, ammensalism and Co existence.
2.3 Structure and Distribution of Population Ecology.
2.4 Characteristics of Population.

Module 3: Natural Resources and Pollution

3.1 Renewable and Non renewable resources.
3.2 Disaster Management.
3.3 Pollution - Types, sources, effects and control measures.
3.4 Green house effect & Ozone layer depletion.

Module 4: Solid & Bio medical waste management

4.1 Solid waste management.
4.2 Sewage and waste water treatment.
4.3 Bio medical waste management.
4.4 Bio remediation, Bio magnification, Bio degradation, Bio accumulation.

Module 5: Environmental laws & Social issues

5.1 Environmental Protection Act 1986.
5.2 Air (Prevention & Control of Pollution) Act 1981.
5.3 Water (Prevention & Control of Pollution) Act 1974.
5.4 Environmental Protection activities by common peoples.

Practicals:

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) Biological Oxygen Demand (BOD)
    c) Chemical Oxygen Demand
    d) Chlorides
    e) Total Hardness, Ca, Mg.
6. Bio remediation of waste water using soil micro organisms.
7. Bioconversion of solid and municipal waste by vermi-composting and composting.
7. Collection, preservation and estimation of zooplanktons.
8. Mapping of national parks and wild life sanctuaries in India with a note of important wild life fauna.
9. Visit to solid waste treatment plant.
10. Visit to drinking water treatment plant.
11. Any other Practical depending upon feasibility.

References:

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. Pravin Meshram.
10. Environmental Studies --------Dr. N. Nandini, Dr. N. Sunitha, Mrs, Sucharita Tandon.

22ZOL34 APPLIED ZOOLOGY

Module 1: Economic importance of Invertebretes

1.1. Importance of Apiculture and Sericulture.
1.2. Importance of Lacculture and Vermiculture.
1.3 Importance of Prawn Culture and Pearl Culture.
1.4 Importance of Corals and Moriculture.

Module 2: Commercial importance of Insects.

2.1. Entamophagy: Entomophagic species and their usage in different parts of world.
2.2. Insects as tools in forensic science.
2.3. Insect culture, collection, preservation and bioethics.
2.4. Insects as biological controlling agents.
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Module 3: Culture and Management of Important Invertebrates

3.1. Culture and management of Silkworms.
3.2. Culture and management of Honey bees.
3.3. Culture and management of Earthworms.
3.4. Culture and management of Lac insect

Module 4: Economic importance of vertebrates

4.1. Importance and scope of diary.
4.2. Rearing and management of diary breeds.
4.3. Importance and scope of Poultry.
4.4. Rearing and management of Poultry breeds.

Module 5: Aquaculture

5.1. Importance and scope of fisheries.
5.2. Distribution of fresh water and marine water fishes of India.
5.3. Fishing industry of India.
5.4. Fishery economics and Fishery research institutes in India.

22ZOL38 PRACTICAL RESEARCH METHODOLOGY AND INSTRUMENTATION

1. Research: Meaning, characteristics, objectives and types of research.
2. Writing article, research paper and research project.
3. Scientific misconduct: Falsification, Fabrication and Plagiarism (FFP).
4. Software tools to identify predatory publication developed by SPPU.
5. Making appropriate corrections in table, figures in scientific papers.
6. Determination of antigen and antibody interaction through ELISA.
7. Demonstration of Western blot analysis.
8. To study the measurement of blood pressure.
9. To study the effect of Calcium ion on heart beat of rat/crab by using Kymograph.
10. Effect of Insulin on blood glucose level in fish/rat by using Glucometer.
11. Effect of thyroxin on oxygen consumption in fish.
12. Determination of Cholesterol in the Adrenal gland of rat.
13. Collection of water sample from different water bodies.