



GOVERNMENT OF KARNATAKA
DEPARTMENT OF COLLEGEIATE EDUCATION



**M.Sc. Zoology Syllabus
From 2018-2019**

M.Sc. DEGREE (SEMESTER) COURSE UNDER CBCS - SCHEME

SCHEME OF TEACHING AND EXAMINATION

(Effective from the academic year 2018-19 and onwards)

**DEPARTMENT OF PG STUDIES AND RESEARCH IN
ZOOLOGY**

**GOVERNMENT COLLEGE
(AUTONOMOUS), KALABURAGI-585 105**

Approved by Academic Council.

[Signature]

PRINCIPAL

Govt. College

Kusnoor Road, GULBARGA-585 105

Government College (Autonomous), Kalaburagi

Course Structure for Master of Science Programmes

Name of the Master Degree: M. Sc. in Zoology

Course Code	Title of the course	Total Credits	Total Hours/Week	Marks Allocation					Total Max. Marks
				Internal		Semester End Exam			
				Max. Marks	Minimum Marks	Duration	Max. Marks	Minimum Marks	
Semester –I									
CCT 1.1	Biosystematics Structure and Function of Non-Chordates	4	4	20	--	3hrs	80	32	100
CCT 1.2	Molecular Cell Biology	4	4	20	--	3hrs	80	32	100
CCT 1.3	Molecular Genetics	4	4	20	--	3hrs	80	32	100
DSET 1.1	a)Biostatistics, Animal Care and Computer Applications or b)Biodiversity	4	4	20	--	3hrs	80	32	100
Practical 1.1		4	8	20	--	4hrs	80	32	100
Practical 1.2		4	8	20	--	4hrs	80	32	100
	Total	24							600
Semester –II									
CCT 2.1	Structure and function of Chordates	4	4	20	--	3hrs	80	32	100
CCT 2.2	Developmental Biology	4	4	20	--	3hrs	80	32	100
DSET 2.1	Parasitology or Evolutionary Biology	4	4	20	--	3hrs	80	32	100
GET 2.1	Economic Zoology	4	4	20	--	4hrs	80	32	100
Practical 2.1		4	8	20	--	4hrs	80	32	100
Practical 2.2		4	8	20	--	4hrs	80	32	100
	Total	24							600
Semester-III									
CCT 3.1	Biology of Reproduction	4	4	20	--	3hrs	80	32	100
CCT 3.2	Animal physiology	4	4	20	--	3hrs	80	32	100
DSET 3.1	*a)Environmental Biology or *b)Aquatic Biology and Fisheries	4	4	20	--	3hrs	80	32	100

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GET 3.1	Human Physiology	4	4	20	--	4hrs	80	32	100
Practical 3.1		4	8	20	--	4hrs	80	32	100
Practical 3.2		4	8	20	--	4hrs	80	32	100
Total		24							600
Semester-IV									
CCT4.1	Animal Biotechnology	4	4	20	--	3hrs	80	32	100
CCT4.2	Applied Zoology	4	4	20	--	3hrs	80	32	100
DSET4.1	a) General Endocrinology or b) Animal Behaviour	4	4	20	--	3hrs	80	32	100
Practical 4.1		4	8	20	--	4hrs	80	32	100
Practical 4.2		4	8	20	--	4hrs	80	32	100
CCPR 4.1		6	6	30	--	--	120	48	150
Total		26							650
Total Credits Semester I to IV		98	-	-	-	-	-	-	-
Total Marks Semester I to IV		-	-	-	-	-	-	-	2450

CCT – Core Course Theory, DSET – Discipline Specific Elective Theory

GET- General Elective Theory, CCPR- Core Course Project

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Details of Course Code and Title of the Paper

PAPER	Title of the Course
Course Code	<u>I SEMESTER</u>
CCT 1.1	Biosystematics Structure and Function of Non-Chordats
CCT 1.2	Molecular Cell Biology
CCT 1.3	Molecular Genetics
DSET 1.1	a) Biostatistics, Animal Care and Computer Applications or b) Biodiversity
Practical 1.1	
Practical 1.2	
	<u>II SEMESTER</u>
CCT 2.1	Structure and function of Chordates
CCT 2.2	Developmental Biology
DSET 2.1	a) Parasitology or b) Evolutionary Biology
GET 2.1	Economic Zoology
Practical 2.1	
Practical 2.2	
	<u>III SEMESTER</u>
CCT 3.1	Biology of Reproduction
CCT 3.2	Animal physiology
DSET 3.1	a) *Environmental Biology or b) *Aquatic Biology and Fisheries
GET 3.1	Human Physiology
Practical 3.1	
Practical 3.2	
	<u>IV SEMESTER</u>
CCT 4.1	Animal Biotechnology
CCT 4.2	Applied Zoology
DSET 4.1	a) General Endocrinology or b) Animal Behaviour
Practical 4.1	
Practical 4.2	
CCPR 4.1	

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*** Project Commences from the beginning of III semester-**
CCT – Core Course Theory, DSET – Discipline Specific Elective Theory
GET- General Elective Theory, CCPR- Core Course Project

***Each candidate shall undertake compulsory “Animals in Nature” Study Tour covering different Institutions and natural biomes with a stress on Biodiversity study. The duration of this Tour shall be about one week. The Study Tour shall be undertaken during third Semester only and shall be completed within the two years period.**

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M. Sc. Ist Semester

Paper CCT 1.1

BIOSYSTEMATICS, STRUCTURE AND FUNCTIONS OF NON-CHORDATES

Teaching hours 64

Unit – I Biosystematics and Applications

- 1.1 Systematics: Meaning Branches and its Applications.
- 1.2 Apomictic species and panmictic species.
- 1.3 Typification and different types of zoological types. Taxonomic keys , Phylogenetic trees, construction methods, Phylogenetic classification , Phenetics and classification and multigene families.

Unit – II Nutrition and Respiration.

- 2.1 Patterns of feeding and digestion in metazoan.
- 2.2 Filter feeding mechanism in polychaeta.
- 2.3 Modifications in the digestive system of invertebrates with special reference to ArthropodaMollusca
- 2.4 Respiration: Respiratory pigments, Organs of respiration- gills, trachea and lungs, mechanism of respiration.

