UG Zoology Honours & Programme course Syllabus under CBPBU (Reduced due to Covid-19 and only applicable as and when notified by the University)

Important Note: <u>HOD of the respective colleges are requested to go thoroughly the entire</u> reduced syllabus and intimate the Chairperson of BOS immediately in case any discrepancies arises before beginning the classes implementing this reduced syllabus)

> SEM-1 ZOOH CORE COURSE I

Basic Concept of Taxonomy & Non Chordates I: Protista to Pseudocoelomates

Theory (Credits 4)

Unit 1: Basics of Animal Classification	11
Definitions: Classification, Systematics and Taxonomy; Hierarchy,	
Codes of Zoological Nomenclature; Principle of priority; Biological species concept in brief	
Unit 2: Protista, Parazoa and Metazoa	19
General characteristics and Classification upto phylum	
Study of Amoeba (locomotion) and Paramecium (reproduction)	
Life cycle and pathogenicity of <i>Plasmodium</i> sp.	
Evolution of symmetry, grade of organization of Metazoa	
Unit 3: Porifera and Cnidaria and Ctenophora	12
General characteristics and Classification up to classes	
Canal system in sponges	
Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs	
Unit 5: Platyhelminthes	10
General characteristics and Classification up to classes	
Life cycle and pathogenicity of Fasciola hepatica	
Unit 6: Nemathelminthes	08
General characteristics and Classification up to classes of phylum Nematoda	

Life cycle, and pathogenicity of *Ascaris lumbricoides*

NOTE: Classification to be followed from Invertebrate Zoology by Ruppert and Barnes VI edition (1987, 1994) Saunders College Pub, except for Protozoa (American Association of Protozoologist ref: Levine 1980) and Porifera (Brusca and Brusca 2002; IV edition. Invertebrate Zoology)

Practical (Credits 2)

1. Identification of whole mount of Euglena, Amoeba and Paramecium.

2. Identification of *Obelia, Physalia, Porpita, Euspongia, Scypha, Aurelia, Tubipora, Sea Anemone, Pennatula, Fungia*

- 3. Study of adult Taenia solium and their life cycles (Slides/ micro- photographs)
- 4. Preparation of dichotomous key from provided taxonomic data of any one Phylum.

Note: Classification to be followed from Invertebrate Zoology by Ruppert and Barnes VI edition (1987, 1994) Saunders College Pub, except for Protozoa (American Association of Protozoologist ref: Levine 1980) and Porifera (Brusca and Brusca 2002; IV edition. Invertebrate Zoology)

SEM-1 ZOOH CORE COURSE II PRINCIPLES OF ECOLOGY THEORY (Credits 4)

Unit 1: Introduction to Ecology

Levels of organization, Laws of limiting factors

Unit 2: Population

Population attributes: Density, natality, mortality, life tables, survivorship curves, age ratio, sex ratio, 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 example, Lotka-Volterra equation for competition

Unit 3: Community

Community characteristics: species richness, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example (hydrosere); Theories pertaining to climax community

Unit 4: Ecosystem

Types of ecosystems; Food chain: Detritus and grazing food chains, Food web; Energy flow through the ecosystem; Ecological pyramids, Nitrogen cycle

Unit 5: Wildlife & Conservation

Wildlife Conservation (ideas of in-situ and ex-situ conservation), Protection laws for wildlife conservation,

Practical (Credits 2)

1. Preparation of nested quardrat and estimation of effective quardrat size (demonstration)

 Determination of population density in a hypothetical community by quadrat method and calculation of Sorenson's Similarity & Shannon-Weiner diversity indices for the same community
Study of an aquatic ecosystem: Identification of any two zooplankton from permanent slides/photographs etc., Demonstration for estimation of Dissolved Oxygen content (Winkler's method) and free CO2 of water and calculation from hypothetical data

. SUGGESTED READINGS

- □ Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
- □ Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *TheInvertebrates: A New Synthesis*, III Edition, Blackwell Science
- □ Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
- □ Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home

