

DRAVIDIAN UNIVERSITY

SRINIVASAVANAM

KUPPAM – 517 426

ANDHRA PRADESH

INDIA



**M.Sc. ZOOLOGY
(SELF SUPPORTING)**

**CURRICULUM
(EFFECTIVE FROM THE ACADEMIC YEAR 2020-21)**

**DEPARTMENT OF ZOOLOGY
SCHOOL OF HERBAL STUDIES AND NATURO
SCIENCES**

REGULATIONS FOR M.Sc. ZOOLOGY (2 YEARS PROGRAMME)

Name of the Programme: M.Sc. Zoology

A brief description of the Programme: This is full time programme to impart knowledge and training in different fields of Zoology so as to equip them for higher studies in research and/or job orientation. The programme obliges students to read original publications and envisages significant inputs in Laboratory work, communication skills, creativity, planning, execution and critical evaluation of the scientific data. The courses formulated have a Zoological slant than biological and are up to date. The course is fine tuned in order to enhance the job opportunities of the students.

School offering the Programme: The School of Herbal Studies and Naturo Sciences will offer two years full time M. Sc program in Zoology (Self-supporting) with new scheme of curriculum for the academic year 2020-2021.

Board of Studies: The 3rd Board of Studies meeting of M. Sc Zoology is approved the Programme structure and CBCS syllabus of M. Sc Zoology 1st, 2nd, 3rd, and 4th semesters on 16-11-2019.

Components of Programme

- 1) Core courses – Compulsory
- 2) Internal Elective Courses – open for the students of the particular program in which they are admitted
- 3) External Elective Courses – open for the students from the other department
- 4) Soft Skill - open for the students from the other department.

Eligibility: A candidate who have passed the three-year B.Sc., Examination with Zoology will be eligible for admission to this programme.

Duration of the course: The programme for the Degree of Master of Science in Zoology shall consist of two years divided into four semesters, over a total of 2450 marks with 100 credits.

- a) The minimum duration for completion of a two-year master program in Zoology is 4 semesters. The maximum period for completion is ten semesters counting from first semester.
 - b) Even if a candidate earns the required number of credits in less than 4/6 semesters, he/she has to necessary study for four semesters for the two years.
- A department shall offer a minimum two internal electives in a semester.
 - External elective shall be offered by a department only when there is a minimum enrolment of five students for that particular elective.
 - One credit shall mean one period of teaching for theory or two periods for laboratory per week in a semester for 90 working days (15 weeks).

Credits (Core and Electives): 100 credits,

Core Courses : 74 credits
Internal Electives (IE) : 16 credits
External Electives (EE): 6 credits (2 EE X 3= 06 credits)
Soft skills: 4 credits (2 SS X 2 = 4 credits)

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100 Credits
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Number of semesters, how the credits are distributed:

Distribution of credits and marks: 1st Semester: 24 credits – 600 Max Marks

2nd Semester: 25 credits – 600 Max Marks

3rd Semester: 27 credits – 650 Max Marks

4th Semester: 24 credits – 600 Max Marks

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100 Credits 2450 Max Marks

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Attendance:

- ✓ A candidate who has less than 75% attendance shall not be permitted to sit for the End-semester examination in the course in which the shortfall exists.
- ✓ However, He/She shall be permitted if He/She has 62.5% and obtain the condonation by paying the specified fee along with the medical certificate.
- ✓ Those candidates who fail to full-fill the above requirements shall not be permitted to take end semester examinations and such candidates shall re-do the course.

Course Fee:

- Each student admitted to the M.Sc. Zoology degree programme will pay a Tuition, Lab, Special, Stationery, Chemical and computer and other fees as decided by the University from time to time

Examination and Evaluation:

Evaluation will be done on a continuous basis, three times during each semester. For the purpose of uniformity, particularly for interdepartmental transfer of credits, there will be a uniform procedure of examination to be adopted by all teachers. There will be two Internal Assessments tests and one End-semester examination in each course during every semester.

Syllabus

From the academic year (2013-2014) Choice Based Credit System (CBCS) is introduced in all departments of the University. According to this system the M.Sc. Zoology programme requires a student to earn 100 credits in four semesters. The basic programme structure and the scheme of examinations are given in tables that follow.

**M.Sc., ZOOLOGY – (CBCS) SEMESTER SYSTEM
(EFFECTIVE FROM THE ACADEMIC YEAR 2020-21)
PROGRAMME STRUCTURE**

The Two-year M.Sc. Zoology programme will have four semesters.

The programme structure will be as given below:

Paper No.	Title of the Paper	Type of Paper	Periods/Week	Duration of Exam (Hours)	IA	EA	Max. Marks	Credits
I Semester								
Zoo 101	Invertebrata & Vertebrata	Core	4	3	30	70	100	4
Zoo 102	Biomolecules and Metabolic Regulation	Core	4	3	30	70	100	4
Zoo 103	Cell Biology & Immunology	Core	4	3	30	70	100	4
Zoo 104	Tools and Techniques in Biology	Core	4	3	30	70	100	4
Practical								
Zoo 105P	Invertebrata & Vertebrata & Biomolecules and Metabolic Regulation	CP	8	4		100	100	4
Zoo 106P	Cell Biology & Immunology and Tools and Techniques in Biology	CP	8	4		100	100	4
Total Marks and Credits for I Semester							600	24
II Semester								
Zoo 201	Biostatistics & Bioinformatics	Core	4	3	30	70	100	4
Zoo 202	Genetics & Evolution	Core	4	3	30	70	100	4
Zoo 203	Animal Physiology	Core	4	3	30	70	100	4
Zoo 204EE	Sericulture-I	EE-I	3	3	15	50	65	3
Zoo 204SS	Soft Skills-I	SS-I	2	2	10	25	35	2
Practical								
Zoo 205P	Biostatistics & Bioinformatics and Genetics & Evolution	CP	8	4		100	100	4
Zoo 206P	Animal Physiology	CP	8	4		100	100	4
Total Marks and Credits for II Semester							600	25

Paper No.	Title of the Paper	Type of Paper	Periods/Week	Duration of Exam (Hours)	IA	EA	Max. Marks	Credits
III Semester								
Zoo 301	Animal Biotechnology & Microbiology	Core	4	3	30	70	100	4
Zoo 302	Developmental Biology	Core	4	3	30	70	100	4
Zoo 303	Choose any one of the following A. Animal Ecology & Environmental Biology B. Biodiversity & Wild life Conservation C. Pathobiology	IE-I	4	3	30	70	100	4
Zoo 304 EE	Biodiversity	EE-II	3	3	15	50	65	3
Zoo 304 SS	Soft Skills-II	SS-II	2	3	15	20	35	2
Practical								
Zoo 305P	Animal Biotechnology & Microbiology and Developmental Biology	CP	8	4		100	100	4
Zoo 306P	Internal Elective Practical	IEP	8	4		100	100	4
Zoo-307	Choose any one of the following A. Seminar Presentation & Viva-Voce B. Ecological field trip	IE-II	2	2	50		50	2
Total Marks and Credits for III Semester							650	27
IV Semester (A)								
Zoo 401	Molecular Biology	Core	4	3	30	70	100	4
Zoo 402	Neurobiology and Animal Behaviour	Core	4	3	30	70	100	4
Zoo 403	Economic Zoology	Core	4	3	30	70	100	4
Zoo 404	Choose any one of the following A. Enzymology B. Endocrinology C. Toxicology	IE-III	4	3	30	70	100	4
Practical								
Zoo 405P	Molecular Biology & Neurobiology and Animal Behaviour	CP	8	4		100	100	4
Zoo 406P	Economic Zoology and Internal Elective	C+IEP	8	4		100	100	4* (2+2)
Total Marks and Credits for IV Semester							600	24

(OR)

IV Semester (B)								
Zoo 401	Molecular Biology	Core	4	3	30	70	100	4
Zoo 402	Choose any one of the following A. Economic Zoology B. Endocrinology C. Toxicology	IE-III	4	3	30	70	100	4
Zoo 403	Dissertation & Viva-Voce	Core	20	3		250	250	10
Practical								
Zoo 404P	Molecular Biology and Internal Elective-II	C+IEP	8	4		100	100	4* (2+2)
Zoo 405S	Seminar Presentation	Core	2	2	50		50	2
Total Marks and Credits for IV Semester							600	24
Total Marks and Credits for 4 Semester							2450	100

Note: Students may opt either IV Semester (A) or IV Semester (B)

IA = Internal Assessment, EE: External Examination, IE: Internal Elective, EE: External Elective, SS: Soft Skills, * 2 Core and 2 IE, C=Core

Total Credits and Marks Semester Wise

Type of Credits/Marks Semester	Core	Internal Elective	External Elective	Soft Skills	Total	Marks
I	24	Nil	Nil	Nil	24	600
II	20	Nil	3	2	25	600
III	12	10	3	2	27	650
IV	18	6	Nil	Nil	24	600
Total	74	16	6	4	100	2450

M.Sc., ZOOLOGY (2 YEARS PROGRAMME)
(CBCS) SEMESTER SYSTEM
(EFFECTIVE FROM THE ACADEMIC YEAR 2020-21)

Programme Core Objectives and Specific Outcomes

Programme Core Objectives (PCOs)

- PCO1:** This is full time programme to impart knowledge and training in different fields of Zoology so as to equip them for higher studies in research and/or job orientation.
- PCO2:** The programme obliges students to read original publications and envisages significant inputs in Laboratory work, communication skills, creativity, planning, execution and critical evaluation of the scientific data.
- PCO3:** The courses formulated have a Zoological slant than biological and are up to date.
- PCO4:** The course is fine tuned in order to enhance the job opportunities of the students.

Program Specific Outcomes (PSOs)

- PSO1:** Understand the basic concepts of animal kingdom including invertebrate & chordate, genetics & evolution, animal physiology.
- PSO2:** Comprehend the nature and functions of cell biology, immunology, endocrinology, biomolecules and metabolic regulation, tools and techniques in Biology, developmental biology, neurobiology and molecular biology
- PSO3:** Be aware of environmental biology, biodiversity, wild life conservation, animal behavior, and toxicology
- PSO4:** Recognize the applications of animal biotechnology & microbiology, enzymology, bioinformatics and biostatistics, economic zoology including sericulture, lac culture and api culture.
- PSO5:** The students read original publications and envisaged the significant inputs in Laboratory work, communication skills, creativity, planning, execution and critical evaluation of the scientific data

SEMESTER – I

Zoo 101: INVERTEBRATA AND VERTEBRATA

Learning objectives of Zoo 101:

- To know the International nomenclature and classification of Invertebrates
- To Classify the taxonomy, coelom, comparative study of different systems of digestion, respiration, circulation, nervous systems of invertebrate and chordates

Learning Outcomes of Zoo 101:

The Course provide an overview to know International Nomenclature and classification of Invertebrates, functional activities of organisms, affinities, morphological features, larval forms and economic importance of invertebrates and comparative anatomy of different systems of invertebrates and vertebrates.

- ✓ Know the animal's classification system and their zoological nomenclature.
- ✓ Describe the Patterns of feeding and digestion in lower metazoan and Feeding in polychaeta, Mollusca, Echinodermata
- ✓ Learn the larvae of crustacean, Echinodermata and their significance
- ✓ Understand the Structure of Gill, lungs, trachea, mechanism of respiration, circulatory system in Annelids, Arthropods & Mollusca and advanced nervous system in Annelida, Arthropoda & Mollusca
- ✓ Understand the comparative anatomy of vertebrates

INVERTEBRATA:

UNIT -1: Taxonomy & Organizational Coelom, Nutrition & Digestion

- 1.1 International code of Zoological nomenclature, Taxonomical procedures.
- 1.2 Acoelomata, Pseudocoelomata, Coelomata, Proterostornia and Dueterostornia
- 1.3 Patterns of feeding and digestion in lower metazoan
- 1.4 Feeding in polychaeta, Mollusca, Echinodermata

UNIT-II: Respiration, Circulation, Nervous System And Larval Forms

- 2.1 Structure of Gill, lungs, trachea, Mechanism of Respiration
- 2.2 Circulatory system in Annelids, Arthropods & Mollusca
- 2.3 Advanced nervous system- Annelida, Arthropoda & Mollusca
- 2.4 Larval forms of Crustacea and Echinodermata

CHORDATA

UNIT- III: Evolutionary time scale, Integumentary system and Circulatory system

- 3.1 Evolutionary time scale, Eras, Periods & Epoch major events in evolutionary time Scale
- 3.2 Vertebrate integument and derivatives, Skin structure and function, glands, scales, Horns, claws, nails, hoofs, feathers, hair
- 3.3 Comparative anatomy of heart structure
- 3.4 Comparative account of aortic arches and portal system

UNIT – IV: Respiratory and Nervous System

- 4.1 Comparative anatomy of Respiratory organs
- 4.2 Comparative anatomy of brain and spinal cord
- 4.3 Organs of vision
- 4.4 Organs of Hearing and tactile responses

SUGGESTED READING MATERIAL:

1. Hyman, L.B. The invertebrates. Vol.1. Protozoa through Ctenophora, Mc Graw Hill Co., New York.
2. Barrington, E.J. W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates. Vol. 8. Mc Graw Hill Co., New York and London.
5. Hyman, L.B. The Invertebrates. Vol.2 Mc Graw Hill Co., New York and London.
6. Barnes, R.D. Invertebrate Zoology, III edition. W.b. Saunders Co., Philadelphia.
7. Russel-Hwlter, W.D. A biology of higher invertebrates, the Mc Millan Co. Ltd., London.
8. Hyman, L.B. The Invertebrates smaller coelomate groups, Vol. V. Mc.GrawHill, Co., New York
9. Read, C.P. Animal Parasitism. Prentice Hall Inc., New Jersey.
10. Sedwick, A. A student text book of Zoology, Vol.II and III. Central Book Depot, Allahabad
11. Parker, T.J., Haswell, W.A. Text Book of Zoology, Mc Millan Co., London.
12. Alexander, R.M. The Chordata. Cambridge University Press, London
13. Barrington, E.J. W. The Biology of Hernichordata and Protochordata. Oliver and Boyd, Edinbrough.
14. Bourne, GH. The structure and functions of nervous tissue. Academic Press, New York
15. Carter, GS. Structure and habit invertebrate evolution Sedwick and Jackson, London.
16. Eccles, J. C. The understanding of the brain. McGraw Hill Co., New York and London.
17. Kingsley, J.S. Outlines of Comparative Anatomy of Vertebrates. Central Book Depot, Allahabad.

