SHARNBASVA UNIVERSITY, KALABURAGI
Department of P.G. Studies & Research in Zoology
Teaching & Evaluation Scheme (w.e.f-2020)
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						
20ZOO11	Biosystematics	04	-	-	3	50	50	100	04
20ZOO12	Structure and function of Non-Chordates	04	-	-	3	50	50	100	04
20ZOO13	Cell and Molecular Biology	04	-	-	3	50	50	100	04
20ZOOXX	**Elective Paper Theory**	04	-		3	50	50	100	04
20ZOOL15	Practical : Biosystematics	-	04	1:2	2	25	25	50	02
20ZOOL16	Practical : Structure and function of Non-Chordates	-	04	1:2	2	25	25	50	02
20ZOOL17	Practical : Cell and Molecular Biology	-	04	1:2	2	25	25	50	02
20ZOOLXX	**Elective Practical Paper**	-	04	1:2	2	25	25	50	02
		16	**16**					**600**	**24**

Elective Theory Papers :
20ZOO141 : Biodiversity
20ZOO142 : Aquatic Biology and Fisheries

Elective Practical Papers :
20ZOOL181 : Practical: Biodiversity
20ZOOL182 : Practical: Aquatic Biology and Fisheries

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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						
20ZOO21	Structure and function of chordates	04	-	-	3	50	50	100	04
20ZOO22	Genetics and Evolution	04	-	-	3	50	50	100	04
20ZOO23	Endocrinology and Reproductive Biology	04	-	-	3	50	50	100	04
20ZOOXX	Elective Paper Theory	04	-		3	50	50	100	04
20ZOOL25	Practical : Structure and function of chordates	-	04	1:2	2	25	25	50	02
20ZOOL26	Practical : Genetics and Evolution	-	04	1:2	2	25	25	50	02
20ZOOL27	Practical : Endocrinology & Reproductive Biology	-	04	1:2	2	25	25	50	02
20ZOOLXX	**Elective Practical Paper**	-	04	1:2	2	25	25	50	02
		16	**16**					**600**	**24**

Elective Theory Papers :
20ZOO241 : Biological Methods
20ZOO242 : Applied Zoology

Elective Lab Papers :
20ZOOL281 : Practical: Biological Methods
20ZOOL282 : Practical: Applied Zoology

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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						
20ZOO31	Animal Behaviour	04	-	-	3	50	50	100	04
20ZOO32	Embryology and Developmental Biology	04	-	-	3	50	50	100	04
20ZOO33	Environmental Biology and Toxicology	04	-	-	3	50	50	100	04
20ZOOXX	**Elective Paper Theory**	04	-		3	50	50	100	04
20ZOOL35	Practical : Animal Behaviour	-	04	1:2	2	25	25	50	02
20ZOOL36	Practical : Embryology and Developmental Biology	-	04	1:2	2	25	25	50	02
20ZOOL37	Practical : Environmental Biology and Toxicology	-	04	1:2	2	25	25	50	02
20ZOOLXX	**Elective Practical Paper**	-	04	1:2	2	25	25	50	02
		16	**16**					**600**	**24**

Elective Theory Papers :
20ZOO341 : General Physiology
20ZOO342 : Animal cell Biotechnology

Elective Practical Papers :
20ZOOL381: Practical :General Physiology
20ZOOL382 : Practical :Animal cell Biotechnology Lab

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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
20ZOO411	Internship Work		-		-	100	100	4
20ZOO412	Internship Report & Viva		-		-	75	75	3
20ZOO421	Project Work				-	100	100	4
20ZOO422	Project Report				-	100	100	4
20ZOO423	Project viva voce				50	50	100	4
20ZOO43	Study Tour and Report		-		-	25	25	1
				Total	**50**	**450**	**500**	**20**

SHARNBASVA UNIVERSITY
KALABURAGI

SYLLABUS

FOR

M.SC. ZOOLOGY

(CHOICE BASED CREDIT SYSTEM)

2020-21

Department of P.G. Studies and Research in Zoology, Sharnbasva University, Kalaburagi

FIRST SEMESTER

20ZOO11 : BIOSYSTEMATICS

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).

64 Hrs

Module 1 : Science of Sytematic Zoology:

1.1 : Introduction and Importance of Taxonomy.
1.2 : History of biological classification.
1.3 : Stages of taxonomy and tasks of taxonomists.
1.4 : Modern trends and approaches in taxonomy.

Module 2 : Species Concept and Taxonomic Collection and Preservation:

2.1 : Species concept - Introduction, typological, biological, nominalistic and Evolutionary.
2.2 : Types of species, infra-specific categories.
2.3 : Modes and Mechanism of speciation.
2.4 : Taxonomic procedures - Collection, preservation, curating and identification.

