UNIVERSITY OF DELHI

CHOICE BASED CREDIT SYSTEM

SYLLABI FOR

UNDERGRADUATE PROGRAM IN

ZOOLOGY

Department of Zoology
University of Delhi
Delhi- 110 007
Applicable for the students seeking admission to the
Bachelor with Honours in Zoology course in the Academic Year
2015-2016
PREAMBLE

“What Physics and Chemistry were to the 20th century, Biology will be to the 21st.” In keeping with this sentiment the present course is designed to help students develop an in-depth understanding of some of the crucial biological issues in modern world. Zoology, the study of animal life, an integral part of biology, aims to understand the behaviour, structure and evolution of animals, using a wide range of approaches, from genes, to molecular and cellular biology, through physiological processes and anatomy, to whole animals, populations and their ecology.

Since Zoologists study life at many levels, from molecules to ecosystems and beyond, the student taking this course will develop knowledge of the full breadth of life, its mechanisms, and the many recent developments in the subject. They will also gain an appreciation of the issues biological developments are presenting to society and understand the scope and limitations of biological knowledge and techniques. The course also combines technical, analytical and communication skills in a way that would make our graduates employable.

Like the physical sciences in the first half of the 20th Century, biology at the start of the 21st Century is achieving a substantive maturity of theory, experimental tools, and fundamental findings thanks to relatively secure foundations in cell and molecular biology, genetics, genomics and biotechnology. These subjects have also forced biologists to connect systematics and evolutionary biology to these modern aspects of the science, leading to a much better understanding from the systems level. Biologists are now addressing the evolution of genetic systems using more than the concepts of population biology alone, and the problems of cell biology using more than the tools of biochemistry and molecular biology alone. It is becoming increasingly clear that solutions to such basic problems as aging, sex, development, and genome size potentially involve elements of biological science at every level of organization, from molecule to population.

Upon completion of this course students will be able to:

- Have an overview of the world of animals.
- Discover Zoology’s contribution to modern society from cloning and gene therapy to pollution control and biodiversity conservation.
- Benefit from dedicated practical laboratories and an optional work placement.
- Carry out detailed fieldwork in the rich diversity of local habitats.

Gain an appreciation of the issues biological developments are presenting to society and understand the scope and limitations of biological knowledge and techniques.
SCHEME AND SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM FOR B.Sc. (HONOURS) ZOOLOGY
<table>
<thead>
<tr>
<th>Semester</th>
<th>Core Course (14)</th>
<th>Ability Enhancement Compulsory Course (2)</th>
<th>Skill Enhancement Course SEC (2)</th>
<th>Discipline Specific Elective DCE (4)</th>
<th>Generic Elective GE (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Non-chordates I: Protista to Pseudocoelomates</td>
<td>English Communication</td>
<td></td>
<td>GE-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Principles of Ecology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Non-chordates II: Coelomates</td>
<td>Environmental Science</td>
<td></td>
<td>GE-2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cell Biology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Diversity of Chordates</td>
<td>SEC -1</td>
<td></td>
<td>GE-3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physiology: Controlling and Coordinating Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fundamentals of Biochemistry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Comparative Anatomy of Vertebrates</td>
<td>SEC -2</td>
<td></td>
<td>GE-4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physiology: Life Sustaining Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biochemistry of Metabolic Processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Molecular Biology</td>
<td>DSE-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Principles of Genetics</td>
<td>DSE-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Developmental Biology</td>
<td>DSE-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evolutionary Biology</td>
<td>DSE-4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester</td>
<td>Course Opted</td>
<td>Course Name</td>
<td>Credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>---------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Ability Enhancement Compulsory Course-I</td>
<td>English communications/Environmental Science</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-I</td>
<td>Non-chordates I: Protista to Pseudocoelomates</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-I Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-II</td>
<td>Principles of Ecology</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-II Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -1</td>
<td>GE-1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -1 Practical/Tutorial</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Ability Enhancement Compulsory Course-II</td>
<td>English Communications/Environmental Science</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-III</td>
<td>Non-chordates II: Coelomates</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-III Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-IV</td>
<td>Cell Biology</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-IV Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -2</td>
<td>GE-2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -2 Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Core course-V</td>
<td>Diversity of Chordata</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-V Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-VI</td>
<td>Physiology: Controlling and Coordinating systems</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-VI Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-VII</td>
<td>Fundamentals of Biochemistry</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-VII Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skill Enhancement Course-I</td>
<td>SEC-1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -3</td>
<td>GE-3</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -3 Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Core course-VIII</td>
<td>Comparative anatomy of vertebrates</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Course-VIII Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-IX</td>
<td>Physiology: Life Sustaining Systems</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Course-IX Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-X</td>
<td>Biochemistry of Metabolic Processes</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course- X Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skill Enhancement Course-2</td>
<td>SEC-2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -4</td>
<td>GE-4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generic Elective -4</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Core course-XI</td>
<td>Molecular Biology</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-XI Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-XII</td>
<td>Principles of Genetics</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-XII</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester</td>
<td>Course Opted</td>
<td>Course Name</td>
<td>Credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------</td>
<td>-----------------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Specific Elective -1</td>
<td>DSE-1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Specific Elective -1 Practical</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Specific Elective -2</td>
<td>DSE-2</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Specific Elective- 2 Practical/Tutorial</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Core course-XIII</td>
<td>Developmental Biology</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-XIII Practical/Tutorial</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core course-XIV</td>
<td>Evolutionary Biology</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Course-XIV Practical/Tutorial</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Centric Elective -3</td>
<td>DSE-3</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Centric Elective -3 Practical/Tutorial</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Centric Elective-4</td>
<td>DSE-4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discipline Centric Elective -1 Practical/Tutorial</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>140</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## CORE COURSE I
### NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

**THEORY**

(Credits 4)

<table>
<thead>
<tr>
<th>Unit 1: Protista, Parazoa and Metazoa</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>General characteristics and Classification up to classes</td>
<td></td>
</tr>
<tr>
<td>Study of <em>Euglena, Amoeba</em> and <em>Paramecium</em></td>
<td></td>
</tr>
<tr>
<td>Life cycle and pathogenicity of <em>Plasmodium vivax</em> and <em>Entamoeba histolytica</em></td>
<td></td>
</tr>
<tr>
<td>Locomotion and Reproduction in Protista</td>
<td></td>
</tr>
<tr>
<td>Evolution of symmetry and segmentation of Metazoa</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 2: Porifera</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>General characteristics and Classification up to classes</td>
<td></td>
</tr>
<tr>
<td>Canal system in sponges</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 3: Cnidaria</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>General characteristics and Classification up to classes</td>
<td></td>
</tr>
<tr>
<td>Metagenesis in <em>Obelia</em></td>
<td></td>
</tr>
<tr>
<td>Polymorphism in Cnidaria</td>
<td></td>
</tr>
<tr>
<td>Corals and coral reefs</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 4: Ctenophora</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>General characteristics and Evolutionary significance</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 5: Platyhelminthes</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>General characteristics and Classification up to classes</td>
<td></td>
</tr>
<tr>
<td>Life cycle and pathogenicity of <em>Fasciola hepatica</em> and <em>Taenia solium</em></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 6: Nemathelminthes</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>General characteristics and Classification up to classes</td>
<td></td>
</tr>
<tr>
<td>Life cycle and pathogenicity of <em>Ascaris lumbricoides</em> and <em>Wuchereria bancrofti</em></td>
<td></td>
</tr>
<tr>
<td>Parasitic adaptations in helminthes</td>
<td></td>
</tr>
</tbody>
</table>

NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

PRACTICAL  
(Credits 2)

1. Study of whole mount of Euglena, Amoeba and Paramecium, Binary fission and Conjugation in Paramecium
2. Examination of pond water collected from different places for diversity in protista
3. Study of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla
4. Study of Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora
5. One specimen/slide of any ctenophore
6. Study of adult Fasciola hepatica, Taenia solium and their life cycles (Slides/micro-photographs)
7. Study of adult Ascaris lumbricoides and its life stages (Slides/micro-photographs)


SUGGESTED READINGS

CORE COURSE II
PRINCIPLES OF ECOLOGY

THEORY (Credits 4)

Unit 1: Introduction to Ecology
History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Unit 2: Population
Unitary and Modular populations
Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion
Exponential and logistic growth, equation and patterns, r and K strategies
Population regulation - density-dependent and independent factors
Population interactions, Gause’s Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses

Unit 3: Community
Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example
Theories pertaining to climax community

Unit 4: Ecosystem
Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies
Nutrient and biogeochemical cycle with one example of Nitrogen cycle
Human modified ecosystem

Unit 5: Applied Ecology
Ecology in Wildlife Conservation and Management
PRINCIPLES OF ECOLOGY

PRACTICALS (Credits 2)

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO₂
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS

- Robert Leo Smith Ecology and field biology Harper and Row publisher
CORE COURSE III
NON-CHORDATES II: COELOMATES

THEORY

(Credits 4)

Unit 1: Introduction to Coelomates
Evolution of coelom and metamerism

Unit 2: Annelida
General characteristics and Classification up to classes
Excretion in Annelida