PRACTICALS OF INVERTEBRATA AND VERTEBRATA

INVERTEBRATA:

1. Protozoa: Elpidium, Paramecium
2. Porifera: Spongilla, sycon, L.S. of Sycon, T.S. of Sycon
3. Coelenterata: Obelia colony, Physalia
4. Platy helminthes: Planaria, Echinococcus granulosus
5. Nemathehelminthes: Ascaris lumbricoides, Ancylostoma duodenale
6. Arthropoda: Nauplius larva, House fly mouth parts
7. Mollusca: Chiton, Glochidium larva
8. Echinodermata: Ophithrix Fragilis, Bipinnaria larva.
9. Hemichardata: Balanoglassus

CHORDATA:

1. Protochordata: Herdmania, Amphioxus
2. Cyclostomata: Petromyzon, myxine
3. Pisces: Pristis, torpedo, Scoliodon, Sphyrna, Trygon, Chanos chanos, Anguilla, Hippoampus, Exocoelous, Clarias.
4. Amphibian: Ichthyophis, Amblystoma, Hyla, Rhacophorour
5. Reptiles: Draco, Chameleon, Russels viper, Naja-Naja, Bungarus, Enhydrina, Crocodilus
6. Aves: Bubo, Columba
7. Mammalia: Orthorhynchus anatinus, tachyglassus, Aculestus, Pteropus, Funambulus, manis, loris
8. Comparative anatomy of vertebrates:
9. Types of Scales: Placoid scales, Cycloid scales, ctenoid scales
10. Types of Feathers: Types of Feathers, Flight Feathers, Contour Feathers, Filoplume Feathers, Down Feathers, Semiplumes, Bristle Feathers
11. Comparative anatomy of horns: True horns, Pronghorns, Antlers, Knob horns, Hair horns.
12. Comparative anatomy of heart structure: Scoliodon L.S. of heart, Rabbit L.S. of heart, Rabbit internal structure of heart, Columba L.S. of heart, Dorsal view of heart of Frog, Ventral view of heart of Frog, Internal structure of Frog heart, Calotes L.S. of heart structure.
13. Comparative anatomy of lungs: Amphibian lung, Reptile lung, Aves lung, Mammalian lung. Comparative anatomy of brain: Amphibian brain, Aves brain

SEMESTER – I

Zoo 102: BIOMOLECULES AND METABOLIC REGULATION

Learning objectives of Zoo 102:

- To understand the chemical bonds, various metabolisms of carbohydrates, lipids, proteins, nucleic acids, hormones and biomedical importance of metabolic products
- To Classify the carbohydrates, lipids, proteins, nucleic acids, hormones

Learning Outcomes of Zoo 102:

The Course provide an overview to understand the chemical bonds, various metabolisms of carbohydrates, lipids, proteins, nucleic acids, hormones and biomedical importance of metabolic products and to Classify the carbohydrates, lipids, proteins, nucleic acids, hormones.

- ✓ Know the Principles and Laws of thermodynamics.
- ✓ Describe the Intermediary Metabolism-I: Glycolysis, TCA Cycle and their Bio-medical importance
- ✓ Classify the carbohydrates, lipids, proteins, nucleic acids, hormones
- ✓ Learn the Clinical disorders of purine and pyrimidine metabolism; Hyperuricemia or gout; Hypo-Uricemia, Orotic aciduria
- ✓ Understand the Definition, Structure and function of different type of carbohydrates, lipids, proteins, nucleic acids, hormones

UNIT-I

- 1.1 Chemical foundations of biology: Chemical bonds, Principles and Laws of thermodynamics.
- 1.2 Carbohydrates: Definition and Classification. Structure and function of important Mono, Oligo and Polysaccharides.
- 1.3 Intermediary Metabolism-I: Glycolysis, TCA Cycle and their Bio-medical importance.
- 1.4 Intermediary Metabolism-II: Gluconeogenesis, HMP Shunt and their Bio-medical importance.

UNIT-II

- 2.1 Proteins: Definition and Classification. Structure and function of important Proteins: Haemoglobin, Myosin and Actin.
- 2.2 Amino acids: Classification, Properties.
- 2.3 Catabolism of Proteins and Amino acids-I: Biosynthesis of Urea- Detoxification of Ammonia- Metabolic disorders of Urea cycle.
- 2.4 Catabolism of Proteins and Amino acids-II: Phenylalanine, Tryptophan, Biosynthesis and degradation of Polyamines and their Bio-medical importance.

UNIT-III

- 3.1 Lipids and Fatty acids: Definition and Classification.
- 3.2 Structure and biological functions of various classes of lipids: Triacylglycerols (triglycerides), Phospholipids, Glycolipids.
- 3.3 β - oxidation of fatty acids, Oxidation of unsaturated fatty acids, Ketogenesis.
- 3.4 Biosynthesis of long chain fatty acids (Palmitic acid), Clinical aspects.

UNIT-IV

- 4.1 Nucleic acids: Structure of purines and pyrimidines. Types of DNA and RNA.
- 4.2 Biosynthesis of purine nucleotides, Catabolism of purines.
- 4.3 Biosynthesis of pyrimidine nucleotides, Catabolism of Pyrimidines,
- 4.4 Clinical disorders of purine and pyrimidine metabolism; Hyperurecemia or gout; Hypo-Uroemia, Orotic aciduria

SUGGESTED READING MATERIAL:

1. D. Voet and J.G Voet, Biochemistry, 1. Wiley & Sons.
2. David L. Nelson and Michael M. Cox, Lehninger; Principles of Biochemistry, McMillan Lange Medical
3. Robert K.Murrey, D.K. Granner, P.A. Mayes and V.W. Rodwell; Harper's Biochemistry, Worth Publishers.
4. 1. Biochemical Techniques: Theory and Practical. 1987. J.P. Robft and B.J. White, Waveland Press, Inc. Prospect Heights, IL, pp. 407.
5. 2. Biochemistry. 1992. R.H. Abeles. Panima Publication. pp 894.
6. 3. Principles of Biochemistry. 2nd ed. 1993. A.L. Lehninger, D.L. Nelson, M.Cox. Panima Publications. pp 1090.
7. 4. Harper's biochemistry. 1988. R.K. Murray. D.K. Granner, P.A. Mayes. Printice Hall International.
8. Biochemistry. 1998. 2nd ed. Zubay. Addison – Wesley Publication.
9. Biochemistry. 1998. 3rd ed. Luber Stryer. Freeman International.
10. Biochemistry of the Nucleic acids. 1992. 11th ed. R.L.P. Adams, J.T. Knowler, D.P. Leader. Chapman and Hall.
11. Proteins: Structure, function and evolution. Dickerson & Geis, 2nd Edn. Benjamin / Cummings, Meulo park, Callf 1983.
12. The Proteins: Neurath and Hill, 3rd Edn. Academic New York.
13. Biochemistry, A problem approach, 2nd ed. Wood, W.B., Addison Wesley, 1981.
14. Biological Chemistry, Mahler & Cordes.
15. Text Book of Biochemistry West, E.S. Todd, Mason & Vanbruggen, Macmillian & Co.
16. Principles of Biochemistry – White – A, Handler, P and Smith E.L. Mc. Graw–Hill.
17. Biochemistry – Cantrow, A. Sehepartz. B. Sunders – Japan.
18. The Carbohydrates: Pigman & Hartman Vol. II – A & II – B.
19. Biochemistry Voet & Voet.
20. Comprehensive biochemistry – Florkin & Storz, Academic Press.
21. Organic Chemistry, T.L. Eeunar, ELBS.
22. Organic Chemistry, J.P.Cohen, Vol.3, Edward Arnold & Co.
23. Basic Principles of organic chemistry Roberts & Cashino (Benjamin).

PRACTICALS OF CHEMISTRY OF BIOMOLECULES AND METABOLIC REGULATION:

1. Estimation of total soluble and structural proteins
2. Estimation of free amino acids
3. Estimation of Total carbohydrates
4. Estimation of Total cholesterol
5. Estimation of Ascorbic Acid
6. Estimation of Total Lipids

SEMESTER – I

Zoo-103: CELL BIOLOGY AND IMMUNOLOGY

Learning objectives of Zoo 103:

- ✓ To know the structure and functions of various organelles of pro and eukaryotic cell and their membrane structure and protein sorting,
- ✓ To understand the nature and components of defence mechanism of human body and cells and organs of the immune system, antigen-antibody interaction

Learning Outcomes of Zoo 103:

This course outline is designed to develop awareness and interest among students on basic structure and function of cell; Scope of Immunology, lymphoid organs, immune system and their functions and antigen & antibody reactions. By the end of the course, students may be able to:

- ✓ Understand the structure and function of cell and its organelles
- ✓ Acquire combined knowledge on Cell division and cell cycle
- ✓ Understand the types of Immune system
- ✓ Know the types of lymphoid organs, lymph nodes and their functions
- ✓ Realize the antigen types and their functions
- ✓ Describe the types and functions of Immunoglobins

Syllabus

UNIT-I.

- 1.1. Structure and Function of intracellular organelles: Plasma membrane, Mitochondria, Golgi complex, Endoplasmic reticulum, Lysosomes, Nucleus.
- 1.2. Membrane: Structure of model membrane, Lipid bi layer and Membrane proteins.
- 1.3. Membrane transport: Active transport – Passive transport – Diffusion – Osmosis – Ion channels, Membrane pumps
- 1.4. Vesicular traffic and Protein sorting: Translocation of proteins in to mitochondria – Endoplasmic reticulum and Golgi - Endocytosis – exocytosis.

UNIT-II

- 2.1 Cell cycle and division: Mitosis, Meiosis, Regulation of cell cycle by cell growth, Cell cycle check points
- 2.2 Functions of cell surface receptors (G-protein coupled receptors, Tyrosine kinases, cytokine receptors).
- 2.3 Models of cell-cell signaling (steroid receptors, Nitric oxide and Carbon monoxide).
- 2.4 Pathways of intracellular signaling transduction (c-AMP pathways, cyclic c-GMP, phospholipids and Ca²⁺, Ras, Raf and MAP kinases).

UNIT-III

- 3.1. Cells of the immune system: Lymphoid cells, Mononuclear cells, granulocytic cells, Mast Cells
- 3.2. Organs of the immune system- primary and secondary lymphoid organs, lymphatic system
- 3.3. Antigens: Antigenic determinants or Epitopes, Immunogenicity, Haptens, Adjuvants
- 3.4. Innate (Non-specific): Anatomical barriers, Phagocytosis, Physiological barriers, inflammatory barriers.

UNIT-IV

- 4.1 Humoral immunity: Immunoglobulins (fine structure of immunoglobulins and Classes).
- 4.2 Cell mediated immunity: Mechanism of cell mediated immunity; brief account on Antigen Presentation, Major Histocompatibility complex
- 4.3 Antigen-antibody interactions: Affinity, Avidity, Cross-reactivity, precipitation reactions and Agglutination reactions and ELISA.
- 4.4 Brief account on immunological disorders:
 - a) Tolerance to autoimmunity
 - b) Transplantation
 - c) Immunodeficiency diseases
 - d) Immunization (active and passive immunity)

SUGGESTED READING MATERIAL:

1. An introduction to Immunology by C.Y. Rao, Narosa publishing house, 2002.
2. Cell and Molecular Biology by EDR De Robertis and EMR De Robertis Jr, Indian Edition, B.I. Publications, Pvt. Ltd.
3. Cell Biology (Fundamentals and Applications) By Gupta/ Jangir, 2001; Agrobios, India.
4. Harpers Review of Biochemistry, Murray, Granier, Mayes and Rodwell, Lange Medical Publications, 25th Ed.
5. Human Physiology by Stuart Era Fox, W.M.C. Brown Publishers, USA 1984 or Recent Edition.
6. Immunology introductory textbook by Nandini Shetty, Wiley Eastern Ltd.
7. Kuby, J. (1998) Immunology, W.H. Freeman and Company, New York.
8. Roitt, I., Brostoff, J. Male, D. (1999/2000) Immunology, 4th Edition. Harcourt Brace and Company Asia, Pvt. Ltd., Singapore.
9. The Cell (A Molecular Approach) by Geoffrey M. Cooper, 2nd Edn. 2000, ISBN.

PRACTICALS OF CELL BIOLOGY AND IMMUNOLOGY

1. Microscopy
2. Mitosis in Onion root tips
3. Meiosis in Onion flower buds
4. Demonstration of motility of bacteria by hanging drop technique
5. Staining of Nuclear material of bacteria
6. Detection of salivary gland chromosomes in Chironomus larvae
7. Isolation of Mitochondria
8. Enumeration of Red blood cells
9. Enumeration of White blood cells
10. Differential count of Leukocytes.

SEMESTER – I

Zoo 104: TOOLS & TECHNIQUES IN BIOLOGY

Learning objectives of Zoo 104:

- ✓ To understand the working principles, construction and applications of the various instruments used in the studies related to various disciplines of biological sciences.

