DAVANGERE UNIVERSITY



Syllabus for

MASTER OF SCIENCE IN ZOOLOGY

Choice Based Credit System (CBCS)

Effective From -2014-15

DEPARTMENT OF STUDIES IN ZOOLOGY DAVANGERE UNIVERSITY DAVANGERE-577007

DAVANAGERE UNIVERSITY SYLLABUS OF M.SC. ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER

Introduction

Davanagere University has semester scheme for post graduate degree program. The University also has Choice Based Credit System (CBCS) for post graduate courses. In view of this, The P.G. Board of Studies in Zoology has prepared the syllabus and scheme of examination for CBCS. One paper has been identified as Electives which can be opted by students of other programmes. The students of M.Sc. Zoology who would like to opt for credits from other departments shall choose an elective in lieu of this paper only. The elective paper is:

III Sem. Parasitology and Vector Biology

The details of Scheme of Teaching and Examination are given separately. The regulation and scheme of examination are prepared as per the guidelines issued by the University. Care has been taken and the syllabus has been designed to train the students for NET examinations, competitive examinations and public speaking necessary for a teacher/scientist.

Chairperson, P.G. BOS
Chairman
PGBOS in Zoology

Davanagere University

Davangere University Department of Studies in Zoology M.Sc. Zoology (CBCS) Course Structure (2014-15 onwards)

I Semester

Paper code & Title	Teaching Hrs/Week	Exam hrs	Marks Exams	Marks IA	Total Marks	Credits
ZOO1.1: Systematics and Anatomy	4	.3	75	25	100	4
ZOO1.2: Biological Chemistry	4	3	75	25	100	4
ZOO1.3: Comparative Physiology	4	3	75	25	100	4
ZOO1.4: Molecular Cell Biology	4	3	75	25	100	4
ZOO1.5: Lab: Systematics and Anatomy	4	3	40	10	50	2
ZOO1.6:Biological Chemistry	4	3	40	10	50	2
ZOO1.7:Lab:Comparative Physiology	4	3	40	10	50	2
ZOO1.8:Lab:Molecular Cell Biology	4	3	40	10	50	2
Total					600	24
Seminar	. 1	-	-	25	25	1
		^	. 4			25

II Semester

Paper code & Title	Teaching Hrs/Week		Exam hrs	Marks Exams	Marks IA	Total Marks	Credits
ZOO201: Basic and Applied				** 1			
Entomology		4	2	75	25	100	4
ZOO2.2: Environmental	1	Ē					
Pollution and Toxicology		4	2	75	25	100	4
ZOO2.3: Ecology		4	2	75	25	100	4
ZOO2.4: Develomental Biology		4	2	75	25	100	4
ZOO2.5: Lab:Entomology		4	3	35	15	50	2
ZOO2.6:Lab:Environmental		ν.					
Pollution and Toxicology		4	3	35	15	. 50	2
ZOO2.7: Lab: Ecology		4	3	35	15	50	2
ZOO2.8: Lab: Develomental							
Biology		4	3	35	15	50	2
Total						600	24
Seminar		1	-	-	25	25	1
							25

III Semester

Paper code & Title	Teaching	Exam	Marks	Marks	Total	Credits
	Hrs/Week	hrs	Exams	IA	Marks	
ZOO3.1:Parasitology and vector						
Biology (Elective)	4	2	75	25	100	4
ZOO3.2:Immunology	4	2	75	25	100	4
ZOO3.3:Genetics	4	2	75	25	100	4
ZOO3.4:Fisheries And						
Aquaculture	4	2	75	· . 25	100	4
ZOO3.5:Lab-Parasitology and						
vector Biology	4	3	40	10	50	2
ZOO3.6:Lab-Immunology	4	3	30	10	50	2
ZOO3.7:Lab-Genetics	4	3	40	10	50	2
ZOO3.8:Lab-Fisheries And						
Aquaculture	4	3	40	10	50	. 2
Total					600	24
Seminar	1	-	-	25		1
						25

AZ 501 is for students from others courses opting for a choice paper.Students of M.Sc. Zoology shall opt for a choice paper offered by other department

IV Semester

Paper code & Title	Teaching Hrs/Week		Exam hrs	Marks Exams	Marks IA	Total Marks	Credits
ZOO4.1: Animal cell							
Biotechnology		4	2	70	25	100	4
ZOO4.2:Microbiology		4	2	70	25	100	4
ZOO4.3:Neurobiology And							
Behivour		4	2	70	25	100	4
ZOO4.4:Biodiversity And Wild							
life Management		4	2	70	25	100	4
ZOO4.5:Lab- Animal cell							
Biotechnology		4	3	40	10	50	2
ZOO4.6:Lab-Microbiology		4	3	40	10	50	2
ZOO4.7:Lab-Neurobiology And Behivour		4	3	40	10	50	2
ZOO4.8:Lab-Biodiversity And Wild life Management		4	3	40	10	50	2
Total						600	24
Seminar		1	-	-	25		1
							25

Calculation of Cumulative grade point average (CGPA)

The Calculation of Cumulative grade point average (CGPA) at the end of 4th semester shall be calculated as the weighted average of the semester GPW. The CGPA is obtained by dividing the total of GPW of all four semesters by the total credit for the programme.

ILLUSTRATION								
Semester	I	II	Ш	IV	Total			
Semester alpha sign grade	A+	A++	A+	A++	_			
Semester GPA	7.63	. 8	8.13	8.5	_			
Semester credits	25	25	25	25	100			
Semester GPW	190.8	200	203.3	212.5	806.5			

Cumulative grade point average (CGPA) Total of semester GPW/Total credits for the programme 806.5/100 =8.07 Programme alpha sign grade:A++

Calculation of Cumulative grade point average (CGPA)

The Calculation of Cumulative grade point average (CGPA) at the end of 4th semester shall be calculated as the weighted average of the semester GPW. The CGPA is obtained by dividing the to GPW of all four semesters by the total credit for the programme.

ILLUSTRATION							
Semester	I	II	III	137	-		
Semester alpha sign grade	A+	A++		IV	Total		
Semester GPA	7.63	Air	A+	A++			
Semester credits		8	8.13	8.5			
Semester GPW	25	25	25	25	100		
Semester Gr W	190.8	200	203.3	212.5	806.5		

Cumulative grade point average (CGPA) Total of semester GPW/Total credits for the programme 806.5/100 =8.07

Programme alpha sign grade:A++



I. Program outcomes:

1: Understand the fundamental aspects of animal sciences, and interpret the complex interactions among various living organisms and Correlate the physiological processes and the functional significance of organ systems.

2: Gain in-depth knowledge about classification, organization, origin and evolution of organisms and their phylogenetic interrelationships.

3: Recognize the need for conservation of the environment, biodiversity and endangered species.

4: Gain knowledge about agro-based small scale industries like sericulture, apiculture, fish, dairy and poultry farming and vermicompost preparation.

II. Program Specific outcomes:

1: Students will be well-versed with the knowledge, tools and methods applied in the field of animal sciences. They would have plethora of job opportunities in the education, health-based sectors, environment, and agriculture related sectors.

2: Students will be made competent to undertake competitive exams successfully. The broad skills and the deeper knowledge in the field would make them highly successful and excellent researcher in advanced areas of research in the Biological sciences.

3: Develop the ability to participate in academic discussions.

III. Course outcomes:

ZOO 1.1 Systematics and Anatomy

- Understand, identify and classify animals and gain in depth knowledge of taxonomic keys, different hierarchies and rules of animal's nomenclature.
- 2. Gain experience about practical collection, curating, cataloging and processing of taxonomic non-chordate species, their physiological processes such as movement, respiration, excretion, nervous system, reproductive system and circulation.
- 3. Acquire knowledge to create phylocode, grades, clades, and cladistics and learn different biometric techniques.
- 4. Identify the different larval forms and their importance in the process of evolution.

