

SCHEME AND SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM
B.Sc. WITH ZOOLOGY

	CORE COURSE (12)	Ability Enhancement Compulsory Courses AEC (2)	Skill Enhancement Courses SEC (4)	Discipline Specific Elective DSE (4)
I	CC- Botany I CC- Zoology I CC- Chemistry I	English Communication		
II	CC- Botany II CC-Zoology II CC- Chemistry II	Environmental Science		
III	CC- Botany III CC-Zoology III CC- Chemistry III		SEC-I	
IV	CC- Botany IV CC-Zoology IV CC- Chemistry IV		SEC-II	
V			SEC-III	DSE-Botany I DSE-Zoology I DSE-Chemistry I
VI			SEC-IV	DSE-Botany II DSE-Zoology II DSE-Chemistry II

Discipline Core Courses (CC):

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

Discipline Specific Electives (DSE):

DSE – I

- (a) Animal Biotechnology + Practical
- (b) Applied Zoology + Practical
- (c) Aquatic Biology + Practical

DSE – II

- (a) Immunology + Practical
- (b) Reproductive Biology + Practical
- (c) Insect Vector and Diseases + Practical

Skill Enhancement Courses (SEC):

I Apiculture

II Aquarium Fish Keeping

III Medical Diagonistics

IV Sericulture

CORE COURSE I
ANIMAL DIVERSITY

THEORY

(CREDITS 4)

Unit 1:

General characters of Protista and classification up to classes; locomotory organelles and locomotion in protozoa.

General characters of Porifera and classification up to classes; canal system in *Sycon*

General characters of cnidaria and classification up to classes; polymorphism in Hydrozoa

Unit 2:

General characters of Platyhelminthes and classification up to classes; life history of *Taenia solium*

General characters of Nemathelminthes and classification up to classes; life history of *Ascaris lumbricoides* and its parasitic adaptations

General characters of Annelida and classification up to classes; metamerism in Annelida

Unit 3:

General characters of Arthropoda and classification up to classes; vision in Arthropoda, Metamorphosis in insects

General characters of Mollusca and classification up to classes; torsion in gastropods

General characters of Echinodermata and classification up to classes; water-vascular system in asteroidea

Unit 4:

General features and phylogeny of protochordates

General features of Agnatha and classification of cyclostomes up to classes

General features of Pisces and classification up to orders; osmoregulation in Fishes

General features of amphibian and Classification up to orders; parental care

Unit 5:

General features of reptiles and classification up to orders; poisonous and non-poisonous snakes; biting mechanism in snakes

General features of aves and classification up to orders; flight adaptations in birds

Classification of mammals 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:

Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julius, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

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

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press. □ Pough H. Vertebrate life, VIII Edition, Pearson International.
- Hall B.K. and Hallgrímsson B. (2008). Strickberger’s Evolution. IV Edition. Jones and Bartlett Publishers Inc.

Mark allocation: (35 + 15) = 50

1. Identification (spotting 5 nos.)	: 15
2. Permanent slide (identification 2 nos)	: 5
3. Identification of snakes	: 5
4. P.N.B.	: 3
5. <i>Viva voce</i>	: 7

CORE COURSE II
COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF
VERTEBRATES

THEORY

(CREDITS 4)

Unit 1:

Derivatives of integument w.r.t. glands and digital tips

Evolution of visceral arches

Brief account of alimentary canal and digestive glands

Unit 2:

Brief account of gills, lungs, air sacs and swim bladder

Evolution of heart and aortic arches

Unit 3:

Succession of kidney; evolution of urinogenital ducts

Comparative account of brain

Types of receptors

Unit 4:

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.

Unit 5:

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.

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

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

- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
- 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.
- Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
- Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.