Learning Outcomes of Zoo 104:

The Course provide an overview to know the general laboratory procedures and maintenance of research equipments, Instrumentation of equipments. By the end of the course, students may be able to:

- ✓ Understand general laboratory procedures and maintenance of research equipments, microscopy, microtomy, kymograph, and voltage clamp, centrifuge
- ✓ Understand how to isolate cellular constituents by using different centrifuges
- ✓ Realise the need of centrifuges and their uses in research
- ✓ Understand how to separate amino acids and sugars using paper & thin layer chromatography
- ✓ Realise the principle and applications of gas liquid chromatography, HPLC and
- ✓ Learn the principles and applications of electrophoresis and animal cell culture methods
- ✓ Realise the importance of UV-Visible spectrophotometer.
- ✓ Describe the principle of flame photometer and microtomy, kymograph, and voltage clamp

Syllabus

UNIT-I

- 1.1 Microscopy – light and electron microscopy.
- 1.2 Centrifugation – Types of rotors, preparative and analytical centrifuges
- 1.3 Concentration of macromolecules – salting out, flash evaporation, lyophilization, Dialysis.
- 1.4 Chromatography – paper, thin layer, gas, HPLC

UNIT-II

- 2.1. Principles and Application of Electrophoresis: Paper, Agarose, PAGE, SDS PAGE and Iso-Electric focusing.
- 2.2 Blotting techniques
- 2.3 Spectroscopy- Absorption and Emission principles - Principle and application of UV-visible, Spectrofluorometer, flame photometer, Atomic Absorption, NMR in Biology
- 2.4 Radio isotope techniques – types of radio isotopes, detection and measurement of radioactivity, Applications of radio isotopes in biological sciences and safety measures

UNIT-III

- 3.1 Microtomy and staining procedures– types of microtomes, types of stains, staining procedures of biological materials
- 3.2 Voltage clamp and patch-clamp techniques
- 3.3 Kymograph
- 3.4 Oscilloscope

UNIT-IV

- 4.1 Design and functioning of tissue culture laboratory
- 4.2 Cell proliferation measurements
- 4.3 Cell viability testing
- 4.4 Culture media preparation and cell harvesting methods

SUGGESTED READING MATERIAL (ALL LATEST EDITIONS)

1. Animal Cell Culture – A practical approach, Ed. John R. W. Masters IRL Press.
2. Introduction to Instrumental analysis, Robert Braun. McGraw Hill International edition.
3. A Biologists Guide to Principles and Techniques of Practical Biochemistry, K. Wilson & K.W. Goulding, ELBS Edn.
4. Advanced Micropipette Techniques for cell physiology. K. T. Brown and D.G. Hamming
IBRO, Hand Book Series. A Wiley Interscience publications, John Wiley and Sons, New York.
5. Neuro anatomical Techniques, N.J. Strassfeld and T.A. Miller Springer Verlag, New York Heidelberg, Berlin, 1980.
6. Principles of Neuropsychopharmacology by Robert S. Feldman, Jerrold S. Meyer and Unida Quenzer. Sinancer Associates Inc. publishers. Sunderland, Massachusetts, 1997.
7. General Zoological Microtechniques - P.M. Weesner.

PRACTICALS OF TOOLS & TECHNIQUES IN BIOLOGY

1. Isolation of mitochondria from rat liver
2. Verification of Beer-Lambert's law
3. Preparation of block by using paraffin wax microtome
4. Separation of chloroplast pigment by paper chromatography
5. Separation of proteins by using sodium dodecyl sulphate polyacrylamide electrophoresis
6. Electrophoretic separation of DNA (Agarose gel electrophoresis).
7. Separation of amino acids by paper-chromatography

SEMESTER – II

Zoo 201: BIostatISTICS & BIOINFORMATICS

Learning objectives of Zoo 201:

- Students will be able to understand the measures of location and dispersion, curve fitting methods, probability, t-test, ANOVA applications.
- Students will be able to correctly apply a variety of statistical procedures and tests
- Students will know the uses, capabilities and limitations of various statistical procedures
- Students will be able to interpret the results of statistical procedures and tests
- To make the students to know the Internet basics; WWW, HTML and HTTP
- To study Scope, importance and status of Bioinformatics
- To make the students to understand genome analysis, sequence analysis and protein analysis

Learning Outcomes of Zoo 201:

On the completion of the course students should be able to:

- ✓ Solve problems quantitatively using appropriate arithmetical, algebraic, or statistical methods Create and interpret visual representations of quantitative information, such as graphs or charts
- ✓ Understand and critically assess data collection and its representation
- ✓ Understand why biologists need a background in statistics
- ✓ Understand whole genome analysis methods
- ✓ Know the computational tools used for sequence analysis tools
- ✓ Know the use of internet in data analysis
- ✓ Acquire knowledge on DNA microarray techniques
- ✓ Know the different methods of protein analysis

Syllabus

UNIT – I

- 1.1 Definition - scope of biostatistics
- 1.2 Measures of central tendency – arithmetic mean, median and mode
- 1.3 Measures of dispersion -range, mean deviation, standard deviation, Standard error
- 1.4 Co-efficient of variation, types of correlation, linear regression analysis

UNIT –II

- 2.1 Concepts of probability, laws; Normal probability distribution and its application
- 2.2 Tests of significance: Students t-Test (simple, paired), F- test
- 2.3 Application of χ^2 (chi-square) test in biology and testing the goodness of fit.
- 2.4 Analysis of Variance (ANOVA), SPSS

UNIT – III

- 3.1 History of Computers, classification of computers, computer generations
- 3.2 Input, output processing and storage devices –, hard disk, CD – ROM, DVD etc.
- 3.3 Operating system – Introduction – types of operating systems
- 3.4 MS – Office (ACCESS, EXCEL, WORD, POWER POINT), applications of computers in biology

UNIT –IV

- 4.1 Internet basics; WWW, HTML and HTTP
- 4.2 Scope, importance and status of Bioinformatics
- 4.3 Biological databases (Gene bank and Protein sequence database)
- 4.4 Sequence analysis: Pair wise and multiple sequence alignment; human genome project

SUGGESTED READING MATERIAL

1. Computers to-day by Suresh K. Basandra (1999), Published by Galagotia Publications, Pvt. Ltd., New Delhi
2. Microsoft Office, by Setultz, 1997.
3. Database processing by D.M. Kroenke, Galgotia Publications, 1990.
4. Introduction to Biostatistics – By Sokal – Rohlf (2nd Edn) freeman International Editor, 1971.
5. Bio – Statistics – An introductory text – Goldstein, A The Macmillan Co., New York, 1971.
6. Bio – Statistics - By Lewis Alvin E. Affiliated East – West press (P)Ltd., 1971.
7. Statistical analysis in Biology by Mather, K Chapman and Hall, London, 1972.
8. Probit analysis by finney, D.J.S. Chand & Co., Ltd., New Delhi
9. Biostatistics by Lewis Alvin (1971) Affiliates East West Press Pvt., Ltd., New Delhi.
10. Statistical methods in Biology by Bailey Norman T.J. (1965) The English Language Book Society & the English university Press Ltd.
11. Bioinformatics. Murthy, C.S.V. Himalaya Publishing House, Hyderabad
12. Bioinformatics by Andreas D. Baxevanis and B.F. Francis Ouellette, 2nd Ed., 2002.
13. Basic Bioinformatics by S. Ignaeimuthi, S.J. Narosa publications, 2005
14. Introduction to Bioinformatics, S. Sundara Rajan and R. Balaji, Himalaya Publishing

PRACTICALS OF BIOSTATISTICS & BIOINFORMATICS

(a) Statistics

1. Problems on Mean and Median.
2. Problems on Standard Deviation.
3. Problems related to X² test, Student T Test and Probability
4. Problems on Correlation.
5. Problems related to test of significance
6. Analysis of variance (ANOVA)
7. Probit analysis
8. Regression curves
9. Generation of graphs using MSExcel

(b) Computers

1. Literature collection using INTERNET, search engines, websites, browsing and downloading for scientific investigation.
2. Creating an e-mail account, sending and receiving mails.
3. Application of excel sheet for data processing.
4. Preparation of power point presentation with software.
5. Representation of statistical data by Histograms and Pie diagrams.

(c) Bioinformatics

1. Study of Internet resources in Bioinformatics. E.g. NCBI and EMBL.
2. Searches on MEDLINE and PubMed bibliographic databases.
3. Multiple Sequence Alignment.
4. Construction of Phylogenetic Trees for DNA and Proteins.
5. Sequence Retrieval from Databases.
6. Building of Molecules.

7. BLAST, FASTA programs for sequence database search.
8. ORF finder (open reading frame finder)
9. Clustal –W, Phylogenetic Analysis using clustal –X
10. Prot Scale, CFSSP and SMART
11. Sequence data retrieval in Fasta format from NCBI database
12. Searching with Blast
13. Secondary structure Prediction
14. Viewing of PDB files using Rosmol

SEMESTER – II

Zoo 202: GENETICS AND EVOLUTION

Learning objectives of Zoo 202:

- To understand the Concept of gene: Alleles, Multiple alleles
- To describe the Emphasis on Darwinism, Neo-Darwinism, Role of isolating mechanisms, Models of speciation and Micro and Macro Evolution
- To understand the various aspects of Numerical and Structural abnormalities of human chromosomes and syndromes
- To acquire broad knowledge on Gene mapping methods: Linkage-complete and Incomplete linkage, Crossing over and Mutations

Learning Outcomes of Zoo 202:

The Course provide an overview to describe the concepts of the gene, genomic organization, gene mapping methods, mutations, chromosomal aberrations, human genetics, eugenics and theories of evolution, population genetics and molecular evolution

- ✓ Analyse the various factors determining the heredity from one generation to another
- ✓ Acquire combined knowledge with special emphasis on extra chromosomal inheritance

Syllabus

UNIT - I:

- 1.1. Concept of gene: Alleles, Multiple alleles (ABO blood grouping and Rh factor), pseudoalleles; Interaction of genes (lethal genes, complementary genes, duplicate genes)
- 1.2. Gene mapping methods: Linkage-complete and Incomplete linkage; Linkage maps, Recombination.
- 1.3. Crossing over: Types (Somatic or mitotic crossing over and Germinal or meiotic crossing over.
- 1.4. Mutations: a) spontaneous and b) induced mutations; c) Molecular basis of mutations

UNIT- II:

- 2.1. a) Numerical and Structural abnormalities of human chromosomes and syndromes
b) Human karyotype and human genome
- 2.2. Sex linked inheritance
- 2.3. Pedigree analysis, Inborn errors of metabolism- Phenylketonuria, alkaptonuria, Sickle cell anemia;
- 2.4. Eugenics: a) Positive eugenics, Artificial insemination, sperm banks b) Negative eugenics, Amniocentesis, consanguinity, Genetic counseling

UNIT – III:

- 3.1 Emphasis on Darwinism
- 3.2 Neo-Darwinism
- 3.3 Role of isolating mechanisms
- 3.4 Models of speciation (Allopatric, sympatric and parapatric)

UNIT – IV:

- 4.1 A detailed account on destabilizing forces
 - i. Natural Selection
 - ii. Mutation
 - iii. Genetic drift
- 4.2 Phylogenetic gradualism & punctuated equilibrium
- 4.3 Micro & Macro evolution
- 4.4 Gene evolution and Amino acid sequence and phylogeny

SUGGESTED READING MATERIAL

1. Genetics - Monrve W. Strickberger. 3rd Ed., May, 2000.
2. Genetics-K.B.Allluwallia-1985.
3. Principles of Genetics - EJ. Gardner. MJ. Simmons & D.P. Snustad.
4. Molecular Biology of genes- Watson, J.D., N.H. Hopkins, J.W. Roberts, J.A. Steitz &A.M. Weiner. The Benjamin Cummings publishing company. Inc. Tokyo.
5. Basic Human Genetics- EJ. Mange, Arthur P. Mange. Indian Print, 1997.
6. Genetic disorders of Man by M.R. Goodman.
7. An introduction to modern genetics by Ch. Waddingston
8. Dobzhansky, Th. Genetics and origin of species, Columbia University press.
9. Dobzhansky, Th., F.J. Ayala, GL. Stebbins and J .M. Valentine Evolution: Surjeet publications, New Delhi latest edition.
10. P.A. Moody Introduction to Evolution II ed/latest: Kalyani publishers, New Delhi.
11. Hartl, D.L. A primer of population genetics, sinauer Associatesm Inc., Massachusetts.
12. Peter Volpe E. Understanding Evolution, University Book stall, New Delhi.
13. An introduction to genetic analysis. Griffiths, A.J .F., J.B. Miller, D.T. Suzuki, R.C. Lewontin & W.M. Gelbark, W.H. Freeman and Company, New York.