Module 3 : Classification, Phylogenetic Analysis and Zoological Nomenclature:

3.1 : Theories of biological classification.
3.2 : Hierarchy of categories and taxa.
3.3 : Methods of phylogenetic analysis - phenetic and cladistic methods.
3.4 : International Code of Zoological Nomenclature (ICZN), Rules of nomenclature.

Module 4 : Classification of Non-chordates:

4.1: General characters and classification of major invertebrate phyla.
4.2 : General characters and classification of minor phyla.
(Rotifera, ctenophora, acanthocephala, phoronida and onychophora)

Module 5 : Classification of Chordates:

5.1 : General characters and classification of Protochordates.
5.2 : General characters and classification of chordates class from cyclostomata to class mammalia.

Practicals:

1. Biosystematic position of specimens from phylum
   a) Protozoa to Echinodermata, minor phyla.
   b) Protochordata
   c) Class cyclostomata to mammalian.
2. Animal species exhibiting phylogenetic inter-relationships.
   Peripatus : Annelida – Arthropoda.
   Balanoglossus : Protochordata – Chordata.
   Archeopteryx : Reptiles – Aves.
3. Biodiversity survey of few animals in nearby areas/ecosystems.
4. Animal preservation techniques.
5. Taxidermy : Stuffing of small animals.
6. Morphometry of some locally available fishes for identification.
7. Phylogenetic analysis through problems.
8. Construction of phylogenetic tree by taking suitable examples.
9. Identification and grouping of animals by using identification keys.
10. 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.

20ZOO12 : STRUCTURE AND FUNCTION 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.

64 Hrs

Module 1 : Functional Morphology and Body Cavity:

1.1 : Theories on the origin of metazoa.

1.2 : Theories for the origin of coelom. Organization of acoelomates, psedocoelomates, coelomates. Protostomes and deuterostomes.

1.3 : Significance of coelom, metamerism and Tagmatization.

Module 2 : Locomotion and Nutrition:

2.1 : Amoeboid, ciliary and flagellar movements in Protozoa.

2.2 : Hydrostatic movement in Cnidaria, Annelida and Echinodermata.

2.3 : Nutrition in Protozoa and lower metazoans.

2.4 : Filter feeding in Polychaeta.

2.5 : Feeding pattern in insects.

Module 3 : Respiration and Circulation:

3.1 : Organs of respiration – Gills, Lungs and Trachea.

3.2 : Respiratory pigments. Mechanism of respiration in Arthropoda and Mollusca.

3.3 : Canal system in Porifera.

3.4 : Circulatory patterns - Open and closed type circulatory system; Role of body fluids in circulation.

Module 4 : Excretion and Osmoregulation:

4.1 : Excretory organs – Coelomoducts, Nephridia, and Malphigian tubules.

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

4.3 : Mechanism of Osmoregulation.

4.4 : Osmoregulation in marine and fresh water Protozoa and Metazoan.

Module 5 : Nervous co-ordination and Reproduction:

5.1 : Primitive nervous system in Cnidaria and Echinodermata.

5.2 : Advanced nervous system in Arthropoda (crustaceans and insects) and molluscs (Cephalopoda).

5.3 : Brief review of sense organs in different non-chordates.

5.4 : Patterns of reproduction; Asexual, sexual and parthenogenesis.

5.5 : Larval forms in non chordates (Arthropoda and Ehinodermata).

5.6 : Evolutionary significance of larval forms.

Practicals:

1. Observation of microorganisms in given water sample.
2. Study 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 and Nephridia.
3. **Study 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.
    f) Mounting of Malphigian tubules.
4. **Study of Star fish.**
    a) Study of Oral and Aboral view of Star fish.
    b) Study of Water Vascular System of Star fish.
5. **Life cycle of Harmful Insects and tubefeet mounting useful insects (one or two in each).**
    a) Termites
    b) Wasps
    c) Housefly
    d) Anapheles mosquito
    e) Honey Bee
    f) Lac Insect
    g) Silkworm
6. Any other practical depending on feasibility.

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 IssacKehimkar, , BNHS.
10. The Book of Indian Shells. Deepak Apte , BNHS.

20ZOO13 : CELL AND MOLECULAR 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.

64 Hrs

Module 1: Introduction to Molecular Cell Biology:

1.1 : History of cell biology.
1.2 : Levels of organization.
1.3 : The central dogma of molecular biology.
1.4 : The scope of modern cell biology.

Module 2 : Biochemistry of Cell:

2.1 : Proteins- Classification, structure and functions. Amino acids- classification, and general characters.
2.2 : Carbohydrates – Classification and biological significance.
2.3 : Lipids - Classification and functions (Triglycerides and Compound lipids).
2.4 : Nucleic acids – Purines, Pyrimidines, Nucleotides, Structure of DNA & RNA and types of RNA.