Mark allocation: (35 + 15) = 50

1. Identification of bones	: 10
2. Identification of developmental stages	: 7
3. Identification of gametes/placental slides	: 8
4. P.N.B.	: 3
5. <i>Viva voce</i>	: 7

CORE COURSE III
PHYSIOLOGY AND BIOCHEMISTRY

THEORY

(CREDITS 4)

Unit 1:

21

Physiology of digestion in the alimentary canal; absorption of carbohydrates, proteins, lipids
Pulmonary ventilation, respiratory volumes and capacities; transport of oxygen and carbon dioxide in blood

Structure of nephron; mechanism of Urine formation, counter-current mechanism

Composition of blood; hemostasis; structure of heart; origin and conduction of the cardiac impulse, cardiac cycle

Unit 2:

8

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 3:

7

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 4:

13

Glycolysis, Krebs Cycle, pentose phosphate pathway, gluconeogenesis, glycogen metabolism; review of electron transport chain; biosynthesis and β oxidation of palmitic acid

Unit 5:

11

Transamination, deamination and urea cycle

Introduction to enzymes, mechanism of action, enzyme kinetics, inhibition and regulation

PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL

(CREDITS 2)

1. Preparation of haemin 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)
5. Estimation of total protein in given solutions by Lowry's method.
6. Study of activity of salivary amylase under optimum conditions

SUGGESTED READINGS

- Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc GrawHill.

Mark allocation: (35 + 15) = 50

1. Preparation of haemin crystals	: 5
2. Histological slides	: 5
3. Permanent slides	: 5
4. Biochemical estimation	: 10
5. P.N.B.	: 3
6. <i>Viva voce</i>	: 7

CORE COURSE IV

GENETICS AND EVOLUTIONARY BIOLOGY

THEORY

(CREDITS 4)

Unit 1:

11

Mendel's work on transmission of traits, genetic variation, molecular basis of genetic information

Principles of inheritance, chromosome theory of inheritance, incomplete dominance and codominance, multiple alleles, lethal alleles, epistasis, pleiotropy, sex linked inheritance, extra-chromosomal inheritance

Unit 2:

9

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 3:

11

Chromosomal mutations: deletion, duplication, inversion, translocation, aneuploidy and polyploidy;

Gene mutations: induced versus spontaneous mutations, back versus suppressor mutations, Chromosomal mechanisms, dosage compensation

Unit 4:

16

Lamarckism, Darwinism, Neo-Darwinism

Types of fossils, Incompleteness of fossil record, dating of fossils; phylogeny of horse

Biological species concept (advantages and limitations); modes of speciation (allopatric, sympatric)

Unit 5:

14

Organic variations; isolating mechanisms; natural selection (example: industrial melanism);

Types of natural selection (directional, stabilizing, disruptive), artificial selection

Macro-evolutionary principles (example: Darwin's Finches)

GENETICS AND EVOLUTIONARY BIOLOGY

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 Human Karyotypes (normal and abnormal).
3. Study of fossil evidences from plaster cast models and pictures
4. Study of homology and analogy from suitable specimens/ pictures
5. 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

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
- Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
- Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrímsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.

Mark allocation: (35 + 15) = 50

1. Mendelian experiment from data provided : 10
2. Human karyotype from data provided : 10
3. Identification of fossils : 5
4. Biochemical estimation : 10
5. P.N.B. : 3
6. *Viva voce* : 7

DISCIPLINE CENTRIC ELECTIVE COURSES

DSE 1(a)

ANIMAL BIOTECHNOLOGY

THEORY

(Credits 4)

Unit 1:

Concept and scope of biotechnology

Cloning vectors: plasmids, cosmids, phagemids, lambda bacteriophage, M13, BAC, YAC, MAC and expression vectors (characteristics) restriction enzymes: nomenclature, detailed study of type II.

Unit 2:

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:

Production of cloned and transgenic animals: nuclear transplantation, retroviral method, DNA microinjection

Production of pharmaceuticals, production of donor organs, knockout mice.

Unit 4:

Production of transgenic plants and fish.

Applications of transgenic plants: insect and herbicide resistant plants.

Unit 5:

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

ANIMAL BIOTECHNOLOGY

PRACTICAL

(Credits 2)

1. Genomic DNA isolation from *E. coli*
2. Plasmid DNA isolation (pUC 18/19) from *E. coli*
3. Construction of circular and linear restriction map from the data provided.
4. Calculation of transformation efficiency from the data provided.
5. 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

SUGGESTED READINGS

- Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
- Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
- Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
- Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
- Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA.
- Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.