LIST OF PRACTICALS OF GENETICS AND EVOLUTION

1. Blood grouping
2. Rh factor demonstration
3. Mendelian ratios and its related Problems
4. Karyotyping
5. Syndrome charts – demonstration
6. Demonstration of Barr bodies
7. Problems on Hardy Weinberg’s law
8. Test for colorblindness
9. PTC taste test
10. Estimation of DNA by Diphenylamine method
11. Estimation RNA by orcinol method

SEMESTER – II

Zoo 203: ANIMAL PHYSIOLOGY

Learning objectives of Zoo 203:

- To know the aim and scope of physiology
- To understand the comparative animal physiological systems which includes digestion, respiration, circulation, excretion, osmoregulation, thermoregulation and bioluminescence
- To understand the various physiological mechanisms and functioning in the animal kingdom

Learning Outcomes of Zoo 203:

The Course provide an overview to understand the comparative animal physiological systems which includes digestion, respiration, circulation, excretion, osmoregulation, thermoregulation and bioluminescence

- ✓ Learn animal foods & nutritive types, feeding mechanisms in different animals and process and role of enzymes in digestion, absorption & assimilation
- ✓ Recognise the presence of different types of respiratory pigments & their functions
- ✓ Identify organs involved in respiration among aquatic amphibians and terrestrial birds & mammals
- ✓ Recognise the constituents of blood, functions and blood grouping
- ✓ Differentiate neurogenic and myogenic heart and their rhythm & regulation
- ✓ Understand osmoregulation and excretion
- ✓ Understand the structure of Mammalian kidney and the process of urine formation

Syllabus

UNIT-I:

- 1.1. Aim and scope of physiology; General physiological functions and principles. Validity of comparative approach of physiology.
- 1.2. Feeding mechanisms and regulation: Nutrition, Autotrophs, Heterotrophs, Feeding Mechanisms, Digestion, Digestion in mouth, swallowing, Peristalsis, Digestion in the Stomach, Gastric secretion, Gastric juice, Regulation of Gastric secretion, Activities of Gastric Secretion, Digestion in small intestine.
- 1.3. Comparative physiology of digestion: Chemical Action: intracellular digestion, extracellular digestion. Digestive enzymes: Carbohydrases, Lipases and Esterases, Proteinases, Other Digestive enzymes, Absorption.
- 1.4. Gastro-intestinal Hormones in regulation of digestion.

UNIT-II:

- 2.1 Respiration and Metabolism: Types of respiration, Respiratory organs, Mechanism of Respiration.
- 2.2 Circulation of body fluids: Major types of body fluids, Blood, General properties of blood, Composition of blood, Blood groups and Transfusions.
- 2.3 Patterns on nitrogen excretion among different animal groups: Introduction, Nitrogenous Waste Products, Morphology of the excretory system in different groups of animals, Mechanism of urine formation.
- 2.4 Osmoregulation in different animal groups (aquatic and terrestrial).

UNIT- III:

- 3.1 Thermoregulation: Temperature as an environmental factor, Thermoregulation in Invertebrates, Thermoregulation in vertebrates.
- 3.2 Poikilothermic animals: Temperature relation in poikilotherms, Aquatic poikilotherms, Terrestrial poikilotherms, Homoeothermic animals: Temperature relations of homeotherms, Physical heat regulation, Chemical heat regulation.
- 3.3 Hibernation & Aestivation.
- 3.4 Biological Rhythms.

UNIT- IV:

- 4.1 Bioluminescence: Occurrence of bioluminescence among different animals, Mechanism of light production, Control of bioluminescence, Functions of luminescence.
- 4.2 Chromatophores and regulation of their function: Colour production, Chromatophore pigments, Mechanism of action of chromatophore.
- 4.3 Structure and function of muscles, Theories of muscle contraction.
- 4.4 Physiology of receptors (Photo, Phono and chemo receptors).

SUGGESTED READING MATERIAL:

1. C.L. Prosser. Comparative Animal Physiology. W.B. Saunders & Company.
2. C.L. Prosser. Environment and Metabolic Physiology. Wiley-Liss, New York.
3. R. Eckert. Animal physiology, Mechanism and Adaptation. W.H. Freeman & Company.
4. Schiemdt-Nielsen. Animal Physiology, Adaptation and Environment. Cambridge.
5. W.S. Hoar. General Comparative Animal Physiology.

PRACTICALS OF ANIMAL PHYSIOLOGY:

1. Determination of Urea, creatine in blood-Human/Rat
2. Determination of serum content of uric acid, Cholesterol- Human/Rat
3. Effect of injection of insulin/glucagon on the blood sugar and liver glycogen in Rat/Mouse
4. Estimation level of excretory ammonia
5. Estimate level of activity of hepatic and brain glutamate dehydrogenase
6. Estimate level of amino acid content of muscle, gill, brain and liver.
7. Estimate levels of activities of the following enzymes –AAT, ALAT, ACP, LDH and SHD.
8. Blood collection and blood groups determination.
9. Temperature variations in poikilotherms and homoeothermic animals
10. Demonstration of rate of oxygen consumption in crab/fish
11. Assay of amylase

Zoo 204 EE: SERICULTURE (EE-I)

Learning objectives of Zoo 204 EE:

- To Comprehend the cultivation methods of mulberry, rearing of silkworm, diseases of silkworm, silk dying and finishing.

Learning Outcomes of Zoo 204 EE:

The Course provide an overview to know the cultivation methods of mulberry, rearing of silkworm, diseases of silkworm, silk dying and finishing. By the end of the course, students may be able to:

- ✓ Understand the cultivation methods of mulberry
- ✓ Acquire combined knowledge on rearing of silkworm
- ✓ Understand how to silk dying and finishing
- ✓ Recognize the diseases of silkworm

Syllabus

UNIT - I The cultivation of mulberry

- 1.1 The Morphology and Physiology of mulberry
- 1.2 Types of mulberry
- 1.3 Selection and Establishment of the mulberry field
- 1.4 Training Methods and Harvesting method & Management of mulberry field

UNIT - II Rearing of Silkworms

- 2.1 Planning of Rearing
- 2.2 Preparation of Rearing
- 2.3 Rearing and Environment
- 2.4 Rearing of young and advanced stage larvae & Mounting cocoons production and Harvesting of cocoons

UNIT - III Diseases of Silkworm and Preventive measures

- 3.1 Viral diseases
- 3.2 Bacterial diseases
- 3.3 Fungal diseases
- 3.4 Other diseases of silkworm & Silkworm disease control measures

UNIT - IV Silk Dying and Finishing

- 4.1 Machine & chemical finishing
- 4.2 Commonly used equipments and commonly used unit machines
- 4.3 Physical and Chemical testing methods for quality of products / semi-finished Products
- 4.4 Measurement of industrial effluents & Administration and improvement of Sericulture Management

SUGGESTED READING BOOKS

1. Silkworm Rearing, Oxford & IBH Publishing CO. Pvt. Ltd. New Delhi -1997.
2. Silk Dying and Finishing, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi - 2000.

SEMESTER – III

Zoo 301: ANIMAL BIOTECHNOLOGY AND MICROBIOLOGY

Learning objectives of Zoo 301:

- To impart information on the historical aspects development of Biotechnology and Genetic Engineering
- To provide knowledge and in-depth study on Concepts & Scope in Genetic Engineering and Applications of Genetic engineering including r-DNA technology Cloning vectors Cloning Strategies.
- To expose the students on the basic understanding of Application of biotechnology to Animal health, Transgenic animals, Reproduction technologies, Application of Biotechnology in Medicine, Biotechnological applications of Aquaculture
- To discuss the microbial diseases, industrial microbiology

Learning Outcomes of Zoo 301:

On the completion of the course students should be able to:

- ✓ Know the historical aspects development of Biotechnology and Genetic Engineering
- ✓ Understand in-depth study on Concepts & Scope in Genetic Engineering and Applications of Genetic engineering including r-DNA technology Cloning vectors Cloning Strategies.
- ✓ Acquire knowledge on the basic understanding of Application of biotechnology to Animal health, Transgenic animals, Reproduction technologies, Application of Biotechnology in Medicine, Biotechnological applications of Aquaculture
- ✓ Discuss the microbial diseases, industrial microbiology

Syllabus

UNIT-I

- 1.1 General Introduction and Achievements of Biotechnology
- 1.2 Genetic Engineering and r-DNA technology (Restriction endonucleases, DNA ligases, Topoisomerases, Methylases, Nucleases, Polymerases, Reverse transcriptase and their Properties and functions).
- 1.3 Cloning vectors (plasmids, Bacteriophages, Cosmids, Yeasts Shuttle vectors) used in Gene cloning.
- 1.4 Cloning Strategies and Screening Analysis of recombinants (Single colony hybridization Technique), immunologic test, Southern blotting.

UNIT-II

- 2.1 Application of biotechnology to Animal health and disease diagnosis. Transgenic animals: Production of transgenic fish, birds, mice, pigs, sheep, goat and cows,
- 2.2 Reproduction technologies: Artificial insemination, in vitro fertilization, Embryo Transfer technology, Pregnancy diagnosis, superovulation and Artificial womb.
- 2.3 Application of Biotechnology in Medicine: Production of monoclonal antibodies (Hybridoma Technology), Production of vaccines and Production of Growth Hormone.
- 2.4 Biotechnological applications of Aquaculture: Ploidy manipulations in fishes-gynogenesis, androgenesis, sex reversal in fish and Pearl culture.

UNIT-III

- 3.1. History and Scope of Microbiology
- 3.2. Microbial nutrition, growth and their control
- 3.3. Normal microbial flora of Human Body- Skin, Nose, Oral cavity, Pharynx, Respiratory tract, Eye, Ear, Stomach, Intestine, Genitourinary tract.
- 3.4. Microbial diseases and their control
 - a) Bacterial diseases - Tuberculosis, Plague, Anthrax.
 - b) Viral diseases - Influenza, AIDS, Hepatitis.

UNIT-IV

- 4.1. Microbiology of fermented food: Dairy Products, Meat and Fish, Microorganisms as Sources of feed
- 4.2. Industrial Microbiology: Types of fermentation process, Types of fermenters, Downstream processing, Alcoholic beverages
- 4.3. Manufacture of various chemicals: Lactic acid, and Citric acid.
- 4.4. Therapeutic compounds: Antibiotics (penicillin), Industrial enzymes (Amylase,).

SUGGESTED READING MATERIAL:

1. A text book of Biotechnology-RC. Dubey.S.Chand & Company Ltd., New Delhi - 1996.
2. A text book on Biotechnology-(n Ed.) H.D. Kumar. EWP - Private Ltd., New Delhi - 1998.
3. Animal Biotechnology-M.M. Ranga, Agrobios (India), 2000.
4. Biotechnology-Fundamentals & Applications-S.S .Purohit & S.K. Mathur, Agro Botonics-1999.
5. Biotechnology-V. Kumaresan. Saras Publication-1994.
6. C.M. Presscotts, J.P. Harley & D.AKlein Mc Graw Hill. WCB Publication 4th Edition.
7. Elements of Micro biology, by MJ. Pelzar, Jr & E.C.S Chan International students Edition, 1981, MCGRA WHill international Book Company, New Delhi. Microbiology
8. General Microbiology by C.B. Powar & H.F. Dagainawala 1st Edition, Himalaya Publishing House, Bombay, 1982.
9. Text Book of Microbiology, by R Aananthnarayan &C.K. Jayaram Panikar, 4th Edition, Orient Longmen, Hyderabad, 1990.

PRACTICALS OF ANIMAL BIOTECHNOLOGY AND MICROBIOLOGY

1. Bacterial transformation and identification of transformed cells
2. Isolation of plasmid DNA from bacterial cells
3. Digestion of vector DNA with restriction enzyme
4. Preparation of culture media for cultivation of bacteria
5. Streak Plate method
6. Spread Plate Method
7. Simple staining
8. Methylene blue reduction test in Milk
9. Gram staining
10. Microbial estimation of Curd sample
11. Cell counting using Hemocytometer
12. Cell viability testing
13. Preparation of tissue culture medium and membrane filtration.
14. Preparation of single cell suspension from lymphoid organs
15. Pregnancy diagnosis
16. Extraction of DNA from animal cells

SEMESTER – III

Zoo 302: DEVELOPMENTAL BIOLOGY

Learning objectives of Zoo 302:

- To make the students to understand the various concepts of development
- To understand the origin of germ line cells, gamete formation, blastula, gastrulation, organogenesis, programmed cell death, aging and senescence

Learning Outcomes of Zoo 302:

The Course provide an overview of Reproductive process and Development of organs

- ✓ Understand the mechanism of spermatogenesis
- ✓ Realize the egg interaction and sperm entry
- ✓ Know the physiological factors in fertilization process.
- ✓ Understand the mechanism of blastulation process
- ✓ Know the organogenesis and developmental process
- ✓ Understand the development of embryo and membranes
- ✓ Realize the Metamorphosis and regeneration process

Syllabus

UNIT-I:

- 1.1: Origin of germ line cells, Origin and mechanism of cell lineage, migration of germ cells to genital ridges, embryonic stem cells, Nuclear transplantation experiments, Transgenics in analysis of development.
- 1.2: Production of gametes and establishment of polarity and symmetry.
- 1.3: Leydig cells function; Endocrine regulation of spermatogenesis and vitellogenesis.
- 1.4: Fertilization: Cell surface molecules in sperm egg recognition molecular events of post fertilization.

UNIT-II:

- 2.1: Cleavage, Blastula, Gastrulation in different animals, Molecular mechanisms determining germ layers formation; fate maps.
- 2.2: Induction, competence, determination and differentiation.
- 2.3: Developmental gradients in Hydra
- 2.4: Cell aggregation and differentiation in Dictyostelium.

UNIT-III:

- 3.1: Axes and Pattern formation in Drosophila, amphibia and chick.
- 3.2: Organogenesis – Vulva formation in Caenorhabditis elegans; Eye lens induction, limb development.
- 3.3: Regeneration – Types of regeneration, Axial patterning during regeneration.
- 3.4: Metamorphosis – Hormonal regulation of metamorphosis in insects and amphibians.

UNIT-IV:

- 4.1: Environmental regulation of normal development.
- 4.2: Sex determination in animals (The mechanism of mammalian primary sex determination – Secondary sex determination: Hormonal regulation of the sexual phenotype).
- 4.3: Programmed cell death – Incidence of Apoptosis; Apoptosis during animal development; Apoptosis in metamorphosis and morphogenesis; Apoptosis during limb development Biochemical & molecular mechanisms involved in Apoptosis.
- 4.4: Aging and senescence – Reactive oxygen and cell senescence, Dietary restriction and anti aging action., Genetic control of longevity, Age related diseases.