Unit 3: Arthropoda
General characteristics and Classification up to classes
Vision and Respiration in Arthropoda
Metamorphosis in Insects
Social life in bees and termites

Unit 4: Onychophora
General characteristics and Evolutionary significance

Unit 5: Mollusca
General characteristics and Classification up to classes
Respiration in Mollusca
Torsion and detorsion in Gastropoda
Pearl formation in bivalves
Evolutionary significance of trochophore larva

Unit 6: Echinodermata
General characteristics and Classification up to classes
Water-vascular system in Asteroidea
Larval forms in Echinodermata
Affinities with Chordates

NON-CHORDATES II: COELOMATES

PRACTICAL (Credits 2)

1. Study of followingspecimens:
   Annelids - Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria
   Arthropods - Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta, termites and honey bees
   Onychophora - Peripatus
   Molluscs - Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus
   Echinodermates - Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon

2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
3. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
4. Mount of mouth parts and dissection of digestive system and nervous system of Periplaneta*
5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)


SUGGESTED READINGS

# CORE COURSE IV

## CELL BIOLOGY

### THEORY

<table>
<thead>
<tr>
<th>Unit</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview of Cells</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Plasma Membrane</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Various models of plasma membrane structure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transport across membranes: Active and Passive transport</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cell junctions: Tight junctions, Desmosomes, Gap junctions</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Endomembrane System</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mitochondria and Peroxisomes</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peroxisomes</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cytoskeleton</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Structure and Functions: Microtubules, Microfilaments and Intermediate filaments</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Nucleus</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Cell Division</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Mitosis, Meiosis, Cell cycle and its regulation</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Cell Signaling</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>GPCR and Role of second messenger (cAMP)</td>
<td></td>
</tr>
</tbody>
</table>
CELL BIOLOGY

PRACTICAL (Credits 2)

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
2. Study of various stages of meiosis.
3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
4. Preparation of permanent slide to demonstrate:
   i DNA by Feulgen reaction
   ii DNA and RNA by MGP
   iii Mucopolysaccharides by PAS reaction
   iv Proteins by Mercurobromophenol blue/Fast Green

SUGGESTED READINGS

## CORE COURSE V
### DIVERSITY OF CHORDATA

**THEORY**  
(Credits 4)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Chordates</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Protochordata</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>Origin of Chordata</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Agnatha</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Pisces</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Amphibia</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Reptilia</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Aves</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Mammals</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>Zoogeography</td>
<td>8</td>
</tr>
</tbody>
</table>

General characteristics and outline classification

General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Dipleurula concept and the Echinoderm theory of origin of chordates  
Advanced features of vertebrates over Protochordata

General characteristics and classification of cyclostomes up to class

General characteristics of Chondrichthyes and Osteichthyes, Classification up to order Migration, Osmoregulation and Parental care in fishes

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

General characteristics and classification up to order Archaeopteryx-- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms
DIVERSITY OF CHORDATA

PRACTICAL  
(Credits 2)

1. **Protochordata**
   *Balanoglossus, Herdmania, Branchiostoma*, Colonial Urochordata, Sections of *Balanoglossus* through proboscis and branchiogenital regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions. Permanent slide of *Herdmania* spicules

2. **Agnatha**
   *Petromyzon, Myxine*

3. **Fishes**
   *Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas*, Flat fish

4. **Amphibia**
   *Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra*

5. **Reptilia**
   *Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus*
   Key for Identification of poisonous and non-poisonous snakes

6. **Aves**
   Study of six common birds from different orders. Types of beaks and claws

7. **Mammalia**
   *Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous.*
   Mount of weberian ossicles of *Mystus*, pecten from Fowl head
   Dissection of Fowl head (Dissections and mounts subject to permission)
   Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)
   Classification from Young, J. Z. (2004) to be followed

SUGGESTED READINGS

CORE COURSE VI

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

THEORY

(Credits 4)

Unit 1: Tissues

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue

Unit 2: Bone and Cartilage

Structure and types of bones and cartilages, Ossification, bone growth and resorption

Unit 3: Nervous System

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision.

Unit 4: Muscle

Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus

Unit 5: Reproductive System

Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female

Unit 6: Endocrine System

Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones
ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

PRACTICALS

*1. Recording of simple muscle twitch with electrical stimulation (or Virtual)
*2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
*3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
*4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
*5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues

(*Subject to UGC guidelines)

SUGGESTED BOOKS

CORE COURSE VII
FUNDAMENTALS OF BIOCHEMISTRY

THEORY (CREDITS 4)

Unit 1: Carbohydrates
Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates 8

Unit 2: Lipids
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids 8

Unit 3: Proteins
Amino acids: Structure, Classification and General properties of α-amino acids; Physiological importance of essential and non-essential α-amino acids
Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins
Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants 14

Unit 4: Nucleic Acids
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids
Cot Curves: Base pairing, Denaturation and Renaturation of DNA
Types of DNA and RNA, Complementarity of DNA, Hpyo-Hyperchromaticity of DNA 12

Unit 5: Enzymes
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action 18
FUNDAMENTALS OF BIOCHEMISTRY

PRACTICAL (CREDITS 2)

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
3. Action of salivary amylase under optimum conditions.
5. Demonstration of proteins separation by SDS-PAGE.

SUGGESTED READING

### THEORY (CREDITS 4)

**Unit 1: Integumentary System**
Structure, functions and derivatives of integument

**Unit 2: Skeletal System**
Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches

**Unit 3: Digestive System**
Alimentary canal and associated glands, dentition

**Unit 4: Respiratory System**
Skin, gills, lungs and air sacs; Accessory respiratory organs

**Unit 5: Circulatory System**
General plan of circulation, evolution of heart and aortic arches

**Unit 6: Urinogenital System**
Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

**Unit 7: Nervous System**
Comparative account of brain
Autonomic nervous system, Spinal cord, Cranial nerves in mammals

**Unit 8: Sense Organs**
Classification of receptors
Brief account of visual and auditory receptors in man
COMPARATIVE ANATOMY OF VERTEBRATES

PRACTICAL (CREDITS 2)

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit
3. Carapace and plastron of turtle/tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal
5. Dissection of rat to study arterial and urinogenital system (subject to permission)
6. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
7. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)

SUGGESTED READINGS

- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons
- Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House
CORE COURSE IX
ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

THEORY

(Credits 4)

Unit 1: Physiology of Digestion

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit 2: Physiology of Respiration

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration

Unit 3: Renal Physiology

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

Unit 4: Blood

Components of blood and their functions; Structure and functions of haemoglobin
Haemostasis: Blood clotting system, Kallikrein-Kininogen system, Complement system & Fibrinolytic system, Haemopoiesis
Blood groups: Rh factor, ABO and MN

Unit 5: Physiology of Heart

Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses
Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation
ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

PRACTICALS (CREDITS 2)

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli’s haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Recording of frog’s heart beat under *in situ* and perfused conditions*
6. Recording of blood pressure using a sphygmomanometer
7. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney

(*Subject to UGC guidelines)

SUGGESTED READINGS

CORE COURSE X
BIOCHEMISTRY OF METABOLIC PROCESSES

THEORY (CREDITS 4)

Unit 1: Overview of Metabolism 10
Catabolism vs Anabolism, Stages of catabolism, Compartmenatalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms

Unit 2: Carbohydrate Metabolism 16
Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

Unit 3: Lipid Metabolism 14
β-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis

Unit 4: Protein Metabolism 10
Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids

Unit 5: Oxidative Phosphorylation 10
Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System
BIOCHEMISTRY OF METABOLIC PROCESS

PRACTICAL (CREDITS 2)

1. Estimation of total protein in given solutions by Lowry’s method.
2. Detection of SGOT and SGPT or GST and GSH in serum/ tissue
3. To study the enzymatic activity of Trypsin and Lipase.
4. Study of biological oxidation (SDH) [goat liver]
5. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.
6. Dry Lab: To trace the labelled C atoms of Acetyl-CoA till they evolve as CO₂ in the TCA cycle

SUGGESTED READINGS

## CORE COURSE XI
### MOLECULAR BIOLOGY

### THEORY  (CREDITS 4)

<table>
<thead>
<tr>
<th>Unit</th>
<th>(CREDITS)</th>
<th>Content</th>
</tr>
</thead>
</table>
| Unit 1: Nucleic Acids | 4 | Salient features of DNA and RNA  
Watson and Crick model of DNA |
| Unit 2: DNA Replication | 12 | DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres |
| Unit 3: Transcription | 10 | RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors |
| Unit 4: Translation | 12 | Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation |
| Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA | 6 | Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA |
| Unit 6: Gene Regulation | 10 | Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting |
| Unit 7: DNA Repair Mechanisms | 3 | Pyrimidine dimerization and mismatch repair |
| Unit 8: Regulatory RNAs | 3 | Ribo-switches, RNA interference, miRNA, siRNA |
MOLECULAR BIOLOGY