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04

PROGRAMME COURSE BIO SCIENCE SEM-1 :: CORE COURSE-I ANIMAL DIVERSITY

THEORY	(CREDITS 4)
Unit 1. Protista General characters of Protozoa; Life cycle of <i>Plasmodium</i>	4
Unit 2. Porifera General characters and canal system in <i>Scypha</i>	3
Unit 3. Cnidaria General characters of Cnidarians and polymorphism in <i>Physalia</i>	3
Unit 4. Platyhelminthes General characters; Life cycle of <i>Taenia solium</i>	3
Unit 5. Nemathelminthes General characters of Nemethehelminthes;	3
Unit 6. Annelida General characters of Annelida ; Metamerism.	3
Unit 7. Arthropoda General characters	4
Unit 8. Mollusca General characters of mollusca and classification upto class	3
Unit 9. Echinodermata General characters of Echinodermata, Water Vascular system in Starfish.	3
Unit 10. Protochordata Salient features of Hemichordata, Urochordata and Cephalochordata	2
Unit 11. Agnatha General Characters	
Unit 11. Pisces General characters and classification upto order	4
Unit 12. Amphibia General characters, parental care in Anurans	4
Unit 13. Reptilia General characters; Poisonous and non-poisonous snakes	5

Unit 14. Aves: General characters; flight adaptations	5
Unit 15. Mammalia General characters, Adaptive ration with reference to locomotory appendages	6

PRACTICAL

(CREDITS 2)

1. Identification with reasons following specimens:

Non Chordates: Amoeba, Paramoecium, Scypha, Hydra, Obelia, Aurelia, Taeniasolium, Fasciola, Ascarislumbricoides, Metaphire (Earthworm), Hirudinaria, Macrobrachium, Balanus, Lepas, Cyclops, Daphnia, Periplaneta, Scorpion, Millipede, Peripatus, Chiton, Aplysia, Pila, Sepia, Octopus, Star-fish, Sea-urchin, Balanoglossus.

Chordates: Branchiostoma, Ascidia, Petromyzon, Myxine, Scoliodon, Trygon, Catla, Cirrhina, Heteropneustes, Clarias, Necturus, Chamelion, Naja, Columba and Cavia.

2. Identification of following Permanent Slides: Larvae: trochophore, glochidium, nauplius,

3. Identification of Placoid, Cycloid and Ctenoid scales,

SUGGESTED BOOKS

- Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
- Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
- Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
- Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
- Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

ZOOLOGY SEM-1

GENERIC ELECTIVE COURSES

ANIMAL DIVERSITY

THEORY	(CREDITS 4)
Unit 1. Protista	4
General characters of Protozoa; Life cycle of Plasmodium	
Unit 2. Porifera	3
General characters and canal system in Scypha	
Unit 3. Radiata	3
General characters of Cnidarians and polymorphism in Physalia	
Unit 4. Acelomates	3
General characters; Life cycle of Taenia solium	
Unit 5. Pseudocoelomates	3
General characters of Nemethehelminthes	
Unit 6. Coelomate Prostostomes	3
General characters of Annelida ; Metamerism	
Unit 7. Arthropoda	4
General characters	
Unit 8. Mollusca	3
General characters of mollusca	
Unit 9. Coelomate Deuterostomes	3
General characters of Echinodermata, Water Vascular system in Starfish.	
Unit 10. Protochordata	2
Salient features	
Unit 11. Pisces	4
Migration of Fishes	
Unit 12. Amphibia	4
General characters, parental care in Anurans	
Unit 13. Reptilia Terrestrial adaptations in reptiles	5

Unit 14. Aves:

General characters; flight adaptations

Unit 15. Mammalia

General characters

PRACTICAL

(CREDITS 2)

1. Identification with reasons following specimens:

Non Chordates: Amoeba, Paramoecium, Scypha, Hydra, Obelia, Aurelia, Taeniasolium, Fasciola, Ascarislumbricoides, Metaphire (Earthworm), Hirudinaria, Macrobrachium, Balanus, Lepas, Cyclops, Daphnia, Periplaneta, Scorpion, Millipede, Peripatus, Chiton, Aplysia, Pila, Sepia, Octopus, Star-fish, Sea-urchin, Balanoglossus.

Chordates: Branchiostoma, Ascidia, Petromyzon, Myxine, Scoliodon, Trygon, Catla, Cirrhina, Heteropneustes, Clarias, Necturus, Chamelion, Naja, Columba and Cavia.

