SHARNBASVA UNIVERSITY, KALABURAGI.

DEPARTMENT OF PG STUDIES IN ZOOLOGY

Scheme of Teaching and Examination – 2017-18.

Semester	Course code	Title of the Paper	Teaching Hrs	Exam Hrs.	SEE	CIE	Credits
First	17ZOO11	Animal Systematics	4	3	50	50	4
	17ZOO12	Biology of Non Chordates	4	3	50	50	4
	17ZOO13	Molecular Cell Biology	4	3	50	50	4
	17ZOO14	Computer Applications & Methods in Biology / Wildlife Biology & Conservation	4	3	50	50	4
	17ZOO15	Practical based on 17ZOO11	4	3	25	25	2
	17ZOO16	Practical based on 17ZOO12	4	3	25	25	2
	17ZOO17	Practical based on 17ZOO13	4	3	25	25	2
	17ZOO18	Practical based on 17ZOO14	4	3	25	25	2
Second	17ZOO21	Biology of Chordates	4	3	50	50	4
	17ZOO22	Molecular Genetics and Evolution	4	3	50	50	4
	17ZOO23	Histology and Histochemistry	4	3	50	50	4
	17ZOO24	Economic Zoology / Aquatic Biology and Fisheries	4	3	50	50	4
	17ZOO25	Practical based on 17ZOO21	4	3	25	25	2
	17ZOO26	Practical based on 17ZOO22	4	3	25	25	2
	17ZOO27	Practical based on 17ZOO23	4	3	25	25	2
	17ZOO28	Practical based on 17ZOO24	4	3	25	25	2
Third	17ZOO31	Animal Physiology	4	3	50	50	4
	17ZOO32	Developmental Biology	4	3	50	50	4
	17ZOO33	Ethology	4	3	50	50	4
	17ZOO34	Environmental Biology / Biodiversity	4	3	50	50	4
	17ZOO35	Practical based on 17ZOO31	4	3	25	25	2
	17ZOO36	Practical based on 17ZOO32	4	3	25	25	2
	17ZOO37	Practical based on 17ZOO33	4	3	25	25	2
	17ZOO38	Practical based on 17ZOO34	4	3	25	25	2
		Compulsory field visit & Study Tour of about 3 - 5 days period be undertaken during III semester. Candidate has to submit the detailed tour report along with 17ZOO34 Examination.					
Fourth	17ZOO41	Animal Biotechnology	4	3	50	50	4
	17ZOO42	Parasitology	4	3	50	50	4
	17ZOO43	General Endocrinilogy / Applied Entomology	4	3	50	50	4
	17ZOO44	Project	4	3	50	50	4
	17ZOO45	Practical based on 17ZOO41	4	3	25	25	2
	17ZOO46	Practical based on 17ZOO42	4	3	25	25	2
	17ZOO47	Practical based on 17ZOO43	4	3	25	25	2
	17ZOO48	Submission of Project Report Presentation & Viva 17ZOO44	4	3	25	25	2
		Total Marks (I to IV Semester) 2400					96

SHARNBASVA UNIVERSITY
KALABURAGI

DEPARTMENT OF PG STUDEIS IN ZOOLOGY

SYLLABUS

M.Sc. First Semester

17ZOO11 : ANIMAL SYSTEMATICS

Preamble : Study of the diversification of living forms, both past and present and the relationships among living things through time. Relationships are visualized as evolutionary trees (synonyms: cladograms, phylogenetic trees, phylogenies).

MODULE 1 : SCIENCE OF SYSTEMATIC ZOOLOGY

1.1 Introduction to Science of Taxonomy.
1.2 Terms used in systematic.
1.3 Historical review of taxonomic philosophies.
1.4 Trends and approaches in taxonomy- Morphological, Anatomical, Embryological, Ecological, Behavioural, Cytogenetical, Biochemical, Molecular and Numerical approaches

MODULE 2 : SPECIES CONCEPT AND TAXONOMIC COLLECTION & PRESERVATION.

2.1 Historical perspectives of species concept.
2.2 Types of Species ; Infraspecific groups.
2.3 Models and mechanisms of speciation- Sympatric, Allopatric.
2.4 Collection and preservation of specimens.

MODULE 3 : CLASSIFICATION, PHYLOGENETIC ANALYSIS AND ZOOLOGICAL NOMENCLATURE.

3.1 Components of classification.
3.2 Linnaean/Taxonomic hierarchy.
3.3 Methods of phylogenetic analysis - Phonetic method & Cladistics method.
3.4 International Code of Zoological Nomenclature.

MODULE 4 : CLASSIFICATION OF NON CHORDATES

4.1 General characters and classification of invertebrate phyla (Protozoa to Echinodermata)
4.2 General characters and classification of Minor phyla.

MODULE 5 : CLASSIFICATION OF CHORDATES

5.1 General characters and classification of Protochordata.
5.2 General charcters and classification of Chordata.

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 & Asija Agobios (India) 2000
6. Barnes, R.D.1968. Invertebrate Zoology.IIEd. Saunde rs, Philadelphia.
7. Barrington, E.J.W.1967. Invertebrate Structure and Function, Nelson, London.

PRACTICALS:

1. Identification and Classification of specimens from Phylum Protozoa to Phylum Echinodermata.
2. Identification and classification of specimens of Protochordates.
3. Identification and classification of specimens from class Pisces to Mammalia.
4. Identification of venomous and non-venomous snakes.
5. Estimation of Biodiversity of few animals in nearby areas.
6. Construction of phylogenetic trees by taking suitable examples
7. Animal preservation techniques.
8. Taxidermy – Stuffing of small animals

17ZOO12 : BIOLOGY OF NON-CHORDATES

Preamble : Study of biology of Non Chordates to know how the different systems evolved in their complexity and to compare and contrast the life processes in different groups of Non chordates..

MODULE – I: FUNCTIONAL MORPHOLOGY AND BODY CAVITY:

1.1 Strategies and approaches in functional morphology of non-chordates, Colonial protozoans and theories on the Origin of Metazoa

1.2 Organization of Acoelomates, Psedocoelomates, Coelomates. Theories for the origin of coelom, advantages of the coelom. Protostomes and deuterostomes.