PRACTICAL

1. Study of Polytene chromosomes from Chironomus / Drosophila larvae
2. Preparation of liquid culture medium (LB) and raise culture of E. coli
3. Estimation of the growth kinetics of E. coli by turbidity method
4. Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking
5. Demonstration of antibiotic sensitivity/resistance of E. coli to antibiotic pressure and interpretation of results
6. Quantitative estimation of salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement)
7. Quantitative estimation of RNA using Orcinol reaction
8. Study and interpretation of electron micrographs/photograph showing
   (a) DNA replication
   (b) Transcription
   (c) Split genes

SUGGESTED READINGS

## CORE COURSE XII
### PRINCIPLES OF GENETICS

**THEORY**

<table>
<thead>
<tr>
<th>Unit</th>
<th>(CREDITS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit 1: Mendelian Genetics and its Extension</strong></td>
<td>8</td>
</tr>
<tr>
<td>Principles of inheritance, Incomplete dominance and co-dominance,</td>
<td></td>
</tr>
<tr>
<td>Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked,</td>
<td></td>
</tr>
<tr>
<td>sex-influenced and sex-limited characters inheritance.</td>
<td></td>
</tr>
<tr>
<td><strong>Unit 2: Linkage, Crossing Over and Chromosomal Mapping</strong></td>
<td>12</td>
</tr>
<tr>
<td>Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.</td>
<td></td>
</tr>
<tr>
<td><strong>Unit 3: Mutations</strong></td>
<td>10</td>
</tr>
<tr>
<td>Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached X method.</td>
<td></td>
</tr>
<tr>
<td><strong>Unit 4: Sex Determination</strong></td>
<td>4</td>
</tr>
<tr>
<td>Chromosomal mechanisms of sex determination in Drosophila and Man</td>
<td></td>
</tr>
<tr>
<td><strong>Unit 5: Extra-chromosomal Inheritance</strong></td>
<td>6</td>
</tr>
<tr>
<td>Criteria for extra-chromosomal inheritance, Antibiotic resistance in <em>Chlamydomonas</em>, Mitochondrial mutations in <em>Saccharomyces</em>, Infective heredity in <em>Paramecium</em> and Maternal effects</td>
<td></td>
</tr>
<tr>
<td><strong>Unit 6: Polygenic Inheritance</strong></td>
<td>3</td>
</tr>
<tr>
<td>Polygenic inheritance with suitable examples; simple numericals based on it.</td>
<td></td>
</tr>
<tr>
<td><strong>Unit 7: Recombination in Bacteria and Viruses</strong></td>
<td>9</td>
</tr>
<tr>
<td>Conjugation, Transformation, Transduction, Complementation test in Bacteriophage</td>
<td></td>
</tr>
<tr>
<td><strong>Unit 8: Transposable Genetic Elements</strong></td>
<td>8</td>
</tr>
<tr>
<td>Transposons in bacteria, Ac-Ds elements in maize and P elements in <em>Drosophila</em>, Transposons in humans</td>
<td></td>
</tr>
</tbody>
</table>
PRINCIPLES OF GENETICS

PRACTICALS (CREDITS 2)

1. To study the Mendelian laws and gene interactions.
2. Chi-square analyses using seeds/beads/Drosophila.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. Linkage maps based on data from Drosophila crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

SUGGESTED READINGS

CORE COURSE XIII
DEVELOPMENTAL BIOLOGY

THEORY

(CREDITS 2)

Unit 1: Introduction

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division

Unit 2: Early Embryonic Development

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers

Unit 3: Late Embryonic Development

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)

Unit 4: Post Embryonic Development

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing: Concepts and Theories

Unit 5: Implications of Developmental Biology

Teratogenesis: Teratogenic agents and their effects on embryonic development; In vitro fertilization, Stem cell (ESC), Amniocentesis
DEVELOPMENTAL BIOLOGY

PRACTICAL

(CREDITS 2)

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Study of the developmental stages and life cycle of Drosophila from stock culture
4. Study of different sections of placenta (photomicrograph/ slides)
5. Project report on Drosophila culture/chick embryo development

SUGGESTED READINGS

- Carlson, R. F. Patten's Foundations of Embryology
## CORE COURSE XIV
### EVOLUTIONARY BIOLOGY

<table>
<thead>
<tr>
<th>Unit</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Life’s Beginnings: Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesising machinery, three domains of life, neutral theory of molecular evolution, molecular clock, example of globin gene family, rRNA/cyt c</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Sources of variations: Heritable variations and their role in evolution</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Population genetics: Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium. Natural selection (concept of fitness, selection coefficient, derivation of one unit of selection for a dominant allele, genetic load, mechanism of working, types of selection, density-dependent selection, heterozygous superiority, kin selection, adaptive resemblances, sexual selection. Genetic Drift (mechanism, founder’s effect, bottleneck phenomenon; Role of Migration and Mutation in changing allele frequencies</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>Product of evolution: Micro evolutionary changes (inter-population variations, clines, races, Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from <em>Dryopithecus</em> leading to <em>Homo sapiens</em>, molecular analysis of human origin</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees</td>
<td>2</td>
</tr>
</tbody>
</table>
EVOLUTIONARY BIOLOGY

PRACTICAL  

1. Study of fossils from models/ pictures  
2. Study of homology and analogy from suitable specimens  
3. Study and verification of Hardy-Weinberg Law by chi square analysis  
4. Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies  
5. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.  
6. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.

SUGGESTED READINGS

DISCIPLINE CENTRIC ELECTIVE COURSES

DSE 1

ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

THEORY (Credits 4)

Unit 1: Introduction to Animal Behaviour
Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour, Methods and recording of a behaviour.

Unit 2: Patterns of Behaviour
Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.

Unit 3: Social and Sexual Behaviour
Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects’ society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.

Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

Unit 4: Introduction to Chronobiology
Historical developments in chronobiology; Biological oscillation: the concept of Average, amplitude, phase and period. Adaptive significance of biological clocks.

Unit 5: Biological Rhythm
Types and characteristics of biological rhythms: Short- and Long-term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of synchronization and masking; Photic and non-photic zeitgebers; Circannual rhythms; Photoperiod and regulation seasonal reproduction of vertebrates; Role of melatonin.

Unit 8: Biological Clocks
Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy.
ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

PRACTICAL

1. To study nests and nesting habits of the birds and social insects.
2. To study the behavioural responses of wood lice to dry and humid conditions.
3. To study geotaxis behaviour in earthworm.
4. To study the phototaxis behaviour in insect larvae.
5. Visit to Forest/Wildlife Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
6. Study and actogram construction of locomotor activity of suitable animal models.
7. Study of circadian functions in humans (daily eating, sleep and temperature patterns).

SUGGESTED READINGS

- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
- Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulos (ed.) R.D. Lewis. (3rd Ed) 2002 Baren and Noble Inc. New York, USA
- The Clock that times us. 1982. Moore Ed et al.
DSE 2

BASICS OF NEUROSCIENCE

THEORY (Credits 4)

Unit 1: Introduction to Neuroscience 6

Origins of Neuroscience; Neuroanatomy, Neurophysiology, and Systems Neurobiology

UNIT 2: The Nervous system-An Introduction 14

Introduction to the structure and function of the nervous system: Cellular components: Neurons; Neuroglia; Neuron doctrine; The prototypical neuron – axons and dendrites as unique structural components of neurons. The ionic bases of resting membrane potential; The action potential- its generation and properties; The action potential conduction.

UNIT 3: Cellular and Molecular Neurobiology 14

Molecular and cellular approaches used to study the CNS at the level of single molecules, Synapse: Synaptic transmission, Types of synapses; synaptic function; Principles of chemical synaptic transmission; Principles of synaptic integration; EPSPs and IPSPs. Ion channels, Neural transmission,

Unit 4. Neurotransmitters 10

Different types of neurotransmitters– catecholamines, amino acidergic and peptidergic neurotransmitters; Transmitter gated channels; G-protein coupled receptors and effectors, neurotransmitter receptors; Ionotropic and metabotropic receptors.

UNIT 5: Neurobiology and Neuropharmacology of Behaviour 16

The principles of signal transduction and information processing in the vertebrate central nervous system, and the relationship of functional properties of neural systems with perception and behavior; sensory systems, molecular basis of behavior including learning and memory. Molecular pathogenesis of pain and neurodegenerative diseases such as Parkinson’s, Alzheimer’s, psychological disorders, addiction, etc.
BASICS OF NEUROSCIENCE

PRACTICAL

1. Dissection and study of Drosophila nervous system using GFP reporter.
2. Observation and quantitation of Drosophila photoreceptor neurons in healthy and diseased condition.
4. Study of neurons and/or myelin by Nissl, Giemsa or Luxol Fast Blue staining.
5. Study of olfaction in Drosophila.

SUGGESTED READINGS

- Neuroscience: Exploring the brain by Mark F. Baer; Barry W. Connors. 2015
- From Molecules to Networks: An Introduction to Cellular and Molecular Neuroscience by John H. Byrne. Ruth Heidelberg and M. Neal Waxham
- Nerve Cells and Animal Behaviour-2nd Edn-Peter J Simmons and David Young-CUP-2003
- Phantoms in the Brain - Vilayanur S. Ramachandran and Sandra Blakeslee-1998
- The Human Brain Book - Rita Carter-2009
DSE 3
THEORY

Unit 1. Introduction
Concept and scope of biotechnology

Unit 2. Molecular Techniques in Gene manipulation
Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics).
Restriction enzymes: Nomenclature, detailed study of Type II.
Transformation techniques: Calcium chloride method and electroporation.
Construction of genomic and cDNA libraries and screening by colony and plaque hybridization
Southern, Northern and Western blotting
DNA sequencing: Sanger method
Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

Unit 3. Genetically Modified Organisms
Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection
Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock out mice.
Production of transgenic plants: Agrobacterium mediated transformation.
Applications of transgenic plants: insect and herbicide resistant plants.