Unit –III : Excretory and Nervous system

- 3.1 . Organs of excretion – coelom, coelomoducts, Nephridia, Malphighiantubules .Mechanism of respiration and osmoregulation.
- 3.2 . Nervous system: coelenterates and echinodermata.
- 3.3 . Nervous system arthropods : (crustaceans and insects) and mollusc (cephalopoda)
- 3.4 . Trends in evolution of nervous system

Unit-IV: Minor phyla and invertebrate larvae

- 4.1. General organisation and affinities of mesozoa, sipunculida and chaetognatha
- 4.2 Larval forms of free living invertebrates (coelenterate, Annelida, Arthropoda, Mollusca and Echinodermata).
- 4.3 Larval forms of helminthes and crustacean parasites.
- 4.4 Evolutionary significance of larval forms.

REFERENCE BOOKS

1. Invertebrate zoology ----- EL Jordan; P.S. Verma.
2. A Text Book Of Zoology Vol. I ----- P.S. Dhama; JK Dhama
3. A Text Book Of Invertebrate Zoology ----- R.L. Kotpal.
4. Biology of Animals ----- Cleveland P. Hickman JR Larryds. Roberts.

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Paper CCT 1.2
MOLECULAR CELL BIOLOGY

Teaching Hours: 64

Unit-I: Introduction

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

Unit-II: Biochemistry of cell

- 2.1 Biochemistry of cell: Chemical components of the cell- (a) water, salts, ions and their properties
- 2.2 Proteins - primary, secondary and tertiary structures. Peptide bond formation
- 2.3 Carbohydrates - Complex polysaccharides and glycoproteins,
- 2.4 Lipids - triglycerides and compound lipids and (d) Nucleic acid - A pentose, Phosphate and four Bases. Nucleotides, double helix formation. Structure of single and double stranded RNA.

Unit -III: Cell organelles and chromosomes

- 3.1 Structure of eukaryotic chromatin.
- 3.2 Chromosomal condensation during mitosis.
- 3.3 Heterochromatin; Chromosomal nomenclature - chromatid, centromere, kinetophore, telomere, telomerase, satellite, secondary constriction, nucleolar organizer.
- 3.4 Molecular Composition and Models of membrane organelles: Plasma membrane, endoplasmic reticulum, microsomes, golgi complex, lysosomes, mitochondria and chloroplast. Molecular organization and function of cytoskeletal structures: microfilaments, microtubules, cilia and flagella.

Unit-IV: Cell cycle and Cancer biology

- 4.1 Genome organization - hierarchy in organization. Structure of Gene. Gene transcription.
- 4.2. Post-transcriptional processing of RNA. Reverse transcription. Structure of introns, exons. RNA Interference.
- 4.3 Genetic code and genetic engineering: Triplet code, mutations and genetic code. DNA sequencing. Tools of Recombinant DNA- Restriction Enzymes, Cloning Vectors, Plasmids, Phages, Viruses
- 4.4 Cell cycle: Molecular events during different stages of cell cycle - cyclins and cyclin dependent kinases. Regulation of CDK cyclin activity. Cell aging: Biology of aging. Molecular biology of cancer cell- carcinogenesis. Apoptosis: mechanism and significance.

REFERENCE BOOKS:

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., Zipursky, 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.

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Paper CCT 1.3
MOLECULAR GENETICS

Teaching Hours: 64

Unit-I Introduction and Overview

- 1.1 History and scope of molecular genetics.
- 1.2 Identification of DNA as genetic material. Properties, storage and transmission of genetic information
- 1.3 DNA Replication: Semi conservation of double stranded DNA.
- 1.4 DNA polymerases and ligases. Events in replication fork. Discontinuous replication. Leading strand. Circular DNA and its replication

Unit-II Transcription and Translation

- 2.1 Prokaryotic transcription. RNA polymerases. Transcription signals. Classes of RNA molecules-messenger, soluble, ribosomal and transfer.
- 2.2 Transcription in Eukaryotes. Means of studying intracellular RNA- 5-cap formation, 5-end processing, polyadenylation, splicing, editing and nuclear export
- 2.3 Translation: The genetic code. Transfer RNA and amino acyl synthetases. Initiation. Elongation and transfer factors.
- 2.4 The Wobble hypothesis. Polycistronic mRNA. Overlapping genes. Ribosomes.

Unit III Mutation:

- 3.1 Types of mutations. Biochemical bases of mutations.
- 3.2 Mutagenesis-base analogue mutation, ultraviolet irradiation, mutagenesis, intercalating substances and transposable elements.
- 3.3 DNA recombination and repair: Alteration of DNA molecules. Repair of incorrect bases. Repair of thymine dimers. Recombination repair. Isolation.
- 3.4 Characterization and joining of DNA molecules. Genetic transposition

Unit IV Regulation of gene activity:

- 4.1 Principles of regulation. *E. coli* lactose system and Operon model.
- 4.2 Tryptophane Operon. Auto regulation and feedback initiation.
- 4.3 Organization of Eukaryotic genome.
- 4.4 Salient features of Yeast, *Drosophila* and Human genome

REFERENCE BOOKS:

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. Benjamin Lewin. Genes Vols I-IV. Oxford Univ Press, 1995.
7. Principles of Genetics Robert Tamarin

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Paper DSET 1.1

a) BIOSTATISTICS, ANIMAL CARE AND COMPUTER APPLICATIONS

Teaching Hours: 64

PART-A: BIOSTATISTICS

UNIT-I: Introduction

- 1.1 Introduction: Data reduction. Frequency distribution, graphical representation, measures of central tendency and dispersion.
- 1.2 Probability: Conditional probability, addition and multiplication rules of probability, distributions and application
- 1.3 Simple linear regression and correlation, random sampling. **And** Tests of Significance:
- 1.4 Analysis of variance and ANOVA (one way, two way)

PART-B ANIMAL CARE

UNIT-II

- 2.1 Care and handling of laboratory animals.
- 2.2. Committee for the purpose of control and supervision of experiments on animals(CPACSEA).
- 2.3 Alternatives for use of animals for laboratory experiments to prevent vivisection
- 2.4 Computer simulation studies

PART-C: COMPUTER APPLICATIONS

UNIT-III

- 3.1 Computer fundamentals, computer organization, operating system ,computer hardware and computer software,
- 3.2 An over view of MS -OFFICE.
- 3.3 MS- Excel
- 3.4 MS-Power Point Graph

UNIT-IV

- 4.1 Computer networks, internet and its applications, Introduction to bio informatics:
- 4.2 Computer Applications in gene, genome and genomics, proteomics.
- 4.3 Sequence Analysis-BLAST, PASTA, pair wise sequence analysis, multiple sequences-CLUSTLAW and
- 4.4 Computer Applications in Phylogenetic analysis.