Module 3 : Molecular Mechanism of Cell Division and Special Chromosome:

3.1 : Cell cycle: Molecular events of cell cycle and regulation of cell cycle
3.2 : Heterochromatin – types and functions; Euchromatin.
3.3 : Chromosome structure, types and functions.
3.4 : Special chromosomes -Polytene and Lampbrush.

Module 4 : Biomembranes:

4.1 : Structure, composition and functions of biomembrane.
4.2 : Active transport and passive transport.
4.3 : Cell communication.
4.4 : Modifications of membranes - Gap junctions and tight junctions, Membrane receptors.

Module 5 : Molecular Organization and Functions of cell Organelles:

5.1 : Endoplasmic reticulum, Mitochondria, Golgi complex and Lysosomes.
5.2 : Microfilaments and Microtubules.
5.3 : Biology of aging:- Concept and mechanism.
5.4 : Molecular biology of cancer cell.

Practicals:

1. **Study of temporary mounting of different tissue.**
   a. Squamous epithelial tissue, Ciliated epithelial tissue and columnar epithelial tissue
   b. Myelinated and Non-myelinated nerve tissue.
   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.
10. Study of gaint chromosome in Salivary glands of Chaironomous larva.
11. Observation of Lacto bacillus from the curd sample.
12. Study of eukaryotes from rectal parasite of frog.
13. 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

20ZOO141 : BIODIVERSITY

Preamble : Biodiversity is the study of variety of life forms which are existed on earth. It also deals with wildlife sanctuaries, National Parks, Biogeographical realms of the world, Endangered species and Extinct species.

64 Hrs

Module 1: Introduction To Biodiversity:

1.1 : Concepts and Definition of biodiversity –
1.2 : Scope of biodiversity science.
1.3 : Biogeographical realms.
1.4 : Values of biodiversity

Module 2 : Levels Of Biodiversity:

2.1 : Genetic diversity : Nature and origin of genetic variations; Measurement of genetic diversity.
2.2 : Species diversity : History and origin of species diversity; Species diversity indices ; Measures of diversity – Alpha, Beta & Gamma diversity.
2.3 : Ecosystem diversity : Classification and nature of ecosystems (in brief); Ecosystem diversity of India (in brief)
2.4: Agro- biodiversity : Origin and evolution of cultivated species diversity and Diversity in domesticated animal species.

Module 3 : Biodiversity Hot Spots And Megadiversity:

3.1 : Biodiversity at global, national and local levels.
3.2 : Hot spots of biodiversity.
3.3 : India as a megadiversity nation.
3.4 : Endemism and endemic species.

Module 4 :Threats To Biodiversity And Conservaton:

4.1: Threats to biodiversity : Deforestation & habitat destruction, Hunting & Overexploitation; Introdution of exotic species, Pollution.
4.2: Endangered, Vulnerable, Rare and Threatened species.
4.3: Conservation of Biodiversity : In-situ and Ex-situ conservation;
4.4 : Role of educational Institutions and NGO's, Biodiversity Awareness programmes

Module 5 : Biodiversity Conventions And Management:

5.1 : Biodiversity conventions : Earth Summit and other conventions; Convention on Biological Diversity
5.2 :Biodiversity Management: Organizations associated with biodiversity management – IUCN, UNEP, UNESCO, WWF, FAD, WCMC –their role and contributions.
5.3 : Biodiversity legislation, Project tiger, CITES
5.4 : Future strategies for Biodiversity Conservation in India

Practicals

1. Importance and Scope of Biodiversity
2. Study of Biogeographical Realms
3. Biodiversity Hotspots of the world
4. Wildlife Sanctuaries of India
5. National Parks of India
6. Wildlife Sanctuaries of Karnataka
7. National Parks of Karnataka
8. Wetlands of India
9. Methods of biodiversity
10. Endangered species of India
11. Extinct species of world
12. Extinct species of India
13. Collection of specimens.
14. Any other practical depending upon feasibility.

References:

1. Dasmann. F Raymond. Wildlife Biology. Wiley Eastern Ltd. India. 1982.
2. Encyclopedia of Nature and Science. Vols 1-18. Bay Books Pvt.Ltd. Sydney, 1974.
3. Burnie. D. (Ed). Animal: the Definitive Visual Guide to the Worlds Wildlife. D.K.Publications, 2001.
4. Myers et al, 2000. Biodiversity Hotspots for Conservation Priorities. Nature, 403, 853-858.
5. A walk on the wild side (an information guide to National Parks and Wildlife Sanctuaries of Karnataka), Karnataka forest Department.
6. Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and applications. Cambridge University Press.
7. Gadgil, M. et. al. A Methodology Manual for Documenting People's Priorities for Biodiversity and Conservation. Shrustiygyaan.
8. Gary E Davis, Science and Ecosystem Management in National Parks, The University of Arizona Press, Tucson, 1996 5. India's 4th national reports on convention on Biodiversity, MOEF 2009.
9. Magguran, A.E. (1996). Ecological diversity and its measurements. Princeton University.
10. Sutherland, W. (2006). Ecological census technique: A Handbook, 2nd Edn. Cambridge University Press.
11. Odum, E. and Barett, G. (2005). Fundamentals of Ecology. Thomson Brooks/Cole