MODULE II: LOCOMOTION AND NUTRITION

2.1 Amoeboid, ciliary and flagellar movements in protozoa (ultrastructural aspects)

2.2 Hydrostatic movement in Cnidaria, Annelida and Echinodermata.

2.3 Significance of Metamerism and arthropodization

2.4 Nutrition in Protozoa and lower metazoans

2.5 Filter feeding in polychaeta, mollusca and echinodermata , Feeding pattern in insects

MODULE III: RESPIRATION AND CIRCULATION

3.1 Organs of respiration – gills, lungs, and trachea;

3.2 Respiratory pigments; Mechanism of respiration

3.3 Patterns of circulation in Protozoa,

3.4 Canal system in porifera

3.5 Circulatory patterns in lower and higher metazoa; Role of body fluids

MODULE IV: EXCRETION AND OSMOREGULATION

4.1 Excretory organs – Coelomoducts, Nephidia, and malphigian tubules,

4.2 Excretory mechanisms in protozoa, parazoa, lower and higher metazoans.

4.3 Mechanism of nitrogen excretion

4.4 Osmoregulation in marine and fresh water protozoa & metazoan.

MODULEV:NERVOUS COORDINATIONAND REPRODUCTION

5.1 Primitive nervous system in coelenterate & Echinodermata;

5.2 Advanced nervous system in Nematodes, Annelida, Arthropoda, mollusca;

5.3 Brief review of sense organs in different Non chordate phyla

5.4 Patterns of reproduction; Asexual & partheogenesis

5.5 Larval forms in Non-Chordates(arthropoda&Echinodermata)and their evolutionary significance

PRACTICALS:

1. Biology of Earthworm
    a) Study of External Features of Earthworm
    b) Study of Digestive System of Earthworm
    c) Study of Nervous System of Earthworm
    d) Mounting of Setae, Ovary. blood glands and Nephridia
2. Biology of Cockroach
    a) Study of Externals features
    b) Study of Digestive system
    c) Study of Nervous system
    d) Study of Reproductive system
    e) Mounting of Mouth Parts
3. Study of external features of Star fish
    a) Study of Oral and Aboral view of Star fish
    b) Study of Water Vascular System of Star fish
4. Mounting of Malphigian tubules from Insects

5. Life cycle of Harmful Insects and useful insects (one or two in each)
    a. Termites
    b. Wasps
    c. Housefly
    d. Anapheles mosquito
    a. Honey Bee
    b. Lac Insect c.Silkworm

6. Study of Non chordate larval forms

REFERENCES:

1. Invertebrate Structure and Function E J W Barrington ELBS 1971
2. The Insects: Structure and Function 4th Edition, Chapman R F Cambridge University Press 1998
3. Text Book of Invertebrate Zoology 7th Edition Vol. I Marshall A J and Williams W D.
4. An Introduction to Invertebrates: Studies in Biology Moore J. Cambridge University Press
5. Invertebrates Hyman Vol I to V
6. Imms A.D. General Textbook of Entomology, Vol. I & II Chapman and Hall London 1997.
7. Kerkut S.A. & Gilbert Comparative Insect Physiology, Biochemistry and Pharmacology. Pergman Press New York
8. Invertebrate Zoology 2nd Edition Robert D Barness Saunders Publication 1968
9. The Book of Indian Butterflies Issac Kehimkar, , BNHS
10. The Book of Indian Shells. Deepak Apte. . BNHS.

17ZOO13- MOLECULAR CELL BIOLOGY

Preamble : Cell and Molecular Biology are related fields of Biology that are often combined and deals about the fundamentals of Biomolecular structure and Function, Biology of aging. Molecular biology of cancer cell- carcinogenesis. **64 hours**

MODULE -I : INTRODUCTION TO MOLECULAR CELL BIOLOGY

1.1 Levels of organization.
1.2 Cell as a morphologic and functional unit within organisms.
1.3 The central dogma of molecular biology.
1.4 The scope of modern cell biology.

MODULE -II : BIOCHEMISTRY OF CELL

2.1 Proteins - primary, secondary and tertiary structures. Peptide bond formation,
2.2 Carbohydrates - Complex polysaccharides and glycoproteins
2.3 Lipids – triglycertides and compound lipids
2.4 Nucleic acid - A pentose, Phosphate and four Bases. Nucleotides, double helix formation. Structure of single and double stranded RNA.

MODULE -III : STRUCTURE OF EUKARYOTIC CHROMATION AND CELL CYCLE

3.1 Chromosomal condensation during mitosis.
3.2 Heterochromatin Chromosomal nomenclature - chromatid, centromere, kinetophore, telomere, telomerase, satellite, secondary constriction, nucleolar organizer.
3.3 Cell cycle: Molecular events during different stages of cell cycle - cyclines and cyclin dependent kinases.
3.4 Regulation of CDK cyclin activity.

MODULE -IV : BIOMEMBRANES

4.1 Molecular organization.
4.2 Transport across cell membrane.
4.3 Cell to cell communication and recognition.
4.4 Modifications of membranes: Gap junctions and tight junctions, Membrane receptors, ion channels, gated channels.

MODULE -V : MOLECULAR ORGANIZATION AND FUNCTIONS OF MEMBRANE ORGANAELLES AND CELL AGING

5.1 Endoplasmic reticulum, microsomes, golgi complex, lysosomes, peroxisomes, mitochondria and chloroplast.
5.2 Molecular organization and function of cytoskeletal structures: Microfilaments, microtubules, cilia and flagella.
5.3 Biology of aging. Molecular biology of cancer cell- carcinogenesis.
5.4 Apoptosis: mechanism and significance.

PRACTICALS:

1.Study of Temporary Mounting of Tissue

a) Squamous Epithelial Tissue, Ciliated Epithelial Tissue and Columnar Epithelial Tissue
b) Myelinated and Non myelinated Nerve cells
c) Smooth Muscles, Striated Muscles and Cardiac Muscle
d) Bone and cartilage
e) Blood Cells – Neutrophils, Basophils, Eosinophils, Lymphocytes and monocytes

2.Estimation of DNA by Discrete Diphenylamine (DPA) Method

3. Estimation of RNA by Orcinol Method
4. Study of Mitosis by observing permanent slides

5.Study of stages of Mitosis in Onion Root Tips

6.Study of Meiosis by observing permanent slides

7.Study of stages of Meiosis in Grasshopper testis

8.Histopathological Examination (HPE) of Normal and Malignant cells.

9.Preparation of Stains and Fixatives

1. Study of Gaint chromosome in Salivary glands of Chaironomous larva
2. Observation of Lacto bacillus from the curd sample
3. Study of Eukaryotes from Rectal parasite of Frog

4.Any other Practical depending upon 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

17ZOO14- COMPUTER APPLICATIONS AND METHODS IN BIOLOGY

Preamble : Use of computer as an aid to store data and Demonstrate the use of Social software (e.g., blog and wiki) and web-based communication technologies (e.g., course management systems, chat, web conferencing) Author ware (e.g., Microsoft office tools, web design programs) multimedia technologies (e.g., digital picture, scanning, audio and video technologies) Database programs (e.g., excel, SPSS, Access). To understand the different separation methods of biology. 64 hours

MODULE -I: INTRODUCTION TO COMPUTER AND ICT

1.1 Computer hardware and soft wares. General maintenance of computer systems.

1.2 Operating systems. Programming languages.

1.3 Integrations ICT in teaching learning, virtual learning resources. Computer simulation of physiological processes.

1.4 Molecular modeling, Image analysis. Computer interfacing with equipments, microscopes. Scanning and micrometric analysis.