2. Study of following Permanent Slides:

Sections of Sponges (Syconioid and Leuconoid), LS of *Hydra*, LS of *Metridium*, CS of Ascaris (Female) through gonadal region, CS of *Metaphire*(Earthworm); Larvae: trochophore, glochidium, nauplius,

3. Staining/slide Preparation and Mounting: mouth parts of cockroach, Identification of Placoid, Cycloid and Ctenoid scales,

SUGGESTED BOOKS

- Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
- Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
- Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
- Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata
- McGraw Hill Publishing Company. New Delhi.
- Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

6

SEM-3 ZOOH & PC

SEM-3 ZOOH CORE COURSE V DIVERSITY OF CHORDATA THEORY (Credits 4)

1
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3
2
6
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PRACTICAL

I. Identification of the following (from specimen or photograph as available) (Credits 2) 1. Protochordata Balanoglossus, Branchiostoma, 2. Agnatha Petromyzon, Myxine 3. Fishes Scoliodon, Sphyrna, Mystus, Exocoetus, Echeneis, Hippocampus, Flat fish 4. Amphibia Ichthyophis/Ureotyphlus, Hyla, Alytes, Salamandra, Axolotl larva 5. Reptilia Chelone/Trionyx, Varanus, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Hydrophis, Crocodylus 6. Aves Study of six common birds from different orders. 7. Mammalia Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, **II.Dissection** of Afferent and Efferent arterial system of *Labeo rohita* or Study from photograph/videograph **III. Dissection** of Fowl head (9th and 10th cranial nerve) or Study from photograph/videograph Classification from Young, J. Z. (2004) & Talwar and Jhingran (1991) for fish to be followed

- □ Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Deugh H. Vertebrate life, VIII Edition, Pearson International.
- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub. Co.
- □ Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

SEM-3 ZOOH CORE COURSE VI

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

THEORY	(Credits 4)
Unit 1: Tissues	6
Structure, location, classification and functions of epithelial tissue,	
Unit 2: Bone and Cartilage	4
Structure and types of bones and cartilages.	
Unit 3: Nervous System	10
Structure of neuron, resting membrane potential, Origin of action potenti and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscularjunction; reflex arc;	al
Unit 4: Muscle	12
Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction;	
Unit 5: Reproductive System Histology of testis and ovary; Physiology of male and female reproduction with special reference to reproductive cycles;	10
Unit 6: Endocrine System	18
Histology of endocrine glands - pituitary, thyroid, pancreas, adrenal; hormones secreted by them and their functions; Classification of hormon Signal transduction pathways for steroidal and non-steroidal (G protein)	es;

hormones;

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

PRACTICALS 2)

(Credits

- Study of permanent slides of Mammalian Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
- 2. Microtomy: Preparation of permanent slides of mammalian tissues (Protocol only).

SUGGESTED BOOKS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. EroschenkdiFio(2008) tlas of with Functional Histology correlations. XII Edition.Lippincott W. & Wilkins.
- Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.

SEM-3 ZOOH CORE COURSE VII FUNDAMENTALS OF BIOCHEMISTRY

THEORY	(CREDITS 4)
Unit 1: Carbohydrates	8
Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates	
Unit 2: Lipids	8
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids	
Unit 3: Proteins	14
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	
Unit 4: Nucleic Acids	12
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Denaturation and Renaturation of DNA Types of DNA and RNA,	
Unit 5: Enzymes	18
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; Enzyme inhibition; Allosteric enzymes

FUNDAMENTALS OF BIOCHEMISTRY

PRACTICAL

(CREDITS 2)

- 1. Qualitative tests of functional groups in carbohydrates, proteins and lipids. (Demonstration based, with special emphasis to Principles and Reactions)
- 2. Demonstration of action of salivary amylase under optimum conditions.
- 3. Demonstration of paper chromatographic separation of amino acids (hypothetical data can used for examination purpose)

- □ Cox, M.M and Nelson, D.L. (2008). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- □ Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
- □ Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
- □ Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

SEM-3 ZOOH SKILL ENHANCEMENT COURSES SEC 1 AQUARIUM FISH KEEPING

(CREDITS 2)

Unit1: 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.

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.

SEM-3 PROGRAMME

CORE COURSE III PHYSIOLOGY AND BIOCHEMISTRY

Unit 1: Nerve and muscle	8
Structure of a neuron, Resting membrane potential, Origin of Action potential and propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal mu	l its scle
Unit 2: Digestion	5
Physiology of digestion in the alimentary canal; Absorption of carbohydrates.	
Unit 3: Respiration	5
Transport of Oxygen and carbon dioxide in blood	
Unit 4: Excretion	5
Structure of nephron, Mechanism of Urine formation,	
Unit 5: Cardiovascular system	6
Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle	
Unit 6: Reproduction and Endocrine Glands	7
Hormonal control of spermatogenesis; hormonal control of menstrual cycle	
Function of hormones secreted from pituitary, thyroid and pancreas	
Unit 7: Carbohvdrate Metabolism	8
Glycolysis, Kreb's cycle, Pentose phosphate pathway	

Unit 10: Enzymes

THEORY

Introduction, Mechanism of action, Enzyme Kinetics.