SUGGESTED READING MATERIAL

1. Austen, C.R. and Short, R.V. Reproduction in Animals
2. Schatten and Schatten. Molecular Biology of Fertilization.
3. F.T. Longo, Fertilization, Chapman & Hall
4. R.G. Edwards, Human Reproduction
5. S.F. Gilbert, Developmental Biology, Sinauer Associates Inc., Massachusetts
6. Ethan Bier The Coiled Spring Harlsor Laboratory Press, NewYork
7. Molecular Developmental Biology – 2008, T. Subramonian, Narosa Publishing House.

PRACTICALS OF DEVELOPMENTAL BIOLOGY

1. Observation of developmental stages in frog and chick
2. Observation of different cleavage stages in the eggs of Lymnea (fresh water snail)
3. Role of shell during developmental of chick
4. Protein turnover during development of chick
5. Phosphorous metabolism in developing chick embryo
6. Role of calcium during development of Chick Embryo
7. Calorific values during the development of chick
8. Ontogeny of excretory pattern in developing chick
9. Vitellogenesis in Crab
10. Fecundity index in Crab
11. Induced breeding in Frog
12. Spermatozoa observation in different vertebrates
13. Histology of Gonads.
14. Sperm Motility.
15. Study of Permanent Stained mounts of Chick.
16. Estimation of Calcium in Shell, Yolk and Albumin of Chick.
17. Cryopreservation.
18. Vitellogenesis and Fecundity in Crabs.
19. Frog - Induced Ovulation and Induced Fertilization.

SEMESTER – III

Zoo 303: IE-A: ANIMAL ECOLOGY AND ENVIRONMENTAL BIOLOGY

Learning objectives of Zoo 303 IE-A:

- To provide fundamental environmental principles that provides an in-depth understanding of our environment.
- The scientific basis for understanding how environmental systems interfere with population and wealth of our natural resources, environmental education, pollution effects and control, monitoring and assessment of environment
- To describe the biology of different environments, energetic of ecosystems, environmental pollution, environmental monitoring and bioremediation

Learning Outcomes of Zoo 303 IE-A:

The Course provide an overview of know the scope of environmental biology, fundamental principles, natural and pollution, effects and control, monitoring and assessment of environment.

- ✓ Understand the scope of environmental biology & Appreciate how ecosystem works
- ✓ Appreciate how elements are cycling in the environment
- ✓ Identify the natural resources and importance of national parks, sanctuaries and biosphere reserves
- ✓ Appreciate the importance of environmental education
- ✓ Describe the types, effects and control of pollution and importance of green house effect, acid rain and ozone depletion
- ✓ Recognise the need of environmental protection acts and laws on air and water pollution
- ✓ Realise the organisations involved in environmental protection
- ✓ Study the importance of monitoring and assessment of environment

Syllabus

UNIT-I

- 1.1 Ecosystem: Food chains and food webs, trophic levels and ecological pyramids. Types of Lotic, Lentic and Marine ecosystems.
- 1.2 Energy flow patterns and energetic of ecosystems – Laws of thermodynamics. Calculation of energy budget. Biomass and productivity.
- 1.3 Population Ecology: Natality, Mortality, Density, Age- Structure, Biotic Potential, Dispersion and Growth pattern. Regulation of Population size - Density dependent and density independent factors.
- 1.4 Types of interactions-Intra-specific and inter-specific, Niche concept.

UNIT-II

- 2.1 Communities: Definition, structure and organization. Major communities – Grassland, Forest and Desert communities. Biotypes, Ecological dominance.
- 2.2 Ecotone and edge effect. Primary and Secondary ecological successions.
- 2.3 Abiotic Factors: Bio-kinetic zone, Temperature tolerance. Thermal stratification Temperature and seasonal variations, Jordan's Rule, Bergman's Rule,
- 2.4 Halocline, Salinity preferandom, Salinity as limiting factor in the distribution of animals. Aspects of light – Photoperiodism and biological rhythms.

UNIT-III

- 3.1 Environmental pollution: Types of pollution and pollutants. Air and water pollution – their sources, biological effects and control measures in general.
- 3.2 Environmental Laws: Environmental Laws in India- Legislation and Execution.
- 3.3 Bioindicators and Environmental monitoring.
- 3.4 Bioremediation; Need and scope of bioremediation.

UNIT-IV

- 4.1 Global climatic changes: Global warming; Green House Effect; IPCC; Kyoto Protocol.
- 4.2 Green House Gases and the role of CO₂ as a major pollutant; Mitigation of atmospheric CO₂ by terrestrial ecosystems;
- 4.3 Carbon sequestration; Bioenergy plantations for mitigating atmospheric CO₂.
- 4.4 Biofuels and Bioenergy.

SUGGESTED READING MATERIAL:

1. Begon, M., J.L. Harper and C.R. Townsend. Ecology, Individuals, populations and communities. Blackwell, Oxford, UK.
2. Cherrette, J.M. Ecological concepts. Blackwell Sci./Publi. Oxford U.K.
3. Elseth, B.O. and K.M. Baumgartner. Population Biology, Van Nostrand Co., New York.
4. Jorgensen, S.E. Fundamentals of Ecological modeling. Elsevier, New York.
5. Kerbs, C.J. Ecological Concepts, Harper & Row, New York.

PRACTICALS OF ANIMAL ECOLOGY AND ENVIRONMENTAL BIOLOGY

1. Estimation of oxygen content in polluted and non-polluted waters.
2. Estimation of carbon dioxide in relation to diurnal variation.
3. Estimation of Organic matter in polluted and non-polluted waters.
4. Estimation of salinity in marine and freshwaters.
5. Qualitative analysis of plankton.
6. Estimation of moisture holding capacity of soils.
7. Estimation of BOD in different water samples
8. Calculation of energy budget of an ecosystem
9. Analysis of OP compounds in water samples through TLC
10. Estimation of inorganic phosphate levels and biomass in surface and sediment waters 8. Determination of Calcium in a sedimentary bed and surface waters of freshwater pond

SEMESTER – III

Zoo 303: IE-B: BIODIVERSITY AND WILD LIFE CONSERVATION

Learning objectives of Zoo 303: IE-B

- To be aware of the wild life in India, wild life habitat analysis, evaluation and conservation, biodiversity and conservation

Learning Outcomes of Zoo 303:IE-B

The Course provide an overview to understand the wild life in India, wild life habitat analysis, evaluation and conservation, biodiversity and conservation

- ✓ Understand the wild life in India, wild life habitat analysis, evaluation and conservation, biodiversity and conservation

Syllabus

UNIT-I

- 1.1 Biodiversity: Definition and characterization. Types of Biodiversity: Genetic, species and ecosystem.
- 1.2 Biodiversity importance, Loss of Biodiversity and protection of Biodiversity.
- 1.3 Biodiversity indices.
- 1.4 Biosphere reserves and mega diversity centers.

UNIT-II

- 2.1 Wild life in India and scheduled animals under Wild Life act. List of endangered species and species on verge of extinction in India and their locations.
- 2.2 Wild life projects sponsored in India for endangered animals.
- 2.3 Sanctuary and National Park – Definition and Characteristics.
- 2.4 Wild life sanctuaries and National Parks in Andhra Pradesh.

UNIT-III

- 3.1 Wild life Habitat Analysis, evaluation, Conservation and Management. Wild life habitat components, analysis and methods of evaluation: physical and biological parameters.
- 3.2 Conservation methods for wildlife management.
- 3.3 Endangered species management in India. Red data book (WWF).
- 3.4 Legislation: Wild Life protection act.

UNIT-IV

- 4.1 Environmental Conservation: Role of Government and Non Government organizations in environmental management and conservation.
- 4.2 Environmental impact Assessment (EIA): Methods followed in EIA in conservation.
- 4.3 Environmental monitoring surveillance.
- 4.4 Natural Resources – Renewable and non renewable resources and their conservation.

SUGGESTED READING MATERIAL

1. Biodiversity-K.C. Agarwal, 1998
2. Conservation Biology, Peggy I. Fieldler & Peter M. Kareiva, 1997
3. The Oxford Anthology of Indian Wild life, Vol. Oxford University Press, New Delhi, Mahesh Rangarajan, 1999
4. The Oxford Anthology of Indian Wild Life, Vol. II Oxford University Press, New Delhi, Mahesh Rangarajan, 1999
5. Principles of Forest Pathology, John Wiley & Sons, Inc, Canada & USA, E.H. Tainter, E.A. Baker, 1996
6. Natural Resource Conservation. An Ecological approach by Oliver S. Owen Mc. Millan Publishing Company, New York.
7. Wild life in India-V.V.Saharia, 1982, Natraco Pub., Dehradun.
8. Biodiversity Principles & Conservation, Kumar & Asija-published by Upadesh Purohit by Agrobios (India), Jodhpur, 2002.
9. Trends in Wild life biodiversity, conservation and management-B.B. Hosetti & M. Venkateshwarlu-Daya Publishing House, Delhi- Vol. II, 2001.
10. Biological Diversity & Environment- M. Shamin Jairajpuri CBS Publishers & Distributors, New Delhi, 1996.
11. Biodiversity, Taxonomy & Ecology- R.K.Tandon & Prithipal Singh-Scientific Publishers, Jodhpur, 1999
12. Environmental impact assessment & management. Editors B.B Hosetti & A. Kumar, 1998, Daya Publishing House, Delhi

PRACTICALS OF WILD LIFE CONSERVATION

1. Tracing of animal pugmark impression
2. Preparation of pugmark impression cast
3. Biosphere reserves in India
4. Identification of wild animals

SEMESTER – III

Zoo 303: IE C: PATHOBIOLOGY

Learning objectives of Zoo 303: IE-C

- To understand the Disease Concept, Host Parasite Relations, Vector Biology and Haematology

Learning Outcomes of Zoo 303:IE-C

The Course provide an overview to understand the Disease Concept, Host Parasite Relations, Vector Biology and Haematology

- ✓ Identify the different parasites
- ✓ Recognise the Host Parasite Relations
- ✓ Differentiate the symptoms of different diseases
- ✓ Understand the vector biology
- ✓ Describe the significance of haematological parameters in diagnosis

Syllabus

UNIT - I Disease Concept

- 1.1 Disease and injury (communicable and non-communicable)
- 1.2 Local and systematic reactions of injury
- 1.3 Cellular reactions to injury
- 1.4 Inflammation and Immunological reactions

UNIT - II Host Parasite Relations

- 2.1 Important human and veterinary parasites (Protozoan and helminthes)
- 2.2 Life cycle and biology of plasmodium, Trypanosoma, Ascaris, Schistosoma and Leishmania
- 2.3 Symptoms of the disease caused parasites
- 2.4 Host - Parasite reactions

UNIT - III Vector Biology

- 3.1 Arthropods as vectors of human diseases (Mosquitoes, lice, flies and ticks)
- 3.2 Mode of transmission of pathogens by vectors
- 3.3 Control methods
 - a. Chemical
 - b. Biological
 - c. Environmental
- 3.4 AIDS

UNIT - IV Haematology

- 4.1 Blood composition and functions of various components
- 4.2 Coagulation mechanism and anticoagulants
- 4.3 Changes in the blood during infection & disease
- 4.4 Types of anaemia

SUGGESTED READING MATERIAL

1. Principles of Pathobiology - Lavia, Mariano F.Hill, Rolla B. Oxford University Press, London, 1975.
2. Text book of Pathology - an introduction to medicine 6th edition Philadelphia. Lea & Febiger, 1953.
3. Veterinary clinical pathology, E.H. Coles D 1967.
4. Clinical Haematology - Dy. L. Aksencu &A. Dranaikota, 1972.
5. Animal parasites, their life cycles and ecology - O. W. Oslsen.

PRACTICALS OF PATHOBIOLOGY

1. Urine Analysis- normal and abnormal constituents.
2. Tissue Processing, section cutting using Microtome, Staining and Preparation of Permanent Histological Slides
3. Diagnostic tests for detection of various conditions-CRP, VDRL, RA, Pregnancy, Dengue and HIV (any four)
4. Physiological Data Acquisition system (Biopac)-ECG, EMG, PFT, Temperature
6. Demonstration of Erythrocyte Sedimentation Rate.
7. Measuring Blood pressure.
8. Permanent histological slides of common diseases (any five basic slides).
9. First aid box and its contents.
10. Study of fractures.

SEMESTER – III

Zoo 304 EE: BIODIVERSITY (EE-II)

Learning objectives of Zoo 304 EE-II:

- To be aware of the wild life in India, wild life habitat analysis, evaluation and conservation, biodiversity and conservation

Learning Outcomes of Zoo 304 EE-II:

The Course provide an overview to understand the wild life in India, wild life habitat analysis, evaluation and conservation, biodiversity and conservation

- ✓ Understand the wild life in India, wild life habitat analysis, evaluation and conservation, biodiversity and conservation
- ✓

Syllabus

UNIT - I Biodiversity an Introduction

- 1.1 Types of Biodiversity
- 1.2 Measures of Diversity
- 1.3 Threats of Biodiversity
- 1.4 Values of Biodiversity

UNIT - II Biodiversity Conservation

- 2.1 Present status and future strategy
- 2.2 Need for Biodiversity
- 2.3 Insitu - Exsitu Conservation - Action plan
- 2.4 Measures taken for conservation in India

UNIT - III Concepts of Biodiversity

- 3.1 Indian and Global Biodiversity
- 3.2 General theories of species diversity. - Ants - Drosophila Fishes.
- 3.3 Biodiversity of Threatened species of Medicinal plants in India
- 3.4 Productivity hypothesis - diversity in space and time

UNIT - IV Biodiversity Strategies

- 4.1 Biotechnology in Biodiversity
- 4.2 Intellectual Property Right (IPR) Patents - Bioethics - Biosafety protocols
- 4.3 Gene Banks - Theory of gene banking - Gene banks at global level
- 4.4 Sustainable use of Biodiversity

SUGGESTED READING BOOKS

1. A.K. Pandey - Taxonomy and Biodiversity.
2. Hosetti, B.B.Venkateswarlu, M. Trends in Wild life Biodiversity Conservation and Management.
3. T.I. Khan, YS. Shishodia, Biodiversity Conservation and Sustainable Development.
4. K.C. Agarwal, Biodiversity (1998)
5. Kumar & Asija., Biodiversity Principles & Conservation, Published by Upadesh Purohit by Agrobios (India), Jodhpur, 2002.