ZOO 1.2 Biological Chemistry

- 1. Describe the aspects of scope and principles of biogical chemistry and interaction of biomolecules, carbohydrates, configuration, classification of proteins and structural organization.
- 2. Learn about lipid organization, biosynthesis, enzyme concept and applications.
- 3. Describe the physical nature, chemical properties and detailed structures of amino acid.
- 4. Learn about enzyme kinetics and its clinical applications. Gain in depth knowledge about nucleic acids and metabolism disorders.

ZOO 1.3 Comparative Physiology

- 1. Understand the concept of physiology of digestion and absorption of different biomolecules.
- 2. Discuss about the patterns of respiration and circulation in animals and understand the importance of osmotic regulation and excretion.
- 3. Comprehend the physiological mechanisms involved in endocrinology.
- 4. Appreciate the regulatory mechanisms of body temperature in animals.

ZOO 1.4 Molecular Cell Biology

- 1. Recognize the importance of cell theory and get an insight into viruses' structure and their classification.
- 2. Understand the process of cell signalling. Understand the mechanism of gene regulation in prokaryotes and eukaryotes.
- 3. Gain knowledge structural organization of cell contents.
- Learn the principles behind working of instruments like microscopes, cytological and histochemical techniques and advanced methods used in cell biology studies.

ZOO 2.1 Basic and Applied Entomology

- 1. Acquire knowledge about origin, evolution, diversity, importance of insects, insect collection, processing and preservation.
- 2. Gain knowledge about pests, pests monitoring and management and insect-plant interactions.
- 3. Learn about various methods of insect control, insecticides and insect resistance.

 Appreciate insects of economic importance and describehousehold pests, pests of stored products and their infestation. Students get awareness about medical entomology and parasitic diseases.

ZOO 2.2 Environmental Pollution and Toxicology

- 1. Understand the concept of biosphere, chemical evolution of life and hydrological cycle.
- 2. Get the knowledge of different types of pollution and awareness about their control.
- 3. Understand the concepts about toxicology and dosage response in animals concerning biotransformation and bioaccumulation.
- 4. Learn different methods used in toxicological studies.

ZOO 2.3 Basic and Applied Ecology

- 1. Understand and organize the fundamental concepts in ecology and structure, functions and importance of different ecosystems and comprehend the concepts related to energy, energy flow, productivity, and energy based classification of ecosystem and differentiate between different ecological pyramids.
- 2. Study in depth about zonation and zonal distribution of animals in aquatic ecosystem and their collections.
- 3. Understand the adaptations of animals for different mode of life along with bioluminescence and echolocation.
- 4. Describe basic types of biogeochemical cycles.

ZOO 2.4 Developmental Biology

- 1. Understand the mechanisms involved in regulation of developmental process in organisms.
- 2. Understand the process of fertilization and sex determination in different animals.
- Acquire knowledge about environmental and chemical disruption of normal development and understand the importance of genes and their expression patterns in determination of body axis in *Drosophila* and mammals.
- 4. Gain knowledge about hormones and their receptors and mechanisms of signal transduction in cell death and neuron formation.

ZOO 3.1 Parasitology and Vector Biology

1. Gain basic knowledge about pathogenic micro-organisms of man and domestic animals.

- 2. Recognize the pathogenicity of Protozoans, Nematodes and Trematodes and learn about treatment process and preventive measures.
- Understand the life cycle of some of the pathogens and roles played by vectors in transmission of diseases like malaria, filaria, dengue etc.
- 4. Comprehend the importance of vector in disease management and importance of Arthropod vectors.

ZOO 3.2 Immunology

- Gain basic knowledge about the immune system and types of immunity.
- 2. Understand the role of immunogens, epitopes and their importance in immunity.
- 3. Elucidate the importance of B and T cells in immune response.
- 4. Have an understanding role of immune system in marinating health and overcome diseases.

ZOO 3.3 Genetics

- 1. Understand the basics of Mendalian genetics and the mechanism of gene regulation in prokaryotes and eukaryotes.
- 2. Understand about chromosomes, role of genes in development, sex determination, sex-linked inheritance in *Drosophila* and man.
- 3. Understand Gain knowledge on banding technics, dermatoglyphics, human karyotyping and its applications in various diseases and syndromes.
- Understand the patterns of inheritance and gene interactions and learn different biostatics techniques used in biology.

ZOO 3.4 Fisheries and Aquaculture

- Learn in detail about identification of different types of fishes and fisheries.
- 2. Gain knowledge about different types of aquaculture techniques.
- Understand about feed, water quality and disease management for aquaculture.
- Develop skills on fish processing, preservation, marketing techniques of fish and fish by-products.

ZOO 4.1 Microbiology

- 1. Acquire knowledge about scope, history and developments in microbiology.
- 2. Understand about microbial metabolisms, process and importance of fermentation.
- 3. Gain in depth knowledge about food microbiology.
- 4. Gain knowledge about soil, aquatic, aerial microbes and their estimations and their contribution towards human welfare.

ZOO 4.2 Neurobiology and Behaviour

- 1. Acquire the knowledge of nervous system and its functioning.
- 2. Understand the molecular basis of functioning of motor system and their disorders.
- 3. Have an insight into behavioural patterns in animals and molecular mechanism of learning and memory.
- 4. Understand the significance of olfactory communication, sound and speech production, and different ways of communication in animals.

ZOO 4.3 Biodiversity, Conservation and Biostatistics

- 1. Understand the concept and importance of biodiversity and biodiversity at different levels.
- 2. Monitor and evaluate biodiversity in field studies and understand the realms of the world and hotspots of India and biodiversity and explore unique animals of Indian biodiversity and distribution and get an awareness about endemic and keystone species.
- 3. Learn the capturing andmarking techniques which would help in during fieldworks involvingcensus and monitoring the health status of wild animals in national parks, sanctuaries and salt water lakes and understand about reasons for loss of biodiversity, different social movements and methods of conservation.
- 4. Get enlightened about different biodiversity conventions, laws and projects for conservation of different wild animals and learn about different statistical procedures, graphical representation for analysis of biological data/samples.

ZOO 4.4 Project Work

- 1. Gain practical knowledge about identification of the research problem and application of appropriate research methodology to achieve goals.
- 2. Develop skills in handling of research animal models, biological techniques and undertake successful field studies.
- 3. Learn tools for data collection and analysis.
- 4. Acquire skills related to scientific writing and preparation of dissertation.

I - SEMESTER

Zoo 1.1- ANIMAL SYSTEMATICS and ANATOMY

12X5=60 Hours

UNIT - I

Importance of Systematics and Taxonomy Goals, task & problems of a taxonomist - challenges in taxonomy Taxonomic characters -modern approaches Taxonomic ranks

UNIT- II

ICZN - origin of the code; major rules governing nomenclature

Biocode -the integrated biological nomenclature

Phylocode. Methods for collection, preservation and cataloguing of insects. Types of identification keys

Methods for inferring phylogenies - Maximum parsimony, Maximum likelihood, Neighborjoining, UPGMA and Bayesian inference -limitations

Biometric techniques in taxonomy, Molecular phylogenetics -DNA barcoding, Phylogenetics software used to produce phylogenetic trees, Interpretation of phylogenetic trees.

Unit III

Integument -Gross anatomy of integument of vertebrates and their derivatives. Skeleton -Components of head skeleton, types of jaw suspensions, cranial kinesis, structure of vertebrae general plan, Evolution of spine, evolution of paired appendages, pectoral and pelvic girdles. Ribs and sternum of fishes and tetrapods. Muslce - muscles of primary swimmers, axial, hypobrachial, appendicular and branchial muscles of tetrapods.

Unit IV

Excretory organs - organs of excretion among invertebrates. Gross anatomy and evolution of

Respiratory structures - general structure and types of internal gills External gills, lungs and gas bladders of fish.

Unit V.