REEFERENCE BOOKS

- 1) Bailey, N.T.J., 1994. Statistical Methods in Biology-II Ed., Cambridge University Press.
- 2) Samuel, M.L., 1991.Statistics for Life Sciences, Dellen Publishing Co, San Francisco.
- 3) Arthur M. Lesk, 2002. Introduction to Bioinformatics, Oxford University Press, New York
- 4) Satish Jain, O level made simple: information Technology, BPB publications

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Paper: DSET 1.1
b) BIODIVERSITY

Teaching hours : 64

UNIT – I: Introduction

- 1.1 Biodiversity: Concepts, Definition. Values of biodiversity: Consumptive use and Productive use; Social, Ethical, Aesthetic, Option & Environment service values.
- 1.2 Genetic diversity: Nature and origin of genetic variations; Measurement of genetic Diversity.
- 1.3 Species diversity: History and origin of species diversity; Species diversity indices ; Measures of diversity – Alpha, Beta & Gamma diversity.
- 1.4 Ecosystem diversity: Classification and nature of ecosystems (in brief); Ecosystem diversity of India (in brief), Agro- biodiversity: Origin and evolution of cultivated species diversity; Vavilovian centers ; Diversity in domesticated animal species.

UNIT – II: Threats and Conservation

- 2.1 Biodiversity at global, national and local levels.
- 2.2 Hot spots of biodiversity; India as a mega diversity nation. Endemism and endemic species.
- 2.3 Threats to biodiversity: Deforestation & habitat destruction, Hunting & Overexploitation; Introduction of exotic species, Pollution. Endangered, Vulnerable, Rare and Threatened species.
- 2.4 Conservation of Biodiversity: Objectives and action plans; Strategies – In-situ and Ex- situ conservation; Peoples movement, Role of educational Institutions and NGO's, Biodiversity Awareness programmes

UNIT – III: Legislation

- 3.1 Biodiversity legislation: Legal aspects with special reference to India; CITES; Trade-related Intellectual Property Rights.
- 3.2 Biodiversity conventions: Earth Summit and other conventions; Convention on Biological Diversity.
- 3.3 Biodiversity and Biotechnology: Role of Biotechnology in: Assessment of biodiversity and bioresources.
- 3.4 Biodiversity conservation; Utilization of Biodiversity/Bioresources. GMO's and their impact on biodiversity.

UNIT – IV: Biodiversity Management

- 4.1 Biodiversity Management: Organizations associated with biodiversity management – IUCN, UNEP, UNESCO, WWF, FAD, WCMC –their role and contributions.
- 4.2 Bioprospecting; Biopiracy; Biosafety.
- 4.3 Intellectual property rights and patents.
- 4.4 Future strategies for biodiversity conservation in India

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REFERENCE BOOKS:

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. B.B.Hosetti, 2005: Glimpses in Biodiversity, Daya Publishing House, Delhi.
5. B.B.Hosetti, 2008: concepts in wildlife management, Daya Publishing House, Delhi.
6. K.C.Agrwal, 2006. Concepts in biodiversity, Narendra Publishers Meerut
7. B.B.Hosetti, 2008: Wild life management in India, Pointer Publishers, Jaipur ,

PRACTICALS 1.1

Practical based on Theory Papers and Depending on the Feasibility

PRACTICALS 1.2

Practical based on Theory Papers and Depending on the Feasibility

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M. Sc. IInd Semester

Paper: CCT- 2.1

STRUCTURE AND FUNCTIONS OF CHORDATES

Teaching Hours: 64

Unit – I: Chordates, Proto chordates and Vertebrate Integument

1.1 Characters and classification of proto-chordata, significance of protochordates in the evolution.

1.2 Origin of chordates and classification

1.3 Vertebrate integument, development, structure of skin in vertebrates.

1.4 Derivatives of Integument; glands, scales, horns, claws, hoofs, feathers & hair.

Unit – II: Skeletal and Digestive system

2.1 Comparative account of jaw suspension

2.2 Comparative account of vertebral column

2.3 Comparative account of girdles and limbs.

2.4 Anatomy of gut in relation to feeding habits- herbivores, carnivores and omnivores.

Unit – III: Circulation and respiration

3.1 Evolution of heart

3.2 Evolution of aortic arches and portal system

3.3 Respiratory organs in fishes and amphibians

3.4 Air sacs in birds

Unit – IV: Nervous and Urino-genital systems

4.1 Comparative anatomy of brain in relation to its function

4.2 Nerves - cranial, peripheral and autonomous nervous system

4.3 Sense organs, simple receptors, organs of olfaction and taste, Lateral line system and electric organs

4.4 Evolution of urino-genital system in vertebrate series.

REFERENCE BOOKS:

- | | | |
|---|---|---|
| 1 | Vertebrate Zoology ----- | EL Jordan; P.S. Verma |
| 2 | A Text Book of Zoology Vol.II ----- | P.S. Dhami; Jk.Dhami. |
| 3 | A Text Book of Vertebrate zoology ----- | R.L.Kotpal. |
| 4 | Biology of Animals --- | Cleveland P. Hickman JR Larryds. Roberts. |

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Paper CCT- 2.2
DEVELOPMENTAL BIOLOGY

Teaching Hours: 64

UNIT-I: Principles of Development in Biology 64 hrs

- 1.1 Introduction to developmental Biology: stages of animal development, embryonic homologies, malformations and teratology.
- 1.2 Developmental patterns in unicellular protists and metazoa.
- 1.3 Function of genes during development.
- 1.4 The developmental mechanics of cell specification

UNIT-II: Early Embryonic Development

- 2.1 Introduction to embryonic development: structure of gametes, recognition of egg and sperm, acrosomal reaction.
- 2.2 The early development of sea urchin, Amphioxus, frog and chick
- 2.3 The genetics of axis specification in drosophila, organizer concept
- 2.4 Early mammalian development: mammalian anterior-posterior axis formation, dorsal-ventral and left-right axes in mammals.

UNIT-III: Later Embryonic Development

- 3.1 Tetrapod limb development.
- 3.2 Sex determination approaches in developmental biology.
- 3.3 Metamorphosis, regeneration and aging.
- 3.4 The development of blood cells: The stem cell concept, the pluripotential hematopoietic stem cells, blood and lymphocyte lineages, hematopoiesis.

UNIT-IV: Stem Cell Biology

- 4.1 Concepts in stem cell biology, definition and properties of stem cell.
- 4.2 Molecular mechanisms of self-renewal ,pluripotency, multipotency and linage differentiation.
- 4.3 Embryonic stem cells – Adult stem cell – Neural stem cell , Hematopoietic , Epithelial cells , Cancer . Stem cells and regeneration, stem cells therapy and ethical issues associated with stem cell biology .
- 4.4 Teratogenesis: Introduction, principles and taratogenic agents.