SEMESTER – IV (A)

Zoo 401: MOLECULAR BIOLOGY

Learning objectives of Zoo 401:

- To impart information on the historical developments in Molecular Biology
- An in-depth study on structure and organization of chromosome, replication process, transcription process, translation process and mutagenesis.
- To understand the molecular nature of genome.
- To expose the students on the basic understanding of various techniques used in molecular studies

Learning Outcomes of Zoo 401:

This course outline is designed to develop interest among students on in-depth study on structure and organization of chromosome, replication process, transcription process, translation process and mutagenesis. By the end of the course, students may be able to:

- ✓ Understand in-depth knowledge on Molecular Biology
- ✓ Know various types of Mutagenesis
- ✓ Understand in detailed mechanisms of DNA Replication
- ✓ Understand the overall concepts of Transcription
- ✓ Understand in detailed mechanisms Translation
- ✓ Describe the DNA damage and repair
- ✓ Differentiate the Types of DNA
- ✓ Learn Genetic regulation, DNA sequencing, DNA finger printing, Polymerase chain reaction, cDNA library, Genomic library, Western and Northern blotting

Syllabus

UNIT-I: Molecular nature of Genome

- 1.1 Watson and Crick Model; Types of DNA; Properties of DNA (C- value paradox, Cot value)
- 1.2 Nuclear and mitochondrial genome
- 1.3 Structure of gene (Cistron, Muton, Recon, Cis-trans test)
- 1.4 DNA damage and repair: Biological induction of repair, photo reactivation, Excision repair, Recombination repair, SOS repair, and Mismatch repair.

UNIT-II: Replication

- 2.1 Replication in Prokaryotes: *Geometry* of DNA replication, semi conservative replication.
- 2.2 Enzymology of DNA replication: DNA Polymerases I, II and III; Replication of Eukaryotic Chromosomes; Eukaryotic DNA polymerases; Multiple forks; Replication of Chromatin.
- 2.3 Discontinuous Replication: Fragments in Replication fork and detection of fragments; Events in the replication fork; De novo initiation and covalent extension.
- 2.4 Bidirectional replication, Termination of replication

UNIT III: Transcription and Translation

- 3.1 Transcription: Types of RNA, enzymes and molecular mechanisms involved in transcription.
- 3.2 Processing of rRNA, tRNA and RNA in Prokaryotes and Eukaryotes, Ribozyme
- 3.3 Translation: Genetic code, Polypeptide chain initiation, elongation and termination
- 3.4 Post translational modification; Role of antibiotics in protein synthesis

UNIT IV: Gene expression and Molecular Biology Techniques

- 4.1 Genetic regulation: Induction, Repression, Lac Operon, Lambda Operon
- 4.2 Tryptophan Operon, Britten and Davidson model for Eukaryotic regulation
- 4.3 DNA sequencing, DNA finger printing, Polymerase chain reaction
- 4.4 cDNA library, Genomic library, Western and Northern blotting

SUGGESTED READING MATERIAL

1. Molecular Biology by David Freifelder, 1993
2. Molecular Biology of Gene-by ID.Watson, 1988
3. Harper's review of Biochemistry by D.W. Martin et al 1990
4. Biochemistry by A.L. Lehninger
5. Cell and Molecular Biology-E.D.P. De Robertis and E.M.F.
6. Concepts in Molecular Biology-S.C. Rastogi, VN. Sharma and Ananda Tandon (1993)
Genes VII by Benjamin Lewin

PRACTICALS OF MOLECULAR BIOLOGY

1. Isolation of DNA
2. Estimation of DNA by diphenylamine method
3. Thermal melting point of DNA
4. Hyperchromacity of DNA
5. Agarose Gel Electrophoresis
6. Estimation of protein content in specific fraction
7. Estimation of RNA by orcinol method
8. Southern and Western blotting

SEMESTER – IV (A)

Zoo 402: NEUROBIOLOGY AND ANIMAL BEHAVIOUR

Learning objectives of Zoo 402:

- To make the students to understand the various types of neurons and nervous system
- To understand the Sodium and potassium pump and Synapses
- To describe Chemical composition of the nervous system and Neurotransmitters
- To understand General introduction: An over view of concept of Animal behavior
- To describe different learning process

Learning Outcomes of Zoo 402:

The Course provide an overview of Neurobiology and Animal Behaviour

- ✓ Make the students to understand the various types of neurons and nervous system
- ✓ Understand the Sodium and potassium pump and Synapses
- ✓ Describe Chemical composition of the nervous system and Neurotransmitters
- ✓ Understand General introduction: An over view of concept of Animal behavior
- ✓ Describe different learning process

Syllabus

UNIT-I

- 1.1 Micro anatomy of neurons and types of nerve cells.
- 1.2 Autonomic nervous system – Sympathetic Division, Parasympathetic Division.
- 1.3 Bioelectrical properties of neurons (Resting membrane potential- Nearnst equation; Sodium and potassium pump; Propagation of nerve impulse.
- 1.4 Synapses: Structure and Integration (Types of synapses; Ultra structure of synapse Chemical transmission; Electrical transmission)

UNIT-II

- 2.1 Chemical composition of the nervous system-cerebrospinal fluid-CNS barriers
- 2.2 Synthesis –storage-release and inactivation mechanisms and functions of the following neurotransmitters; Acetylcholine & Catecholamines (Norepinephrine, Epinephrine, Dopamine)
- 2.3. Amino acid Neurotransmitters-Glutamate and GABA
- 2.4 Neuropeptides (Oxytocin and Vasopressin), Mood Disorders like Depression, Schizophrenia, Neurodegenerative disorders like Parkinsonism, Alzheimer's disease

UNIT-III

- 3.1 General introduction: An over view of concept of Animal behavior
- 3.2 Visual Perception, Auditory perception and Olfactory Perception
- 3.3 Animal aggression and Homing territoriality
- 3.4 Social organization, Advantages, Social organization in insects, primates

UNIT-IV

- 4.1 Conditioning Learning (Classical and Operant conditioning and, Multiple-response learning)
- 4.2 Cognitive Learning (Insight Learning, Sign Learning, Latent Learning)
- 4.3 Kinds of remembering (Redintegrative memory –Recall – Recognition-Relearning Retrieval Process-Theories of Memory).
- 4.4 The nature of forgetting (Decay through disuse- Interference effects, motivated forgetting, improving memory)

SUGGESTED BOOKS

1. Neurobiology. Shepherd, G.M. Oxford University press, London
2. Basic Neurochemistry-G.J. Siegal, R.W. Albers, B.W. Agranoff, R. Katzman (1981) Little, Brown and company. Boston.
1. Introduction to Nervous system-T.H. Bullock, R. Cork, A. Graner (1977); W.H Freeman & Co.
2. Principles of Neural Science –E.R. Kandel and J.H. Schwartz. (1981); Elsevier/North Holland. NY. Oxford.
5. Mechanism of Drug Action on the Nervous System- M.A.B. Brazil, R.W. Ryall. (1979); Cambridge University Press. Cambridge, London and New York.
6. The Bio Chemical basis of Neuropharmacology-J.R. Cooper, F.E. Bloom, &R.H. Roth. (1982); Oxford University Press, NY and London.
1. Principles of NeuroPsychopharmacology- Robert S. Feldman, Jerrold S. Meyer and Lind F. Quenzer. Sinauer Associates, Inc. Publishers. Sunderland. Massachusetts.
2. Alcock, J. Animal behaviour: An evolutionary approach. Sinauer Assoc., Sunderland, Mass. USA.
3. Bradbury, J.W. and S.L. Vehrencamp. Principles of animal communication. Sinauer Assoc. Sunderland, Mass. USA.
4. Clutton-Brock, T.H. the evolution of parental care. Princeton Univ. Press, Princeton, NJ, USA.
5. Eibl-Eibesfeldt, I. Ethology. The biology of behaviour. Holt, Rinehart and Winston, New York.
12. Gould, J.L. The mechanisms and evolution of behaviour.

PRACTICALS IN NEUROBIOLOGY

1. Heteropolar and multipolar neuron
2. Sensory neurons
3. Coelenterata nerve net
4. Pyramidal cell from cortex
5. Motor neuron from spinal cord
6. C.S. of spinal cord
7. Bipolar cell from olfactory bulb
8. Neuromuscular junction
9. Stretch receptors in cray fish
10. Organization of sepia central nervous system
11. Synapse enlarge
12. Stellate ganglion in sepia
13. Isolation and identification of different regions of mice brain
14. Spinal reflexes in decerebrated frog

PRACTICALS IN ANIMAL BEHAVIOR

1. Habituation learning in snails
2. Spatial learning in albino rats
3. Locomotor activity in albino rats
4. Spotters
5. Insight learning in chimpanzee
6. Insight learning in raccoon
7. A chimpanzee using a stick to obtain an apple
8. Thorndike puzzle box
9. Instrumental conditioning

10. Imprinting
11. Feeding behaviour
12. Bee language
13. Courtship behaviour
14. Classical conditioning
15. Social behaviour
16. Pheromones in ants
17. Round and waggle dance of scout honey bee
18. Spatial leaning in bee wolf
19. Symbiosis adaptation
20. Aggressive mimicry

SEMESTER – IV (A)

Zoo 403: ECONOMIC ZOOLOGY

Learning objectives of Zoo 403:

- To understand the aquaculture potential, kinds of aquaculture practices in India, Integrated fish culture, prawn and ornamental fish culture.
- To understand the importance of apiculture and lac culture
- To understand the importance of sericulture.
- To know the economic importance of live stock and poultry.
- To know the vermicomposting and vermiproducs

Learning Outcomes of Zoo 403:

The Course provide an overview to understand the aquaculture potential, kinds of aquaculture practices in India, Integrated fish culture, prawn culture, ornamental fish culture, api culture, lac culture, sericulture, economic importance of Live stocks, poultry and vermiculture.

- ✓ Understand the aquaculture potential of India
- ✓ Learn the kinds of aquaculture practices in India
- ✓ Know the importance of integrated fish culture, prawn and ornamental fishes
- ✓ Understand the importance of api culture and lac culture.
- ✓ Recognize the importance sericulture
- ✓ Learn the importance of Live stock and poultry.
- ✓ Understand the importance of vermiculture.

Syllabus

UNIT-I.

- 1.1 Definition and scope of aquaculture.
- 1.2 Culture of prawns-fresh water, post harvesting processing.
- 1.3 General account of Edible fresh water fishes.
Carp culture: management of ponds, processing and preservation.
- 1.4 Plankton as a live feed for Fisheries.
Poly culture practices.

UNIT-II.

- 2.1 History, scope and status of Sericulture Industry in India.
- 2.2 Species of silkworm, life history of mulberry silkworm (*Bombyx mori*) and tasar silkworm (*Antheraea mylitta*).
- 2.3 Silk worm diseases.
- 2.4 Brief idea of cocoon processing for silk fabric - cocoon boiling, reeling, rereeling, winding, doubling, twisting and weaving

UNIT-III:

- 3.1 Types of honey bees.
- 3.2 Life cycle, culture of honey bees using movable frame hive.
- 3.3 Methods of bee keeping, enemies of bees.
- 3.4 Bye products of Honey bees and its economic importance.

UNIT-IV:

- 4.1 Lac culture – Lac insect,(*Laccifera lacca*); - Life cycle, Lac processing, Lac products and Economic Importance.
- 4.2 Pearl culture and Pearl Industry. Vermiculture and Composting
- 4.3 Economics of Poultry keeping: Morphology of different breeds of Chicken-Brooding and Rearing of Chicks-Processing of Egg, Meat and By-Products of Poultry.
- 4.4 Dairy farm management, Milch breeds. Draught breeds, Dual purpose breeds and New Cross breeds of Cows and Buffaloes in India.

SUGGESTED READING MATERIAL:

1. Sukla, G.S. and Upadhyay, V.B., 2000 Economic Zoology – ISBN – 81-7133-137-8 Rastogi Publications, Meerut, India.
2. Jawaid Ahsan and Subhas Prasad Sinha, 2000 A Handbook on Economic Zoology- ISBN-81-219-0876-O S. Chand & Co., Ltd., New Delhi.
3. Ashok Kumar and Prem mohan Nigam, 1991 Economic and Applied Entomology Emkay Publications, New Delhi.
4. Shammi, Q.J. and Bhatnagar, S., 2002 Applied Fisheries: ISBN-81-7754-114-5 Agrobios (India), Jodhpur – India.
5. Major Hall, C.B. 2005 Ponds and Fish culture - ISBN-81-7754-146-3 Agrobios (India), Jodhpur – India.
6. Keith Wilson, N.D.P., 2005 A Handbook of Poultry Practice – ISBN-81-7754-O-69-6 Agrobios (India), Jodhpur – India.
7. Banerjee, G.C. 1992 Poultry – III- Edition – ISBN-81-204-008-4 Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. B.Sc. Zoology: Syllabus (CBCS) 45
8. Banerjee, 1988 A Text Book of Animal husbandry-VIII-Edition-ISBN-81-204-1260-5 Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
9. Kaushish, S.K., 2001 Trends in Livestock Research – ISBN-81-7754-112-9 Agrobios (India), Jodhpur – India.
10. Ismail, S.A. 1997. Vermicology the Biology of Earth worm Orient Longman, India
11. A. Mary violet Christy 2008 vermy technology MJP Publ. Chennai

PRACTICALS OF ECONOMIC ZOOLOGY

1. Identification of Fish by-products.
2. Identification of Important Cultivable species of Aquaculture.
3. Study of the method of Rearing of Silk worm.
4. Estimation of Sericin content from Silk worm Cocoon.
5. Identification of the stages of Silk worm Life cycle.
6. Identification of pearl producing molluscs and characterization of pearls.
7. Study of the method of apiculture
8. Technique of induced breeding in the fish.