20ZOO142 : AQUATIC BIOLOGY AND FISHERIES

Preamble : Aquatic biology is a scientific discipline that investigates all life forms that inhabit oceans and freshwater. Aquatic biology is the study of living organisms in both saltwater and freshwater. The field of Aquatic biology is deeply based in maths and science. **64 Hrs**

Module 1 : Aquatic Environment:

1.1 : Classification of freshwater habitats - Lotic and lentic ecosystems- lakes, rivers

1.2 : Structure of aquatic ecosystems - Morphometry - 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, control of nutrient and macrophyte biomass

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 and gas bladder, Swimming modes (fin versus body trunk, swimming muscles and tail beat)

3.4 : Growth curves Reproduction- Reproductive cycles, reproductive behaviour, parental care, Pheromones.

Module 4 : Fish Culture Practices:

4.1 : Freshwater carps (Indian major and minor)

4.2 : Lacustrine fish culture (ornamental).

4.3 : 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 Institute in India

Practicals:

1. Use of limnological equipments such as Secchi's disk, Sedgewickr after counting cell, Ekman's dredge (grab), Water sampling bottle and Plankton net.
2. Determination of total alkalinity and dissolved organic matter,O_2,Co_2,Cl_2
3. Determination of total hardness, calcium and magnesium, hardness,
4. pH, Electrical conductivity, Primary productivity, Zooplankton analysis.
5. Determination of length-weight analysis in fishes.
6. Determination of absolute and relative fecundity in fishes.
7. Identification of important fish parasites (external and internal).
8. Identification of fishing gears and fish byproducts.
9. Identification of fish food organisms (phytoplankton and zooplankton, benthic invertebrates)
10. Any other practical depending on feasibility

Referecnes:

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.

SECOND SEMESTER

Department of P.G. Studies and Research in Zoology, Sharnbasva University, Kalaburagi

20ZOO21 : STRUCTURE AND FUNCTION OF CHORDATES

Preamble : Describing the diversity and features of various chordate groups, ranging from Proto-chordates 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 chordates groups. The content of this paper deals about the origin and evolution of vertebrate groups from the earliest extinct ancestors to current living vertebrates that enable adaptation to aquatic and terrestrial environment. **64 Hrs**

Module 1 : Origin and Evolution of Proto-chordate and Chordates:

1.1 : Protochordate phylogeny- Systematic position of protochordates.
1.2 : Theories on origin of chordates.
1.3 : Life cycles of Salpa, Doliolium and Amphioxus.
1.4 : Significance of retrogressive metamorphosis in ascidians.

Module 2 : Origin and Evolution of Pisces:

2.1 : Origin and salient features of Ostracoderm, Placoderm, Acanthodii, Sarcopterygii and Actinopterygii.
2.2 : Chondrichthyes and Osteichthyes.
2.3 : Lateral line system.
2.4 : Migration in fishes: Definition and types.

Module 3 : Origin and Evolution of Amphibia and Reptilia:

3.1 : Origin and evolution of Amphibians and Reptiles.
3.2 : Neoteny; Adaptive radiation in amphibians.
3.3 : Adaptive radiation in Reptiles.
3.4 : Poisonous and non poisonous snakes in India.
3.5 : Poison apparatus in snakes.

Module 4 : Origin and Evolution of Aves:

4.1 : Origin and evolution of birds.
4.2 : Aerial adaptations and mechanism of flight.
4.3 : Adaptive radiation in birds - Galapagos finches.
4.4 : Courtship behaviour in birds: Definition and types.
4.5 : Migration in birds and ecological importance of birds.

Module 5 : Origin and Evolution of Mammals:

5.1 : Origin and evolution of mammals.
5.2 : Structural peculiarities of Prototheria, Metatheria and Eutheria.
5.3 : Adaptive radiation in Marsupials and Human skin colour.
5.4 : Dentition in Mammals: Definition and types.

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) Mounting of Scoliodon Brain
   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) Mounting of rat 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 one suitable examples
6. Study of Urochordates with one suitable examples
7. Study of classes of vertebrates with 3-4 suitable examples each.
8. Osteology of Frog, Bird and Rat
9. Identification of venomous and non-venomous snakes
10. Field visit to study different types of local variety of bony fishes nearby Kalaburagi
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. ACCBS Publishers and distributors, 1995.
2. Young, J.Z. The Life of Vertebrates, III ed Ed Clarendon Press Oxford,1981.
3. William D MacFarland, P and Harvey Pough,Tom J C and Heiser, J.B. Vertebrate Life, Collier Macmillan Publishers, London, 1979.
4. Romer, W.H. The Vertebrate Body, Saunders, Philadelphia, 1956.
5. Vertebrate Zoology – R.L. Kotpal, 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.