Reference Books:

1. Gilbert, S.F. Developmental Biology. 10th Edition, Sinauer Associated Inc.,Massachusetts
2. Balinsky, B.I. Introduction to Embryology. Saunders, Philedelphia
3. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
4. Hamburger V and Hamilton HL. Handbook of chick developmental stages.SaundersPublications. 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-ULPPublicatiions, India.First Edition, 1979.

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Paper DSET-2.1
a) PARASITOLOGY

Teaching Hours: 64

Unit- I Host and Parasite Relationship

- 1.1 General introduction, different types of animal association-
- 1.2 Parasitism and types of parasites, Primary and secondary hosts, transmission of parasitic infection.
- 1.3 Parasitic Zoonosis, epidemiology of parasitic zoonosis, transmission.
- 1.4 Host-parasitic interactions- parasitic effects benefitting the parasites, parasitic effects benefitting the host

Unit- II Parasitic protozoans

- 2.1 Introductions – Life cycle, mode of transmission, pathogenicity and control
- 2.2 Mastigophora – Trypanosoma, Leishmania
- 2.3 Sarcodina – Entamoeba, Balantidium.
- 2.4 Sporozoa- Toxoplasma, Plasmodium.

Unit- III Helmenthic Parasites

- 3.1 Introduction-Life cycle and Biology(including pathology and control measures).
- 3.2 Nematode- Ascaris, Wuchereria,
- 3.3 Trematoda – Polystoma, schistosoma, Fasciola.
- 3.4 Cestoda- Taenia

Unit –IV Arthropod Parasites

- 4.1 Morphology, life history and medical importance of disease transmitting vectors-
- 4.2 Diptera: Aedes, Anopheles,(Malaria, chikungunya, Dengue fever)(transmission cycle). Siphonoptera: Xenophylla. Phthirptera: Pediculus. Hemiptera: Cimex.
- 4.3 Morphology, life history and importance of acarines- Ticks, Argas, Boophilus. Mites- *Sarcoptes*, *Leptotrombidium*, *Psoroptes*, *Demdex*, *Dermanyssus*.
- 4.4 Myasis- venomous, irritating and allergic arthropods – control measures. Vector status of cockroach.

REFERENCES.

1. Asha .C. Chandler, (7th Ed), Introduction to parasitology, with special reference to the parasites of man, New York, Wiley, 1944. 716 PP.
2. Despommier, Gwadz, Hotez, Knirsch: Parasitic Diseases(5th Ed), Apple tree productions, LLC, 2005, 375 PP.
3. William .M . Samuel Margo J. Pybus A . Alan Kocan.(2nd Ed) Parasitic diseases of wild mammals, Iowa state university press, Ames, Iowa, USA, 2008.
4. Stephen A. Berger, John Marr, Human Parasitic Diseases source book, Jones and Bartlett learning, 2006. 537pp.
5. D.M. Molynous, Advances in Parasitology – Control of Human Parasitic Diseases, (1st ed). Academic Press. 690 PP.
6. Jeremy Farrar and Peter Hotez and Thomas Junghanss and Gagandeep Kang and David Laloo and Nicholas J. White . Manson 's Tropical Diseases.(23rd Ed). Elsevier publication . 2013. 1360 PP.

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Paper DSET-2.1
b) EVOLUTIONARY BIOLOGY

Teaching Hours: 64

Unit I

- 1.1 Introduction
- 1.2 An overview of landmarks in Evolutionary Biology
- 1.3 Concept of organic evolution: Origin of life. Evolution through ages - Geological time scales.
- 1.4 Evidences of organic evolution. Evolution of man through ages.

Unit II

- 2.1 Darwinism: Contributions of Charles Darwin, Alfred Russell Wallace and Thomas Malthus.
- 2.2 Postulates of Darwinism - objectives and evidences. Recent developments on Lamarkian concepts.
- 2.3 Speciation: Biological and phylogenetic concepts of species.
- 2.4 Pattern and mechanisms of reproductive isolation. Models of speciation - Allopatric, Sympatric and Strasipatric

Unit III

- 3.1 Origin of higher categories: Phyletic gradualism and punctuated equilibrium. Major trends in the origin of higher categories. Micro and macro evolution.
- 3.2 The evolution of life histories: Basic questions in the evolution of life history.
- 3.3 Evolutionary age and size at maturation. Life history tradeoffs - optimality arguments and trade off surfaces.
- 3.4 Empirical evidences of life history tradeoffs. Evolution of clutch size and reproductive investment. Evolutionary life span and ageing.

Unit IV

- 4.1 Evolution of sex: The problem with sex. Sex and recombination.
- 4.2 Hypothesis and advantage of sex and recombination. Sex ratio, sex allocation and sex Determination
- 4.3 Evolution of inbreeding and out breeding.
- 4.4 Impact of evolutionary biology on medicine.

REFERENCES.

- 1. Futuyama, D.J. Evolutionary Biology- III Ed. Sinauer Associates Inc. Massachusetts, 1998.
- 2. Gerhart, J and Kirchner, M. Cell, Embryos & Evolution. Blackwell Science Publishers, 1997.
- 3. Genetics and the Origin of species : Columbia, DobzhanskyTh 1964
- 4. Keynes, R. Charles Darwin's Zoology Notes & Specimen List from H.M.S Beagle. Cambridge University Press, 2000.
- 5. Price, P.W. Biological Evolution. Saunders College Publishing, 1995.
- 6. Smith, J.M. Evolutionary Genetics. Oxford University Press,

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Paper GET 2.1
ECONOMIC ZOOLOGY

Teaching Hours : 64

Unit I: Aquaculture

- 1.1 Introduction: Definition, scope and status of aquaculture. Technique culturing fishes: Carps (Indian major & minor carps), Trouts, Catfishes, Ornamental fishes, Shell fishes (Prawns, Pearl oysters).
- 1.2 Fish seed technology: natural collection, bundh breeding, induced breeding, seed transportation. Aquaculture systems: Inland farms, tanks, pens and cages, feeding habits and food utilization, energy requirements, sources and metabolism, live foods, artificial feeds.
- 1.3 Fishes diseases and their control: Protozoa, fungal, bacterial, viral, environmental and nutritional, algal toxins, vitamin deficiency diseases. Fishing, control of weeds, pests and predators.
- 1.4 Farm management and economics: Concepts, economic principles of farm, management of Hatcheries, Nurseries, Rearing ponds, and Stocking ponds.