Circulation,- heart of vertebrates-evolutionary modifications.. Evolution of major aortic and venous systems. Vascular system in invertebrates. Digestive tract in relation to food habits. Evolutionary features

REFERENCES:

Kapoor V. C (2008) Theory And Practice Of Animal Taxonomy Oxford & IBH Pub.Co

- 2. Simpson G G (1961) Principles of animal taxonomy Columbia University Press
- 3. Pollard J W (1985) Evolutionary theory Paths into the future John Wiley & Sons
- 4. Scott Freeman & Herron Jon C (1998) Evolutionary analysis, Prentice Hall, New Jersey
- 5. Michael White J. D (1978) Modes of speciation W.H Freeman
- 6. Hickman Cleveland P, Roberts Larry S (Jr) & Larson Allan (1995) Integrated principles of Zoology. 9th Edition WBC Brown publishers
- 7. Hickman Cleveland P, Roberts Larry S (Jr) & Larson Allan (1995) Integrated principles of Zoology. 9th Edition WBC Brown publishers
- 8. Armugam N (1986) Essentials of evolution Saras Publication

Unit - I

Classification, structure and properties of Carbohydrates-Monosaccharides – Glucose, Fructose and Galactose. Disaccharides – Maltose, Lactose, Sucrose, Cellobiose and Trehalose Polysaccharides – Glycogen, Starch, Cellulose and Inulin. Heteropolysaccharides – Hyaluronic acid, chitin, heparin, chondroitin and keratin sulfate. Physiologically important carbohydrates.

UNIT - II

Lipids-Classification, structure and properties of fatty acids, triglycerides. Oxidation of fatty acids $-\beta$ oxidation, regulation and disorders. Palmitate biosynthesis and its regulation. Bile salts and bile pigments. Ketone bodies and their importance.

UNIT -III

Amino acids- classification, chemical nature and properties. Classification of proteins, physical-chemical properties, structure – primary, secondary, tertiary and quaternary. Protein synthesis Metabolism of aromatic amino acids.

Laboratory synthesis of peptides.

Laboratory synthesis of peptides.

Protein Targeting & Degradation

Protein folding - Diseases of protein misfolding

UNIT - IV

Classification of enzymes.

Enzyme Kinetics

Factors affecting enzyme catalyzed reactions.

Enzyme inhibition.

Allosteric regulationss of E-activity

Co-enzymes, metalloenzymes, isoenzymes and Multienzyme complexes.

Clinical applications of enzymes.

UNIT -V

Nucleic acids – Classification, chemical nature and structure.

Nucleosides, nucleotides, nucleoside analogs and polynucleotides.

Biosynthesis of purines and pyrimidines.

Salvage pathway.

Disorders of nucleic acid metabolism.

REFERENCES:

1. Conn. E.E. Stumpf P.F. Bruening G and Dooi R,.H (1995) Outlines of Biochemistry. John Wiley and Sons, Singapore.

2. Garrett R.H. and Grisham C.M. (1995) Biochemistry, Saunders College Publishing.

Florida.

3. Murray R.K., Granner D.K., Mayes P.A. and Rodwell (1988) Harper's Biochemistry XXIst edn. Prentice Hall International Inc. Connecticut.

4. Sadasivam S. and Manickam (1996) Biochemical Methods, New Age International

Publishers, New Delhi.

Varely H.(1980) Practical Clinical Biochemistry VI CBS Publishers

6. Devlin, T.M. 1993. Text Book of Biochemistry with clinical Correlations, Wiley-Liss, Inc., New York.

Wilson, K. and Kenneth H. Goulding, 1987. A Biologist's Guidie to principles and Techniques of Practical Biochemistry, 3rd Edition, English Language Book Society.

P.M. Vasudevan & S.S. Kumari (2001) Tet book of Biochemistry (3rd edn.) Jaypee

Brother publicaation, New Delhi

9. Nelson DL & Cox MM (2005) Lehninger's principle of Biochemistry, W.H. Freeman & Company, New York

Zoo 1.3: COMPARATIVE PHYSIOLOGY

UNIT- I

Digestive Enzymes
Digestion and absorption of carbohydrates, proteins and lipids
Regulatory mechanisms of digestion
Gastro-intestinal motility
Gastro-intestinal disorders

UNIT-II

Comparative study of aquatic and terrestrial respiration Respiration in insects and birds Transport of O_2 and CO_2 Role of Blood as a buffer Haemodynamics

UNIT-III

Ionic and water balance in tissues
Osmoregulation in aquatic, amphibious and terrestrial animals
Patterns of N2 excretion
Urine formation in a nephron
Regulation of renal function

UNIT-IV

Principles of Endocrinology
Mechanisms of water- and lipid soluble hormone action
Hormonal regulation of fuel metabolism
Estrous cycle and its hormonal basis
Endocrine regulation of insect metamorphosis

UNIT - V

Energy balance and thermal physiology
Laws of thermodynamics, Sources of energy, Food intake and its regulation.
Thermal physiology, Thermal adaptation strategies. Heat exchange.
Ectotherms and Endotherms - Thermal regulation mechanisms
Role of hypothalamus in temperature regulation. Heterotherms. Fever.

REFERENCES:

- 1. Schmidt-Nielsen K, 1995, Animal Physiology, Adaptation and Environment. Cambridge University Press.
- 2. Kay I, 1998, Introduction to Animal Physiology, Bios Scientific Publishers, UK
- 3. Verne R.M. and Levy M.N (Eds) (1990) Principles of Physiology, C.V. Mosby Company, St. Louis.
- Campbell et.al (1984) Clinical physiology 5th Edn. Blackwell Scientific Publications, Oxford.
- 5. Dacie I.V. and Lewis S.M. (1984) Practical Haematology, 6th Edn. (International student Edition) Churchill, Livingstone, Edinburgh.
- 6. Ganong U.F. (1989) Review of Medical Physiology, Lange California.
- 7. Guyton A.C. (1991) Text Book of Medical Physiology, VIII edn. Saunders Co., Jovanovich
- 8. Jensen D. (1976) The Principales of Physiology, Appleton Century Crafts, New York.
- Louco G.N. (1993) Physiological Animal Ecology, Longman Scientific and Technical, Essex.
- Oser B.L. (1976) Hawkis Physiological Chemistry 14th edn. (Indian Edition) Tata McGraw-Hill Pub.Co. New Delhi.
- 11. Paganelli C.V. and Farhi L.E. (1989) Physiological Function in Special Environments, Springer Verlag, new York.
- 12. Schmidt Nilsen K. (1994) Animal Physiology, 4th edn. Cambridge University Press, New York.
- 13. Shepherd G.M. Neurobiology- Principales of Neurol Science, E.Kandel and P.Schwartz.
- Wilson I.A. (1979) Principles of Animal Physiology 2nd edn. Macmillan Pub. Co. Inc. New York.

ZOO 1.4: MOLECULAR CELL BIOLOGY $12 \times 5 = 60 \text{ Hours}$

UNIT -1:

Introduction: Historical highlights, cell theory, organization of prokaryotic and eukaryotic cells.

Viruses - Structure and classification of animal viruses, Reverse

transcription (Teminism). bacterial viruses - structure, lysogenic and lytic life cycle, transformation experiment.

DNA as a data storage medium, c-value paradox, Structure of DNA and RNA, Replication of DNA in prokaryotes and eukaryotes.

Transcription in prokaryotes and eukaryotes, RNA processing, spliceosomes, interference(RNAi), Si RNA RNA

UNIT -2:

Molecular composition and models of membrane architecture - Davson - Danielli model, Fluid mosaic model, cell-cell adhesion, Cell Junctions

Transport across cell membrane - Diffusion, Active transport, ion pumps, uniports, symports and antiports, membrane potential.

Cell-cell signalling - cell surface receptors, second messenger system signalling from plasma membrane to nucleus, signal transduction.

Structure, origin and evolutionary significance of Mitochondria, Mitochondrial genetic system.

UNIT -3:

Structural organization of nucleus and nucleolus.

Morphology and functional elements of eukaryotic chromosomes-

Centromere, nucleolar organizers, Telomere, heterochromatin and euchromatin.

