



Shri Sangameshwar Education Society, Solapur
Kannada Linguistic Minority Institute

Sangameshwar College, Solapur
Autonomous

NAAC Accredited with 'A' Grade (III Cycle CGPA 9)

Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.O.S. in: Zoology

UG-II NEP2020 Programmes: B.Sc.-II (Zoology: Major, Minor, SEC, Field Project) to be implemented from A.Y. 2024-2025

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.Sc.-II Semester-III									
Course Type		Course Title	Credits	Teaching Hours		Evaluation Marks			Course Code
				Per week	Total	CA	SEE	Total	
Major Core	DSC1-T5	Cell Biology	2	2	30	20	30	50	24MJ37131
	DSC1- P3	Practical based on DSC1-T5	2	4	60	25	25	50	24MJ37132
	DSC1-T6	Fundamentals of Biochemistry	2	2	30	20	30	50	24MJ37133
	DSC1- P4	Practical based on DSC1-T6	2	4	60	25	25	50	24MJ37134
Minor Core	DSC2- T3	Principles of Genetics	2	2	30	20	30	50	24MN37131
	DSC2- T4	Systematics and Diversity of Life-Protists to Chordates	2	2	30	20	30	50	24MN37132
	DSC2- P3	Practical based on DSC2-T3 and T4	2	4	60	25	25	50	24MN37133
SEC	SEC2	Apiculture	2(1+1)	3(1+2)	45	20	30	50	24SE37131
B.Sc.-II Semester-IV									
Course Type		Course Title	Credits	Teaching Hours		Evaluation Marks			Course Code
				Per week	Total	CA	SEE	Total	
Major Core	DSC1-T7	Principles of Ecology	2	2	30	20	30	50	24MJ37141
	DSC1- P5	Practical based on DSC1-T7	2	4	60	25	25	50	24MJ37142
	DSC1-T8	Histology and Animal Physiology: Controlling and Coordinating Systems	2	2	30	20	30	50	24MJ37143
	DSC1- P6	Practical based on DSC1- T8	2	4	60	25	25	50	24MJ37144
Minor Core	DSC2- T5	Agrochemicals and Pest Management	2	2	30	20	30	50	24MN37141
	DSC2- T6	Biotechniques	2	2	30	20	30	50	24MN37142
	DSC2- P4	Practical based on DSC2-T5 and T6	2	4	60	25	25	50	24MN37143
SEC	SEC3	Sericulture	2(1+1)	3(1+2)	45	20	30	50	24SE37141
Field Project	FP1	Field Project in Zoology-I	2	4	60	25	25	50	24FP37141

DSC1 : Discipline Specific Core course related to major

DSC2 : Discipline Specific Core course related to minor

SECi : Skill Enhancement Course i ; i=1,2,3

Ti : Theory course number i ; i=1,2,3,4,5,6,7,8.....

Pi : Practical course number i ; i=1,2,3,4,5,6,.....