Unit 4. Culture Techniques and Applications
Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)
Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy
PRACTICAL (Credits 2)

1. Genomic DNA isolation from *E.coli*
2. Plasmid DNA isolation (pUC 18/19) from *E.coli*
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided.
6. To study following techniques through photographs
   a. Southern Blotting
   b. Northern Blotting
   c. Western Blotting
   d. DNA Sequencing (Sanger’s Method)
   e. PCR
   f. DNA fingerprinting
7. Project report on animal cell culture

SUGGESTED READINGS

DSE 4

BIOLOGY OF INSECTA

THEORY (Credits 4)

Unit I: Introduction 4
General Features of Insects
Distribution and Success of Insects on the Earth

Unit II: Insect Taxonomy 4
Basis of insect classification; Classification of insects up to orders

Unit III: General Morphology of Insects 8
External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits
Thorax: Wings and wing articulation, Types of Legs adapted to diverse habitat
Abdominal appendages and genitalia

Unit IV: Physiology of Insects 28
Structure and physiology of Insect body systems - Integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive, and nervous system
Sensory receptors
Growth and metamorphosis

Unit IV: Insect Society 6
Group of social insects and their social life
Social organization and social behaviour (w.r.t. any one example)

Unit V: Insect Plant Interaction 4
Theory of co-evolution, role of allelochemicals in host plant mediation
Host-plant selection by phytophagous insects, Insects as plant pests

Unit VI: Insects as Vectors 6
Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors

BIOLOGY OF INSECTA
PRACTICAL

1. Study of one specimen from each insect order
2. Study of different kinds of antennae, legs and mouth parts of insects
3. Study of head and sclerites of any one insect
4. Study of insect wings and their venation.
5. Study of insect spiracles
7. Morphological studies of various castes of Apis, Camponotus and Odontotermes
8. Study of any three insect pests and their damages
9. Study of any three beneficial insects and their products

Field study of insects and submission of a project report on the insect diversity

SUGGESTED READINGS

- A general text book of entomology, Imms , A. D., Chapman & Hall, UK
- The Insects: Structure and function, Chapman, R. F., Cambridge University Press, UK
- Principles of Insect Morphology, Snodgrass, R. E., Cornell Univ. Press, USA
- Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F., M Saunders College Publication, USA
- The Insect Societies, Wilson, E. O., Harward Univ. Press, UK
- Host Selection by Phytophagous insects, Bernays, E. A., and Chapman, R. F., Chapman and Hall, New York, USA
- Physiological system in Insects, Klowden, M. J., Academic Press, USA
- The Insects, An outline of Entomology, Gullan, P. J. , and Cranston, P. S., Wiley Blackwell, UK
- Insect Physiology and Biochemistry, Nation, J. L., CRC Press, USA
THEORY

Unit 1: Introduction to Bioinformatics
Importance, Goal, Scope; Genomics, Transcriptomics, Systems Biology, Functional Genomics, Metabolomics, Molecular Phylogeny; Applications and Limitations of Bioinformatics

Unit 2: Biological Databases
Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD)

Unit 3: Data Generation and Data Retrieval
Generation of data (Gene sequencing, Protein sequencing, Mass spectrometry, Microarray), Sequence submission tools (BankIt, Sequin, Webin); Sequence file format (flat file, FASTA, GCG, EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data retrieval systems (SRS, Entrez)

Unit 3: Basic Concepts of Sequence Alignment
Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming, BLAST and FASTA); Local and global alignment, pair wise and multiple sequence alignments; Similarity, identity and homology of sequences.

Unit 4: Applications of Bioinformatics
Structural Bioinformatics (3-D protein, PDB), Functional genomics (genome-wide and high throughput approaches to gene and protein function), Drug discovery method (Basic concepts)

Unit 5: Biostatistics
Introduction, calculation of standard deviation, standard error, Co-efficient of Variance, Chi-square test, Z test, t-Test
PRACTICAL

1. Accessing biological databases
2. Retrieval of nucleotide and protein sequences from the databases.
3. To perform pair-wise alignment of sequences (BLAST) and interpret the output
4. Translate a nucleotide sequence and select the correct reading frame of the polypeptide from the output sequences
5. Predict the structure of protein from its amino acid sequence.
6. To perform a “two-sample t-test” for a given set of data
7. To learn graphical representations of statistical data with the help of computers (e.g. MS Excel).

SUGGESTED READINGS

DSE 6

PARASITOLOGY

THEORY (CREDITS 4)

Unit I: Introduction to Parasitology

Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship

Unit II: Parasitic Protists

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*, *Plasmodium vivax*

Unit III: Parasitic Platyhelminthes

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana*

Unit IV: Parasitic Nematodes

Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Trichinella spiralis*. Study of structure, life cycle and importance of *Meloidogyne* (root knot nematode), *Pratylenchus* (lesion nematode)

Unit IV: Parasitic Arthropoda

Biology, importance and control of ticks, mites, *Pediculus humanus* (head and body louse), *Xenopsylla cheopis* and *Cimex lectularius*

Unit V: Parasitic Vertebrates

A brief account of parasitic vertebrates; Cookicutter Shark, Candiru, Hood Mockingbird and Vampire bat
PARASITOLOGY

PRACTICAL (Credits2)

- Study of life stages of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani* and *Plasmodium vivax* through permanent slides/micro photographs

- Study of adult and life stages of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana* through permanent slides/micro photographs

- Study of adult and life stages of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Trichinella spiralis* through permanent slides/micro photographs

- Study of plant parasitic root knot nematode, *Meloidogyne* from the soil sample

- Study of *Pediculus humanus* (Head louse and Body louse), *Xenopsylla cheopis* and *Cimex lectularius* through permanent slides/photographs

- Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry]

- Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a by product]

Submission of a brief report on parasitic vertebrates

SUGGESTED READINGS


## ENDOCRINOLOGY

### THEORY (Credits 4)

**Unit 1: Introduction to Endocrinology**

- History of endocrinology, Classification, Characteristic and Transport of Hormones, Neurosecretions and Neurohormones

**Unit 2: Epiphysis, Hypothalmo-hypophysial Axis**

- Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction.
- Structure of hypothalamus, Hypothalamic nuclei and their functions, Regulation of neuroendocrine glands, Feedback mechanisms

**Unit 3: Peripheral Endocrine Glands**

- Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis
- Hormones in homeostasis, Disorders of endocrine glands

**Unit 4: Regulation of Hormone Action**

- Hormone action at Cellular level: Hormone receptors, transduction and regulation
- Hormone action at Molecular level: Molecular mediators, Genetic control of hormone action
ENDOCRINOLOGY

PRACTICAL

1. Dissect and display of Endocrine glands in laboratory bred rat*
2. Study of the permanent slides of all the endocrine glands
3. Compensatory ovarian/ adrenal hypertrophy in vivo bioassay in laboratory bred rat*
4. Demonstration of Castration/ ovariectomy in laboratory bred rat*
5. Estimation of plasma level of any hormone using ELISA
6. Designing of primers of any hormone

SUGGESTED READINGS

- General Endocrinology C. Donnell Turner Pub- SaundersToppan
- Endocrinology: An Integrated Approach; Stephen Nussey and Saffron Whitehead.
- Vertebrate Endocrinology by David O. Norris,
DSE 8

FISH AND FISHERIES

THEORY

(Credits 4)

UNIT 1: Introduction and Classification:

General description of fish; Account of systematic classification of fishes (upto classes); Classification based on feeding habit, habitat and manner of reproduction.

UNIT 2: Morphology and Physiology:

Types of fins and their modifications; Locomotion in fishes; Hydrodynamics; Types of Scales, Use of scales in Classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration, buoyancy; Osmoregulation in Elasmobranchs; Reproductive strategies (special reference to Indian fishes); Electric organs; Bioluminiscence; Mechanoreceptors; Schooling; Parental care; Migration

UNIT 3: Fisheries

Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Arabian Sea and the Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations

UNIT 4: Aquaculture

Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products

UNIT 5: Fish in research

Transgenic fish, Zebrafish as a model organism in research
FISH AND FISHERIES

PRACTICAL

(Credits 2)

1. Study of Petromyzon, Myxine, Pristis, Chimaera, Exocoetus, Hippocampus, Gambusia, Labeo, Heteropneustes, Anabas

2. Study of different types of scales (through permanent slides/photographs).

3. Study of crafts and gears used in Fisheries

4. Water quality criteria for Aquaculture: Assessment of pH, conductivity, Total solids, Total dissolved solids

5. Study of air breathing organs in Channa, Heteropneustes, Anabas and Clarias

6. Demonstration of induced breeding in Fishes (video)

7. Demonstration of parental care in fishes (video)

8. Project Report on a visit to any fish farm/pisciculture unit/Zebrafish rearing Lab.

SUGGESTED READINGS

- Q Bone and R Moore, Biology of Fishes, Taylor and Francis Group, CRC Press, U.K.