Molecular organization of chromatin, Nucleosome model

Cytoskeleton - microfilaments, microtubules and intermediate filaments - structure and functions, cilia and flagella.

Endomembrane systems - structure and functions of endoplasmic reticulum. Golgi complex and lysomes - Structure and biogenesis of ribosomes.

UNIT - 4:

Cell-cycles and cell division: Phases of cell-cycle, cyclins and cyclin Regulation of Cdk - cyclin activity. dependent kinases,

Molecular aspects of cell division, Meiotic division and genetic recombination, Mitotic

Cell differentiation - Definition, General characteristics of cell differentiation (nucleocytoplasmic) Inductive interactions with neighboring cells - extrinsic (environmental) effects on differentiation.

Microscopy – Bright and dark field microscopy phase contrast, fluorescence, scanning & transmission electron microscopy – Principle, methods and applications

Cytological and histochemical techniques: Fixatives and stains. Hematoxylin-Eosin staining, staining techniques for the localization of proteins, and carbohydrates in tissue sections.

Southern, Northern and Western blot techniques, DNA finger printing, FISH, Chromosome painting.- Principle, methods and applications

Polymerase chain reaction, DNA sequencing, Autoradiography - Principle, methods and applications

REFERENCES:

- 1. Carl P. Swanson (1989) Cell: V edition, Prentice-Hall Publishers, New Delhi.
- 2. Geoffery Cooper M.(1997) The Cell: The Molecular approach, ASM Press, Washington.
- 3. E. D. P. De Robertis, E. M.F. De Robertis (1995) Cell and Molecular Biology, VIII edition, Indian edition.
- 4. Philip, Sheeler (1987) Cell and Molecular Biology, III edition, John Wiley New York.
- Gerald Karp (1996) Cell and Molecular Biology: Concepts and experiments, John Wiley, New York.
- 6. J. M. Ashwerth (1975) Cell differentiation, Chapman and Hall Publishers, London.
- 7. C. P. Swanson and P. L. Webster (1989) The Cell, V Edition, Prentice Hall of India, New Delhi.
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- 9. C. J. Avers (1986) Molecular Cell biology, Addison Wasley Publishing Co., England.
- 10. J. Brachet (1985) Molecular Cytology, Vol.I and Vol.II The Cell Cycles, Academic press Inc.,
- J. E. Celis, (1994): Cell Biology a laboratory hand book, Vol.I, II and III, Academic press.
- 12. J. H. Darnell, Lodish and D. Baltimore (1995) Molecular Cell Biology, Scientific American Books, New York.
- D. Friefelder (1987) Molecular Biology, II Edition, Jones and Barlett Publishers Inc., Boston.
- 14. L. J. Kleinsmith and Valeri M. Kish (1995) Principles of Cell and Molecular Biology, II edition, Harper Collins College publishers.
- 15. B. Lewin (Ed) 1996) Genes, VII edition, John Wiley and Sons, New York.
- 16. David E. Sadava (1993) Cell Biology Organelles, Structure and function, Jones and Bartlett publication.
- 17. R. Schlief (1986) Genetics and Molecular Biology, Addison WasleyPublishing
- J. D. Watson, N.H. Hopkins, J.W. Roberts, J.A. Steitz and A. M. Weiner (1987)
 Molecular Biology of the Gene, Vol.I & II general principles, IV edition, The
 Benjamin Cummings Publishing Co., Inc.,

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I - SEMESTER PRACTICALS

Zoo 1.5- SYSTEMATICS and ANATOMY - LAB 4 Hours / Week

- 1. Construction of dichotomous key
- 2. Construction of phenogram
- 3. Construction of cladogram
- 4. Identification of major groups of Formicidae -using identification key
- 5. Identification of major Elasmobranchs -using identification key
- 6. Microscopic anatomy of artery, vein, lung, kidney, oesophagus, stomach, intestine, liver, testis and ovary of frog
- 7. Fixation of tissue and preparation of paraffin block
- 8. Preparation of paraffin slides
- 9. Staining of paraffin slides
- 10. Osteology.

Zoo 1.6: BIOLOGICAL CHEMISTRY - LAB

4 hours/week

- 1. Color reactions of monosaccharides.
- 2. Color reactions of disaccharides.
- 3. Color reactions of polysaccharides.
- 4. Identification of unknown carbohydrate.
- 5. Colorimetry.
- 6. Estimation of blood glucose.
- 7. Estimation of free fatty acids.
- 8. Estimation of cholesterol.
- 9. Flourimetry
- 10. Flame photometry
- 11. Paper chromatography for sugars.
- 12. Column chromatography

Zoo 1.7 COMPARATIVE PHYSIOLOGY -LAB

4 hours/week

- 1. Determination of glucose by glucose oxidase method
- 2. Detection of excretory products in urine
- 3. Active uptake of indigocarmine by Malpighian tubules
- 4. Starvation and liver glycogen levels
- 5. Determination of Respiratory quotient

- 6. Reproductive systems of insects
- 7. Collection of insect eggs and study of their development
- 8. Neuroendocrine cells of insects.
- 9. Ascorbic acid and its metabolites in urine
- 10. Hydrolysis of starch

Zoo 1.8: MOLECULAR CELL BIOLOGY - LAB

4 hours/week

- 1. Microscopy
 - 2. Study of mitosis in Allium cepa
 - 3. Meiosis in grasshoppers
 - 4. Preparation of mitotic chromosomes from bone marrow cells of rodents.
 - 5. Sperm abnormality assay in mice
- 6. Staining of blood cells to study the types of blood cells and differential counting of blood cells.
- - 8. Isolation of RNA from yeast
- 9. Isolation of DNA from liver/spleen, Thymus of rodents

10.Reading of DNA sequence from autoradiogram.

G REGISTRAR

Davangere University Davangere - 577 002

PAPER 2.1: BASIC and APPLIED ENTOMOLOGY

60 hrs

12

Unit 1. Insect Taxonomy

Taxonomic keys, Evolution of insects, Features of insects – chitin, trachea, flight, eclosion. Major insect orders, families. Insect collection, mounting and display.

Unit 7. Pests, pest monitoring and management, Insect-plant interaction

12 hrs

- a) Pest- Definition, categories, causes for outbreak, general equilibrium position, economic damage, economic injury level, economic threshold level, losses caused by pests.
- b) Pest monitoring- pest surveillance, forecasting, survey and sampling techniques, crop loss estimation
- c) Integrated pest management (IPM)-Definition, concepts, goals and strategies of IPM, key components of IPM, IPM program development and models.
 - d) Host plant and insect interaction- Plant nutrition and secondary metabolites, host plant resistance mechanisms- ecological and genetic resistance, genetically modified resistant plants, sequestration and detoxification in insects.
 - e) **Pheromones-** Types, chemical characteristics, pheromone olfaction mechanisms, biosynthesis of pheromones, pheromone application in pest management, pheromone traps and lures.

Unit 3. Insect control, Insecticides and insect resistance:

12

- a) Insecticides- Nomenclature, types (stomach/contact poisons, systemic insecticides; organochlorines, organophoshates, carbamates, pyrethroids, inorganics, botanicals, synergists, fumigants, insect growth regulators), formulations, toxicity parameters- LD₅₀, LC₅₀, LT₅₀, KD₅₀, ED₅₀/EC₅₀, safety measures, advantages and disadvantages of pesticides.
- b) Insect resistance- History of resistance, cross and multiple resistance, resistance development, resistance mechanisms and management.
- c). Biological control. History, concepts, classical examples, natural and biological control, predators, parasitoids, entomopathogenic microorganisms, entomophagous nematodes, biopesticides, exotic biocontrol agents, augmentative and conservation biocontrol, advantages and disadvantages of biological control.

Unit B. Insects of economic importance:

12 hrs

- a) Household pests- House fly, cockroaches, bed bugs -biology, economic importance and management.
- b) Pests of crops- Rice, vegetables, mango, coffee, coconut, cotton and sugarcanebiology, damage and management of major pests.

c) Pests of stored products- Rice weevil, Pulse beetle, and Rice moth -biology, damage and management.

d) Honey bees- Honey bee species, role of bees in pollination, bee keeping and

management practices, bee products, pests of honey bees.

e) Silkworm- Silkworm species, silkworm rearing and management practices, pests of silkworms.

f) Lac insect- Bioecology of lac insect, host plants and lac cultivation.