O Ei : Open Elective course number i ; i=1,2,3

FPi : Field Project i ; i=1,2,3

CA : Continuous Assessment SEE: Semester End Exam

B.Sc.-II Sem-III : Major Core : DSC1- T5 : Cell Biology (24MJ37131) Cr 2		Hours 30
	Learning Outcomes: To impart the knowledge about different kinds of cells and their structure and to study the structural organization of plasma membrane and its significance, structural organization of endomembrane system and its functioning, structure of Mitochondria and energy synthesis mechanism, structural component of cytoskeleton and their functions, nucleus and its different parts, the chromatin structure. To understand the mechanisms of equational and reductional divisions of cell, the cell signaling	
Unit 1	Types of Cells and Cell Organelles - Prokaryotic and Eukaryotic cells . - Difference in Plant cell and Animal cell Plasma Membrane - Structure and functions of plasma membrane - Singer & Nicolson's model of plasma membrane Endomembrane System - Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes Mitochondria - Mitochondria: Ultrastructure - functions of Mitochondria - Electron Transport system and mechanism of ATP synthesis Cytoskeleton - Structure and Functions: Microtubules, Microfilaments, Intermediate filaments.	17
Unit 2	Nucleus and Chromatin - Structure and functions of Nucleus - Nuclear envelope - Nuclear pore complex - Nucleolus - Nuclear lamina Chromatin - Structure of nucleosome - Euchromatin, Heterochromatin - Barr bodies	6
Unit 3	Cell Division - Cell cycle, - Mitosis and Meiosis - Significance	4
Unit 4	Cell Signalling - Types of cell signalling - Brief idea of G-Protein Coupled Receptor (GPCR) - Role of secondary messengers (cAMP)	3
Course Outcomes: Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the basic structure and characteristics of prokaryotic and eukaryotic cells. Differentiate between plant cells and animal cells based on structural and functional features. Explain the structure and various functions of the plasma membrane. Describe the Singer and Nicolson's fluid mosaic model and its significance in membrane biology. Identify the components of the endomembrane system and explain their structure and functions. Describe the roles of the endoplasmic reticulum, Golgi apparatus, and lysosomes in cellular processes. Describe the ultrastructure of mitochondria and explain its		

function as the powerhouse of the cell. Explain the process of electron transport and the mechanism of ATP synthesis through oxidative phosphorylation. Explain the organization and functions of cytoskeletal elements: microtubules, microfilaments, and intermediate filaments. Appreciate the role of the cytoskeleton in maintaining cell shape, intracellular transport, and cell division.

CO2: Describe the structure and functions of the nucleus and its components including the nuclear envelope, pores, nucleolus, and nuclear lamina. Explain the structure of chromatin, nucleosomes, and differentiate between euchromatin and heterochromatin. Explain the concept and significance of Barr bodies.

CO3: Explain the phases of the cell cycle and its regulation. Describe the processes of mitosis and meiosis, and interpret their biological significance.

CO4: Explain different types of cell signalling mechanisms. Explain the basic concept of G-Protein Coupled Receptors (GPCR) and the role of secondary messengers like cAMP in signal transduction.

References:

1. Cell and Molecular Biology: Concepts and Experiments. Karp, G. (2010). VI Edition. John Wiley and Sons. Inc.
2. Cell and Molecular Biology. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. The Cell: A Molecular Approach. Cooper, G.M. and Hausman, R.E. (2009). V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA
4. Molecular Biology of the Cell, Bruce Albert, Bray Dennis, Lewis Julian, Raff Martin, Roberts Keith and Watson James (2008). V Edition, Garland publishing Inc., New York and London.
5. The World of the Cell. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

B.Sc.-II Sem-III : Major Core : DSC1- P3 : Practical based on DSC1-T5 (24MJ37132) Cr 2	
Experiment	Title
1	To study the structural and optical components of compound microscope.
2	Preparation of temporary stained squash of onion root tip to study various stages of mitosis.
3	Study of various stages of meiosis in onion /Rheo flower buds.
4	Temporary stained preparation of nucleus from given sample.
5	Temporary stained preparation of mitochondria from given sample by using Janus Green B stain.
6	Demonstration/ Observation of Barr body using permanent slide(s) (spotter)/ Buccal smear – Identification of Barr Body.
7	Study of osmosis :Effect of Isotonic, hypotonic and hypertonic solution on blood cells.
8	Study of WBCS(leucocytes) by blood smear staining technique and their identification.
9	Preparation of bacterial smear for simple staining of bacteria (Lactobacillus).
10	Isolation of cell organelles by subcellular fractionation.
11	Measurement of onion epidermal cell at 4X, 10X and 40X.
12	Visualization of plant and animal cell.