- C.B.L. Srivastava, Fish Biology, Narendra Publishing House

- J.R. Norman, A history of Fishes, Hill and Wang Publishers

- S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House
DSE 9

IMMUNOLOGY

THEORY

(Credits 4)

Unit 1: Overview of Immune System

10

Historical perspective of Immunology, Early theories of Immunology, Cells and organs of the Immune system

Unit 2: Innate and Adaptive Immunity

10


Unit 3: Antigens

8

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes

Unit 4: Immunoglobulins

10

Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Polyclonal sera, Hybridoma technology: Monoclonal antibodies in therapeutics and diagnosis

Unit 5: Major Histocompatibility Complex

6

Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation

Unit 6: Cytokines

4

Properties and functions of cytokines, Therapeutics Cytokines

Unit 7: Complement System

4

Components and pathways of complement activation.

Unit 8: Hypersensitivity

3

Gell and Coombs’ classification and brief description of various types of hypersensitivities

Unit 9: Vaccines

5

Various types of vaccines.
PRACTICAL

1* Demonstration of lymphoid organs.

2. Histological study of spleen, thymus and lymph nodes through slides/photographs

3. Preparation of stained blood film to study various types of blood cells.


5. ABO blood group determination.

6* Cell counting and viability test from splenocytes of farm bred animals/cell lines.

7. Demonstration of
   a. ELISA
   b. Immuneelectrophoresis

* The experiments can be performed depending upon usage of animals in UG courses.

SUGGESTED READINGS


DSE 10

REPRODUCTIVE BIOLOGY

THEORY

(CREDITS 4)

Unit 1: Reproductive Endocrinology


Unit 2: Functional anatomy of male reproduction

Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract

Unit 3: Functional anatomy of female reproduction

Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foetal – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

Unit 4: Reproductive Health

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning
REPRODUCTIVE BIOLOGY

PRACTICAL (CREDITS 2)

1. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat
7. Study of modern contraceptive devices

SUGGESTED READINGS

- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
DSE 11
WILD LIFE CONSERVATION AND MANAGEMENT

THEORY (CREDITS 4)

Unit 1: Introduction to Wild Life
Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Unit 2: Evaluation and management of wild life
Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.

Unit 3: Management of habitats
Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity.

Unit 4: Population estimation
Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Unit 5: Management planning of wild life in protected areas
Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbence.

Unit 7: Management of excess population
Bio-telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Unit 8: Protected areas
National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.
PRACTICALS

1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
4. Demonstration of different field techniques for flora and fauna
5. PCQ, Ten tree method, Circular, Square & rectangular plots, Parker’s 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

SUGGESTED READINGS


GENERIC ELECTIVE COURSES
GE 1
ANIMAL CELL BIOTECHNOLOGY

THEORY (CREDITS 4)

UNIT 1: Introduction
Concept and Scope of Biotechnology

UNIT2: Techniques in Gene manipulation
Outline process of genetic engineering and recombinant DNA technology, Isolation of genes, Concept of restriction and modification: Restriction endonucleases, DNA modifying enzymes

Cloning Vectors: Plasmids, Phage vectors, Cosmids, Phagemids, BAC, YAC, HAC. Shuttle and Expression Vectors.

Construction of Genomic libraries and cDNA libraries

Transformation techniques: microbial, plants and animals: Cloning in mammalian cells, Integration of DNA into mammalian genome- Electroporation and Calcium Phosphate Precipitation method.

UNIT 3: Animal cell Culture

Basic techniques in animal cell culture and organ culture, Primary Culture and Cell lines, Culture media- Natural and Synthetic, Stem cells, Cryopreservation of cultures.

Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting, DNA sequencing: Sanger method, Polymerase chain reaction, DNA Fingerprinting and DNA microarrays.

UNIT 4: Fermentation

Different types of Fermentation: Submerged & Solid state; batch, Fed batch & Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized.

Downstream Processing: filtration, centrifugation, extraction, chromatography, spray drying and lyophilization.

UNIT 5: Transgenic Animal Technology

Production of transgenic animals: nuclear transplantation, Retroviral method, DNA microinjection method, Dolly and Polly.

UNIT 6: Application in Health
Development of recombinant Vaccines, Hybridoma technology, Gene Therapy.
Production of recombinant Proteins: Insulin and growth hormones.

UNIT 7: Bio safety Physical and Biological containment.
PRACTICAL (CREDITS 2)

1. Packing and sterilization of glass and plastic wares for cell culture.
2. Preparation of culture media.
3. Preparation of genomic DNA from E. coli/animals/human.
4. Plasmid DNA isolation (pUC 18/19) and DNA quantitation using agarose gel electrophoresis (by using lambda DNA as standard).
5. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III.
6. Preparation of competent cells and Transformation of E. coli with plasmid DNA using CaCl₂, Selection of transformants on X-gal and IPTG (Optional).
7. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting, PCR, DNA Microarrays

SUGGESTED READINGS

**ANIMAL DIVERSITY**

<table>
<thead>
<tr>
<th>THEORY</th>
<th>(CREDITS 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1. Protista</td>
<td>4</td>
</tr>
<tr>
<td>General characters of Protozoa; Life cycle of Plasmodium</td>
<td></td>
</tr>
<tr>
<td>Unit 2. Porifera</td>
<td>3</td>
</tr>
<tr>
<td>General characters and canal system in Porifera</td>
<td></td>
</tr>
<tr>
<td>Unit 3. Radiata</td>
<td>3</td>
</tr>
<tr>
<td>General characters of Cnidarians and polymorphism</td>
<td></td>
</tr>
<tr>
<td>Unit 4. Aceolomates</td>
<td>3</td>
</tr>
<tr>
<td>General characters of Helminthes; Life cycle of Taenia solium</td>
<td></td>
</tr>
<tr>
<td>Unit 5. Pseudocoelomates</td>
<td>3</td>
</tr>
<tr>
<td>General characters of Nemethehelminthes; Parasitic adaptations</td>
<td></td>
</tr>
<tr>
<td>Unit 6. Coelomate Protostomes</td>
<td>3</td>
</tr>
<tr>
<td>General characters of Annelida ; Metamerism.</td>
<td></td>
</tr>
<tr>
<td>Unit 7. Arthropoda</td>
<td>4</td>
</tr>
<tr>
<td>General characters. Social life in insects.</td>
<td></td>
</tr>
<tr>
<td>Unit 8. Mollusca</td>
<td>3</td>
</tr>
<tr>
<td>General characters of mollusca; Pearl Formation</td>
<td></td>
</tr>
<tr>
<td>Unit 9. Coelomate Deuterostomes</td>
<td>3</td>
</tr>
<tr>
<td>General characters of Echinodermata, Water Vascular system in Starfish.</td>
<td></td>
</tr>
<tr>
<td>Unit 10. Protochordata</td>
<td>2</td>
</tr>
<tr>
<td>Salient features</td>
<td></td>
</tr>
<tr>
<td>Unit 11. Pisces</td>
<td>4</td>
</tr>
<tr>
<td>Osmoregulation, Migration of Fishes</td>
<td></td>
</tr>
<tr>
<td>Unit 12. Amphibia</td>
<td>4</td>
</tr>
<tr>
<td>General characters,Adaptations for terrestrial life, parental care in Amphibia.</td>
<td></td>
</tr>
<tr>
<td>Unit 13.</td>
<td>5</td>
</tr>
<tr>
<td>Amniotes; Origin of reptiles. Terrestrial adaptations in reptiles.</td>
<td></td>
</tr>
<tr>
<td>Unit 14. Aves:</td>
<td>5</td>
</tr>
<tr>
<td>The origin of birds; Flight adaptations</td>
<td></td>
</tr>
<tr>
<td>Unit 15. Mammalia</td>
<td>6</td>
</tr>
<tr>
<td>Early evolution of mammals; Primates; Dentition in mammals.</td>
<td></td>
</tr>
</tbody>
</table>
1. Study of following specimens:
   **Non Chordates:** Euglena, Noctiluca, Paramecium, Sycon, Physalia, Tubipora, Metridium, Taenia, Ascaris, Nereis, Aphrodite, Leech, Peripatus, Limulus, Hermitcrab, Daphnia, Millipede, Centipede, Beetle, Chiton, Dentalium, Octopus, Asterias, and Antedon.
   **Chordates:** Balanoglossus, Amphioxus, Petromyzon, Pristis, Hippocampus, Labeo, Icthyophis/Uraeotyphlus, Salamander, Rhacophorus Draco, Uromastix, Naja, Viper, model of Archaeopteryx, any three common birds-(Crow, duck, Owl), Squirrel and Bat.

2. Study of following Permanent Slides:

3. Temporary mounts of
   - Septal & pharyngeal nephridia of earthworm.
   - Unstained mounts of Placoid, cycloid and ctenoid scales.