(CREDITS 4)

PHYSIOLOGY AND BIOCHEMISTRY

PRACTICAL

(CREDITS 2)

- 1. Identification of permanent histological sections/photomicrographs of mammalian pituitary, thyroid, pancreas, adrenal gland
- 2. Identification of permanent histological section slides/photomicrographs of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
- 3. Demonstration of qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose) with special emphasis to principles and reactions

- □ 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'sIllustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

SKILL ENHANCEMENT COURSES SEC 1 AQUARIUM FISH KEEPING AND MANAGEMENT

(CREDITS 2)

Unit1: 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.

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.

SEM-5 ZOOH & PC

SEM-5 ZOOH CORE COURSE XI

MOLECULAR BIOLOGY

THEORY	(CREDITS 4)
Unit 1: Nucleic Acids Salient features of RNA and DNA, Watson and Crick model of DNA	4
Unit 2: DNA Replication	12
DNA Replication in prokaryotes, Semi-conservative, bidirectional and semi-discontinuous Replication.	
Unit 3:Transcription	10
RNA polymerase and transcription Unit, mechanism of transcription in Prokaryotes; mRNA, transcription factors in prokaryotes	
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	
Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA Structure of globin mRNA; Split genes: concept of introns and exons, Basic concept of splicing	6
Unit 6: Gene Regulation	10
Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from <i>lac</i> operon	
Unit 7: DNA Repair Mechanisms	3
Pyrimidine dimerization and mismatch repair	
Unit 8: Regulatory RNAs	3

RNA interference, miRNA, siRNA

MOLECULAR BIOLOGY

PRACTICAL

(CREDITS 2)

- 1. Study of Polytene chromosomes from Chironomous / Drosophila larvae (Photograph)
- 2. Demonstration of quantification of DNA (Diphenylamine reagent) [protocol only, hypothetical data can used for exam purpose]
- 3. Demonstration of quantification of RNA (Orcinol reaction) [protocol only, hypothetical data can used for exam purpose]
- 4. Study and interpretation of electron micrographs/ photograph showing
 - (a) DNA replication
 - (b) Transcription
 - (c) Split genes

- □ Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The Worldof the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, SanFrancisco.
- □ Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IV Edition.
- □ Cooper G. M. and Robert E. Hausman R. E. *The Cell: A Molecular Approach*, V Edition, ASM Press and Sinauer Associates.
- □ De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and MolecularBiology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- □ Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). Gene XI, Jones and Bartlett
- □ McLennan A., Bates A., Turner, P. and White M. (2015). *Molecular Biology* IV Edition. GS, Taylor and Francis Group, New York and London.

SEM-5 ZOOH CORE COURSE XII PRINCIPLES OF GENETICS THEORY (CREDITS 4)

Unit 1: Mendelian Genetics and its Extension	8
Principles of inheritance, Incomplete dominance and co-dominance,	
Multiple alleles, Lethal alleles, Epistasis, Pleiotropy	
Unit 2: Linkage, Crossing Over and Chromosomal Mapping	12
Linkage and crossing over, Cytological basis and Molecular mechanisms of cred	ossing over including models of
recombination	
Unit 3: Mutations	10
Types of gene mutations (Classification), Types of chromosomal aberrations	
(Classification, figures and with one suitable example of each)	
Unit 4: Sex Determination	4
Mechanisms of sex determination in Drosophila and Human	
Unit 5: Extra-chromosomal Inheritance	6
Criteria for extra-chromosomal inheritance, Infective heredity in <i>Paramecium</i>	and Maternal effects
Unit 6: Polygenic Inheritance	3
Polygenic inheritance with suitable examples.	
Unit 7: Recombination in Bacteria and Viruses	9
Conjugation, Complementation test in Bacteriophage	
Unit 8: Transposable Genetic Elements	8
Transposons in bacteria, Transposons in humans	

PRACTICALS (CREDITS 2)

- 1. Chi-square analyses using seeds/beads/Drosophila.
- 2. Linkage maps based on data from *Drosophila* crosses.
- 3. Study of human karyotype (normal and abnormal).
- 4. Pedigree analysis of some human inherited traits.

- □ Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles ofGenetics*. 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 ofGenetics*. 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
- □ Fletcher H. and Hickey I. (2015). *Genetics*. IV Edition. GS, Taylor and Francis Group, New York and London.