Unit II: Apiculture:

- 2.1 Scope and its importance. Classification and morphology of honey bees, species and races of honey bees, tribal life and bee hunting. sexseperation, com building, orientation of comb, communication collection of propolis and water.
- 2.2 Entomophily: Bee plants, floral design, colour, smell, pollen and necter production and composition. Pollen calendar. Relationship between floral design and mouth parts of honey bees. Pollen and nectar collection.
- 2.3 Honey and its chemical composition, medicinal importance.
- 2.4 Beekeeping and management: Rearing of honey bees, equipments, combfoundation, queen rearing(rearing techniques, feed contents, feeding and economics of queen rearing, requeening, bee nursing, honey and wax extraction. economic importance of honey, wax, bee pollination, pollen and Venom.

Unit III. Sericulture:

- 3.1 Components, origin and development of the art and science of sericulture. Global silk production, quality and quantity of silk produced in India, economics of silk production, foreign exchange.
- 3.2 Morphology and life cycle of *Bombyxmori*. Structure and functions of Silk glands. Silkworm rearing: Building, equipments, disinfection, environmental factors, spacing, feeding and bed cleaning. Modern rearing technology: Seed cocoons, preservation, grainage activity LSPs, egg production, incubation, artificial hatching,
- 3.3 Seed organisation and seed area and bivoltine rearing Silkworm Pathology: diseases and their control measures
- 3.4 Lac insects: external morphology, culture, economic importance

Unit IV: Poultry:

- 4.1 Introduction to poultry and their economic value
- 4.2. Breeding techniques of poultry breeds viz. white leghorn, jengle fowl, giriraj, turkeybird and duck
- 4.3 Housing techniques: diseases of poultry
- 4.4 Marketing of poultry products eg. Eggs, meat and poultry waste



REFERENCE BOOKS:

1. Hickling, C.E. 1962. Fish and fish culture. Faber and Faber, London.
2. Jhingran, V.G. 1977. Fish and Fisheries of India. Hindustan Publ., New Delhi.
3. Scnmitz, R.J. 1996. Introduction to Freshwater Biology. Gulf Publishing Company, New Delhi.
4. T.V.R. Pillay 'Principles and practice of Aququculture. 2nd edition, Fishing News books.
5. R.K.Rath. 'Fresh water aquaculture'. 2nd Edition. Scientfic Publishers. Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, ICAR, (2006), DIPA, New Delhi, INDIA.
6. Srivastava., 1979. Applied Entomology. Vol II.
7. Singh .S., 1962. Beekeeping in India. ICAR. New Delhi.India.
8. Snodgrass,R.E. 1956. Anatomy of the Honeybee. Cornell Univ. Press. Ithaca. New York.
9. Winston, M. 1984. The Biology of the Honeybee. Harvard. Uni. Press. London. UK.
10. Tazima. Y. 1958. Silkworm egg. CSB Publication, Bombay.
11. Yashimoro Tanaka. 1964. Sericology, CSB Publication, Bombay.
12. Tanaka, Y. 1953. "Genetics of the silkworm, Bombyxmori" – advances in genetics, Demerec.M. (Ed), Vol.5, Academic press, New York.
13. Tazima, Y. !964. " The genetics of the Silkworm". Logos Press Ltd., London.

PRACTICALS 2.1

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PRACTICALS 2.2

Practical based on Theory Papers and Depending on the Feasibility

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M. Sc. IIIrd Semester

Paper- CCT 3.1 BIOLOGY OF REPRODUCTION

Teaching Hours: 64

Unit I: Gonadal Development and Reproduction:

- 1.1 An overview of Reproduction:
- 1.2 Sex determination and differentiation of gonads, sex accessory ducts and glands,
- 1.3 Role of Hormones in Sex differentiation
- 1.4 Regulation of Hypothalamo – Hypophysis – Gonadal axis in reproduction.

Unit II: Male Reproduction:

- 2.1 Histoarchitecture of testis, spermatogenesis; Function of sertoli and Leydig cells; Seminiferous epithelial cycle and wave length, hormonal control of spermatogenesis.
- 2.2 Functional morphology and hormonal regulation of epididymis, vas deferens, prostate gland, seminal vesicle, Cowper's gland
- 2.3 Biology of spermatozoa & biochemistry of semen
- 2.4 Biological actions of androgens.

Unit III: Female Reproduction:

- 3.1 Anatomy of female reproductive system, histoarchitecture of the ovary,
- 3.2 Folliculogenesis, follicular atresia, ovulation, corpus luteum, estrous and menstrual cycle and their hormonal regulation, biological action of estrogens.
- 3.3 Implantation, : types of implantation, sequential events and hormonal regulation, delayed implantation., Pregnancy or gestation – endocrine control of pregnancy in rat., Parturition –factors involved in parturition – Prostaglandins, Oxytocin, Corticosteroids & other factors.
- 3.4 Placenta-histophysiology and endocrine functions, endocrine control of Pregnancy and Parturition, Lactation-Development of mammary glands, Lactation and its hormonal control.

Unit IV: Modern trends in Reproduction:

- 4.1 Fertility control in male and females-Natural methods, barrier methods, intrauterine devices, hormonal contraceptives, surgical and immunological approaches:
- 4.2 Amniocentesis: ARTs-Ovulation induction, IVF, gamete intra-fallopian tube transfer, surrogate pregnancy, gestational carrier.
- 4.3 Reproductive toxicology: toxicology of male and female reproductive systems.
- 4.4 Effects of environmental chemicals and metals on reproductive systems.

REFERENCE BOOKS:

1. Adiyodi and Adiyodi 1977: Reproductive biology of invertebrates (IBH; New Delhi)
2. Adler. N.T. 1981: Neuroendocrinology of Reproduction.
3. Austin C.R & Short. R.V 1972: Reproduction in mammals (Cambridge University Press; London)
4. Balin. H and Glasser. S, 1976 : Reproductive Biology (ExperiaMedica Amsterdam)
Birkhead. R.T. David J.H and Pitnick S, 2009: Sperm Biology-An evolutionary perspective (Elsevier/ Academic press).
5. Chester-Jones I (1987): Fundamentals of Comparative vertebrate Endocrinology (Pleum Press: NY)
6. Gorbman A Dickhoff W.W. Vigna S R C Clark N.R and Ralph C I 1983: Comparative

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- Endocrinology (John Willey and Sons; NY)
7. Gupta. 1999: Reproductive Immunology (Narosa publications)
 8. John D. 1995: Endocrinology and Metabolism (Academic press: USA)
 9. Jones R.E. 1980. The Vertebrate Ovary ,Comparative biology and evolution (Plenum Press).
 10. Jones R.E. 1991. Human Reproductive biology (II Ed). (Academic press: USA)
 11. Johnson M.H. Evertitt B.J. & Brockmann H.J. 2008: Essential Reproduction 4th Edn (Blackwell Science; USA)
 12. Knobil.E. and Neil. J.D. 1998 :L Encyclopidia of Reproduction-Vol. I-IV, Academic press
 13. Knobil.E& Neil J.D 1994 : The physiology of Reproduction-II Ed, Vol. I & II, Reven Press Ltd
 14. Peters H and McMatty K.P. 1980. The Ovary (Granada Publishing House; NY)
 15. Richard E.J. 1991. Human Reproductive biology (II Ed) (Academic Press; USA)
 16. Sarkar. H.B.D 1996. Principles of Vertebrate Reproductive Biology
 17. Schimdi 1971. Biology of Lactation (Academic press: USA)
 18. Saidapur.S.K. 1989. (Ed) Reproductive cycles of Indian vertebrates. (Allied Publishers Ltd. New Delhi)
 19. Wooding P & Burton G. 2008. Comparative Placentation; Structure, functions & evolution (Springer).