20ZOO22 : GENETICS AND EVOLUTION

Preamble : Transmission of genetic information provides an introduction to the principles of genetics and the genetics of evolutionary change. The mechanism of evolution involving natural selection leading to adaptation and random mutations due to genetic variation in natural populations. The study of genetics came to form the core in the theory of evolution. This course will help the students to think about genetic problems and about the wider social and ethical issues arising from molecular genetic studies.

64 Hrs

Module 1: Introduction:

1.1 : History and scope of Molecular genetics.
1.2 : DNA as genetic material.
1.3 : Regulation of gene expression in prokaryotes
1.4 : Regulation of gene expression in eukaryotes.

Module 2 : Genetics:

2.1 : Interaction of genes - Epistasis, Polygenic inheritance.
2.2 : Linkage and Crossing over – Coupling, test Cross, Linkage, Maps, Recombination.
2.3 : Chromosomal aberrations – Structural and numerical changes.
2.4 : Gene mutations - in Drosophila and Man.

Module 3 : Genome Expression:

3.1 : Mechanism of Replication - Origin, Pattern, Elongation and Fidelity of replication.
3.2 : Mechanism of Transcription - Initiation, Elongation, Termination, Post transcriptional modifications
3.3 : Mechanism of Translation - Translation process,Initiation, Elongation, Termination and Functions.

Module 4 : Cytogenetics:

4.1 : Human chromosome and Karyotypes.
4.2 : Autosomal and sex chromosomal anamolies.
4.3 : Genomics and Proteomics
4.4 : Prenatal diagnosis.

Module 5 : Concepts of Evolution:

5.1 : Lamarkism, Neolamarkism, Darwinism, Neodarwinism and Natural selection.
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
    a) Chironomous larva.
    b) Drosophila larva.
2) Study of genetics of blood group in Man.
3) Study of X- Chromatin or Barr body in cells of humans (female) buccal smear.
4) Human chromosome analysis / Karyotype analysis.
    a) Normal male b) Normal female

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

B. Structural Abnormalities
    a) Translocation b) Cri- Du- Chat syndrome

5) Study of Drosophila mutants.
    a) Study of Normal male and Normal female.
    b) Study of Sepia eye and White eye mutants, Bar eye.
    c) Study of Ebony body and Yellow body mutants.
    d) Study of Vestigial wings and Curly wings.
6) Evidence for principle of organic evolution – Homologous organs serial homology and Analogous organs.
7) Study of sex comb and genital plates in different Drosophilla.
8) Study of vestigial organs.
9) Study of Fossils.
10) Study of Living fossils and Connecting links.
11) Any other practicals depending on the feasibility.
12)

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

20ZOO23 : ENDOCRINOLOGY AND REPRODUCTIVE BIOLOGY

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 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 Pituitary : Hypothalamo-hypophysial portal system
2.2 Structuree and functions of Thyroid, Parathyroid, Adrenal gland, Pancreas and Pineal glands
2.3 Gastro-intestinal hormones
2.4 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 (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.

Module 5 : Reproduction Biology:

5.1 Spermatogenesis and its hormonal regulation, Histoarchitecture of mammalian testis.
5.2 Study of accessory reproductive organs, epididimis, vas deferens, prostrate gland, seminal vesicles, cowper's gland and composition of semen.
5.3 Oogenesis and their hormonal regulation. Histoarchitecture of mammalian ovary.
5.4 Estrous and Menstrual cycle and its hormonal regulation.
5.5 Implantation, Gestation and parturition and lactation in brief.
5.6 Fertility and infertility controls in male and female. ART's.

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 (ovary, testis, Adrenal , Thyroid , Pancreas, Parathyroid.)
4. Hormone assays and working principle of RIA and ELISA
5. Study of male and female reproductive system in Rat
6. Study of male and female accessory reproductive glands in Rat
7. Study of procedure for bilateral Orchiectomy and Overactomy in Rat
8. Study of histo-architecture of mammalian testis, epidydimus, vas deferens, seminal vesicle, prostate gland, cowper's gland
9. Study of spermatozoan count and identification of normal and abnormal spermatozoa on the basis of morphology and motility
10. Study of Estrus cycle in rats
11. Visit to veterinary Institutes to learn breeding techniques.
13. Study of histo architecture of ovary ,Fallopian tube, Uterus,
14. Pathology of reproductive system: cryptorchid testis, prostrate cancer
15. Contraceptive methods : IUD, Hormonal pill, PCOD, Endometrosis.