B.Sc.-II Sem-III : Major Core : DSC1-T6 : Fundamentals of Biochemistry (24MJ37133) Cr 2		Hours 30
	Learning Outcomes: To study about the classification, properties and significance of Carbohydrates, Lipids. properties of amino acids. To study about the different levels of structural organizations of Proteins. To understand the classification and working mechanism of Enzymes. To study the types of antibodies and their significance.	
Unit 1	Carbohydrates • Classification of Carbohydrates • Structure and examples of Monosaccharides	6

	• Properties of monosaccharides. • Structure and examples of Disaccharides • Types, nature and formation of Glycosidic bond • Reducing and non-reducing sugars • Structure and examples of Polysaccharides- Homo polysaccharides and Hetero polysaccharides • Biological Significance carbohydrates	
Unit 2	Lipids • Classification of lipids • General properties of lipids • Saturated and unsaturated fatty acids • Triacylglycerol, Phospholipids, Cholesterol , Steroids • Lipid Profile: HDL, LDL, Ratios • Biological Significance of lipids.	6
Unit 3	Amino Acids and Proteins Amino Acids • Amino acids: Structure • Classification of Amino acids based on R group and it's properties • General Properties of amino acids • Essential and non essential amino acids Proteins • Primary structure of proteins: formation of polypeptide chain in primary structure • Secondary structure with alpha helix, beta sheets (Parallel and anti-parallel) • Tertiary & quaternary structure of proteins • Stabilizing forces of proteins: Covalent interactions – Peptides bonds and Disulfide links • Non-covalent interactions- Hydrogen Bond, Hydrophobic interactions, Van Der Waals Interactions, Electrostatic or ionic bond or salt bond or salt bridge, Dipole movements • Simple and conjugate proteins with their significance	10
Unit 4	Enzymes • Nomenclature and classification • Co-factors • Properties of enzymes • Mechanism of enzyme action • Factors affecting enzyme actions • Isoenzyme Immunoglobulins • Basic Structure. • Types of immunoglobulins • Biological significance of antibodies	8
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Classify carbohydrates into monosaccharides, disaccharides, and polysaccharides. Describe the structure and properties of monosaccharides with suitable examples. Explain the formation and structure of disaccharides and glycosidic bonds. Differentiate between reducing and non-reducing sugars. Describe the structure and types of polysaccharides (homo and heteropolysaccharides). Discuss the biological roles and importance of carbohydrates. CO2: Classify lipids and Explain their general properties. Distinguish between saturated and unsaturated fatty acids. Explain the structure and functions of triacylglycerol, phospholipids, cholesterol, and steroids. Interpret lipid profile components such as HDL, LDL, and their ratios. Evaluate the biological significance of lipids in health and metabolism. CO3: Illustrate the general structure of amino acids. Classify amino acids based on the nature of the R-group and their chemical properties. Discuss essential and non-essential amino acids. Describe the general physical and chemical properties of amino acids. Explain the levels of protein structure: primary, secondary, tertiary, and quaternary. Describe different types of secondary structures such as α -helix and β -sheets. Identify the covalent and non-covalent interactions responsible for protein stability. Differentiate between simple and conjugated proteins and explain their biological significance. CO4: Explain the nomenclature and classification of enzymes. Describe the role of cofactors in enzymatic activity. Explain the properties of enzymes and the mechanism of enzyme action. Identify		

factors that influence enzyme activity and Explain the concept of isoenzymes. Describe the basic structure and types of immunoglobulins. Discuss the biological significance and functions of antibodies in immune response.

References:

- 1.Principles of Biochemistry, Lehninger, Cox, M.M and Nelson, D.L. (2008). V Edition, W.H. Freeman and Co., New York.
- 2.Biochemistry, Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). VI Edition, W.H. Freeman and Co., New York.
- 3.Harper's Illustrated Biochemistry, Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- 4.Instant Notes in Biochemistry, Hames, B.D. and Hooper, N.M. (2000). II Edition, BIOS Scientific Publishers Ltd., U.K.