Unit 5. Medical entomology and parasitic diseases:

12

a) Vector biology and human parasites- Malaria, filariasis and leishmaniasisdistribution and biology of vectors and parasites, host-parasite interactions and co-evolution, defense mechanisms, epidemiology and control.

b) Arboviral diseases- Yellow fever, dengue, Japanese encephalitis and Kyasanur Forest Disease (KFD)-epidemiology, vector biology and management.

c) Molecular parasitology: Molecular mechanisms of susceptibility and resistance, immunity and immune responses.

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Biology (Academic Press: USA)

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- 23. Silver J B 2008 Mosquito ecology 3rd ed. (Springer)
- 24. Smyth J D 1994 Animal Parasitology (Cambridge University Press)
- 25. Tautz J 2008 The Buzz about bees 1st ed. (Springer)
- 26. Van Emden H F and Peakall D B 1996 Beyond Silent Spring: Integrated Pest Management and Chemical Safety (Chapman & Hall: London)
- 27. Winston M 1984 The Biology of the honeybee (Harvard Uni. Press: London, UK)

Zoo 2.2 Environmental Pollution and Toxicology

Unit 1: Concept of Biosphere: Components – Pedosphere, Hydrosphere, Atmosphere. Hydrological Cycle. Chemical evolution of life. Soil characteristics and soil pollution – sources, effects and mitigation. Solid waste: Sources, collection, transport, disposal and recycling.

Unit 2: Air pollution, effects. Ozone hole. Acid rain, global warming and climate change. Its biological and ecological effects. Photochemical smog. Guidelines for industrial establishments.

Unit 3: Water pollution: Causes, effects and mitigation. Drinking water purification process. Waster water treatment, Anaerobic digester, activated sludge plants. Trickling filter, Rain water harvesting.

Unit 4. Dose-response relationships. Acute and chronic toxicity. Pharmacokinetics and half life. Factors influencing toxicity – route of administration, age, metabolism. Tissue specific toxiticity. Bioaccumulation, biotransformation. Xenobiotic metabolism, metabolizing enzymes, conjugation, excretion.

Unit 5. Toxicity testing, methods. LD and LC 50 determination. ED 50, Toxicity of metals – Lead, mercury, arsenic, cadmium. Pesticide toxicity – organophosphates, Organochlorides, Pyrethroids, carbamates – their mode of action. Antidotal therapy. Microbial and plant toxins. Animal venoms.

REFERENCES:

- 1. W. Dekant and H.G. Neumann (1992) Tissue specific Toxicity: Biochemical mechanisms, Academic Press, Harcourt Brace Fovanovich, Publishers, London.
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- 10. F. Moriarty (1983) Ecotoxicology, II edition, Academic Press, London.
- 11. Duffus J. H. (1980) Environmental Toxicology, Edward Arnold Publishers London.

2.3 Basic and Applied Ecology

Z00 2.3: Basic and Applied ecology
Module 1. Ecological principles and concept of an ecosystems, Biotic and abiotic factors.
Types of ecosystem; marine, fresh water grassland ecosystems, energy from and energy from models, Food chain, food web Eltorian pyramids, ecological succession.

Module 2. Nekton, Benthos Plankton collection and preservations, sedimentary and toxic metal cycles productivity; types estimation of productivity by light and desk bottle method, factors affecting productivity.

Module 3. Adaptations of animals to temperature all light, aeral, volant care and aquatic adaptations Bioluminisence and Echolocation.

Module 4. Population dynamics, structure pattern of population distribution population growth and density, fluctuations and dispersal barriers population and migration. Mutalism, commensalism parasitism synergism, antagonism prey predator relationships.

Module 5. Biogeochemical cycles: Carbon, oxygen, Nitrogen, Phosphorous, sulphur cycles. Renewable energey, Solar, wind, Geothermal. Nuclear energy, Hydroelectric projects.

Zoo 2.4: Developmental Biology

Unit I Life Cycles

Stages of Development, Life Cycle of Frog and *Drosophila*, developmental patterns among metazoan. Developmental mechanics of cell specification., Morphogenesis and cell adhesion.

Unit 2. Fertilization;

Structure of gametes, Egg and sperm recognition, sperm capacitation, Fusion, prevention of polyspermy, egg activation, Rearrangment of cytoplasm. Sex detramination in mammals, *Drosophila* and influence of environmental factors.

Unit 3. Genes and Deveopment

Gene theory – its embryological origin, Genomic equivalence, Differential gene expression during development, Differential gene expression during development, Methylation pattern and control of gene expression, Dosage compensation, Genes and human developmental abnormalities, Polarity, segmentation genes. Homebox.

Unit 4 Cell-Cell communication and development

Induction and competence, Paracrine factors, Cell surface receptors and their signal transduction pathways, Cell death pathways. Interaction between pathways.

Unit5. Neural and muscle development

Neural tube, Neuronal types, Development of vertebrate eye, The neural crest, axonal specificity and pathfinding. Somites and their derivatives, myogenesis, nerve-muscle interaction.

Semester II Practicals

Zoo 2.5: BASIC and APPLIED ENTOMOLOGY

Zoo 2.6 Environmental Pollution and Toxicology

- 1. Determination of LC₅₀.
- 2. Determination of LD₅₀ of a pesticide in mice (Probit analysis).
- 3. Detection of organo-phosphates by chromatography.
- 4. Estimation of catalase activity
- 5. Residual analysis
- 6. Effect of heavy metals on enzyme activity
- 7. Transplacental teratogenesis
- 8. Detection of mercuric chloride by enzyme inhibition.
- 9. Experiments to study the genotoxicity of chemicals

Zoo 2.8 Basic and Applied Ecology

Zoo 2.8: Developmental Biology

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III SEMESTER

THEORY Zoo 3.1 : PARASITOLOGY AND VECTOR BIOLOGY

12X5 =60 Hours

UNIT-I:

General parasitology- Introduction, different types of animal association- parasitism and types of parasites, kinds of hosts, transmission of parasites.

Parasitic zoonosis, epidemiology of parasitic zoonosis, transmission of parasitic infection.

Parasitic adaptations – Behaviour and parasitism- parasitic effects benefiting the parasites, parasitism and life history theory, parasitic effects benefiting the host.

UNIT-II:

Classification of Protozoa with special reference to parasitic forms.

Life cycle and biology of protozoa (pathology and control measures also)

Mastigophora – Trypanosoma, Leishmania, , Chilomastix, Giardia, Trichomonas

Sarcodina – Entamoeba, Lodamoeba

Chilophora – Balantidium

Sporozoa – Toxoplasma, Plasmodium, Babesia

UNIT-III

Classification of helminth parasites
Life cycle and biology of helminth parasites (pathology and control measures also).
Nematoda – Strongyloides, Ancylostoma, Necator, Ascaris, Enterobius, Wuchereria,
Onchocerca, Loa, Dracunculus, Trichiuris, Trichinella.
Trematoda- Polystoma, Schistosoma, Echinostoma, Paragonimus, Clonorchis, Fascioloa
Cestoda - Taenia, Diphyllobothrium, Echinococcus, Dipylidium, Spirometra
Acanth pocephala- Macracanthorhynchus

UNIT-IV

Morphology and life history of insects responsible for disease transmission: Deptera- Culicoides, Aedes, Culex, Anopheles
Siphanoptera: Xenophylla, Ctenocephalides, Echidnophaga, Tunga
Phthirptera – Pediculus, Pthirus
Hemiptera _ Cimex, Triatoma

UNIT-V

Morphology and life history of Acarines-Ticks: Argas, Rhipicephalus, Boopilus, Haemaphysalis Mites: Sarcoptes, Leptotrombidium, Psoroptes, Demdex, Dermanyssus Insects and acarines as vectors of human and animal diseases- Myasis- Venomous Utricating and allergic arthropods- contol measures

REFERENCES:

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- 2. F.E.G Cox (1996) Illustrated History of Tropical diseases, Wellcome Trust London
- 3. Cable R. L (1963): An Illustrated Manual of Parasitology
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- 19. Service M. W (2000): Medical Entomology for Students, Cambridge University Press
- 20. Robert L. S and J. Janovy (2006): Foundations of Parasitology (McGraw Hill)

Zoo 3.2: immunology

UNIT-I

Overview of the immune system Historical perspective
Innate and adaptive immunity
Cells and organs of immune system
The complement system

UNIT - II

Immunogens and immunogenicity
Epitopes and their characteristic properties.
Major histocompatiblity complex
Processing and presentation of antigens

UNIT-III

Structure and functions of antibodies.