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Paper CCT 3.2
ANIMAL PHYSIOLOGY

Teaching Hours: 64

Unit I : Digestion and Respiration.

- 1.1.Types of nutrition,
- 1.2.Method of feeding : Intracellular , Extracellular digestion
- 1.3.Digestion: Mechanical and chemical.
- 1.4.Respiration: Aquatic respiration, aerial respiration, respiratory system of reptiles, respiratory system of Aves, respiratory system of mammals.

Unit II: Circulation and Excretion.

- 2.1 Organs and Physiology of circulation: Types of circulation, circulatory organs , hearts in different vertebrate groups, Structure mammalian heart.
- 2.2 Components of blood and functional significance. Cascade of biochemical reactions (factors) involving in coagulation of blood.
- 2.3. Functional Anatomy of mammalian Kidney and its renal units. Physiology of urine formation.The significance of henle's loop. Role of hormones in renal physiology
- 2.4 Formation of nitrogenous excretory products ammonia, Urea, Uric acid.

Unit III: Nervous Coordination.

- 3.1 Structure and types of neuron. Glial cells and functions.Fundamentals of nerve impulse.
- 3.2. Basic concepts of nerve impulse, Sodium potassium pump, resting potential, Action potential, Role of ion channels.
- 3.3. Types of synapses- electrical and chemical, gap junctions ,ligand gated channels and the mechanism of synaptic transmission, cholinergic adrenergic and GABAergic transmitters, Neuromuscular Junction.
- 3.4. Molecular biology of sodium, potassium, ionic channels, patch clamp studies and their importance.

Unit IV: Muscular Physiology.

- 4.1. Types of muscles: striated, non striated and cardiac muscles .Ultra structure of striated muscle.
- 4.2. Muscle Contraction – Muscle Protein, Sliding filament theory, Energetics of muscle contraction.
- 4.3. Defects in muscle function, Muscle coordination disease, Muscular dystrophy.
- 4.4 Aging physiology concepts related to muscle function.

REFERENCE BOOKS

1. Animal Physiology -----Samson & Writy
2. Animal Physiology -----Nelson&Nelson
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. Animal Physiology ---- B.S.Tomer&Neera Singh



Paper DSET 3.1
a) ENVIRONMENTAL BIOLOGY

Teaching Hours : 64

Unit – I: Fundamental of the Ecosystem

- 1.1. Structure and function of the Ecosystem – abiotic and biotic interactions, energy flow, cycling of nutrients in ecosystems (biogeochemical cycles, N C P)
- 1.2. Major types ecosystems – Aquatic (lentic and lotic ecosystems), terrestrial ecosystems (forest, grass land, desert ecosystems).
- 1.3. Primary production and decomposition in different ecosystems. Ecological pyramids
- 1.4. Population and Ecology: Characteristics of a population. population growth curves, population regulation. Nature of communities; Community structure and attributes, levels of species diversity, edges ecology.

Unit – II : Environmental Pollution and Management

- 2.1. Environmental Pollution – Water, Air and Soil Pollution – sources of pollutions, effects and control measures of pollutants.
- 2.2. Global Environmental Problems – Global Climate Change and biodiversity; status; major drivers of biodiversity change.
- 2.3. Biodiversity change, biodiversity management approaches, Environmental Laws Related to water, air and soil
- 2.4. Natural resources and their management – Renewable and Non-renewable resources.

UNIT – III: Ecotoxicology

- 3.1. Classification of toxins, Assessment of toxicity – Acute and chronic toxicity, LC₅₀ and LD₅₀ assessment, Dose response relationship for toxicity assessment
- 3.2. Molecular mechanisms of toxicant action.
- 3.3. Biomagnifications – Bioaccumulation of toxic substance and risk: Exposure assessment dose dosage, risk characterization, risk analysis and communications and occupational health and illness.
- 3.4. Impact of pollution on bioindicator species

Unit – IV: Waste Treatment Technology

- 4.1. Sewage and waste water treatment – Aerobic and anaerobic treatment technologies
- 4.2. Sources and causes of solid waste and treatment of solid waste.
- 4.3. Bioremediation – advantages and disadvantages, In-situ and ex-situ bioremediation of contaminated soils.
- 4.4. Vermicomposting technology use in waste treatment.

REFERENCE BOOKS:

1. Fundamentals of Ecology. E.P.Odum, G W Barrett.
2. Environmental Science .William .P.Cunninsham Barborawoodworthsaigo.
3. The use of Earthworms in waste disposal by . Edward, C.A.
4. Introduction to Environmental Engineering & Science Gilbert M. Masters.
5. Essential of Ecology by colin R. Townsend Michael Begon John.L.Harper.
6. Environmental Biology -- A.G.Agarwal.
7. Environmental Science by G.Tyler Miller.
8. Toxicology -- Y.K.Lahir.

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Paper DSET 3.1

b) AQUATIC BIOLOGY AND FISHERIES

Teaching Hours: 64

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 math and science.

Unit I: 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

Unit II: 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.

Unit III: 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.

Unit IV : Fish culture practices and induced breeding in India:

- 4.1 Freshwater carps (Indian major and minor)
- 4.2 Lacustrine fish culture (ornamental).
- 4.3 Mariculture – Finfish and shellfish culture. Hybridization and cryopreservation
- 4.4 Fishing gears and crafts, Fishing industry in India, fishery economics, fishery research Institute in India

REFERECNE BOOKS

1. Beaven C R 1998 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-

Paper GET-3.1
HUMAN PHYSIOLOGY

Teaching hours : 64

Unit-I: Introduction to Physiology

- 1.1 Introduction to physiology: Cell and general physiology.
- 1.2 Internal environment and homeostasis.
- 1.3 Functional organization of human body. Cell and its function.
- 1.4 Anatomy and physiology of skeletal and smooth muscles. Anatomy and physiology of cardiac muscles.