Any other experiments 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).
15. Chester-Jones I (1987): Fundamentals of Comparative vertebrate Endocrinology (Pleum Press: NY)

20ZOO241 : BIOLOGICAL METHODS

Preamble : The course objective is to provide students with a basic understanding of Various techniques used in biological sciences .Types of Microscope and their use. .Principles and use of analytical instruments: centrifuge, spectrophotometer, pH meter. Chromatography and its types, Electrophoresis, PCR and ELISA. Computational tools in the field of Biology

64 Hrs

Module 1 : Instrumentation in Biology:

1.1 : Centrifugation - Principle and application of centrifugation, differential and density gradient centrifugation.
1.2 : Electrophoresis - Principle, structural components and applications of electrophoresis.
1.3 : Chromatography - Principle and applications of chromatography, TLC, Paper and Column Chromatography.
1.4 : Spectrophotometer – Principle and applications of Spectrophotometer, pH meter.

Module 2 : Microscopic Techniques:

2.1 : Light microscopic, Phase contrast microscopic.
2.2 : Fluorescence microscope, confocal microscope.
2.3 : Electron microscope (SEM and TEM).
2.4 : Microscopy of living cells.

Module 3 : Histological Techniques:

3.1 : Microtome - Types and Applications.
3.2 : Collection and preservation of animal tissue, Fixation, Embedding, Sectioning, Staining, Identification of different components.
3.3 : Tissue Preparation for light microscopy.
3.4 : Cryotechniques – History and applications of Cryotechniques.

Module 4 : Computer Applications:

4.1 : Basics of computer.
4.2 : Data processing and plotting , excel, presentation and drawings.
4.3 : Power point and word processors . Networking, access to internet : Dail up ,leased line , cable and wifi connections
4.4: Molecular modeling , image analysis . Computer interfacing with equipments , microscopes, scanning and micrometric analysis.

Module 5 :Biostastics:

5.1 :Introduction: Data reduction, frequency distribution, graphical representation , measures of central tendency and dispersion.
5.2 :Probability : Conditional probability , addition and multiplication rules of probability , distributions and applications .
5.3 :Simple linear regression and correlation and random sampling and test of significance.
5.4 : Mean, standard deviation/ error , t-test, analysis of variance (ANOVA) and its significance value .

Practicals:

1. Centrifugation technique
2. Chromatography
    a. Thin layer chromatography
    b. Column chromatography
    c. Paper chromatography
3. Protein estimation by UV spectrometer
4. Working principle of Gel electrophoresis
5. Measurement of pH, preparation of buffer
6. Demonstration of fixation, embedding, microtomy, staining, dehydration ,processing, cleaning, mounting, labeling, etc.
7. Care and handling of laboratory animals
8. Cell culture methods
9. Biostatics:
    a) Calculation of measures of dispersions – range, mean deviation, standard deviation, variance and coefficient of variance.
    b) Computation of test of significance – comparison of sample mean with population mean and two sample means
    c) Calculate the coefficient of correlation between two variables
    d) Computation of One Way Analysis of Variance (ANOVA)
    e) Using Chi Square Test, test the independence of two variables
10. Any other practical depending upon feasibility.

References:

16. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
17. A biologist Guide to principles and Techniques of Practical Biochemistry-K, Wilson and K.H. GouldingEIBSEdn.
18. Essentials of Biophysics, P Narayanan, New Age Int. Pub. New Delhi. 2000.
19. Clark &Swizer. Experimental Biochemistry. Freeman, 2000.
20. Principles and Practice of Bioanalysis, R F Venn, Taylor and Francis, 2003.
21. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
22. Boyer. Modern Experimental Biochemistry. Benjamin, 1993
23. Freifelder. Physical Biochemistry. Freeman, 1982.
24. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.
25. Robert Braun. Introduction to instrumental analysis. McGraw Hill
26. David W. Mount's "Bioinformatics" [Cold Spring Harbor Press; ISBN 0879697121].
27. James Tisdall. Beginning Perl for Bioinformatics An Introduction to Perl for Biologists. Publisher: O'Reilly Media. October 2001.

20ZOO242 : APPLIED ZOOLOGY

Preamble : Applied 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. **64 Hrs**

Module 1 : Sericulture:

1.1 : Origin and history of sericulture.
1.2 : Silkworm rearing methods; Silkworm rearing methods.
1.3 Classification of silkworm and popular silkworm breeds and hybrid: Life cycle of silkworm, B.mori.
1.4 : Importance of sericulture.
1.5 : Silk worm pathology : Viral, Bacterial and Fungal diseases.

Module 2 : Apiculture:

2.1 : Introduction and scope of apiculture.
2.2 : Different species of honeybees.
2.3 : Management of bee keeping.
2.4 : Bee products and by products and their uses.