B-cell generation, activation and differentiation.

The humoral response

Regulation of immune effector response.

UNIT - IV

T-cell receptor complex and accessory molecules.
 T-cell maturation activation and differentiation.
 T-cell effector response.
 Cytokines and leukocyte activation and migration.

UNIT-V

The immune system in health and disease-Tolerance and autoimmunity Transplantation immunology Vaccines Immunodeficiency

REFERENCES:

- Abbas A. K. and Lichtman A. H. (2009) Basic Immunolgy-Functions and Disorders of the Immune System, Third edn. Reed Elsevier, India Pvt. Ltd., Noida.
- Eales, Lesley-Jane (2001) Immunology for life scientists. John Wiley and Sons., Surrey.
- 3. Elgert K. D. (1996) Understanding the Immune System, Wiley Liss, New york.

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Zoo 3.3-GENETICS

12x5 = 60 Hours

UNIT - I

Mendelian Genetics - Mendelian principles; Molecular structure of the gene; Genetic code; Regulation of gene expression in Prokaryotes and 'Eukaryotes - Operon concept; Attenuation and Anti-terminations; Environment and gene expression - Penetrance and Expressivity; Sex limited and Sex influenced traits; Phenocopies'.

UNIT-II

Giant chromosomes; Genetic regulation of Development in Drosophila; Linkage-construction of linkage maps in Drosophila, Sex determination – molecular basis of sex determination in Drosophila and Man; Sex linked inheritance in Drosophila and Man; Gene mutations; Transposable Genetic elements; DNA repair mechanisms.

UNIT-III

Human karyotype; International System for Human Cyto-genetic Nomenclature (ISCN); Chromosome aberrations- structural and numerical variations- Chromosomal syndromes; Human genome project; Genetic counseling; Genetic Screening- Amniocentesis, Chorionic Villus Sampling, Cardocentesis; Chromosome banding techniques – G-,C-, Q-; Dermatoglyphics.

UNIT-IV

Genome imprinting; Genetics of behavior- twins in genetic Studies; Pedigree analysis- Genetics of Blood Group Inheritance; Inheritance of Autosomal and sex chromosomal traits; Multifactorial and polygenic Inheritance; Population genetics-Hardy Weinberg law; Factors changing allelic frequencies – Selection, Genetic drift, Migration and Meiotic drive.

IINIT V

Population and sample- Sampling techniques; Organization of biological data – Tabular and Graphical Methods; Analysis of data – Measures of central tendency (Mean, Median, Mode) Standard deviation; Probability & Frequency distribution – Normal, Binomial and Poisson distributions; Correlation and regression; Chi-Square test; Test of significance, t-test, Analysis of Variance (ANOVA).

REFERENCES:

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2. H. K. Jain, (1999) Genetics, Principles, Concepts & Implications, Oxford and IBH Publishers, New Delhi

3. A.P. Jha (1997) Genes and evolution, McMillan Publishers, New Delhis

- Publishers, 4. T.A. Brown (1998) Genetics a molecular approach, III edition, Chapman & Hall London.
- 5. Daniel L. Hard (2001) Genetics: Analysis of genes and genomes, IV edition, Jones & Bartlett publishers, Boston.
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- 16. B. Lewin (1996), Genes, VII edition, John Wiley & Sons, New York.
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- Norman T. J. Bailey (1994) Statistical methods in biology, 3rd edition, 24. University Press. Cambridge
- 25.T.H. Hassard (1991) Understanding Biostatistics, Mosby year Book St.

Zoo 3.4 Fisheries and Aquaculture

Unit 1

12x5 = 60 hours

The inland capture fisheries resources of India; Riverine fisheries, resources and their fisheries management; Coldwater fisheries resources and their fisheries management; Lacoustrine fisheries resources and their fisheries management; Estuarine fisheries resources and their management; Marine fisheries resources and their fisheries management. Commercially important shell fishes and fin fishes: Freshwater carps, catfishes, murrels, prawns; Brackish water fisheries, Mullets, prawns and milk fishes etc.. Marine fisheries, midwater and demersal fisheries; fishes of elasmobranchies.

Unit 2

Definition and history of aquaculture: Scope and importance of aquaculture; different system of aquaculture: monoculture, polyculture, integrated fish forming, pond culture, cage culture, penculture, raft culture, raceway culture, sewage fed fish culture with suitable examples; factors for success of fish culture enterprises.

Unit 3

Present status of aquaculture, Preparation of culture pond, Prestocking management, control of aquatic weeds, aquatic insects, weed fish, predators, algal blooms and their control, Liming and fertilization, manuring of nursery and rearing ponds, criteria of selection of species for culture, seed procurement and stocking, Post stocking management, Phased manuring, supplement feed and feeding, water quality management for aquaculture.

Unit 4

Breeding and culture of freshwater fish; Breeding and culture of freshwater and brackish water prawns, principles of diseases diagnosis and fish health management, Disease caused by protozoans, fungi, bacteria and parasites, symptoms and control measure.

Unit 5

Principles and importance of fish preservation, sun-drying, Salt curing, pickling, Smoking, Chilling, Frying and Canning; Processing and preservation of fish products and byproducts. Past products, minced meat, Fish Protein Concentrate, Fish meal, Shark Liver Oil, Fish body oil, Liquid fish (fish ensilage), Shark fins, Fish skin leather, Ambergris, Fish cake, Fish salads, Fish wafers, Fish soup, Fish hydrolysate, Fish sauce, Fish glue, Isinglass, Chitosan, Pearls Seaweeds- edible, Industrial and Pharmaceutical products.

REFERENCES:

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- D. Hamori (1993) Constitutional disorders and hereditary diseases in domestic animals, Elsevier scientific publishing Co.,
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- 11. R. F. Gordon (1997) Poultry diseases, A Baillipre Tindall Publishers, London.
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- D. Acker and M. Cunningham (1998) Animal Science and industry, V edition, Prentice Hall, New Jersey.

III SEMESTER

PRACTICALS

Zoo 3.5.: PARASITOLOGY AND VECTOR BIOLOGY- LAB 4 Hours/Week

Parasites- Lab specimens

Intestinal

Lymphatic system

Hepatic

Blood

Ectoparasites

- 2. Blood smear preparation for identification of malarial parasite
- 3. Fluorescent dye detection of malarial parasite
- A. Habitat specificity Intestinal parasites of cockroach and fish
- 5. Vectors life cycle
- 6. Identification of mosquitoes
 - 7. Classification of blood meal from mosquito gut content
- 8. Field collection of vectors types and dominance
- 9. Rat fever (Leptospirosis) Histopathology
- 10. Histopathology of infected organs
- H. Plant nematodes

Zoo 3.6: Immunology - LAB 4 HOURS /WEEK.

- 1. Study of Cells of immune system
- 2. Organs of immune system.
- Agglutination reaction
- 4. Precipitation reaction
- 5. Quantitative precipitation assay.
- 6. Immunoelectrophoresis
- 7. Rocket immunoelectrophoresis
- 8. Countercurrent immunoelectrophoresis
- 9. Preparation of antisera

- 10. Precipitation of immunoglobulins by ammonium sulphate method.
- 11. Isolation and purification of Immunoglobulin G
- 12. Enzyme Linked ImmnoSorbent Assay (ELISA)
- 13. Dot ELISA
- 14. Hapten conjugation method
- 15. Scale grafting in fish.