MODULE -II : M.S. OFFICE

2.1 Data processing and plotting, Excel, presentations and drawings.

2.2 Power point and word processors. Corel Draw.

2.3 Networking. Access to Internet: dialup, leased line, cable and wifi connections.

2.4 Internet browsers, search engines and information retrieval. Cloud computing.

MODULE -III : MICROSCOPY

3.1 Light, phase contrast, dark - field fluorescence.

3.2 Electron microscopy - transmission and scanning.

3.3 Histological and histochemical staining techniques.

3.4 Cell and tissue culture: types of culture, cell lines and culture media. Contact inhibition of Growth. Immuno-fluorescence and vital stains.

MODULE -IV : SEPARATION TECHNIQUES AND INSTRUMENTATION

4.1 Chromatography and gel filtration. Electrophoresis and electro-focusing.

4.2 Cell fractionation, gradient centrifugation and subcellular fractions.

4.3 Spectroscopy- UV and visible, Raman and atomic absorption. Cytophotometry, Flow cytofluorimetry- Cell sorting.

4.4 Care and handling of laboratory animals. Alternatives for use of animals for laboratory experiments to prevent vivisection.

MODULE -V: RADIOISOTOPES , TRACER TECHNIQUES AND BIOSTTISTICS

5.1 Definition and properties of radioisotopes

5.2 Units and measurement of radioactivity

5.3 Autoradiography and its utility

5.4 Mean, Standard deviation/error, t-test,analysis of variance (ANOVA) and its significance value

PRACTICALS :

I. Computer Application:

1. Introduction to Computer
2. Components of the computer
3. Central Processing Unit and Mother Board
4. Input devices
   a. Key board
   b. Mouse
   c. Scanner
5. Output devices
   a. Printer
   b. Monitor
6. Storage devices
   a. Hard Disk
   b. Floppy Disk
   c. Compact Disk
   d. Modem
   e. Pen Drive
   f. USB
7. Microsoft Paint
8. Microsoft Office
   a. MS Word
   b. MS Excel
   c. MS Power Point
9. Computer interfacing with Equipment
   a. Scanning (MRI)
   b. Microscope (Computer Camera)
10. Access to Internet
    a. E-Mail
    b. Creating an E-Mail Account
    c. Internet Browsing
    d. Search Engines

II. Methods in Biology

Seperation Techniques

1. Chromatography
   a. Paper Chromatography
   b. Columnar Chromatography
2. Centrifugation Technique
3. Micrometry
4. Care and Handling of Laboratory animals
5. Biostatistics
6. Preparation of culture media

7. Micro techniques: fixation, embedding, Microtomy, staining, dehydration, hydration, processing, cleaning ,mounting, labeling etc.

REFERENCES:

1. Young, S. S. Computerized data acquisition & Analys is for life Sciences: A Hands-on guide. Cambridge University Press, 2001.
2. Snedecor ,G.W and Cochran, W.G. Statistical Methods . Ed VI. Oxford and IBH Publishing co, New Delhi, 1967.
3. Higgins, D & Taylor, W (Eds). Bioinformatics Sequen ce, Structure. Chapman & Hall, 1995.
4. Bailey, N.T.J. Statistical Methods in Biology-III E d. Cambridge University Press, 1995.
5. John, R.W.M. Ed. Animal Cell Culture- A practical approach. IRL Press.
6. Robert Brown. Introduction to instrumental analysis . McGraw Hill International Editions.
7. Wilson, K & Goulding, K.H. A Biologists Guide to Pr inciples and Techniques of Practical Biochemistry. ELBS Ed.

SHARNBASVA UNIVERSITY
KALABURAGI

DEPARTMENT OF PG STUDEIS IN ZOOLOGY

SYLLABUS

M.Sc. Second Semester

17ZOO21- BIOLOGY OF CHORDATES

Preamble : Describing the diversity and features of various vertebrate groups, ranging from the oldest living fishes to the relatively more recent evolution of mammals is the central theme of studying the subject involving anatomical systems including organs and tissues as well as their function and differentiation in various vertebrate groups. The content of this paper deals about the evolution of vertebrate groups from the earliest extinct ancestors to current living vertebrates that enable adaptation to aquatic and terrestrial environment. **64 Hrs**

MODULE - I : ORIGIN AND EVOLUTION OF CHORDATES AND PROTOCHORDATES

1.1 - Origin of chordate in the light of recent theories.
1.2 - Protochordata: Life cycles of Salpa, Doliolium.
1.3 - Life cycles of Amphioxus.
1.4 - Significance of retrogressive metamorphosis in ascadians.

MODULE - II : ORIGIN AND EVOLUTION OF PISCES

2.1 - Agnatha and Placoderms .
2.2 - Chondrichthyes and Osteichthyes
2.3 - Lateral line system.
2.4 - Migration in fishes

MODULE - III : ORIGIN AND EVOLUTION OF AMPHIBIA AND REPTILIA

3.1 - Origin and evolution of amphibia and reptilia
3.2 - Breeding behaviour and parental care of living Amphibians
3.3 - Neoteny Adaptive radiation in amphibians.
3.4 - Poisonous and non poisonous snakes in India : Poison apparatus

MODULE - IV : ORIGIN AND EVOLUTION OF AVES

4.1 - Aerial adaptations and mechanism of flight,
4.2 - Courtship and breeding behavior in birds , Migration in birds
4.3 - Birds and Human welfare.
4.4 - Aquatic and Flightless birds.

MODULE - V : MAMMALIA

5.1 - Origin and evolution of mammals.
5.2 - Adaptive radiation in Marsupials.
5.3 – Aquatic and egg laying mammals .
5.4 – Dentition in mammals.