B.Sc.-II Sem-III : Major Core : DSC1- P4: Practical based on DSC1-T6 (24MJ37134) Cr 2	
Experiment	Title
1	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch).
2	Identification tests for Proteins (albumin and Casein).
3	Biochemical tests of samples containing lipids.
4	Quantitative analysis of reducing sugars (DNSA method)
5	Quantitative analysis of Proteins (Biuret method).
6	Paper chromatography of isolation of amino acids from mixed sample.
7	Identification of unknown amino acids through paper chromatography.
8	Study of Anti serum ABD and ABO blood group identification.
9	Action of Salivary amylase under optimum conditions.
10	Effect of PH on action of salivary amylase
11	Effect of temperature on the action of salivary amylase.
12	Preparation of buffer solution and measurement of pH.- 04,07 and 09.

B.Sc.-II Sem-III : Minor Core : DSC2- T3 : Principles of Genetics (24MN37131) Cr 2		Hours 30
	Learning Outcomes: The course is designed to revise basic concepts of Genetics and then move on to advanced concepts. To explain the basic concepts in genetics, different mendelian laws. To elaborate different kinds of allelic and gene interaction .To explain the steps involved in crossing over. To give the detailed descriptions about various kinds of mutation and their significance and causes of mutations, mechanism of sex determination, different kinds of genetic disorders in human beings.	
Unit 1	Basic Concepts in Genetics, Mendelian Principles and Allelic and genetic interaction Arrangement of genetic material in nucleus Concept of genes and alleles Homologous chromosomes Concept of homozygous and heterozygous Concept of dominance and recessive Haploid, Diploid, Hybrid, Mono hybrid, Dihybrid, Phenotype and Genotype Mendelian Genetics Introduction Contrasting characters in Pea plant studied by Mendel Law of Dominance, Law of Segregation and Law of Independent Assortment Allelic and genetic interaction Allelic interactions: Incomplete dominance and co-dominance Genetic interactions: Supplementary, Complementary & Inhibitory interactions Multiple alleles, Lethal alleles	14
Unit 2	Linkage, Crossing Over Linkage : Characteristics of genetic linkage Types of linkage (complete and incomplete linkage) Bateson and Punnett experiment on coupling and Repulsion.	6

	Crossing over: mechanisms of crossing over, steps of crossing over during meiosis, Synapsis and Synaptosomal complex. Recombination frequency as a measure of linkage intensity.	
Unit 3	Mutations and Genetic Disorders Mutations Types of gene mutations Mutagens and causes of mutation: physical and chemical mutagens Types of chromosomal aberrations: Numerical- Polyploidy, Aneuploidy Structural- Deletion, Duplication, Inversion, Translocation. Genetic Disorders Human Genetic Disorders: Normal Human Karyotype. Mechanism and symptoms of Down's Syndrome, Klinefelter's Syndrome and Turner's Syndrome	8
Unit 4	Sex Determination Genetic Basis of Sex Determination- Chromosomal Type Chromosomal Sex Determination Mechanisms Dosage Compensation Inheritance of Sex-linked, sex-influenced and sex-limited characters	4
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the arrangement of genetic material within the nucleus. Define and differentiate genes and alleles. Explain the concepts of homologous chromosomes, homozygous and heterozygous conditions. Describe the principles of dominance and recessiveness. Define and use terms like haploid, diploid, hybrid, monohybrid, dihybrid, phenotype, and genotype. Outline Mendel's experiments and the contrasting characters studied in pea plants. Explain Mendel's laws: Law of Dominance, Law of Segregation, and Law of Independent Assortment. Apply Mendelian principles to predict genetic outcomes in monohybrid and dihybrid crosses. Explain allelic interactions including incomplete dominance and codominance. Describe types of genetic interactions: supplementary, complementary, and inhibitory. Explain concepts of multiple alleles and lethal alleles and their genetic implications. CO2: Define genetic linkage and distinguish between complete and incomplete linkage. Interpret Bateson and Punnett's experiment on coupling and repulsion. Explain the mechanism and stages of crossing over during meiosis, including synapsis and synaptosomal complex formation. Calculate recombination frequency and relate it to the intensity of linkage. CO3: Define mutation and classify types of gene mutations. Identify physical and chemical mutagens and their effects. Describe chromosomal aberrations—numerical (polyploidy, aneuploidy) and structural (deletion, duplication, inversion, translocation). Discuss human genetic disorders with reference to karyotypes and explain the causes and symptoms of Down's Syndrome, Klinefelter's Syndrome, and Turner's Syndrome. CO4: Explain the chromosomal basis of sex determination in humans and other organisms. Explain mechanisms of chromosomal sex determination and dosage compensation. Differentiate between sex-linked, sex-influenced, and sex-limited inheritance patterns.		
References: 1. Gardner, E.J. et al. (2006) Principles of Genetics (John Wiley). 2. Russell, P.J. (2010) Genetics (Benjamin Cummings). 3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. (VIII edition) Wiley India. 4. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. (V edition) John Wiley and Sons Inc. 5. Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012). Concepts of Genetics. (X edition) Benjamin Cummings. 6. Carroll S.B.; Doebley J.; Griffiths, A.J.F. and Wessler, S.R. (2018) An Introduction to Genetic Analysis. W. H. Freeman and Co. Ltd.		