3.6 FISHERIES AND AQUACULTURE

Practical for Zoo 3.4

Fisheries and Aquaculture

- I. Identification and classification of commercially important fin fishes and shell fishes; Fresh Water, Brackish Water, Marine Water Fishes; Five examples for each; commercially important shell fish, oysters, crabs, molluscan and prawns.
- Estimation of Primary productivity by light and dark bottle method II.
- Preparation of fish pituitary extract and detection of dosage for injection III.
- IV. Study the important fish byproducts
- Physicochemical analysis of pond water for determination of pH, Dissolved ٧. oxygen, free Co2, Ammonia, Total Hardness, Alkalinity etc.,
- VI. Visit to a fish seed hatchery

ZOO 3.7 - GENETICS-LAB

4 Hours/Week

- 1. Preparation of culture media and maintenance of Drosophila -Study the life cycle. 2. Morphological features of Drosophila
- 3. Drosophila mutants
- 4. Mounting of Genital plate and Sex comb
- 5. Study of Polytene chromosome of Drosophila.
- 6 Chromosome banding techniques and karyotyping. 7. Study the dermatoglyphics pattern and its significance.
- 8. Chromatographic separation of eye pigments in drosophila

30

9. Study of Human blood group genetics and estimation of allelic frequencies

10. Experiments to demonstrate the pattern of inheritance of characters in Drosophila -

Expt. 1: To demonstrate Mendel's law of segregation

Expt. 2.: To demonstrate Mendel's law of independent assortment

Expt .3: To demonstrate Pattern of inheritance of X-linked genes

11. Genetic problems

12. Biostatistics problems

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IV SEMESTER THEORY

ZOO 4.1: ANIMAL CELL BIOTECHNOLOGY 12x5 =60 Hours

UNIT -I

Introduction, Historical perspective, advantages and limitations of animal tissue culture. Major differences in vitro, Types of tissue culture.

Biology of cultured cells – Culture environment, cell adhesion, cell proliferation, differentiation, Initiation of culture, cell senescence, continuous cell lines.

Design and layout of laboratory,-Construction, sterile handling area, incubation, bench. Preparation, wash up, maintenance of sterile condition.

Equipments - Essential, beneficial and useful equipments, consumable items.

Culture medium- Physico-chemical properties, complete media, serum, serum free media. balanced salt solutions, selection of medium and serum.

Preparation and sterilization – Apparatus, Reagents and media, storage Contamination- Source and types of contamination

UNIT-II

Primary culture- types of primary culture, Isolation of tissues – mouse and chick embryos, human biopsy material, Explant culture, primary cell culture, disaggregation- enzymatic, mechanical. Suspension culture.

Cell lines: Definition, Evolution of cell lines, continuous cell lines, cell line designation, maintenance, subculture, maintenance records. Cell line banking, cryopreservation, cell viability assays

Organ culture - Methods, Raft and grid methods, Watch glass technique, Maximow single slide technique, agar gel technique, histotypic culture; Gel and sponge technique, hollow fibres, spheroids

Large scale cultures - Fermentor design, scaleup in suspension and monolayer. Downstream processing.

UNIT-III

Culture and maintenance of human and mouse embryonic stem cells.

Stem cells in gene therapies, stem cell based therapies for autoimmune diseases

Hybridoma technology - Production and Application of Monoclonal antibodies Use of animal cells as replacement for whole animal in toxicity testing.

Commercial application of animal tissue culture - Uses of animal cells in vaccine production

Cell cultures in the production of medicinally important compounds -pharmaceuticals, enzymes, hormones etc.,

UNIT-IV

Genetic engineering-

General introduction and concept, Transduction and transfection, C-DNA, Recombinant DNA techniques, Restriction enzymes, Salient features of cloning vectors, Different types of cloning vectors, Plasmids, Cosmids, Phagemids, Shuttle vectors, Viral vector.

Outline of gene cloning, gene cloning procedures, C-DNA cloning, Gene libraries, Chromosome Walking and jumping, Recombinant selection and screening - genetic methods, immunochemical methods, South-western screening, nucleic acid hybridization, product recovery.

Application of recombinant DNA technique in Medicine and industry. Use of genetically engineered microorganisms in the environment, genetic engineering approach to detoxification.

UNIT-V

Methods to introduce genes into animal cells, electroporation, viral vectors, retroviruses, lipofection, calcium phosphate co precipitation.

Transferring genes into animal oocytes, Eggs and embryos - Transgenic animals. Use of transgenic technology in research, knock out mice.

Production of human disease equivalents in the mouse, Novel therapies for human diseases.

Transgenic technology in the improvement of farm animals, transgenesis in animal cloning.

Regulation of genetic engineering - Biosafety regulations, risk versus benefits, ethics involved in animal cloning and stem cell research. Ethics of xenotransplantation.

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 - 19. S.N. Jogdand (2006) Industrial Biotechnology (Approach to clean Technology) Himalaya publishing House, Mumbai
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Zoo 4.2 - MICROBIOLOGY

UNIT I (12 hrs)

Introduction to microbiology, historical perspectives, contributions of early microbiologists, Koch Postulates. Branches and scope of microbiology. Origin and evolution of microorganisms, discovery of anaerobic life, evolutionary chronology, trends in evolution of archaebacteria, eubacteria and eukaryotes. Evolution of prokaryotic and eukaryotic metabolism. Modern methods of tracing and analysis of evolution.

UNIT II (12 hrs)

Microbial metabolism: Energy sources and classification; metabolism in autotrophs, heterotrophs; hexose and pentose phosphate pathways; synthesis of peptidoclycan, intermediary metabolism and secondary metabolites. Aerobic and anaerobic respiration, fermentation, electron transport system and substrate phosphorylation.

UNIT III (12 hrs)

Fermentation: Ethanol, lactic acid, mixed acids, 2-3 butanidiol, costridial and propionic acid fermentation with emphasis on their ecological niches, merits and demerits.

Food Microbiology: Classification of foods and oriental foods; Basic principles of food spoilage and methods of food preservation; Milk and milk products, milk microflora and their estimation, milk-borne diseases and prevention; Food poisoining, food-borne diseases and prevention.

Soil Microbiology: Soil microflora and methods of their estimation, role of soil microorganisms, bioconversion and decomposition. Biological nitrogen fixation (symbiotic and non-symbiotic), microbial phosphorus solubilization and their importance in soil fertility and agriculture. Aquatic Microbiology: Microbes in water and methods of their estimation (e.g. MPN), drinking water microbial standards and water purification; Water-borne diseases and prevention.

UNIT V (12 hrs)

Microbial symbiosis, mutualism, plant-microbe interactions (e.g. Microbial Ecology: mycorrhizas), animal-microbe interactions (human, ruminants and non-ruminants). Microbes in hydrothermal vents and coral reefs.

Air Microbiology: Microflora of air and methods of their estimation, minitoring air allergens, airborne diseases and prevention.

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- 6. Microbial Ecology. Atlas RM and Bartha R. Benjamin-Cummings Sci. Press, USA
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- 9. Instant Notes in Microbiology. Nickilin et al., Via Books Pvt. Ltd., New Delhi
- 10. Methods in Microbiology. Norris JR. Academic Press, London
- 11. Foof Microbiology. Adams MR and Moss MO, Panima Publ\., New Delhi
- 12. Microbiology and Immunology Concepts. Barrett JT, Lippincott-Raven, USA
- 13. Industrial Microbiology. Casida LE. Wiley Eastern Ltd., New delhi
- 14. Immunology. Elgert KD. Jon Wiley and Sons, USA
- 15. Advances in Agricultural Microbiology. Subba Rao NS, Oxford and IBH Pub., New Delhi.
- 16 Microbial Ecology. Atlas RM and Bartha R. Benjamin-Cummings Sci. Press, USA
- 17. Microbial Ecology. Cambell R. Blackwell Scientid\fic Pub., London
- 19. Bacterial Metabolism. Doelle HW, Academic Press, London
- 20. Instant Notes in Microbiology. Nickilin et al., Via Books Pvt. Ltd., New Delhi
- 21. Methods in Microbiology. Norris JR. Academic Press, London
- 22. Introduction to Fungi. Webster J. Cambridge University Press, Cambridge.