SEM-5 ZOOH DISCIPLINE CENTRIC ELECTIVE COURSE DSE-1 ANIMAL BIOTECHNOLOGY

THEORY (Credit	s 4)
Unit 1. Introduction	8
Concept and scope of biotechnology	
Unit 2. Molecular Techniques in Gene manipulation	24
Cloning vectors: Plasmids, Cosmids, Phagemids, Expression vectors (characteristics).	
Restriction enzymes: Nomenclature, detailed study of Type II.	
Southern and Western blotting	
DNA sequencing: Sanger method	
Polymerase Chain Reaction	
Unit 3. Genetically Modified Organisms	18
Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection	,
Applications of transgenic animals.	
Unit 4. Culture Techniques and Applications	10
Animal cell culture.	
Recombinant DNA in medicines; Gene therapy	

ANIMAL BIOTECHNOLOGY

PRACTICAL

(Credits 2)

- 1. Construction of circular and linear restriction map from the data provided.
- 2. To study following techniques through photographs
 - a. Southern Blotting
 - b. Western Blotting
 - c. DNA Sequencing (Sanger's Method)
 - d. PCR
- 3. Project/review report on animal cell culture

SEM-5 ZOOH DISCIPLINE CENTRIC ELECTIVE COURSE DSE-2 IMMUNOLOGY

THEORY	(Credits 4)
Unit 1: Overview of Immune System	10
Cells and organs of the Immune system	
Unit 2: Innate and Adaptive Immunity	10
Anatomical barriers, Inflammation, Cell and molecules involved in in Adaptive immunity (Cell mediated and humoral),	nnate immunity,
Unit 3: Antigens	8
Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens.	
Unit 4: Immunoglobulins	10
Structure and functions of different classes of immunoglobulins, A interactions, Immunoassays (ELISA and RIA), Polyclonal sera, Hybridoma	Antigen-antibody 1 technology
Unit 5: Major Histocompatibility Complex	6
Structure and functions of MHC molecules.	
Unit 6: Cytokines	4
Properties and functions of cytokines,	
Unit 7: Complement System	4
Classical pathway of complement activation.	
Unit 8: Hypersensitivity	3
Brief description of various types of hypersensitivities	
Unit 9: Vaccines	5

Various types of vaccines.

IMMUNOLOGY

PRACTICAL

(Credits 2)

- 1. Histological study of spleen, thymus and lymph nodes through slides/ photographs
- 2. Preparation of stained blood film to study various types of blood cells. (Photographs can be used)
- 3. ABO blood group determination. (Demonstration with an emphasis to Principle and Protocol)
 - 5. Demonstration of
 - a) ELISA
 - b) Immunoelectrophoresis
- * The experiments can be performed depending upon usage of animals in UG courses.

- 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.

SEM-5 PROGRAMME ZOO DISCIPLINE CENTRIC ELECTIVE COURSE DSE-1 IMMUNOLOGY

THEORY	(Credits 4)
Unit 1: Overview of Immune System	10
Cells and organs of the Immune system	
Unit 2: Innate and Adaptive Immunity	10
Anatomical barriers, Inflammation, Cell and molecules involved in Adaptive immunity (Cell mediated and humoral),	innate immunity,
Unit 3: Antigens	8
Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens.	
Unit 4: Immunoglobulins	10
Structure and functions of different classes of immunoglobulins, interactions	Antigen-antibody
Unit 5: Major Histocompatibility Complex	6
Structure and functions of MHC molecules.	
Unit 6: Complement System	4
Classical pathway of complement activation.	
Unit 8: Hypersensitivity	3
Brief description of various types of hypersensitivities	
Unit 9: Vaccines	5
Various types of vaccines.	

IMMUNOLOGY

PRACTICAL

(Credits 2)

- 3. Histological study of spleen, thymus and lymph nodes through slides/ photographs
- 4. Preparation of stained blood film to study various types of blood cells. (Photographs can be used)
- 3. ABO blood group determination. (Demonstration)
- 5. Demonstration of ELISA (Indirect method)
- * The experiments can be performed depending upon usage of animals in UG courses.

- 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.

SEM-5 PROGRAMME ZOO SKILL ENHANCEMENT COURSES

SEC 3

APICULTURE

	(CREDITS 2)
Unit 1: Biology of Bees	(4)
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 Brief idea about selection of Bee species for Apiculture Brief idea about Bee keeping equipment Brief idea about the method of extraction of honey (Indigenous or modern)'	(10)
Unit 3: Diseases and Enemies	(5)
Bee Diseases and Enemies	
Control and Preventive measures	
Unit 4: Bee Economy	(2)
Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc	
Unit 5: Entrepreneurship in Apiculture Bee Keeping Industry – Recent Efforts.	(4)