Mark allocation: (35 + 15) = 50

1. Genomic and plasmid isolation : 10
2. Construction/calculation from data provided : 10
3. Techniques (demonstration) : 5
4. P.N.B. : 3
5. *Viva voce* : 7

DSE 1(b)

APPLIED ZOOLOGY

THEORY

(CREDITS 4)

Unit 1:

Host, definitive host, intermediate host, parasitism, symbiosis, commensalism, reservoir, zoonosis

Transmission, prevention and control of diseases: tuberculosis, typhoid

Brief account of *Rickettsia prowazekii*, *Borrelia recurrentis* and *Treponema pallidum*

Unit 2:

Life history and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense*

Life history and pathogenicity of *Ancylostoma duodenale* and *Wuchereria bancrofti*

Unit 3:

Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*

Medical importance and control of *Pediculus humanus corporis*, *Anopheles*, *Culex*, *Aedes*, *Xenopsylla cheopis*

Unit 4:

Preservation and artificial insemination in cattle; induction of early puberty and synchronization of estrus in cattle

Principles of poultry breeding, management of breeding stock and broilers, processing and preservation of eggs

Unit 5:

Genetic improvements in aquaculture industry; induced breeding and transportation of fish seed

Crafts and gears used in capture/culture of fish

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*, *Pyrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
5. Visit to poultry farm or animal breeding centre. Submission of visit report
6. Maintenance of freshwater aquarium

SUGGESTED READINGS

- Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers.
- Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications and Distributors.
- Kumar and Corton. Pathological Basis of Diseases.
- Atwal, A.S. (1986). Agricultural Pests of India and South East Asia, Kalyani Publishers.
- Dennis, H. (2009). Agricultural Entomology. Timber Press (OR).
- Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
- Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
- Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.

Mark allocation: (35 + 15) = 50

1. Identification of slides/specimens : 5
- Identification of arthropod vectors : 10
(plants and stored grains)
2. Identification of economically important insects : 5
3. Submission of field report : 5
4. P.N.B. : 3
5. *Viva voce* : 7

DCE 1(c)**AQUATIC BIOLOGY****THEORY****(Credits 4)****UNIT 1:**

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:

Lakes: origin and classification, lake as an Ecosystem, lake morphometry, physico-chemical characteristics: light, temperature, thermal stratification, dissolved solids, carbonate, bicarbonates, phosphates and nitrates, turbidity; dissolved gases (oxygen, carbon dioxide).

Nutrient cycles in lakes - nitrogen, sulphur and phosphorous.

UNIT 3:

Different stages of stream development; major stream biota; physico-chemical environment; Adaptation of hill-stream fishes.

UNIT 4:

Salinity and density of Sea water; continental shelf; adaptations of deep sea organisms; coral reefs, sea weeds.

UNIT 5:

Causes of pollution: agricultural, industrial, sewage, thermal and oil spills, eutrophication, management and conservation (legislations), sewage treatment water quality assessment- BOD and COD.

AQUATIC BIOLOGY

PRACTICAL

(Credits 2)

1. Identification of important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
2. Study of locally available fish species
3. Determination of 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. Visit to any river/lake, and report submission.

SUGGESTED READINGS

- Anathakrishnan : Bioresources Ecology 3rd Edition
- Goldman : Limnology, 2nd Edition
- Odum and Barrett : Fundamentals of Ecology, 5th 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

Mark allocation: (35 + 15) = 50

1. Identification of macrophytes/plankton	: 5
Identification of fish	: 5
(plants and stored grains)	
2. Determination of physic-chemical parameters	: 7
3. Demonstration of instruments	: 5
4. P.N.B.	: 3
5. <i>Viva voce</i>	: 7

DSE 2(a)

IMMUNOLOGY

THEORY

(CREDITS 4)

Unit 1:

Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

Unit 2:

Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

Unit 3:

Basic properties of antigens, B and T cell epitopes, haptens and adjuvants

Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis

Unit 4:

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 5:

Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

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.
4. Ouchterlony's double immuno-diffusion method.
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

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication
- Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

Mark allocation: (35 + 15) = 50

1. Identification of histological slides	: 5
2. Determination of blood group/	: 10
type of blood cells	
3. Duchterlony's method/ cell counting	: 10
4. P.N.B.	: 3
5. <i>Viva voce</i>	: 7

DSE 2(b)
REPRODUCTIVE BIOLOGY

THEORY

(CREDITS 4)

Unit 1:

Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female;

Reproductive System: development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

Unit 2:

Outline and histology 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:

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;

Unit 4:

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 5:

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. Examination of vaginal smear rats from live animals.
2. 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.
3. Sperm count and sperm motility in rat
4. Study of modern contraceptive devices

SUGGESTED READINGS

- Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd
- Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

Mark allocation: (35 + 15) = 50

1. Preparation of vaginal smears	: 10
2. Identification of slides	: 5
3. Sperm count/motility	: 7
4. Identification of contraceptive devices	: 3
5. P.N.B.	: 3
6. <i>Viva voce</i>	: 7

DSE 2(c)

INSECT VECTORS AND DISEASES

THEORY

(Credits 4)

Unit I:

General features of insects, morphological features, head – eyes, types of antennae, mouth parts w.r.t. feeding habits

Brief introduction of carrier and vectors (mechanical and biological vector), reservoirs, host-vector relationship, vectorial capacity, adaptations as vectors, host specificity

Unit II:

Classification of insects up to orders; detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit III:

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:

Fleas as important insect vectors; host-specificity, study of flea-borne diseases – plague, typhus fever; control of fleas

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 V:

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 capitinis*, *Pediculus humanus corporis*, *Phthirus pubis*, *Xenopsylla cheopis*, *Cimex lectularius*, *Phlebotomus argentipes*, *Musca domestica*, through permanent slides/ photographs
3. Submission of a project report on any one of the insect vectors and disease transmitted

SUGGESTED READINGS

- Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press,
- Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall
- Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell

Mark allocation: (35 + 15) = 50

1. Preparation of mouth parts	: 10
2. Identification of slides	: 10
3. Submission of project report	: 5
4. P.N.B.	: 3
5. <i>Viva voce</i>	: 7

SKILL ENHANCEMENT COURSES

SEC 1

APICULTURE

(CREDITS 2)

Unit 1:

History, classification and biology of honey bees
Social organization of bee colony

Unit 2:

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:

Bee diseases and enemies
Control and preventive measures

Unit 4:

Products of apiculture industry and its uses (honey, bees wax, propolis), pollen *etc*

Unit 5:

Bee keeping industry – recent efforts, modern methods in employing artificial beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

- Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- Bisht D.S., Apiculture, ICAR Publication
- Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.

SEC – 2
AQUARIUM FISH KEEPING

(CREDITS 2)

Unit1:

The potential scope of aquarium fish industry as a cottage industry,
Exotic and endemic species of aquarium fishes

Unit 2:

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:

Use of live fish feed organisms.
Preparation and composition of formulated fish feeds

Unit 4:

Live fish transport - fish handling, packing and forwarding techniques.

Unit 5:

General aquarium maintenance – budget for setting up an aquarium fish farm as a cottage industry

SEC 3

MEDICAL DIAGNOSTICS

(Credits 2)

Unit 1:

Blood composition; preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain; platelet count using haemocytometer

Unit 2:

Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

Urine Analysis: physical characteristics; abnormal constituents

Unit 3:

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 4:

Causes, types, symptoms, diagnosis and prevention of tuberculosis, hepatitis, chicken pox and AIDS

Unit 5:

Tumour types (benign/malignant), 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
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- 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 Cotran, Pathologic Basis of Disease, VIIIIEdition, Saunders
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

SEC 4

SERICULTURE

(CREDITS 2)

Unit 1:

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:

Life cycle of *Bombyx mori*
General biology and host plants
Structure of silk gland and secretion of silk

Unit 3:

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 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:

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

- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore

- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.