4. Dissections of
   - Digestive and nervous system of Cockroach.
   - Urinogenital system of Rat

**SUGGESTED BOOKS**

THEORY (Credits 4)

UNIT 1: Aquatic Biomes

Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

UNIT 2: Freshwater Biology


Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.

UNIT 3: Marine Biology

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

UNIT 4: Management of Aquatic Resources

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills,

Eutrophication, Management and conservation (legislations), Sewage treatment

Water quality assessment- BOD and COD.
PRACTICAL

1. Determine the area of a lake using graphimetric and gravimetric method.

2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.

3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/water body.

4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler)and their significance.

5. A Project Report on a visit to a Sewage treatment plant/ Marine bio-reserve/ Fisheries Institutes.

SUGGESTED READINGS

- Anathakrishnan : Bioresources Ecology 3rd Edition
- Goldman : Limnology, 2nd Edition
- Pawlowski: Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
- Wetzel : Limnology, 3rd edition
- Trivedi and Goyal : Chemical and biological methods for water pollution studies
- Welch : Limnology Vols. I-II
ENVIRONMENT AND PUBLIC HEALTH

THEORY (Credits 4)

UNIT I: Introduction
Sources of Environmental hazards, hazard identification and accounting, fate of toxic and persistent substances in the environment, dose Response Evaluation, exposure Assessment.

UNIT II Climate Change
Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health

Unit III Pollution
Air, water, noise pollution sources and effects, Pollution control

Unit IV Waste Management Technologies
Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath.

Unit 5 Diseases
Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid
PRACTICAL (Credits 2)

1. To determine pH, Cl, SO_4, NO_3 in soil and water samples from different locations.

SUGGESTED BOOKS


GE 5

EXPLORING THE BRAIN: STRUCTURE AND FUNCTION

THEORY (Credits 4)

Unit 1: Introduction: Early and Nineteenth century views of the Brain; Neuroscience today; Evolution of brain in vertebrates

Unit 2: Neurons and Glia: Neurons – Soma, Axon, Dendrite; Classification of Neurons; Glia – Astrocytes, Myelinating Glia, Non-neuronal cells

Unit 3: Evolution and Adaptation of Brain: Brain evolution and behavioral adaptation; Theories of brain evolution – involving addition of structure or areas, involving new formation and reorganization of circuits.

Unit 4: Organization of the Brain: Anatomical references, Cerebrum, cerebellum, brain stem, spinal cord; Cranial nerves, Meninges, ventricular system; CT and MRI imaging of the brain

Unit 5: Understanding Brain Structure through Development: Formation of neural tube, Primary brain vesicles; Differentiation of forebrain, midbrain and hindbrain. Cerebral cortex – neocortical evolution and structure-function relationship

Unit 6: Chemical Control of Brain and Behaviour: Structure and connection of the secretory hypothalamus; Diffuse modulatory systems of the brain – noradrenergic, serotonergic, dopaminergic and cholinergic system; Drugs and diffuse modulatory systems.

Unit 7: Rhythms of the Brain: Electroencephalogram; Sleep – why do we sleep, Non-REM and REM sleep, neural mechanisms of sleep; Circadian rhythms.

Unit 8: Mental illness and the Brain: Psychosocial and biological approaches to mental illness; Anxiety disorders; Mood disorders; Schizophrenia.
EXPLORING THE BRAIN: STRUCTURE AND FUNCTION

PRACTICAL

(CREDITS 2)

1. Dissection and study of Drosophila nervous system using GFP reporter.
2. Observation and quantitation of Drosophila photoreceptor neurons in healthy and diseased condition.

SUGGESTED READINGS


Project work/ Home assignment
THEORY (Credits 4)

Unit 1: Basic concept of food and nutrition
Food Components and food-nutrients
Concept of a balanced diet, nutrient needs and dietary pattern for various groups- adults, pregnant and nursing mothers, infants, school children, adolescents and elderly

Unit 2: Nutritional Biochemistry:
Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role
Vitamins- Fat-soluble and Water-soluble vitamins- their dietary source and importance
Minerals- Iron, calcium, phosphorus, iodine, selenium and zinc: their biological functions

Unit 3: Health
Introduction to health- Definition and concept of health
Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin A deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders- their causes, symptoms, treatment, prevention and government programmes, if any.
Life style related diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention through dietary and lifestyle modifications
Social health problems- smoking, alcoholism, drug dependence and Acquired Immuno Deficiency Syndrome (AIDS) - their causes, treatment and prevention
Common ailments- cold, cough, and fevers, their causes and treatment

Unit 4: Food hygiene:
Potable water- sources and methods of purification at domestic level
Food and Water borne infections: Bacterial infection: Cholera, typhoid fever, dysentery; Viral infection: Hepatitis, Poliomyelitis, Protozoan infection: amoebiasis, giardiasis; Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention
Brief account of food spoilage: Causes of food spoilage and their preventive measures

PRACTICAL (Credits 2)
1. To detect adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric
3. Estimation of Lactose in milk
4. Ascorbic acid estimation in food by titrimetry
5. Estimation of Calcium in foods by titrimetry

6. Study of the stored grain pests from slides/photograph (*Sitophilus oryzae*, *Trogoderma granarium*, *Callosobruchus chinensis* and *Tribolium castaneum*): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.

7. Project- Undertake computer aided diet analysis and nutrition counseling for different age groups.

    OR

    Identify nutrient rich sources of foods (*fruits and vegetables*), their seasonal availability and price

    OR

    Study of nutrition labeling on selected foods

**SUGGESTED BOOKS**

- Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2007; New Age International Publishers
- Srilakshmi B. Nutrition Science; 2002; New Age International (P) Ltd.
- Srilakshmi B. Food Science; Fourth Ed; 2007; New Age International (P) Ltd.
- Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.
- Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.
- Manay MS, Shadaksharaswamy. Food-Facts and Principles; 1998; New Age International (P) Ltd.
- Gibney et al. Public Health Nutrition; 2004; Blackwell Publishing
## HUMAN PHYSIOLOGY

**THEORY** (CREDITS 4)

### Unit 1: Digestion and Absorption of Food
12
Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins; Nervous and hormonal control of digestion (*in brief*)

### Unit 2: Functioning of Excitable Tissue (Nerve and Muscle)
10
Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding filament theory), Neuromuscular junction

### Unit 3: Respiratory Physiology
6
Ventilation, External and internal Respiration, Transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases.

### Unit 4: Renal Physiology
8
Functional anatomy of kidney, Mechanism and regulation of urine formation.

### Unit 5: Cardiovascular Physiology
10
Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG

### Unit 6: Endocrine and Reproductive Physiology
14
Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), Brief account of spermatogenesis and oogenesis, Menstrual cycle
HUMAN PHYSIOLOGY

PRACTICAL  (CREDITS 2)

2. Preparation of haemin and haemochromogen crystals.
3. Estimation of haemoglobin using Sahli’s haemoglobinometer.
4. Examination of permanent histological sections of mammalian oesophagus, stomach, duodenum, rectum, lung, kidney, thyroid, pancreas, adrenal, testis, ovary.

SUGGESTED READINGS

THEORY (Credits 4)

Unit I: Introduction to Insects 6
General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

Unit II: Concept of Vectors 6
Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Unit III: Insects as Vectors 8
Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit IV: Dipteran as Disease Vectors 24
Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies;
Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes
Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly
Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit IV: Siphonaptera as Disease Vectors 6
Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Unit V: Siphunculata as Disease Vectors 4
Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases – Typhus fever, Relapsing fever, Trench fever, Vagabond’s disease, Phthiriasis; Control of human louse

Unit VI: Hemiptera as Disease Vectors 6
Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures
INSECT VECTORS AND DISEASES

PRACTICAL (CREDITS 2)

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs: *Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phititus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica*, through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors

Submission of a project report on any one of the insect vectors and disease transmitted

SUGGESTED READINGS

SKILL ENHANCEMENT COURSES
SEC 1

APICULTURE

(CREDITS 2)

Unit 1: Biology of Bees
History, Classification and Biology of Honey Bees
Social Organization of Bee Colony

Unit 2: Rearing of Bees
Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth
Bee Pasturage
Selection of Bee Species for Apiculture
Bee Keeping Equipment
Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: Diseases and Enemies
Bee Diseases and Enemies
Control and Preventive measures

Unit 4: Bee Economy
Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

Unit 5: Entrepreneurship in Apiculture
Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

Unit 1: Introduction to Aquarium Fish Keeping
The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

Unit 2: Biology of Aquarium Fishes
Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

Unit 3: Food and feeding of Aquarium fishes
Use of live fish feed organisms. Preparation and composition of formulated fish feeds

Unit 4: Fish Transportation
Live fish transport - Fish handling, packing and forwarding techniques.