Zoo 4.3- NEUROBIOLOGY AND BEHAVIOUR 12X5=60 Hours

UNIT-I

Organization of nervous systems lonic basis of resting membrane potential Generation and conduction of action potential Neural transmission and integration Sensory transduction

UNIT-II

Motor systems – Excitation-Contraction coupling Molecular basis of muscle contraction Skeletal muscle mechanics and fibre types Smooth muscle and cardiac muscle Neuro-Muscular disorders

WNIT-III

Instincts and Imprinting
Habituation, sensitization and Associative learning
Cognitive abilities and reasoning
Types of memory and learning
Molecular mechanisms of learning and memory

UNIT-IV

Olfactory communication – Pheromones in insects and mammals Vomeronasal organ Sound production and auditory communication in insects 'Dance language' in honeybees Speech production and features of language

UNIT-V

Features of sexual reproduction
Parental investment of the sexes
Sexual selection
Mate choice, competition and aggression
Mating systems – polygamy, monogamy, polygyny.

REFERENCES:

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Zoo 4.4-BIODIVERSITY ANDWILDILIFE MANAGEMENT

UNIT -I

Biodiversity concepts- Ecosystem diversity, Genetic diversity, Species diversity, Biodiversity from ecological, taxonomical and evolutionary prospective (Alpha, Beta and Gamma diversity); Biodiversity assessment- Inventorying and Monitoring biodiversity- Sources of information. Data collection and management- Taxon data sheet.

UNIT -II

Zoo geographical regions of the world and Ecological subdivisions of India; Biodiversity Hotspots; Biome essays- Tropical and Temperate forests, Tundra, Boreal forests, Cave and Mountains, Coastal ecosystems, Mangroves and Estuaries, Coral reefs, Lakes and Rivers.

UNIT-III

Unique Indian animals- Diversity and distribution; Endemic species, Species interaction-Concept of niche, territory and home range, Keystone species; Capturing and marking techniques- entrapment, electro fishing, darting, tagging and banding, Population analysisterritory mapping, line transect, capture-recapture, pellet count, pug mark, call track count; Radio telemetry; Still and Video photography.

UNIT- IV

Threats to Biodiversity- Habitat destruction, Exotic species introduction, Over exploitation; Diseases and their control; Species extinction; IUCN Red list criterions and categories; Biodiversity conservation- insitu methods- National parks and Sanctuaries; exsitu methods-Captive breeding program- role of Zoos and Botanical gardens.

UNIT-V

Legal aspects- National and International conventions- CITES, TRAFFIC; Wildlife laws-Wildlife (protection) Act-1972; Indian biodiversity laws; Special projects- Project Tiger, Gir Lion project, Project Elephant, Crocodile breeding project.

REFERENCES:

- 1. Sagreiya K.P. (1967) Forests and Forestry, National Book Trust, India.
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- Daniel J.C and Gerrao J.S. (1990) Vegetation types of India in relation to environmental conditions In: conservation in developing countries, problems and prospects eds., Bombay Natural History Society, Bombay
- 12. Nair, S.M. (1992) Endangered animals of India and their Conservation, National Book Trust, India.
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- 18. R.B. Primack (1999) Essentials of conservation biology, Sunderland, Bostan University, Massichersettes U.S.A.

IV - SEMESTER PRACTICALS

ZOO 4.5: ANIMAL CELL BIOTECHNOLOGY- LAB 4 Hours/week

- 1. Introduction to the general requirements of animal tissue culture laboratory.
- 2. Cleaning, washing, Preparation and sterilization methods for tissue culture work.
- 3. Preparation of media, serum, BSS, PBS, trypsin etc.,
- 4. Trypan blue dye exclusion test for cell viability
- 5 Lymphocyte culture technique, Preparation of human metaphase chromosomes.
- 6. Growth and maintenance of tumor cell lines.
- 7. Cell proliferation test using MTT assay
- 8. Separation of peripheral blood mononuclear cells (PBMCs) with Histopaque.
- 9. Mouse macrophage and lymphocyte culture
- 10. Primary explant culture of mouse pup/adult/ chick embryo organs
- 11. Mouse bone marrow/hemopoetic cell cultures
- 12. Contamination of cultures
- 13. Study of restriction sites in λ DNA Demonstration
- 14. Western blot technique -Demonstration.

Zoo 4.6 MICROBIOLOGY

- 1. Microbiology Instrumentaion
- 2. Staining techniques Grams staining, endospore staining
- 3. Intracellular lipids acid-fast staining, negative staining
- 4. Culture media, sterilization of media. Stock culture, subculture,
- 5. Microbial isolation
- 6. Microbial quality of water, milk and used towels.
- 7. Selective isolation of microbes (bacteria, actinomycetes, yeast, fungi)
- 8. Antibiotics

Zoo 4.7: NEUROBIOLOGY AND BEHAVIOUR - LAB

- 1. Methylene blue visualization of sensory neurons in Drosophila.
- 2. Differentiation of mechanoreceptors and chemoreceptors in Insects.
- 3. Golgi-staining technique.
- 4. Stimulus contraction parameters in muscles Kymographic studies.
- 5. Effect of Neurotransmitters/mimics on pacemaker neurons cardiac pacemakers.
- 6. Habituation in earthworms/crab.

- 7. Olfactory discrimination in insects
- 8. Social insects study of insect colonies.
- 9. Recording and analysis of insect (cricket) calls, bird calls.
- 10. T-Maze labyrinth, learning in mice.
- 11. Filial imprinting in chicks.
- 12. Sensitization in crabs.

Zoo 4.8 – BIODIVERSITY AND WILDLIFE MANAGEMENT

- 1. Habitat analysis: Aquatic habitat- water quality analysis- salinity, pH, Temp etc Terrestrial habitat- Soil analysis- Nutrient test
- 2. Species diversity analysis: Diversity survey, quadrat analysis. Pit fall trap method. Line transect,
- 3. Diversity Indices, Uses and application of softwares PAST, Biodiversity Pro.
- 4. Rank abundance curve, Bray Curtis cluster analysis. Rarefaction curve, Principal component analysis.
- 5. Identification of bird species by audio- visual methods
- 6. Visit to observe and record types of ecosystem and associated flora and fauna. (Protected and unprotected areas, Biological parks etc)



OPEN ELECTIVE COURSE

ECONOMIC ZOOLOGY

5×5=25 hrs

Unit 1.

Introduction to economic zoology, scope and importance of economic zoology. Vermiculture: Establishment of vermiculture unit, earthworm as a tool for conversion of waste material into vermicompost, earthworms as poultry and fish feed, vermiwash.

Unit 2.

Apiculture: Types of bees, colony organization in bees, Tools used in apiculture, commercial beekeeping and its practices in India, composition and uses of honey and bee products.

Unit 3.

Sericulture: Types of silk worms, rearing methods of silkworms, life cycle of *Bombyx mori*, diseases of silk worm, uses of silk, Importance of sericulture as a rural industry, Sericulture in India and abroad.

Unit 4.

Aquaculture: Culture of major carps (indigenous and exotic), composite fish culture, preservation and processing of fish, fish by products.

Poultry: Different breeds of chickens (indigenous and exotic), rearing of poultry breeds, diseases of poultry, egg production and economics, Status of poultry in India.

Unit 5.

Dairy: Breeds of Cattle: Cow and Buffalow, milch (indigenous and exotic) and draught breeds, disease of dairy, milk processing, Indian scenario of milk production, dairy products.

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