PRACTICALS:

1) Biology of Scoliodon
    a) Study of External Features of Scoliodon
    b) Study of Digestive System of Scoliodon
    c) Study of Male Urogenital system of Scoliodon
    d) Study of Female Urogenital system of Scoliodon
    e) Study of Cranial Nerves of Scoliodon
    f) Study of Placoid Scales and Ampulla of Lorenzini
    g) Study of Brain of Scoliodon
    h) Study of membranous labyrinth
2) 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) Study of Brain
3) Mounting of scales from bony and cartilaginous fishes
4) Comparative anatomy of heart, brain, integument & its derivatives, aortic arches, urogenital system in vertebrates.
5) Study of Cephalochordates with suitable examples
6) Study of Urochordates with suitable examples
7) Study of classes of vertebrates with suitable examples
8) Osteology of Frog, Bird and Rat
9) Field visit to study different types of local variety of bony fishes nearby Kalaburagi
10) Identification of venomous and non-venomous snakes
11) Identification and documentation of birds of Kalaburagi area
12) 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 Pough Tom.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

17ZOO22 - MOLECULAR GENETICS AND EVOLUTION

Preamble: Transmission of genetic information provides an introduction to the principles of genetics. The genetics of the evolutionary process or the genetics of evolutionary change, came close to being all of evolutionary biology. The mechanism of evolution involving natural selection leading to adaptation and random mutations, as both the study of genetic variation in natural populations and the study of the mathematical equations of selection are reckones to a field called population genetics, genetics came to form the core in the theory of evolution. the course will help students think about genetic problems and about the wider social and ethical issues arising from genetics.

64 Hrs

MODULE - I : INTRODUCTION :

1.1 - History and scope of molecular genetics.
1.2 - Identification of DNA as genetic material.
1.3 - Properties, storage and transmission of genetic information.
1.4 - Regulation of gene express in prokaryotes and eukaryotes.

MODULE - II : REPLICATION :

2.1 - Structure of DNA in brief ,
2.2 - Semi conservation of double stranded DNA.
2.3 - DNA polymerases and ligases.
2.4 - Events in replication fork. Discontinous replication. Leading strand; Circular DNA and its replication.

MODULE - III : TRANSCRIPTION :

3.1 - Transcription: Prokaryotic transcription.
3.2 - RNA polymerases. Transcription signals.
3.3 - Classes of RNA molecules-messenger, soluble, ribosomal and transfer.
3.4 -Transcription in Eukaryotes. Means of studying intracellular RNA- 5-cap formation, 5-end processing, polyadenylation,splicing, editing and nuclear export.

MODULE – IV : TRANSLOCATION

4.1 - Translation: The genetic code.
4.2 - Transfer RNA and aminoacyl synthetases.
4.3 - Initiation. Elongation and transfer factors.
4.4 - The Wobble hypothesis.
4.5 - Polycistronic mRNA. Overlapping genes. Ribosomes.

MODULE - V : CONCEPTS OF EVOLUTION.

5.1 - Darwinism, , Natural selection, Lamarkism, Neolamarkism.
5.2 - Modes of speciation, Isolating mechanism
5.3 - Origin of Unicellular and multicellular organisms.
5.4 - Evolution of horse and human, Eugenics

PRACTICALS:

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

A. Numerical abnormalities
   a) Down's syndrome
   b) Monosomy 21
   c) Klinefelter syndrome
   d) Turners syndrome

B. Structural Abnormalities
   f) Translocation
   g) Cri- Du- Chat syndrome

6) Study of Drosophila mutants
   a) Study of Normal male and Normal female
   b) Study of Sepia eye and White eye mutants
   c) Study of Ebony body and Yellow body mutants
   d)Study of Vestigial wings and Curly wings
7) Evidence for principle of organic evolution – Homologous structure and Analogous structures
8) Study of Vestigial organs
9) Study of Fossils
10) Study of Living fossils and Connecting links
11) Any other practical's depending on the feasibility

REFERENCES:

1. Atherly.A.G., Girten,J.R and Mcdonald, J.F. The Science of Genetics. Saunders college,1999.
2. Gardner, E.J., Simmons, M.J and Snustad. D.P. Genetics IIIEd. John Willy & Sons, New York, 1990.
3. Stickberger, N.W. Genetics. MacMillan Publishing Co. New York, 1985.
4. Watson, J.D et al., Recombinant DNA. W.H.Freeman & Co, 1992.
5. Trevor,B.B and Julian Burke. Gene structure and transcription. Oxford Univ Press, 1998.
6. Genetics by Monroe W Strickberger
7. Evolution by Monroe W Strickberger
8. genetics by Peter J Russell
9. Genetics by P K Gupta
10. Evolution by Dobzhansky, Ayala, Stebbins, Valentine

17ZOO23 – HISTOLOGY AND HISTOCHEMISTRY

Preamble: Histology and Histochemistry is to study the chemical, physical and biological principles of fixation, staining and histochemistry. Hence it aims to educate the students to understand the principles underlying the histological protocols. These studies may be conducted by using tissues of different animals. The ability to visualize differential staining and to identify microscopic structures by the use of histological stains. Histology is essential tool to study structure and arrangement of various tissues and biomolecules.

64 Hrs

MODULE - 1: BONE, BLOOD CELLS AND INTEGUMENT:

1.1 - Bone development, growth, calcification, remodeling and healing of fracture
1.2 - Blood – Red Blood corpuscles, white blood corpuscles, platelets
1.3 - Haemopoesis or Blood cell development
1.4 - Structure and functions of integument system

MODULE - 2 : MUSCULAR AND NERVOUS SYSTEM:

2.1 - Muscular system – Organization, functions and types
2.2.- Structure of Smooth, Skeletal and Cardiac muscle fibers
2.3 - Muscle tendon attachment and Intercalated disc
2.4 - Nervous system – organization, function and classification of nerve fibers. Neuron types, Sense organs – structure and functions of Eye, Ear, and Nose.

MODULE - 3: REPRODUCTIVE AND ENDOCRINE SYSTEM:

3.1 – Female reproductive system: Histological structure and functions of the Ovary, Uterus, Oviduct, and Mammary gland.
3.2 – Male reproductive system: Histological structure and function of the Testes, Epididymis, Vas deferens, Prostate gland, Cowpers gland and Seminal vesicle.
3.3 - Endocrine glands – Structure and functions of Pituitary and Adrenal gland.
4.4 – Structure and functions of Pancreas, Thyroid, Parathyroid, and Pineal gland.

MODULE - 4: IMMUNUE ORGANS:

5.1 – An overview of organization and functions of immune system.
5.2 - Structure and functions of Lymph node: Tonsil.
5.3 - Structure and functions of Thymus.
5.4 - Structure and functions of spleen.

MODULE - 5: HISTOCHEMISTRY:

4.1 – Histochemistry and its applications proteins.
4.2 – Localization of proteins, lipids, carbohydrates and nucleic acids.
4.3 – Enzyme histochemistry and Immunohistochemistry and its applications.
4.4 – In-situ hybridization techniques and applications.

PRACTICALS:

1. Fixation, embedding, sectioning and staining of mammalian tissues for histological and histochemical Studies – Stomach, Intestine, Liver, Kidney, Ovary and Testes, Pancreas.

2. Study of permanent histological tissues: Skin, Tongue, Taste buds, Salivary gland, Hyaline cartilage, Spleen, Thymus, Adrenal , Trachae , Cowper's gland, Vagina , Lymph gland, Thyroid, Seminal vesicles, Retina, Fallopian tube, Uterus, Vas deference, Epididymis,, Prostate gland, Parathyroid gland etc.