SEMESTER – IV (A)

Zoo 404:IE-A: ENZYMOLOGY

Learning objectives of Zoo 404 IE-A:

To describe the enzyme classification, catalysis, purification of enzymes, enzyme kinetics, enzyme inhibition, clinical aspects of enzymes, immobilized enzymes

Learning Outcomes of Zoo 404 IE-A:

The Course provide an overview of know the enzyme classification, catalysis, purification of enzymes, enzyme kinetics, enzyme inhibition, clinical aspects of enzymes, immobilized enzymes

- ✓ Describe the enzyme classification, catalysis, purification of enzymes, enzyme kinetics, enzyme inhibition, clinical aspects of enzymes, immobilized enzymes

Syllabus

UNIT-I:

- 1.1 Historical Background, overview and specific examples, nomenclature and classification of enzymes–IUB system, chemical nature and properties of enzymes.
- 1.2 Enzyme specificity (Absolute specificity, Group specificity, Broad specificity).
- 1.3 Enzyme catalysis, Quantitative measurement of enzyme activity, Assay of enzyme activity-units of enzyme activity.
- 1.4 Isolation and purification of enzymes, intracellular distribution of enzymes.

UNIT-II:

- 2.1 Theories of enzyme kinetics - kinetic theory and collision theory.
- 2.2 Enzyme kinetics and its importance, derivation of Michaelis-Menton equation, Methods of V_{max} and K_m determination, construction of Line weaver burk plots.
- 2.3 Effect of reactant concentrations (Rate constant, First order, Second order and Zero order kinetic reactions, Ramachandran plot, determination of slope).
- 2.4 Effect of Temperature, pH and enzyme concentration on reaction rate.

UNIT-III:

- 3.1 Inhibition of enzyme activity (competitive, non-competitive, uncompetitive and mixed inhibition).
- 3.2 Kinetics of allosteric enzymes.
- 3.3 Regulation of enzyme activity (Metabolic regulation), Catalytic efficiency of enzymes (feed back inhibition, covalent modification).
- 3.4 Mechanism of enzyme action (Lock and Key, Induced fit model), catalytic site, role of metal ions.

UNIT-IV:

- 4.1 Clinical Aspects of enzymology, Medical and Therapeutic applications of enzymes; Enzymes-Clinical diagnosis.
- 4.2 Immobilized enzymes, various methods of immobilization-ionic bonding, absorption, covalent bond (based on R groups of amino acids).
- 4.3 Iso enzymes and multiple forms of enzymes.
- 4.4 Enzyme engineering–economic importance of enzyme production. Enzymes in industries- food, biotechnology and other industries.

SUGGESTED READING MATERIAL:

1. Biochemical calculations. I.H. Segel, 2nd Ed., John Wiley & Sons.
2. Biochemistry. D. Voet & J.G. Voet, J.Wiley & Sons.
3. Enzyme Kinetics. I.W. Segil.
4. Enzyme Kinetics. D.V. Roberties, Cambridge University Press.
5. Harper's Biochemistry. Robert K. Murray, Peter A. Mayer, D.K. Granner, V.W. Rodwell, Lange Medical.

PRACTICALS OF ENZYMOLOGY

1. Effect of Temperature on Rat liver succinate dehydrogenase activity
2. Effect of PH on Rat liver succinate dehydrogenase activity
3. Effect of substrate concentration succinate dehydrogenase activity
4. Effect of Enzyme concentration succinate dehydrogenase activity
5. Determination of Optimal conditions for succinate dehydrogenase activity
3. Determination of kinetic constants such as K_m and V_{max}
4. Inhibitor sensitivity (determination of IC_{50})
5. Effect of inhibitors on SDH activity and determination of inhibitors constant
6. Estimation of GOT and GPT in the serum samples
7. Isolation and purification of arginase
8. Isolation of LDH isozymes using electrophoresis
9. Determination of K_s (substrate constant) for any allosteric enzyme using Hill equation

SEMESTER – IV (A)

Zoo:404 IE B: ENDOCRINOLOGY

Learning objectives of Zoo 404: IE-B

- To describe the characteristic features of hormones, hormone classification
- To study the Mechanism of hormone action and General account of Pheromones
- To describe the Structure and functions of hormones of Pineal, Pituitary, thyroid and Parathyroid, Adrenals, Pancreas and Gastrointestinal tract, Hormones in female sexual cycle, Pregnancy and lactation Hormones of Testis and regulation of spermatogenesis
- To understand the Biosynthesis and secretion of hormones, Hormone receptors, Hormones in crustaceans and Hormones in insects

Learning Outcomes of Zoo 404: IE-B

The Course provide an overview to understand the different hormones secretion and their action

- ✓ Explain the characteristic features of hormones
- ✓ Classify the hormone types
- ✓ Discuss the Mechanism of hormone action and General account of Pheromones
- ✓ Describe the Structure and functions of hormones of Pineal, Pituitary, thyroid and Parathyroid, Adrenals, Pancreas and Gastrointestinal tract, Hormones in female sexual cycle, Pregnancy and lactation Hormones of Testis and regulation of spermatogenesis
- ✓ Understand the Biosynthesis and secretion of hormones, Hormone receptors, Hormones in crustaceans and Hormones in insects

Syllabus

UNIT-I

- 1.1 Introduction to Endocrinology- Historical back ground, characteristic features of hormones
- 1.2 Classification and chemical nature of hormones
- 1.3 Mechanism of hormone action (Peptide and Steroid hormones)
- 1.4 General account of Pheromones

UNIT-II

- 2.1 Structure and functions of hormones of Pineal, Pituitary, thyroid and Parathyroid
- 2.2 Structure and functions of hormones of Adrenals, Pancreas and Gastrointestinal tract
- 2.3 Hormones in female sexual cycle, Pregnancy and lactation
- 2.4 Hormones of Testis and regulation of spermatogenesis

UNIT-III

- 3.1 Biosynthesis and secretion of hormones corticosteroid hormones-peptide hormones-catecholamines
- 3.2 Hormone receptors; receptor structure and signal transduction mechanism-G-protein family
- 3.3 Hormones in crustaceans - growth, development and reproduction.
- 3.4 Hormones in insects - growth, development and reproduction.

UNIT-IV

- 4.1 Growth hormones and growth factors
- 4.2 Hormones and homeostasis (Calcium, glucose, Phosphate, water)
- 4.3 Hormonal regulation of carbohydrate, nitrogen and lipid metabolism
- 4.4 Hormones as pharmaceuticals

SUGGESTED READING MATERIAL

1. Barrington. E.J.W. General and comparative Endocrinology Cambridge Press, Oxford.
2. Bentley, P.J. Comparative Vertebrate Endocrinology, Cambridge Press, Oxford
3. Williams, R.H. Text Book of Endocrinology, W.B. Saunders Co., Philadelphia.
4. Martin, C.R. Endocrine Physiology. Oxford Univ. Press, Oxford.
5. Prakash S. Lohar. Endocrinology-Hormones and human health-2005. MJP Publishers-Chennai

LIST OF PRACTICALS OF ENDOCRINOLOGY

1. Observation of the histological section of the pituitary, adrenals, pancreas and gonads
2. Isolation and extraction of pituitary gland from fish
3. Estimation of glucose levels in the blood of frog/rat exposed to adrenaline and insulin
4. Estimation proteins in the reproductive tissues of a fish injected with pituitary extract
5. Estimation of SDH activity in the haemolymph of eyestalk ablated crab
6. Estimation of oxygen consumption in eyestalk ablated crab
7. Demonstration on the effect of ligature on the development of larvae of insects
8. Estimation of glucose in alloxon-induced diabetes
9. Effect of adrenalectomy on total proteins in the liver of albino rats

SEMESTER – IV (A)

Zoo-404:IE C: TOXICOLOGY

Learning objectives of Zoo 404: IE-C

- To understand the Introduction and scope of toxicology and classification of xenobiotics and Principles of toxicology
- To describe the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics and Biomagnifications
- To understand the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics. Biomagnification, Toxic Response of Blood, Toxic Response of Liver, Toxic Response of Kidney and Toxic Response of Reproductive system

Learning Outcomes of Zoo 404:IE-C

The Course provide an overview to understand the Principles of toxicology, Xenobiotics of Biotransformation, Bioaccumulation and Biomagnification

- ✓ Explain the Introduction and scope of toxicology and classification of xenobiotics and Principles of toxicology
- ✓ Describe the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics and Biomagnification
- ✓ Understand the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics. Biomagnification, Toxic Response of Blood, Toxic Response of Liver, Toxic Response of Kidney and Toxic Response of Reproductive system

Syllabus

UNIT- I

- 1.1 Introduction and scope of toxicology and classification of xenobiotics.
- 1.2 Principles of toxicology- Dose response relationship- Toxicity tests {acute (LD₅₀, LC₅₀, ED₅₀) and chronic toxicity tests on aquatic and terrestrial animals}, Variations in toxic response.
- 1.3 Mechanism of toxic action of pesticides (Receptor concept, nature of receptors, Theory of toxicants- receptors interactions and mechanism of action of some pesticides)
- 1.4. Toxicokinetics-
 - i) Classic toxicokinetics
 - ii) Physiologic toxicokinetics

UNIT- II:

- 2.1 Translocation of toxicants; Absorption of Toxicants, Distribution of Toxicants, Excretion of Toxicants
- 2.2 Biotransformation of Xenobiotics; Biotransformation sites, Biotransformation enzymes, Biotransformation reaction and bioactivation
- 2.3 Bioaccumulation of Xenobiotics; Bioconcentration, Bioaccumulation and Biomagnification; Biomagnification of lipophilic and recalcitrant substances
- 2.4 Toxic effect of metals - Mercury, Lead, Cadmium and Arsenic

UNIT- III:

- 3.1 Toxic Response of Blood: Toxicology of erythron, leukon, platelets and homeostasis
- 3.2 Toxic Response of Liver; Mechanism and types of toxin – induced liver injury; critical factors in toxicant induced liver injury; detoxification mechanisms by liver.
- 3.3 Toxic Response of Kidney; Susceptibility of the kidney to toxic injury; Biochemical mechanisms / mediators of renal cell injury.
- 3.4 Toxic Response of Reproductive system; Endocrine disruption (including screening and puberty) in humans and mammals. Testicular and ovarian dysfunction. Deterioration in fertility by toxicants.

UNIT- IV:

- 4.1 Xenobiotic effect on basic metabolism (Carbohydrates, Proteins, Lipids)
- 4.2 Teratogens and Teratology (Relationships between maternal and developmental toxicity)
- 4.3 Antidotal therapy; Types of antidotes and antidotal procedures.
- 4.4 Risk assessment – Hazard identification; Risk characterization and Safety evaluation of Chemicals.

SUGGESTED READING MATERIAL

1. Casarett & Doull's- Toxicology- The basic science of poisons- C.D. Klassen, Mary, O.D & John Doull.
2. Concepts of Toxicology Dr. Omkar, Vishal Publishing C.2003.
3. Environmental toxicology of pesticides- F. Mastimura, G.M.Boush and T.Misato.
4. Introduction of Biochemical Toxicology- E.Hodgson & F.E.Gutherie.
5. Pesticides action and metabolism- O'Brrien.
6. Pesticides and Human Welfare- D.L. Gunn and J.G.R.Stevens. Oxford University Press-1978.
7. The Encyclopedia of Americana- Vol.15.

LIST OF PRACTICALS OF TOXICOLOGY

1. Determination of LC₅₀ and LD₅₀ of selected toxicants in different animals.
2. Effect of temperature on the ciliary activity in the normal and pesticide / metal exposed fresh water mussels.
3. SDH activity in different tissues of frog / fish with reference to malathion / mercury / cadmium.
4. Effect of toxicants on the rate of oxygen consumption of aquatic animals.
5. Effect of toxicants on soluble and structural proteins of fish/frog.
6. Teratogenic effects of pesticides on mice.
7. Pesticidal effects on morphology of tissue.

SEMESTER – IV (B)

Zoo 401: MOLECULAR BIOLOGY

Learning objectives of Zoo 401:

- To impart information on the historical developments in Molecular Biology
- An in-depth study on structure and organization of chromosome, replication process, transcription process, translation process and mutagenesis.
- To understand the molecular nature of genome.
- To expose the students on the basic understanding of various techniques used in molecular studies

Learning Outcomes of Zoo 401:

This course outline is designed to develop interest among students on in-depth study on structure and organization of chromosome, replication process, transcription process, translation process and mutagenesis. By the end of the course, students may be able to:

- ✓ Understand in-depth knowledge on Molecular Biology
- ✓ Know various types of Mutagenesis
- ✓ Understand in detailed mechanisms of DNA Replication
- ✓ Understand the overall concepts of Transcription
- ✓ Understand in detailed mechanisms Translation
- ✓ Describe the DNA damage and repair
- ✓ Differentiate the Types of DNA
- ✓ Learn Genetic regulation, DNA sequencing, DNA finger printing, Polymerase chain reaction, cDNA library, Genomic library, Western and Northern blotting

Syllabus

UNIT-I: Molecular nature of Genome

- 1.1 Watson and Crick Model; Types of DNA; Properties of DNA (C- value paradox, Cot value)
- 1.2 Nuclear and mitochondrial genome
- 1.3 Structure of gene (Cistron, Muton, Recon, Cis-trans test)
- 1.4 DNA damage and repair: Biological induction of repair, photo reactivation, Excision repair, Recombination repair, SOS repair, and Mismatch repair.