Unit 5: Maintenance of Aquarium
General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry
THEORY

(Unit 1: Introduction to Medical Diagnostics and its Importance  2)

(Unit 2: Diagnostics Methods Used for Analysis of Blood  10)
Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

(Unit 3: Diagnostic Methods Used for Urine Analysis  6)
Urine Analysis: Physical characteristics; Abnormal constituents

(Unit 4: Non-infectious Diseases  6)
Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

(Unit 5: Infectious Diseases  3)
Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

(Unit 6: Tumours  3)
Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

SUGGESTED READINGS

- Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses*
- Guyton A.C. and Hall J.E. *Textbook of Medical Physiology*, Saunders
Unit 1: Foundations of Research
Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

Unit 2: Research Design
Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

Unit 3: Data Collection, Analysis and Report Writing
Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology

Unit 4: Ethical Issues
Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

SUGGESTED READINGS
- Wadhera, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing
- C.R.Kothari: Research Methodology, New Age International, 2009
SEC 5
SERICULTURE

(CREDITS 2)

Unit 1: Introduction
Sericulture: Definition, history and present status; Silk route
Types of silkworms, Distribution and Races
Exotic and indigenous races
Mulberry and non-mulberry Sericulture

Unit 2: Biology of Silkworm
Life cycle of *Bombyx mori*
Structure of silk gland and secretion of silk

Unit 3: Rearing of Silkworms
Selection of mulberry variety and establishment of mulberry garden
Rearing house and rearing appliances
Disinfectants: Formalin, bleaching powder, RKO
Silkworm rearing technology: Early age and Late age rearing
Types of mountages
Spinning, harvesting and storage of cocoons

Unit 4: Pests and Diseases
Pests of silkworm: Uzi fly, dermestid beetles and vertebrates
Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial
Control and prevention of pests and diseases

Unit 5: Entrepreneurship in Sericulture
Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

SUGGESTED READINGS

- Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.
SCHEME AND SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM FOR B.Sc. PROGRAMME WITH LIFE SCIENCE
<table>
<thead>
<tr>
<th></th>
<th>CORE COURSE (12)</th>
<th>Ability Enhancement Compulsory Courses AEC (2)</th>
<th>Skill Enhancement Courses SEC (4)</th>
<th>Discipline Specific Elective DSE (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>CC- Botany I</td>
<td>English Communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>CC- Zoology I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>CC- Chemistry I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>CC- Botany III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td>DSE-Botany I DSE-Zoology I DSE-Chemistry I</td>
</tr>
<tr>
<td>VI</td>
<td></td>
<td></td>
<td></td>
<td>DSE-Botany II DSE-Zoology II DSE-Chemistry II</td>
</tr>
</tbody>
</table>
**Discipline Core Courses: Zoology**

1. Animal Diversity  
2. Comparative Anatomy and Developmental Biology of Vertebrates  
3. Physiology and Biochemistry  
4. Genetics and Evolutionary Biology

**Discipline Specific Electives: Zoology (Any two)**

1. Applied Zoology  
2. Animal Biotechnology  
3. Aquatic Biology  
4. Immunology  
5. Reproductive Biology  
6. Insect, Vector and Diseases

**Skill Enhancement Courses: Zoology**

1. Apiculture  
2. Aquarium Fish Keeping  
3. Aquatic Biology  
4. Medical Diagnostics  
5. Public Health and Hygiene  
5. Sericulture
CORE COURSE I
ANIMAL DIVERSITY

THEORY (CREDITS 4)

Unit 1: Kingdom Protista
4
General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa

Unit 2: Phylum Porifera
3
General characters and classification up to classes; Canal System in Sycon

Unit 3: Phylum Cnidaria
3
General characters and classification up to classes; Polymorphism in Hydrozoa

Unit 4: Phylum Platyhelminthes
3
General characters and classification up to classes; Life history of Taenia solium

Unit 5: Phylum Nemathelminthes
5
General characters and classification up to classes; Life history of Ascaris lumbricoides and its parasitic adaptations

Unit 6: Phylum Annelida
3
General characters and classification up to classes; Metamerism in Annelida

Unit 7: Phylum Arthropoda
5
General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects

Unit 8: Phylum Mollusca
4
General characters and classification up to classes; Torsion in gastropods

Unit 9: Phylum Echinodermata
4
General characters and classification up to classes; Water-vascular system in Asteroidea

Unit 10: Protochordates
2
General features and Phylogeny of Protochordata

Unit 11: Agnatha
2
General features of Agnatha and classification of cyclostomes up to classes

Unit 12: Pisces
4
General features and Classification up to orders; Osmoregulation in Fishes
Unit 13: Amphibia
General features and Classification up to orders; Parental care

Unit 14: Reptiles
General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes

Unit 15: Aves
General features and Classification up to orders; Flight adaptations in birds

Unit 17: Mammals
Classification up to orders; Origin of mammals

Note: Classification of Unit 1-9 to be followed from “Barnes, R.D. (1982). Invertebrate Zoology, V Edition”
ANIMAL DIVERSITY

PRACTICAL  (CREDITS 2)

1. Study of the following specimens:

2. Study of the following permanent slides:
   T.S. and L.S. of Sycon, Study of life history stages of Taenia, T.S. of Male and female Ascaris

3. Key for Identification of poisonous and non-poisonous snakes

An “animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

SUGGESTED READINGS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Theory</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit 1: Integumentary System</strong></td>
<td>Derivatives of integument w.r.t. glands and digital tips</td>
<td>4</td>
</tr>
<tr>
<td><strong>Unit 2: Skeletal System</strong></td>
<td>Evolution of visceral arches</td>
<td>3</td>
</tr>
<tr>
<td><strong>Unit 3: Digestive System</strong></td>
<td>Brief account of alimentary canal and digestive glands</td>
<td>4</td>
</tr>
<tr>
<td><strong>Unit 4: Respiratory System</strong></td>
<td>Brief account of Gills, lungs, air sacs and swim bladder</td>
<td>5</td>
</tr>
<tr>
<td><strong>Unit 5: Circulatory System</strong></td>
<td>Evolution of heart and aortic arches</td>
<td>4</td>
</tr>
<tr>
<td><strong>Unit 6: Urinogenital System</strong></td>
<td>Succession of kidney, Evolution of urinogenital ducts</td>
<td>4</td>
</tr>
<tr>
<td><strong>Unit 7: Nervous System</strong></td>
<td>Comparative account of brain</td>
<td>3</td>
</tr>
<tr>
<td><strong>Unit 8: Sense Organs</strong></td>
<td>Types of receptors</td>
<td>3</td>
</tr>
<tr>
<td><strong>Unit 9: Early Embryonic Development</strong></td>
<td>Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.</td>
<td>12</td>
</tr>
<tr>
<td><strong>Unit 10: Late Embryonic Development</strong></td>
<td>Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.</td>
<td>10</td>
</tr>
<tr>
<td><strong>Unit 11: Control of Development</strong></td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>
Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death
PRACTICAL (CREDITS 2)

1. Osteology:
   a) Disarticulated skeleton of fowl and rabbit
   b) Carapace and plastron of turtle / tortoise
   c) Mammalian skulls: One herbivorous and one carnivorous animal.

2. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.

3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.

4. Study of placental development in humans by ultrasound scans.

5. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

SUGGESTED READINGS

CORE COURSE III
PHYSIOLOGY AND BIOCHEMISTRY

THEORY (CREDITS 4)

Unit 1: Nerve and muscle
Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction

Unit 2: Digestion
Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

Unit 3: Respiration
Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood

Unit 4: Excretion
Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism

Unit 5: Cardiovascular system
Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle

Unit 6: Reproduction and Endocrine Glands
Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle
Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal

Unit 7: Carbohydrate Metabolism
Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain

Unit 8: Lipid Metabolism
Biosynthesis and β oxidation of palmitic acid

Unit 9: Protein metabolism
Transamination, Deamination and Urea Cycle

Unit 10: Enzymes
Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation
PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL

(CREDITS 2)

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)

2. Estimation of total protein in given solutions by Lowry’s method.
3. Study of activity of salivary amylase under optimum conditions

SUGGESTED READINGS

CORE COURSE IV
GENETICS AND EVOLUTIONARY BIOLOGY

THEORY

(CREDITS 4)

Unit 1: Introduction to Genetics
Mendel’s work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

Unit 2: Mendelian Genetics and its Extension
Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance

Unit 3: Linkage, Crossing Over and Chromosomal Mapping
Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics - an alternative approach to gene mapping

Unit 4: Mutations
Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations,

Unit 5: Sex Determination
Chromosomal mechanisms, dosage compensation

Unit 6: History of Life
Major Events in History of Life

Unit 7: Introduction to Evolutionary Theories
Lamarckism, Darwinism, Neo-Darwinism

Unit 8: Direct Evidences of Evolution
Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

Unit 9: Processes of Evolutionary Change
Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

Unit 10: Species Concept
Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)
Unit 11: Macro-evolution
Macro-evolutionary Principles (example: Darwin’s Finches)

Unit 12: Extinction
Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution
PRACTICAL (CREDITS 2)

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Charts:
   a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
   b) Darwin’s Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

SUGGESTED READINGS

THEORY (Credits 4)

Unit 1: Introduction
Concept and scope of biotechnology 8

Unit 2: Molecular Techniques in Gene manipulation
Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics) 24
Restriction enzymes: Nomenclature, detailed study of Type II.
Transformation techniques: Calcium chloride method and electroporation.
Construction of genomic and cDNA libraries and screening by colony and plaque hybridization
Southern, Northern and Western blotting; DNA sequencing: Sanger method
Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

Unit 3: Genetically Modified Organisms
Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection 18
Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.
Production of transgenic plants: Agrobacterium mediated transformation.
Applications of transgenic plants: insect and herbicide resistant plants.