Unit-II: Nutrition and digestion

- 2.1 Basic nutritive materials, and vitamins, balance diet.
- 2.2 Functional morphology of the gastrointestinal tract. Physiology of digestion and absorption.
- 2.3 Malnutrition, over-nutrition and obesity.
- 2.4 Hyperacidity, amebiasis, worms and gastroenteritis.

Unit-III: Circulation

- 3.1 Arteries, veins and capillaries and their diseases.
- 3.2 Blood flow and blood pressure. Regulation of blood circulation.
- 3.3 Composition of blood, blood groups, blood transfusion and artificial blood.
- 3.4 Cardiac arrhythmias, ECG myocardial infarction and cardiac arrest.

Unit-IV: Nervous system

- 4.1. General organization of the nervous system, division of the nervous system peripheral and central nervous system. Sensory and motor systems.
- 4.2 Structure and functional differentiation of brain.
- 4.3 Neuronal integration at circuit and associate level
- 4.4 Mental reasoning, physiology of dream, brain waves and their importance.

REFERENCE BOOKS:

1. Text book of medical physiology: Guyton AC and Hall JE, Xth edition Saunders , Philadelphia, 2004.
2. Concise medical physiology: Chaudhuri SK, 4th edition, Central Book Agency, 2002, Kolkata.
3. Biological sciences: Taylor DJ, Green, NPO and Stout GW edited by Soper R, Cambridge University Press, 3rd edition 1997, Cambridge UK.
4. Animal physiology: Schmidt-Nielson K, 5th edition, Cambridge University Press, Cambridge UK.
5. Human physiology: Wiki books contributors.
http://en.wikibooks.org/wiki/Human_Physiology.
6. Human Physiology: An Integrated Approach with Interactive Physiology: Dee Unglaub Silverthorn DU, 3rd edition, Prentice Hall.

PRACTICALS 3.1

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Paper: CCT 4.1
ANIMAL BIOTECHNOLOGY

Teaching 64 hrs

Unit I Introduction:

- 1.1 Concept and Scope of Biotechnology, Current Status and Future
- 1.2 Animal Cell and Tissue Culture: Principles of tissue culture, Requirement Equipments, Culture media, Temperature, pH etc. Application of cell culture
- 1.3 Stem Cell Technology: Properties of stem cells, Growth and differentiation of adult stem cells,
- 1.4 Advantage and disadvantages of stem cell technology.

Unit II Cloning and Transfer Techniques

- 2.1 Gene Cloning and Gene Transfer Techniques Somatic cell nuclear transfer, Recombinant DNA Technology-Molecular tools, Cloning vectors, Cloning strategies
- 2.2 Genetic Engineering Guidelines, Gene transfer methods Micro injection, Electroporation, Polyctions, Lipofection, Retroviral infection.
- 2.3 In-vitro fertilization, Embryo transfer and cloning in mammals, Procedure used and limitation of IVF
- 2.4 Embryo Transfer Technique, Cloning of different Mammals.

Unit III Transgenic animals and Gene Therapy

- 3.1 Transgenic animals and Gene Therapy: Production of transgenic animals, Gene targeting, Knock-out and Knock-in Technology.
- 3.2 Transgenic animals- Ethical concerns and Patenting. Gene therapy: Somatic versus- germ line therapy, Gene therapy in animals and embryos.
- 3.3 Application of Animal Biotechnology
- 3.4 Production of regulatory proteins (TRF, GRF, Somatostatin, Somatomedin), Epidermal growth factors, Anticoagulants, Recombinant vaccines, DNA vaccines, Monoclonal antibodies, Hybridoma Technology. DNA probes, Biochips, DNA finger printing, Aquaculture and Animal feed additives.

Unit IV Nano-Technology and Immunology

- 4.1 Nanotechnology and its Application in Biology, Human Genome Project and its Applications
- 4.2 Cells and Tissues of Immune system, Types of Immunity Innate and Acquired Immunity, Antigens, Antigenicity and Immunogenicity,
- 4.3 Structure and function of function of Antibody molecules, Monoclonal antibodies, Antigen-Antibody interactions.
- 4.4 Cell mediated Immunity and Humoral Immunity, Hypersensitivity and Autoimmunity

See

References:

1. Chirikjian, J.C. Biotechnology: Theory and Techniques. Vol. 1- II Jones and Bartlett, 1995
2. Glick, B. R. and Pasernak, J.J. Molecular Biotechnology: Principles and Applications of Recombinant DNA II (Ed) A.S.M. Press 1998
3. Primrose, S. B. Molecular Biotechnology-I (Ed). Panima Publishing Corporation, New-Delhi, Bangalore, 2001
4. Cels, J. E. (Ed) Cell Biology: A Laboratory Handbook-Vol. I and U. Academic Press, 1998.

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Paper CCT 4.2
APPLIED ZOOLOGY

Teaching hours : 64

Unit I Sericulture and Apiculture

- 1.1 Modern rearing methods for chawki and lateage silkworm, procurement and incubation of eggs,
- 1.2 synchronization of hatching, brushing and feeding lea quality and its preservation.
Rearing from brushing to mounting for seed production and silk production
- 1.3 Apiculture: Importance, history and development of bee keeping.
- 1.4 Different species of honeybees and their distribution. Management of bees,
Product and by product of apiculture and their use

Unit II Vermiculture and Aquaculture

- 2.1 Vermiculture: Introduction and importance of Vermiculture,
- 2.2 Uses of earthworms for biodegradation of organic waster materials, Earthworms as protein source, Vermiculture technique.
- 2.3 Aquaculture: Fin-fish Culture: Freshwater, brackish-water and marine fish culture in India.
- 2.4 Shell-fish Culture: Prawn edible bivalve and Pearl culture.

Unit-III Dairy

- 3.1 History, Importance and scope of Dairy
- 3.2 Dairy breeds and Management: Cattle breeds: Milk breeds, Draught breeds, Exotic breeds Buffalo breeds: Swap buffaloes and Riverine Buffaloes
- 3.2 Principles and methods of breeding: Inbreeding, out breeding and cross breeding.
Fertility and breeding efficiency, artificial I insemination
- 3.3 Dairy products: Physico-chemical properties of cow and buffalo milk, Processing, preservation and marketing of milk and milk products.
- 3.4 Dairy pathology: Viral, Bacterial, parasites (Endo-Ecto) and vaccination programs

Unit-IV Poultry, Lac culture and Fur Animal farming

- 4.1 History and Importance and Scope of poultry- Poultry Breeds - Principles and techniques and methods of breeding
- 4.2 Poultry products: Egg, Meat, feather, excreta, nutritive value of egg and meat.
Poultry pathology: Viral, Bacterial, fungal and protozoan diseases and their control, vaccines and for infections.
- 4.3 Lac culture: Lac insect (Scientific name), composition of Lac, strains of Lac insect, cultivation of Lac host plants (in brief) processing of Lac and uses of La
- 4.4 Fur Animal farming - Rabbit meat production. Disposal and utilization of fur wool and recycling of waste by products. Grading of wool.