3. Histochemical detection of proteins by Mercury bromophenol blue.

4. Histochemical detection of lipids by Sudan Black B.

5. Histochemical detection of carbohydrates by Periodic acid Schiff's reagent

6. Histochemical detection of DNA in tissues by Nuclear Stains.
7. Preparation of temporary and permanent slides for observation and to identify different tissues
8. Any other experiments depending on feasibility

REFERENCES:

1. Berne. R.N. and Levy. M.N. 1996 Principles of physiology (Mosby year book)
2. Bloom and Fawcett. D. 1972 Text book of histology 10th ed.
3. David H.C. 1987 Histology 9th ed. (Horper International Pub)
4. Histochemical, (Harper and Row: London and John Weatherwill Inc. Tokyo Incl Mission: USA)
5. McManus J.F.A. and Mowry R.W. 1960 Staining methods.
6. Pearse A G E 1968 Histochemistry Vol.1 & 2 (Churchill Livingstone: London)

17ZOO24 : ECONOMIC ZOOLOGY

Preamble: Economic zoology deals with animal world that is associated with economy, health, and welfare of humans. The economic value of an animal is generally accepted as the amount of money people are willing to pay for it. In the modern world, perhaps it is the most popular way to accept as a profession to earn money either by selling by-products of animals or by selling meat as a diet. Keeping this in mind the multidisciplinary nature of economic zoology includes the main topics like sericulture, sericulture, lac culture, apiculture, poultry, fisheries were incorporated in this paper.

64 Hrs

MODULE - 1: SERICULTURE AND APICULTURE:

1.1 Origin and history of Sericulture; Silkworm rearing methods; Silkworm rearing appliances and their uses; Incubation and black boxing of silkworm eggs; Brushing of silkworm larvae.

1.2 Feeding, bed cleaning and spacing in silkworm rearing; Moulting; Diseases of silkworms; Pests of silkworms.

1.3 History, development and importance of bee keeping; Different species of honeybees.

1.4 Management of bee keeping; Bee product and by products and their uses.

MODULE - 2: VERMICULTURE AND LAC CULTURE:

2.1 Introduction and importance of vermiculture, Types of earthworms; Vermiculture and vermicomposting technique.

2.2 Use of earthworms in biodegradation of organic waste materials; Earthworms as protein source; Vermiwash.

2.3 Lac insect, external morphology; Cultivation of Lac host plants (in brief);Processing of Lac

2.4 Uses and economic importance of Lac.

MODULE - 3: DAIRY TECHNOLOGY:

3.1 Importance and scope of Dairy; Dairy breeds and Management; Cattle breeds; Milk breeds; Draught breeds; Exotic breeds; Buffalo breeds.

3.2 Principles and methods of breeding; Inbreeding; Out breeding and cross breeding; Fertility and breeding efficiency; Artificial insemination.

3.3 Dairy products: Properties of Cow milk and Buffalo milk; Processing and Preservation of milk and marketing of milk and milk products.

3.4 Dairy pathology: Viral, Bacterial, Endo and ecto-parasites; Vaccination programs.

MODULE - 4: POULTRY FARMING:

4.1 Importance and Scope of poultry; Poultry Breeds.

4.2 Techniques and methods of breeding.

4.3 **Poultry products:** Egg, Meat, feather, excreta, nutritive value of egg and meat.

4.4 **Poultry pathology:** Viral, Bacterial, fungal and protozoan diseases and their control, vaccination programs.

MODULE - 5: AQUACULTURE:

5.1 Development and scope of aquaculture; Methods of aquaculture; fresh water, brackish water and marine water fish culture in India.

5.2 Composite fish culture; Preservation and processing of fishes; fish byproducts.

5.3 Shell fish culture: Prawn, bivalve and pearl cultures.

5.4 Applications and economic importance of aquaculture.

PRACTICALS:

1. Study of morphology and life cycle of silk worm, *Bombyx mori*
2. Display of digestive system of silk worm
3. Mounting of silk glands
4. Study of different cocoons and plants of silk worms, silk worms diseases
5. Study of bee keeping apparatus dissect and display of digestive system of hone bee
6. Mounting of , mouth parts ,stinging apparatus and venom gland, wax gland, pollen brush and basket in honey bee
7. Dissect and display digestive system and nervous system of earthworm
8. Mounting of setae, ovary, nephridia in earthworms
9. Identification and Economic importance of fresh water, marine water and shell fishes
10. Study of dairy breeds and poultry breeds and their common diseases
11. Study of lac insect and shellac
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

SHARNBASVA UNIVERSITY
KALABURAGI

DEPARTMENT OF PG STUDEIS IN ZOOLOGY

SYLLABUS

M.Sc. Third Semester

17ZOO31: ANIMAL PHYSIOLOGY

PREAMBLE: Animal physiology is the study of how animals work, or more specifically the physical and chemical processes that occur within animals. Examples of these processes include gas exchange, blood and circulation, digestion, nervous and muscle systems with special reference to mammals. **64 Hrs**

MODULE 1 : DIGESTION.

1.1 : Mechanical and Chemical digestion.
1.2: Functional anatomy of digestive system.
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: Respiratory pigments.
2.4: Nervous and Chemical control of respiration.

MODULE 3 : CIRCULATION

3.1: Circulatory system.
3.2 : Structure, functions and regulation of heart beat.
3.3: Composition of blood.
3.4: Blood coagulation and theories.

MODULE 4 : NEUROMUSCULAR CONTRACTION AND COORDINATION

4.1: Structure and functions of different types of muscles.
4.2: Mechanism of muscle contraction and relaxation - the sliding filament theory : Contractile proteins.
4.3: Structure and functions of neurons : Nature and Conduction of nerve impulse - Synaptic transmission.
4.4: Neuromuscular junction and neurotransmitters.

MODULE 5 : EXCRETION AND REPRODUCTION

5.1: Functional anatomy of mammalian kidney - Physiology of urine formation.
5.2 : Formation of nitrogenous excretory products - ammonia, urea and uric acid.
5.3: Functional anatomy of male reproductive system.
5.4: Functional anatomy of female reproductive system.

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.

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. Text book of S Chand publications.

17ZOO32 : DEVELOPMENTAL BIOLOGY

PREAMBLE: To introduce the concepts and processes in developmental biology. To understand and appreciate the mechanisms and unfolding of the knowledge during development. To expose the learner about new developments in embryology and its relevance to human being. **64 Hours**

MODULE 1 : INTRODUCTION

1.1 An overview of developmental biology.
1.2 Scope and Branches of developmental biology.
1.3 Anatomical and Experimental approach to developmental biology.
1.4 Stages of animal development.