Module 3 : Vermiculture:

3.1 : Introduction and importance of vermiculture.
3.2 : Collection of earthworms, Types of earthworms.
3.3 : Easblishment of Vermiculture unit.
3.4 : Earthworm as a tool for organic waste management and as fish and poultry feed.
3.5 Vermiwash : vermicompost, vermiprotein.

Module 4 : Dairy Technology:

4.1 : Importance and scope of Dairy.
4.2 : Dairy breeds and their Management: Cattle breeds; Milk breeds; Draught breeds; Exotic breeds; Buffalo breeds.
4.3 : Principles and methods of breeding; Inbreeding; Out breeding, cross breeding and artificial insemination.
4.4 : Dairy products: Processing and preservation of milk and milk products.
4.5 : Dairy pathology: Viral, Bacterial diseases.

Module 5 : Poultry Farming:

5.1 : Importance and scope of poultry; Poultry breeds.
5.2: Techniques and methods of breeding.
5.3: Poultry products: Egg, Meat, feather, excreta, nutritive value of egg and meat.
5.4: Poultry pathology: Viral, Bacterial, fungal diseases.

Practicals:

1. Study of morphology and life cycle of silk worm, *Bombyxmori*
2. Disect and display of digestive system of silk worm
3. Mounting of silk glands
4. Study of different cocoons and plants of silk worms
5. Study of Silk worms diseases
6. Study of bee keeping apparatus
7. Dissect and display of digestive system of honey bee
8. Mounting of , mouth parts ,stinging apparatus and venom gland, wax gland, pollen brush and basket in honey bee
9. Dissect and display digestive system and nervous system of earthworm: study of types of earthworm.
10. Mounting of setae, and spermatheca in earthworms
11. Study of dairy breeds and their common diseases
12. Study of poultry breeds and their common diseases
13. 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

THIRD SEMESTER

20ZOO31 : ANIMAL BEHAVIOUR

Preamble : Many of us derive inspiration from watching natural history documentaries and their outstanding catalogue of wild animal behaviors. In this course, we will explore how scientists study animal behavior, and in particular how behavior is shaped by the evolutionary forces of natural and sexual selection. This course will help the students to understand the remarkable behaviors 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 : Significance of animal behaviour,
1.4 : Neural aspects of behaviour.

Module 2 : Types of animal behavior:

2.1 : Types of behaviour: Innate and acquired behaviour
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, drive, models of motivation, stress.
3.2 : Migration and homing with special reference to birds.
3.3 : Optimal foraging theory.
3.4 : Chemical, visual, tactile and audio communication functions of communication.

Module 4 : Ecology and Behavior:

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

Module 5 : Chronobiology:

5.1 : Chronobiology - Introduction, history and milestones.
5.2 : Biological rhythms - circadian and circannual rhythms.
5.3 : Camouflage and mimicry- types of mimicry.
5.4 : Application of pheromones and their biological actions in invertebrates and vertebrates.

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
7. Stereotyped Behaviour
   a. Greylag goose /Imprinting
   b. Stickleback fish
   c. Herring gull
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. To study the geotaxis, phototaxis, chemotaxis and hydrotaxi of earthworm.
12. 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 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.

20ZOO32 : EMBRYOLOGY AND 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 Hrs

Module 1 : Introduction:

1.1 : Theories of developmental biology.
1.2 : Scope and branches of developmental biology.
1.3 : Classification of eggs based on different criteria.
1.4 : Stages of animal development.

Module 2 : Gametogenesis, Fertilization and Early Development:

2.1 : Gametogenesis - Spermatogenesis and oogenesis, structure of gametes (Sperm and Egg).
2.2 : Fertilization - Types, mechanism and significance.
2.3 : The early development of drosophila and Sea urchin.
2.4 : The early development of frog, chick and human being.

Module 3 : Metamorphosis, Regeneration and Parthenogenesis:

3.1 : Morphological and biochemical changes during insect metamorphosis.
3.2 : Morphological and biochemical changes during amphibian metamorphosis, Neoteny.
3.3 : Regeneration in planaria and salamender.
3.4 : Parthenogenesis - Definition, types and significance.

Module 4 : Implantation, placenta and Teartology:

4.1 : Implantation - Types, mechanism and hormonal regulation.
4.2 : Foetal membranes – Types, structure and function.
4.3 : Placenta – Types, structure and functions.
4.4 : Tartology - Introduction, Principles and tartogenic agents.

Module 5 : Experimental Embryology:

5.1 : Nuclear transplantation experiment in frog.
5.2 : In-vitro fertilization and embryo transformation experiment in man and test tube baby.
5.3 : Animal cloning experiment in mammals (Dolly).
5.4 : Stem cells - Introduction, Types and Applications; Amniocentesis.