Unit 4: Culture Techniques and Applications
Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia) 10
Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy
PRACTICAL

(Credits 2)

7. Genomic DNA isolation from *E. coli*
8. Plasmid DNA isolation (pUC 18/19) from *E. coli*
9. Restriction digestion of plasmid DNA.
10. Construction of circular and linear restriction map from the data provided.
11. Calculation of transformation efficiency from the data provided.
12. To study following techniques through photographs
   a) Southern Blotting
   b) Northern Blotting
   c) Western Blotting
   d) DNA Sequencing (Sanger's Method)
   e) PCR
   f) DNA fingerprinting
7. Project report on animal cell culture

SUGGESTED READINGS

DSE 2
APPLIED ZOOLOGY

THEORY (CREDITS 4)

Unit 1: Introduction to Host-parasite Relationship 3
Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis

Unit 2: Epidemiology of Diseases 7
Transmission, Prevention and control of diseases: Tuberculosis, typhoid

Unit 3: Rickettsiae and Spirochaetes 6
Brief account of Rickettsia prowazekii, Borrelia recurrentis and Treponema pallidum

Unit 4: Parasitic Protozoa 8
Life history and pathogenicity of Entamoeba histolytica, Plasmodium vivax and Trypanosoma gambiense

Unit 5: Parasitic Helminthes 5
Life history and pathogenicity of Ancylostoma duodenale and Wuchereria bancrofti

Unit 6: Insects of Economic Importance 8
Biology, Control and damage caused by Helicoverpa armigera, Pyrilla perpusilla and Papilio demoleus, Callosobruchus chinensis, Sitophilus oryzae and Tribolium castaneum

Unit 7: Insects of Medical Importance 8
Medical importance and control of Pediculus humanus corporis, Anopheles, Culex, Aedes, Xenopsylla cheopis

Unit 8: Animal Husbandry 5
Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle

Unit 9: Poultry Farming 5
Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs

Unit 10: Fish Technology 5
Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed
APPLIED ZOOLOGY

PRACTICAL (CREDITS 2)

1. Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*, *Aedes* and *Xenopsylla*.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of *Helicoverpa (Heliothis) armigera*, *Papilio demoleus*, *Pyrrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*.
5. Visit to poultry farm or animal breeding centre. Submission of visit report.

SUGGESTED READINGS

- Kumar and Corton. *Pathological Basis of Diseases*.
DCE 3
AQUATIC BIOLOGY

THEORY (Credits 4)

UNIT 1: Aquatic Biomes

Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

UNIT 2: Freshwater Biology


**Streams:** Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.

UNIT 3: Marine Biology

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

UNIT 4: Management of Aquatic Resources

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment

Water quality assessment- BOD and COD.
PRACTICAL

6. Determine the area of a lake using graphimetric and gravimetric method.

7. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.

8. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.

9. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.

10. A Project Report on a visit to a Sewage treatment plant/Marine bio-reserve/Fisheries Institutes.

SUGGESTED READINGS

- Anathakrishnan : Bioresources Ecology 3rd Edition
- Goldman : Limnology, 2nd Edition
- Pawlowski : Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
- Wetzel : Limnology, 3rd edition
- Trivedi and Goyal : Chemical and biological methods for water pollution studies
- Welch : Limnology Vols. I-II
DSE 4
IMMUNOLOGY

THEORY (CREDITS 4)

Unit 1: Overview of the Immune System 10
Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

Unit 2: Cells and Organs of the Immune System 8
Haematopoiesis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

Unit 3: Antigens 8
Basic properties of antigens, B and T cell epitopes, haptens and adjuvants

Unit 4: Antibodies 8
Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis

Unit 5: Working of the immune system 12
Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.

Unit 6: Immune system in health and disease 10
Gell and Coombs’ classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

Unit 7: Vaccines 4
General introduction to vaccines, Various types of vaccines
IMMUNOLOGY

PRACTICAL

(CREDITS 2)

1*. Demonstration of lymphoid organs
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
5. ABO blood group determination.
6*. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of
   a) ELISA
   b) Immunoelectrophoresis

(*Subject to UGC guidelines)

SUGGESTED READINGS


REPRODUCTIVE BIOLOGY

THEORY (CREDITS 4)

Unit 1: Reproductive Endocrinology


Unit 2: Functional anatomy of male reproduction

Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract

Unit 3: Functional anatomy of female reproduction

Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

Unit 4: Reproductive Health

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning
REPRODUCTIVE BIOLOGY

PRACTICAL (CREDITS 2)

8. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
9. Examination of vaginal smear rats from live animals.
11. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
12. Human vaginal exfoliate cytology.
13. Sperm count and sperm motility in rat
14. Study of modern contraceptive devices

SUGGESTED READINGS

- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
GE 6
INSECT, VECTORS AND DISEASES

THEORY (Credits 4)

Unit I: Introduction to Insects 6
General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

Unit II: Concept of Vectors 6
Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Unit III: Insects as Vectors 8
Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit IV: Diptera as Disease Vectors 24
Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies;
Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes
Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly
Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit IV: Siphonaptera as Disease Vectors 6
Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Unit V: Siphunculata as Disease Vectors 4
Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases – Typhus fever, Relapsing fever, Trench fever, Vagabond’s disease, Phthiriasis; Control of human louse

Unit VI: Hemiptera as Disease Vectors 6
Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures
INSECT VECTORS AND DISEASES

PRACTICAL

(CREDITS 2)

10. Study of different kinds of mouth parts of insects

11. Study of following insect vectors through permanent slides/photographs: *Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phthirius pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica*, through permanent slides/photographs

12. Study of different diseases transmitted by above insect vectors

Submission of a project report on any one of the insect vectors and disease transmitted

SUGGESTED READINGS

SKILL ENHANCEMENT COURSES

SEC 1

APICULTURE

(CREDITS 2)

Unit 1: Biology of Bees

History, Classification and Biology of Honey Bees
Social Organization of Bee Colony

Unit 2: Rearing of Bees

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth
Bee Pasturage
Selection of Bee Species for Apiculture
Bee Keeping Equipment
Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: Diseases and Enemies

Bee Diseases and Enemies
Control and Preventive measures

Unit 4: Bee Economy

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

Unit 5: Entrepreneurship in Apiculture

Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

Unit 1: Introduction to Aquarium Fish Keeping
The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

Unit 2: Biology of Aquarium Fishes
Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

Unit 3: Food and feeding of Aquarium fishes
Use of live fish feed organisms. Preparation and composition of formulated fish feeds

Unit 4: Fish Transportation
Live fish transport - Fish handling, packing and forwarding techniques.

Unit 5: Maintenance of Aquarium
General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry
SEC - 2
MEDICAL DIAGNOSTICS

THEORY (Credits 2)

Unit 1: Introduction to Medical Diagnostics and its Importance  2

Unit 2: Diagnostics Methods Used for Analysis of Blood  10
Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

Unit 3: Diagnostic Methods Used for Urine Analysis  6
Urine Analysis: Physical characteristics; Abnormal constituents

Unit 4: Non-infectious Diseases  6
Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

Unit 5: Infectious Diseases  3
Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Unit 6: Tumours  3
Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
SEC 3

PUBLIC HEALTH AND HYGIENE

(CREDITS 2)

Unit 1: Introduction to Public health and Hygiene  
Significance of Public health and Hygiene, Nutrition and health, classification of foods, Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders

Unit 2: Environment and Health hazards  
Environmental degradation, Environmental Pollution – Air, water, soil and noise; Associated health hazards

Unit 3: Communicable diseases  
Different types of communicable diseases and their control measures – Tuberculosis, Measles, Dengue, Leprosy

Unit 4: Life Style related Non-Communicable diseases  
Different types of Life style related non-communicable diseases - Hypertension, Coronary Heart diseases, Stroke, Diabetes mellitus, Obesity and Mental ill-health - their causes and prevention through dietary and lifestyle modifications

Unit 5: Social health problems  
Smoking, alcoholism, drug dependence and Acquired Immuno-Deficiency Syndrome (AIDS) - their causes, treatment and prevention
SERICULTURE

(CREDITS 2)

Unit 1: Introduction
Sericulture: Definition, history and present status; Silk route
Types of silkworms, Distribution and Races
Exotic and indigenous races
Mulberry and non-mulberry Sericulture

Unit 2: Biology of Silkworm
Life cycle of Bombyx mori; Structure of silk gland and secretion of silk

Unit 3: Rearing of Silkworms
Selection of mulberry variety and establishment of mulberry garden
Rearing house and rearing appliances
Disinfectants: Formalin, bleaching powder, RKO
Silkworm rearing technology: Early age and Late age rearing
Types of mountages
Spinning, harvesting and storage of cocoons

Unit 4: Pests and Diseases
Pests of silkworm: Uzi fly, dermestid beetles and vertebrates
Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial
Control and prevention of pests and diseases

Unit 5: Entrepreneurship in Sericulture
Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

SUGGESTED READINGS

- Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.