MODULE 2 : GENES AND DEVELOPMENT

2.1 Embryological origin of gene theory.
2.2 Evidence of genomic equivalence.
2.3 Nuclear transplantation experiment in frog.
2.4 Cloning in mammals, Stem cell concept.

MODULE 3 : GAMETOGENESIS, FERTILISATION AND EARLY DEVELOPMENT

3.1 Gametogenesis: Spermatogenesis and Oogenesis; Structure of gametes (Sperm and Egg).
3.2 Fertilization: Types, Mechanism and Significance.
3.3 The early development of Drosophila and Sea urchin.
3.4 The early development of frog , chick and human being.

MODULE 4 : METAMORPHOSIS, REGENERATION AND SENESCENCE

4.1 Morphological and biochemical changes during insect metamorphosis.
4.2 Morphological and biochemical changes during amphibian metamorphosis, Neoteny.
4.3 Regeneration in Planaria and Salamender.
4.4 Concept and mechanism of Ageing.

MODULE 5 : EMBRYOGENESIS

5.1 Implantation: Types, mechanism and hormonal regulation.
5.2 Foetal membranes – Types, structure and function. Amniocentesis.
5.3 Placenta – Types structure and functions.
5.4 Tartology: Introduction, Principles and tartogenic agents.

PRACTICALS:

1. Types of eggs (Insect egg, Fish egg, Frog egg, Snake egg, Chick egg and Mammalian egg).
2. Development of Frog egg: cleavage (Early & Late), Blastula, Gastrula Tadpole Larva.
3. Metamorphosis in Frog.(Gosner stages) – Charts
4. Preparation of Whole mounts of Chick Embryo (18Hrs, 24Hrs, 36Hrs, 48Hrs and 72 Hrs).
5. Observation of permanent slides of whole mount of Chick Embryo (18Hrs, 24Hrs, 36Hrs, 48Hrs and 72 Hrs).
6. Observation of permanent slides of Transverse section of Chick Embryo (36Hrs, 48Hrs)
7. Developmental stages of Insects (Silk moth and Mosquito).
8. Observation normal and abnormal male gametes.
9. Visit to IVF centre- Procedure and Limitations.
10. Any other Practical depending upon feasibility.

REFERENCE BOOKS :

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.

17ZOO33 : ETHOLOGY

PREAMBLE: Many of us derive inspiration from watching natural history documentaries and their astounding catalogue of wild animal behaviours. In this course, we will explore how scientists study animal behaviour, and in particular how behaviour is shaped by the evolutionary forces of natural and sexual selection. This course will help the students to understand the remarkable behaviours of wild animals from an evolutionary perspective.

64 Hrs

MODULE :1 - INTRODUCTION

1.1 Brief history of animal behaviour.
1.2 Diversity and unity in the study of behaviour and complex behaviour.
1.3 Development of behaviour: Accommodative and Associate learning.
1.4 Neural aspects of behaviour.

MODULE : 2 - TYPES OF ANIMAL BEHAVIOUR

2.1 Types of behavior: Innate and acquired behavior
2.2 Genetic basis of behaviour.
2.3. Stereotyped behaviour: Kinesis, taxis, orientation and reflexes.
2.4 Social organization in insects.

MODULE : 3 – MOTIVATION AND COMMUNICATION

3.1 Motivation, decision making on different scales, drive, models of motivation, stress
3.2 Conflict behavior: territorial conflicts, threat display, displacement activities and fighting as conflict behaviour.
3.3 Stimuli and communication: Diverse sensory capacities, sign stimuli, stimulus filtering. Communication.
3.4 Application of pheromones and their biological actions in invertebrates & vertebrates.

MODULE: 4 - ECOLOGY AND BEHAVIOR

4.1 Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defenses.
4.2 Aggression, homing, dispersal. Host-parasite relations.
4.3 Courtship and ritual behaviour: Mate selection, male-male selection, female choice and maternal behaviour.
4.4 Social organizations in primates.

MODULE:5 - CHRONOBIOLOGY

5.1 Biological rhythms: Circadian and circannual rhythms.
5.2 Hormones and behavior(Pineal gland).
5.3 Chemical communication, body coloration, social life in insects (Termites and honey bees).
5.4 Hormone in insect & crustacean metamorphosis.

PRACTICALS:

1. Imprinting
2. Insight learning
3. Classical Conditioning
4. Operent Conditioning
5. Courtship Behaviour
   a. Andean Flamingo
   b. Lesser Flamingo
   c. Peacock
   d. Mallard Duck
   e. Stickle Back Fish
   f. Giraffe
6. Insight Behaviour /Learning
   a. Chimpanzee Tool Use
   b. Oranguton in rain
   c. Oranguton Roof Preparation
   d. Cheetah with Cubs
7. Stereotyped Behaviour
   a. Greylag Goose /Imprinting
   b. Stickleback Fish
   c. Herring Gull
   d. European Nutcracker
8. Teritorial Behaviour
   a. Common Black Bird
   b. Wood Pecker
9. Nesting Behaviour
   a. Bower Bird
   b. Baya Bird
   c. Tailor Bird
10. Honey bee Communification
    a. Round Dance
    b. Waggle Dance
11. Study of positive & negative phototaxis.

REFERENCE BOOKS:

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 BehaviourPsychology, 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.

17ZOO34 : ENVIRONMENTAL BIOLOGY

PREAMBLE: Environmental Sciences are necessarily to be taught in an inter-disciplinary curriculum. There is need to strengthen the students to understand essential aspects of environmental sciences in diverse subject areas such as chemistry, biology, pollution, geosciences, atmospheric sciences, biodiversity, natural resources management and wildlife management. There is also an additional emphasis in providing opportunities to understand the integration of modern sciences such as geographical information systems (GIS) and remote sensing applications to environmental sciences. This integration has been enabled in the syllabus. **64 Hrs**

MODULE 1 : ENVIRONMENT AND ECOSYSTEM

1.1: Atmosphere, Hydrosphere, Lithosphere, Biogeographical realms.
1.2: Abiotic and biotic interactions, Energy flow ; Food chain and Food Web.
1.3: Types of Ecosystem : Aquatic (Lentic and Lotic ecosystem) Terrestrial ecosystems(forest, grass land, desert ecosystems)
1.4: Hydrological cycle: Biogeochemical cycles (N,C,P cycles)

MODULE 2 : POLLUTION AND MANAGEMENT

2.1: Pollution: Types, sources, effects & control measures (Water, Air, Soil, Noise, Thermal, Nuclear hazards).
2.2: Natural Resources and their Management –Renewable and Non Renewable resources.
2.3: Disaster management: Floods , Earth quake, Cyclone and Landslides.
2.4: Environmental Laws ; Role of pollution control board

MODULE 3 : ECOTOXICOLOGY AND CLIMATE CHANGE

3.1: Toxic Pollutants and their impact on Flora, Fauna and Humans.
3.2: Biomagnifications, Biodegradation, Biotransformation, Bioaccumulation of Toxicants.
3.3: Global warming, Ozone layer depletion, Acid Rain & nuclear winter.
3.4: Monitoring environmental Pollutants Physical and Chemical methods .Biological indicators and monitoring; GIS.