Practicals :

1. Types of eggs (Insect egg, Fish egg, Frog egg, Snake egg, Chick egg and Mammalian egg).
2. Development of frog eggs (Cleavage, Late cleavage, Blastula, Gastrula Tadpole Larva).
3. Metamorphosis in Frog.(Gosnear 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 (Silkmoth and Mosquito).
8. Observation normal and abnormal male gametes.
9. Visit to IVF centre - Procedure and Limitations.
10. 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.

20ZOO33 : ENVIRONMENTAL BIOLOGY AND TOXICOLOGY

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 (Nitrogen, Carbon and Phosphorus 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 (PCB)

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 and 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 : Social issues and the environment:

5.1 : Environmental movements : Chipko, appiko, silent valley, bishnoi of rajasthan. Rain water harvesting.
5.2 : Watershed management, human rights, rights of animals. Reduce, reuse and recycle.
5.3 : Environment protection act. Wildlife protection act, forest conservation act.
5.4 : Public awareness, using an environmental calendar of activities.

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. Submission of tour report.
12. 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.

20ZOO341 : GENERAL 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 : 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 : Artificial respiration.

Module 3 : Circulation and Excretion:

3.1 : Structure, function and neurohumoral regulation of circulation.
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 : 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, Neuromuscular junction and neurotransmitters.
4.4 : Structure and functions of sense organs: Vision, hearing and tactile response.

Module 5 :Immunology and Thermoregulation.

5.1: Innate and acquired immunity.
5.2 : Structure and functions of immune cells, tissues and organs.
5.3 : Immunopathology : Allergy, hypersensitivity and immunodeficiency.
5.4: Types of thermoregulation, comfort zone, body temperature, physical, chemical, neural regulation, acclimatization.

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.

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.

20ZOO342 : ANIMAL CELL 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 : Basics of Animal Cell Biotechnology:

1.1 : Biotechnology : Concept, history, scope and current status of biotechnology.
1.2 : Cell culture : Types, applications and laboratory techniques in animal cell culture.
1.3 : Culture media : Types of culture media. Cell lines and storage.
1.4 : Stem cell : Types and properties of stem cells, differentiation of stem cells. Advantages and disadvantages of stem cell technology.

Module 2 : Applied Animal Biotechnology:

2.1 : Gene cloning : Gene cloning methods; Molecular tools; Restriction enzymes, ligases and other enzymes, cloning vectors (Plasmid, Phagemids, Phage, Cosmid, BAC, YAC and HAC). Applications of gene cloning.
2.2 : Selection and screening of transformed cells : Gene cloning strategies; Generation of genomic and cDNA libraries; Applications of genomic and cDNA libraries.
2.3 : Gene transfer techniques : Transformation, Microinjection, Electroporation, Lipofection and Retroviruses.
2.4 : Animal cloning : Somatic cell nuclear transfer (SCNT) in Dolly. Advantages and disadvantages of SCNT.

Module 3 : Transgenic Animals and Gene Therapy:

3.1 : Transgenic animals: Applications and Genetically modified organisms (GMO's) pig, cow, chickens and fishes (any two).
3.2 : Gene targeting: Gene knock out and knock in technology (Bacteria, Sea urchin and Mice), Gene silencing;
3.3 : Gene therapy Methods: Somatic and germ line therapy; applications of gene therapy.
3.4 : Gene therapy in adult animals and embryos.

Module 4 : Applications of Animal Biotechnology:

4.1 : Hybridoma technology production and applications of monoclonal antibodies (MAbs).
4.2 : Recombinant vaccines : preparation and role of genetic engineering in the production of vaccines.
4.3 : Genetic engineering for the production of Insulin, Lactalbumin and Somatostatin.
4.4 : Applications of rDNA technology.

Module 5 : Techniques in Molecular Biotechnology:

5.1 : Electrophoresis : Definition and types (AGE, PAGE, One and two dimensional gel electrophoresis) and Electrofocussing;
5.2 : Blotting Techniques : Southern blotting and Western blotting techniques.
5.3 : Polymerase chain reaction : methods and applications
5.4 : Nanobiotechnology: Nanoparticles: Properties, synthesis, characterization and applications of nanotechnology

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. Separation of Amino acids by paper chromatography
5. Identification of bacteria's through Gram's staining method
6. Cell viability test by using trypan blue
7. Extraction of DNA and RNA from animal tissues
8. Isolation of Casein, Lactose, and Albumin from Milk
9. Isolation and characterization of microbes useful in Fermentation
10. Methods of cultivating Bacteria and Fungi
11. Protozoan's culture in laboratory as a model for cell culture preparation of different types of media and preparation of buffers.
12. Demonstration and principle of Agarose Gel Electrophoresis, PAGE.
13. Demonstration of instruments used in Animal Biotechnology
14. Any other practical depending upon feasibility

Refrences:

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