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REFERENCE :

1. Srivasthava. K P , Text book of Applied Entomology Vol. I & II Kalyani Publishers 1996
2. Mishra R C , Perspectives in Indian Apiculture. Allied Scientific Publishers, Bikanar, India, 1999
3. Lee, K E . Earthworms; Their Ecology and Relationship with Soils and Land use. Academic Press, London, 1985
4. Snathanam, R. Sukumaran, N and Natarajan, P. A Manual of Fresh water Aquaculture , Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1990
5. Bell F W and Canterbarry, E R. Aquaculture for Developing Countries- A Feasibility Study. Cambridge ; Ballinger Publishing Co. 1976

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Paper DSET 4.1
a) GENERAL ENDOCRINOLOGY

Teaching hours : 64

Unit I: Invertebrate endocrine systems:

- 1.1 Autocrine, paracrine and endocrine secretions - an overview of mammalian endocrine system.
- 1.2 Endocrine glands of annelida and arthropoda- A comparative account.
- 1.3 Methods in Endocrine research.
- 1.4 Neuroendocrine concept.

Unit II: Mechanism of hormone action:

- 2.1 Types of hormone receptors-membrane bound cytoplasmic and nuclear receptors.
- 2.2 Regulation of receptor number, signal transduction- secondary messengers, cyclic AMP, prostaglandin
- 2.3 Calmodulin mediated pathways, genomic mechanism of hormone action – thyroid & steroid hormones.
- 2.4 Termination of hormone action.

Unit III: Endocrine hormones

- 3.1 Morphology, Biosynthesis and Biological action of hormones of endocrine glands-
- 3.2 Structure and functions of thyroid, parathyroid, adrenal gland, pancreas and pineal glands
- 3.3 Pathophysiology of hormonal impairments such as cretinism, Cushing syndrome and Addison's disease.
- 3.4 Hormones and metabolism, Regulation of Carbohydrate, Protein & Lipid metabolism.

Unit IV:

Hypothalamus and hypophysial axis

- 4.1 Hypothalamus- structure and functions, hypothalamohypophysial portal system, regulation of hypophysial secretions.
- 4.2 Morphology of pituitary gland (fishes – mammals).
- 4.3 Functional cell types of hypophysis, hypophysial hormones and physiological role
- 4.4 Causes for impaired and excessive secretions – Pathophysiology of pituitary dwarfism, gigantism and acromegaly

REFERENCE BOOKS:

1. Bentley, P.J. 1994: Comparative vertebrate endocrinology –III Ed. Cambridge Univ. Press (NY)
2. Chandra. S. Nagi : Introduction to Endocrinology PHI (New Delhi)
3. Degroot. L.J. and Neill, J.D. 2001: Endocrinology-IV Ed, Vol. I-III. W.B. Saunders company (Ed)
4. Gorbman and Beru .1962: A text book of Comparative Endocrinology
5. Highman and Hill 1972: Comparative Endocrinology of Invertebrates
6. Machodley Prentree.1996: Comparative endocrinology and reproduction (Narosa publication house; New Delhi)
7. Mandal. A. 1994: Handbook of Neuroendocrinology, EMKAY publications
8. Nelson. R.J. 1995: An Introduction to behavioural endocrinology Sinauer Associates, Inc.
9. Nooris. D.O. 1996 :Vertebrate endocrinology IIIrd Ed., Academic Press
10. Pickford G.E & Atz W.J.1957: The Physiology of Pituitary gland of fishes (Zoological Survey; New Delhi)
11. Saidapur.S.K.1989: (Ed) Reproductive cycles of Indian vertebrates. Allied Publishers Ltd, New Delhi
12. Turner. C.D. and Bugnara.J.T 1976: General Endocrinology., W.B. Saunders
13. Zarrow M.X and McCarthy. J.L 1964: Experimental endocrinology (Academic Press; New York).

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Paper DSET 4.1
b) ANIMAL BEHAVIOUR

Teaching hours : 64

Unit – I

- 1.1 Introduction to animal behaviour and brief history. Branches of Ethology.
- 1.2 Development of behaviour :Accomodative and associate learning.
- 1.3 Hormones and early development. Genetic basis of behaviour. Neural control of behaviour.
- 1.4 Stereotype behaviour: Kinesis, taxis, orientation and reflexes.

Unit – II

- 2.1 Motivation, Decision making on different scales, drive, Models of Motivation, stress.
- 2.2 Conflict behaviour: Territorial conflicts, Threat display, Displacement activity.
- 2.3 Stimuli and communications: Diverse sensory capacities, sign stimuli, stimulus filtering communication.
- 2.4 Applications of pheromones and their biological actions in vertebrates and invertebrates.

Unit- III

- 3.1 Ecological aspects of behaviour: Habitat selection Food selection, Optimal foraging theory, Anti predator defences.
- 3.2 Aggression, Homing, territoriality, Dispersal. Host-Parasite relations.
- 3.3 Courtship and ritual behaviour: Mate selection, Male –Male selection, Female choice and Maternal behaviour.
- 3.4 Social organisation in Insects primates.

Unit IV

- 4.1 Biological Rhythms :Carcadian and circannual rhythms.
- 4.2 Hormones and behaviour:
- 4.3 Chemical communication, body colouration, social life in insects (termites and honey bees).
- 4.4 Hormones in insects and crustacean metamorphosis.

REFERENCE BOOKS.

- 1 Aubrey Manning and Marine .S . Dawkins. An Introduction To Animal Behaviour. Cambridge University Press .1995.
- 2 McFarland. D . The Oxford Companion To Animal Behaviour.
- 3 McFarland . D. Animal Behaviuor Psychology, Ethology and Evolution. Pitman Publications . 1985.
- 4 Slater .P .J . B. Essentials of Animal Behaviour . Cambridge university Press.1999.
- 5 Krebs J.R. and Davies . N.B. An Introduction To Behavioural Ecology – III(Ed). Blackwell Science Ltd. 1993.

PRACTICALS 4.1

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