UNIT-II: Replication

- 2.1 Replication in Prokaryotes: *Geometry* of DNA replication, semi conservative replication.
- 2.2 Enzymology of DNA replication: DNA Polymerases I, II and III; Replication of Eukaryotic Chromosomes; Eukaryotic DNA polymerases; Multiple forks; Replication of Chromatin.
- 2.3 Discontinuous Replication: Fragments in Replication fork and detection of fragments; Events in the replication fork; De novo initiation and covalent extension.
- 2.4 Bidirectional replication, Termination of replication

UNIT III: Transcription and Translation

- 3.1 Transcription: Types of RNA, enzymes and molecular mechanisms involved in transcription.
- 3.2 Processing of rRNA, tRNA and RNA in Prokaryotes and Eukaryotes, Ribozyme
- 3.3 Translation: Genetic code, Polypeptide chain initiation, elongation and termination
- 3.4 Post translational modification; Role of antibiotics in protein synthesis

UNIT IV: Gene expression and Molecular Biology Techniques

- 4.1 Genetic regulation: Induction, Repression, Lac Operon, Lambda Operon
- 4.2 Tryptophan Operon, Britten and Davidson model for Eukaryotic regulation
- 4.3 DNA sequencing, DNA finger printing, Polymerase chain reaction
- 4.4 cDNA library, Genomic library, Western and Northern blotting

SUGGESTED READING MATERIAL

6. Molecular Biology by David Freifelder, 1993
7. Molecular Biology of Gene-by ID.Watson, 1988
8. Harper's review of Biochemistry by D.W. Martin et al1990
9. Biochemistry by A.L. Lehninger
10. Cell and Molecular Biology-E.D.P. De Robertis and E.M.F.
7. Concepts in Molecular Biology-S.C. Rastogi, VN. Sharma and Ananda Tandon (1993)
Genes VII by Benjamin Lewin

PRACTICALS OF MOLECULAR BIOLOGY

9. Isolation of DNA
10. Estimation of DNA by diphenylamine method
11. Thermal melting point of DNA
12. Hyperchromacity of DNA
13. Agarose Gel Electrophoresis
14. Estimation of protein content in specific fraction
15. Estimation of RNA by orcinol method
16. Southern and Western blotting

SEMESTER – IV (B)

Zoo 402:IE-A: ENZYMOLOGY

Learning objectives of Zoo 402: IE-A:

- To make the students to understand the various types of neurons and nervous system
- To understand the Sodium and potassium pump and Synapses
- To describe Chemical composition of the nervous system and Neurotransmitters
- To understand General introduction: An over view of concept of Animal behavior
- To describe different learning process

Learning Outcomes of Zoo 402: IE-A:

The Course provide an overview of Neurobiology and Animal Behaviour

- ✓ Make the students to understand the various types of neurons and nervous system
- ✓ Understand the Sodium and potassium pump and Synapses
- ✓ Describe Chemical composition of the nervous system and Neurotransmitters
- ✓ Understand General introduction: An over view of concept of Animal behavior
- ✓ Describe different learning process

Syllabus

UNIT-I:

- 1.5 Historical Background, overview and specific examples, nomenclature and classification of enzymes–IUB system, chemical nature and properties of enzymes.
- 1.6 Enzyme specificity (Absolute specificity, Group specificity, Broad specificity).
- 1.7 Enzyme catalysis, Quantitative measurement of enzyme activity, Assay of enzyme activity-units of enzyme activity.
- 1.8 Isolation and purification of enzymes, intracellular distribution of enzymes.

UNIT-II:

- 2.5 Theories of enzyme kinetics - kinetic theory and collision theory.
- 2.6 Enzyme kinetics and its importance, derivation of Michaelis-Menton equation, Methods of Vmax and Km determination, construction of Line weaver burk plots.
- 2.7 Effect of reactant concentrations (Rate constant, First order, Second order and Zero order kinetic reactions, Ramachandran plot, determination of slope).
- 2.8 Effect of Temperature, pH and enzyme concentration on reaction rate.

UNIT-III:

- 3.5 Inhibition of enzyme activity (competitive, non-competitive, uncompetitive and mixed inhibition).
- 3.6 Kinetics of allosteric enzymes.
- 3.7 Regulation of enzyme activity (Metabolic regulation), Catalytic efficiency of enzymes (feed back inhibition, covalent modification).
- 3.8 Mechanism of enzyme action (Lock and Key, Induced fit model), catalytic site, role of metal ions.

UNIT-IV:

- 4.5 Clinical Aspects of enzymology, Medical and Therapeutic applications of enzymes; Enzymes-Clinical diagnosis.
- 4.6 Immobilized enzymes, various methods of immobilization-ionic bonding, absorption, covalent bond (based on R groups of amino acids).
- 4.7 Iso enzymes and multiple forms of enzymes.
- 4.8 Enzyme engineering—economic importance of enzyme production. Enzymes in industries- food, biotechnology and other industries.

SUGGESTED READING MATERIAL:

6. Biochemical calculations. I.H. Segel, 2nd Ed., John Wiley & Sons.
7. Biochemistry. D. Voet & J.G. Voet, J.Wiley & Sons.
8. Enzyme Kinetics. I.W. Segil.
9. Enzyme Kinetics. D.V. Roberties, Cambridge University Press.
10. Harper's Biochemistry. Robert K. Murray, Peter A. Mayer, D.K. Granner, V.W. Rodwell, Lange Medical.

PRACTICALS OF ENZYMOLOGY

6. Effect of Temperature on Rat liver succinate dehydrogenase activity
7. Effect of PH on Rat liver succinate dehydrogenase activity
8. Effect of substrate concentration succinate dehydrogenase activity
9. Effect of Enzyme concentration succinate dehydrogenase activity
10. Determination of Optimal conditions for succinate dehydrogenase activity
3. Determination of kinetic constants such as K_m and V_{max}
4. Inhibitor sensitivity (determination of IC_{50})
5. Effect of inhibitors on SDH activity and determination of inhibitors constant
6. Estimation of GOT and GPT in the serum samples
7. Isolation and purification of arginase
8. Isolation of LDH isozymes using electrophoresis
9. Determination of K_s (substrate constant) for any allosteric enzyme using Hill equation

SEMESTER – IV (B)

Zoo:402 IE B: ENDOCRINOLOGY

Learning objectives of Zoo 402: IE-B

- To describe the characteristic features of hormones, hormone classification
- To study the Mechanism of hormone action and General account of Pheromones
- To describe the Structure and functions of hormones of Pineal, Pituitary, thyroid and Parathyroid, Adrenals, Pancreas and Gastrointestinal tract, Hormones in female sexual cycle, Pregnancy and lactation Hormones of Testis and regulation of spermatogenesis
- To understand the Biosynthesis and secretion of hormones, Hormone receptors, Hormones in crustaceans and Hormones in insects

Learning Outcomes of Zoo 402:IE-B

The Course provide an overview to understand the different hormones secretion and their action

- ✓ Explain the characteristic features of hormones
- ✓ Classify the hormone types
- ✓ Discuss the Mechanism of hormone action and General account of Pheromones
- ✓ Describe the Structure and functions of hormones of Pineal, Pituitary, thyroid and Parathyroid, Adrenals, Pancreas and Gastrointestinal tract, Hormones in female sexual cycle, Pregnancy and lactation Hormones of Testis and regulation of spermatogenesis
- ✓ Understand the Biosynthesis and secretion of hormones, Hormone receptors, Hormones in crustaceans and Hormones in insects

Syllabus

UNIT-I

- 1.1 Introduction to Endocrinology- Historical back ground, characteristic features of hormones
- 1.2 Classification and chemical nature of hormones
- 1.3 Mechanism of hormone action (Peptide and Steroid hormones)
- 1.4 General account of Pheromones

UNIT-II

- 2.1 Structure and functions of hormones of Pineal, Pituitary, thyroid and Parathyroid
- 2.2 Structure and functions of hormones of Adrenals, Pancreas and Gastrointestinal tract
- 2.3 Hormones in female sexual cycle, Pregnancy and lactation
- 2.4 Hormones of Testis and regulation of spermatogenesis

UNIT-III

- 3.1 Biosynthesis and secretion of hormones corticosteroid hormones-peptide hormones-catecholamines
- 3.2 Hormone receptors; receptor structure and signal transduction mechanism-G-protein family
- 3.3 Hormones in crustaceans - growth, development and reproduction.
- 3.4 Hormones in insects - growth, development and reproduction.

UNIT-IV

- 4.1 Growth hormones and growth factors
- 4.2 Hormones and homeostasis (Calcium, glucose, Phosphate, water)
- 4.3 Hormonal regulation of carbohydrate, nitrogen and lipid metabolism
- 4.4 Hormones as pharmaceuticals

SUGGESTED READING MATERIAL

1. Barrington. E.J.W. General and comparative Endocrinology Cambridge Press, Oxford.
2. Bentley, P.J. Comparative Vertebrate Endocrinology, Cambridge Press, Oxford
3. Williams, R.H. Text Book of Endocrinology, W.B. Saunders Co., Philadelphia.
4. Martin, C.R. Endocrine Physiology. Oxford Univ. Press, Oxford.
5. Prakash S. Lohar. Endocrinology-Hormones and human health-2005. MJ Publishers-Chennai

LIST OF PRACTICALS OF ENDOCRINOLOGY

1. Observation of the histological section of the pituitary, adrenals, pancreas and gonads
2. Isolation and extraction of pituitary gland from fish
3. Estimation of glucose levels in the blood of frog/rat exposed to adrenaline and insulin
4. Estimation proteins in the reproductive tissues of a fish injected with pituitary extract
5. Estimation of SDH activity in the hemolymph of eyestalk ablated crab
6. Estimation of oxygen consumption in eyestalk ablated crab
7. Demonstration on the effect of ligature on the development of larvae of insects
8. Estimation of glucose in alloxon-induced diabetes
9. Effect of adrenalectomy on total proteins in the liver of albino rats

SEMESTER – IV (B)

Zoo-402:IE C: TOXICOLOGY

Learning objectives of Zoo 404: IE-C

- To understand the Introduction and scope of toxicology and classification of xenobiotics and Principles of toxicology
- To describe the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics and Biomagnification
- To understand the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics. Biomagnification, Toxic Response of Blood, Toxic Response of Liver, Toxic Response of Kidney and Toxic Response of Reproductive system

Learning Outcomes of Zoo 404:IE-C

The Course provide an overview to understand the Principles of toxicology, Xenobiotics of Biotransformation, Bioaccumulation and Biomagnification

- ✓ Explain the Introduction and scope of toxicology and classification of xenobiotics and Principles of toxicology
- ✓ Describe the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics and Biomagnification
- ✓ Understand the Translocation of toxicants, Biotransformation of Xenobiotics, Bioaccumulation of Xenobiotics. Biomagnification, Toxic Response of Blood, Toxic Response of Liver, Toxic Response of Kidney and Toxic Response of Reproductive system

Syllabus

UNIT- I

- 1.1 Introduction and scope of toxicology and classification of xenobiotics.
- 1.2 Principles of toxicology- Dose response relationship- Toxicity tests {acute (LD₅₀, LC₅₀, ED₅₀) and chronic toxicity tests on aquatic and terrestrial animals}, Variations in toxic response.
- 1.3 Mechanism of toxic action of pesticides (Receptor concept, nature of receptors, Theory of toxicants- receptors interactions and mechanism of action of some pesticides)
- 1.4. Toxicokinetics-
 - ii) Classic toxicokinetics
 - ii) Physiologic toxicokinetics

UNIT- II:

- 2.1 Translocation of toxicants; Absorption of Toxicants, Distribution of Toxicants, Excretion of Toxicants
- 2.2 Biotransformation of Xenobiotics; Biotransformation sites, Biotransformation enzymes, Biotransformation reaction and bioactivation
- 2.3 Bioaccumulation of Xenobiotics; Bioconcentration, Bioaccumulation and Biomagnification; Biomagnification of lipophilic and recalcitrant substances
- 2.4 Toxic effect of metals - Mercury, Lead, Cadmium and Arsenic

UNIT- III:

- 3.1 Toxic Response of Blood: Toxicology of erythron, leukon, platelets and homeostasis
- 3.2 Toxic Response of Liver; Mechanism and types of toxin – induced liver injury; critical factors in toxicant induced liver injury; detoxification mechanisms by liver.
- 3.3 Toxic Response of Kidney; Susceptibility of the kidney to toxic injury; Biochemical mechanisms / mediators of renal cell injury.
- 3.4 Toxic Response of Reproductive system; Endocrine disruption (including screening and puberty) in humans and mammals. Testicular and ovarian dysfunction. Deterioration in fertility by toxicants.

UNIT- IV:

- 4.1 Xenobiotic effect on basic metabolism (Carbohydrates, Proteins, Lipids)
- 4.2 Teratogens and Teratology (Relationships between maternal and developmental toxicity)
- 4.5 Antidotal therapy; Types of antidotes and antidotal procedures.
- 4.6 Risk assessment – Hazard identification; Risk characterization and Safety evaluation of Chemicals.

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6. Teratogenic effects of pesticides on mice.
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