MODULE 4 : WASTE TREATMENT TECHNOLOGY

4.1: Solid waste management : Causes, Effects and Control measures.
4.2: Sewage and waste water treatment – Aerobic and Anaerobic Treatment technologies.
4.3: Bio Medical waste management; causes , effects and control measure.
4.4 Bio remediation advantages and disadvantages , In-situ and Ex-Situ bioremediation of contaminated soils.

MODULE 5 : LAWS AND SOCIAL ISSUES

5.1 Environmental awareness; Environmental educational institutes and other agencies.
5.2 Resettlement and rehabilitation of people, wasteland reclamation.
5.3 Environment and Human Health; Human rights.
5.4 Environmental protection Act and related Acts.

PRACTICALS :

1. Collection and identification of animal biodiversity of selected ecosystem.
2. Physico-chemical analysis of soil pH, moisture, temperature, humidity.
3. Estimation of soil organic matter.
4. Air Monitoring for Particulate Matter.
5. Physico chemical parameters of different water samples:

a) Dissolved Oxygen
b) Biological Oxygen demand (B O D)
c) Chemical Oxygen demand
d) Chlorides
e) Salinity.

6. Bio remediation of waste water using soil micro organisms .
7. Bioconversion of solid & municipal waste by vermi-composting & composting.
7. Collection, preservation and estimation of Zooplankton.
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. Submission of tour report.

REFERENCE BOOKS:

1. Fundamentals of Ecology. E.P.Odum, G W Barrett.
2. Environmental Science . Willam .P.Cunninsham Barbora woodworth saigo.
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 Begon John.L.Harper.
6. Environmental Biology -- A.G.Agarwal.
7. Environmental Science by G.Tyler Miller.
8. Toxicology -- Y.K.Lahir.

SHARNBASVA UNIVERSITY
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DEPARTMENT OF PG STUDEIS IN ZOOLOGY

SYLLABUS

M.Sc. Fourth Semester

17ZOO41 : ANIMAL BIOTECHNOLOGY

Preamble: Understand the importance of modern biotechnology and to design an experiment with step-by-step to address a research problems. To provide an examples of current applications of animal biotechnology and advances in the different areas of animal biotechnology like the concept and application of monoclonal antibody, gene cloning, animal cloning, producing transgenic animals, gene therapy to cure many diseases and to explain general principles of generating transgenic animals through rDNA technology.

64 Hrs

MODULE 1: INTRODUCTION, CELL CULTURE AND STEM CELL TECHNOLOGY:

1.1 Concept, Scope and current status of Biotechnology

1.2 Cell culture techniques: Requirements, equipments, culture media ; Applications of cell culture ; cell lines and storage.

1.3 Stem cell technology: types and properties of stem cells; differentiation of stem cells.

1.4 Advantages and disadvantages of stem cell technology

MODULE 2: GENE AND ANIMAL CLONING:

2.1. Gene cloning: Gene cloning method; Molecular tools; Restriction enzymes, ligases and other enzymes, cloning vectors.

2.2. Selection and screening of transformed cells; Cloning strategies; Construction of genomic and cDNA library; Application of gene cloning.

2.3. Gene transfer techniques- Transformation: Microinjection; Electroporation; Polycations; Lipofection and Retroviral infection.

2.4. Animal cloning: Cloning in different animals (with special reference to Dolly); Somatic cell nuclear transfer (SCNT).

MODULE 3: TRANSGENIC ANIMALS AND GENE THERAPY:

3.1. Transgenic animals: Importance of rDNA technology; Genetically modified organisms (GMO's).

3.2. Gene targeting; Gene knock out and knock in technology; Gene silencing;

3.3. Applications of transgenic animals – Ethical concerns.

3.4. Gene therapy: Methods; Somatic and germ line therapy: Gene therapy in adult animals and embryos.

MODULE 4: APPLICATION OF ANIMAL BIOTECHNOLOGY:

4.1. Production of regulatory protein Insulin and Somatostatin; Whole blood; RBC; Platelet concentration; Albumin.

4.2. Production of clotting factors; Hemoglobin; Anticoagulants (heparin, vitamins, plasminogen activator).

4.3. Hybridoma technology- Production and applications of monoclonal antibody.

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

MODULE 5: TECHNIQUES IN MOLECULAR BIOTECHNOLOGY:

5.1. Electrophoresis and Electrofocussing;

5.2. Blotting techniques; DNA finger printing.

5.3. Polymerase Chain Reaction–Methods and applications.

5.4. Nanobiotechnology: Nanoparticles: Properties, Synthesis, Characterization and applications of nanotechnology

ZCP 3.6. Practical Course in Animal Biotechnology

1. General requirements of animal biotechnology laboratory
2. Sterilization Techniques – Physical, Chemical & Radiation
3. Separation of Amino acids by paper chromatography
4. Identification of bacteria's through Graham'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. Preparation of buffers used in animal biotechnology
9. Preparation of different types of medias
10. Protozoan's culture in laboratory as a model for cell culture
11. Demonstration & principle of Agarose Gel Electrophoresis
12. Demonstration & principle of PolyAcrylamide Gel Electrophoresis (PAGE)
13. Demonstrations & working principles of Instruments used in animal Biotechnology
14. Cell Death during development (Apoptosis)
15. Any other practical depending upon feasibility

REFRENCE BOOKS:

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), Blackwell Publishing, West Sussex, UK
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. Kenith Welson and John Walker Cambridge University Press
9. Chirikjian, J.C. *Biotechnology: Theory and Techniques* Vol. I-II. Jones and Bartlett, 1995
10. Glick, B.R. and Pasternak, J.J. *Molecular Biotechnology: Principles and Applications of Recombinant DNA* II (Ed) A.S.M. Press, 1998.
11. Primrose, S.B. *Molecular Biotechnology*- II (Ed). Panima Publishing Corporation, New Delhi/ Bangalore, 2001.
12. Celis, J.E. (Ed) *Cell Biology: A Laboratory Handbook*- Vol. I and II. Academic Press, 1998.
13. Young, S. S. Computerized data acquisition & Analysis for life Sciences: A Hands-on guide. Cambridge University Press, 2001.
14. Robert Brown. Introduction to instrumental analysis. McGraw RHill InternationalEditions.
15. Wilson, K & Goulding, K.H. A Biologists Guide to Principles and Techniques of Practical Biochemistry. ELBS Ed.

17ZOO42 : PARASITOLOGY

Preamble: Parasitology is the study of parasites, their hosts, and the relationship between them. It is one of the important biological disciplines. The scope of Parasitology is not determined by the organism or environment, but by their way of life. The parasites and vectors of man have been classified and described under the following headings: Geographical distribution, habitat, morphology and life cycle, pathogenicity and clinical features, diagnosis, treatment and prophylaxis.

64 Hrs

MODULE 1: INTRODUCTION:

1.1 Introduction and Scope of Parasitology
1.2 Origin and evolution of parasites
1.3 Host-parasitic relationship and Animal associations.
1.4 Classes of parasites and hosts.

MODULE 2: PARASITIC DISEASES:

2.1 Structure, Life cycle, mode of transmission, pathogenicity and control of **protozoan parasites** : Entamoeba, Trypanosoma and Plasmodium.

2.2 **Trematoda :** Fasciola, Schistosoma.
2.3 **Cestoda :** Taenia, Echinococcus, Hymenolepis.
2.4 **Nematoda:** Ascaris, Waucheraria, Ancylostoma.

MODULE 3: ECTOPARASITES AND VECTOR BIOLOGY:

3.1 Habitat, Life cycle, Pathogenicity and Prevention of ticks and mites.
3.2 Habitat, Life cycle, Pathogenicity and Prevention of fleas.
3.3 Habitat, Life cycle, Pathogenicity and Prevention of hose flies and lice.
3.4 Habitat, Life cycle, Pathogenicity and Prevention of mosquitoes.

MODULE 4: HOST- PARASITIC RELATIONSHIP:

4.1 Cellular and Physiological aspects.
4.2 Immunological and Molecular aspects.
4.3 Social and Behavioural aspects.
4.4. Larval migrants.

MODULE 5 PARASITOIDES AND BACTERIAL INFECTION:

5.1 **Parasitoides:** Types, Ecobiology, Chemical cues with suitable examples.
5.1 **Bacterial infection**: Cholera, Tuberculosis. Diphtheria, Anthrax, Typhoid, Tetanus, Leprosy.
5.3 **Viral Infection**: Rabies, Dengue fever, Japanese encephalitis.
5.4 **Viral infection**: KFD, Hepatitis and Polio.

PRACTICALS:

1. Study of important protozoan parasites of human and domestic animals.
2. Staining and study of protozoan blood parasites.
3. Study of intestinal parasites of frog and insects.
4. Study of vectors and their and mouth parts:

a) Mosquitoes b) Flea c) Ticks d) Housefly d) Cockroach

6. Study of slides and specimens: pathogens of Malaria, Filariasis, Leishmaniasis, Trypanosomiasis, Ascariasis, diseases of liver fluke, tape worm and other nematodes etc.
7. Study of some ectoparasites: lice, leech, ticks and mites etc.
8. Study of some endoparasites: Taenea, Entomeoba, Fasciola, Ascaris etc
9. Field visit to collect soil samples for isolation and identification of nematodes
10. Any other practical depending upon feasibility

REFERENCE BOOKS:

1. Smyth, J.D 2000. Animal Parasitology. Cambridge low Edition.U.K.
2. Arira, D.R. And Arora,B. 2001. Medical parasitology. 1st Edition. Satish kumar jain forCBS 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. Shoban Lal Nagin 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.

17ZOO43: GENERAL ENDOCRINOLOGY AND BIOLOGY OF REPRODUCTION

Preamble: Endocrinology is the study of the endocrine system in the human body. This is a system of glands which secrete hormones. Hormones are chemicals that affect the actions of different organ systems in the body. The endocrine system involves a number of feedback mechanisms for maintaining homeostasis in the body. **64 hrs**

MODULE:1- INTRODUCTION:

1.1 History; Aim and Scope of Endocrinology.
1.2 Techniques in Endocrinology; Classification of Hormones.
1.3 Concept of Homeostasis; Feedback systems.
1.4 Hormones and behavior.

MODULE:2 – ENDOCRINE GLANDS AND HORMONES:

2.1 Structuree and functions of Hypothalamus Pitutary: hypothalamo-Hypophysial portal system
2.2 Structuree and functions of Thyroid, Parathyroid, Adrenal gland, Pancreas and Pineal glands
2.3 Hormones of Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas,
2.4 Gastro-intestinal hormones and secondary endocrine glands.

MODULE:3- MECHANISM OF HORMONE ACTION:

3.1 Hormone receptors – Types, structure and regulation.
3.2 Mechanism of Hormone action – Peptide hormones (Signal transduction, G-protein, Protein kinase-C).
3.3 Steroid and Thyroid hormones; Calmodulin.
3.4 Termination of hormone action; Hormone inactivation.

MODULE 4: PATHOPHYSIOLOGY OF ENDOCRINE GLANDS AND BIOSYNTHESIS OF HORMONES:

4.1 Pathophysiology: Hypothalamus, Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas.
4.2 Biosynthesis of hormones: Steroid hormones, melatonin, Catecholamine's.
4.3 Thyroid hormones, Peptide hormones; Insulin.
4.4 Growth factors: Neurotropic growth factor, Haemopiotic growth factor, Epidermal growth factor, Transforming growth factor; Fibroblast growth factor.

MODULE 4: ANATOMY OF MALE AND FEMALE REPRODUCTION:

5.1 Histo-architecture of the testis, Spermatogenesis and its hormonal regulation,
5.2 Functional morphology and hormonal regulation of Epididymis, Vas deferens, Prostate gland, Seminal vesicle, Cowper's gland; Androgens.
5.3 Histo-architecture of ovary, Folliculogenesis, Follicular atresia. Mechanism ofovulation, Luteogenesis, Lutinization.
5.4 Estrous and Menstrual cycle and its hormonal regulation; Estrogens.

PRACTICALS:

1. Display of endocrine glands in Fish and Rat
2. Mounting of Pituitary and Pineal gland in Fish, Rat / Mice
3. Preparation of permanent histological slides of endocrine glands
4. Hormone assays and working principle of RIA and ELISA
5. Study of precocious metamorphosis in frogs treated with extracts of thyroid gland
6. Study of male and female reproductive system in Rat
7. Study of male and female accessory reproductive glands in Rat
8. Study of procedure for bilateral Orchiectomy and Overactomy in Rat
9. Study of histo-architecture of mammalian testis, epidydimus, vas deferens, seminal vesicle, prostate gland, cowper's gland
10. Study of spermatozoan count and identification of normal and abnormal spermatozoa on the basis of morphology and motility
11. Study of Estrus cycle in rats
12. Study of histo-architecture of mammalian ovary, uterus, fallopian tubule
13. Any other experiments depending on the feasibility

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