B.Sc.-II Sem-III : Minor Core : DSC2- T4 : Systematics and Diversity of Life-Protists to Chordates (24MN37132) Cr 2		Hours 30
	Learning Outcomes: - To give the brief idea of origin of life on Earth, Products of evolutionary process. - To introduce about structural organization and diversity of Protists and acoelomate Metazoa .	

	- To explain about structural organization and diversity of pseudocoelomate and coelomates non chordates. - To explain about structural organization and diversity of Protochordates and Chordates.	
Unit 1	1. Origin of Life on Earth, Products of evolutionary Process - Origin of life on Earth: Arrival of simple form from primordial chemicals - Multicellularity: from simple collections of poorly differentiated cells to complex body plans. Systematics and taxonomy. - Species concept, clades. - Nomenclature (binomial and trinomial) and utility of scientific names. - Classification: morphological and evolutionary (molecular). - Relationship of taxa: phylogenetics and cladistics with special reference to paraphyly, monophyly, apomorphy, plesiomorphy and phenoplasticity.	6
Unit 2	Diversity in Protists and acoelomate Metazoa - Structure and diversity in Protists - Origin of Metazoans: Diploblastic and triploblastic organization; - Symmetries- Asymmetric, Bilateral symmetry, Radial symmetry, Spherical symmetry. - Body cavities- Acoelomate, Pseudo coelomate, True Coelomate. - Protostomes and deuterostomes. - Special features and structural diversity in sponges. - Cnidarians: Special features; transition of third germ layer; Polymorphism and division of labour; coral reef forming Cnidarians. - The Bilateria: Basic characteristics. - The acoelomates: Basic organization and adaptive radiations in flatworms	8
Unit 3	Diversity in pseudocoelomate and coelomates non chordate - The Ecdysozoa: characteristics of the representative taxa. - Pseudo coelomates; Basic organization and adaptive radiations in roundworms. - The coelomates: Basic organization and adaptive radiations in Arthropods (Crustaceans and Insects). - Ancestors/ fossil arthropods. - Basic organization and diversity in Annelids. - Basic organization and diversity in Molluscs. Disruption of bilateral symmetry and its significance. - Basic organization of Echinoderms; their affinity to Chordates.	8
Unit 4	Diversity in Protochordates and Chordates - Chordates – Primitive Chordates and their affinities. - Hemichordates, Urochordates and Cephalochordates. - Advent of vertebrates: Cyclostomes, their evolutionary status and affinities. - Basic organization and diversity of fishes, their evolutionary transitions from Water to Land invasion - Early Tetrapodes. - Amphibians diversity and adaptability to dual mode of life. - Amniotes: the amniotic egg, adaptive radiations in reptiles; the avian ancestors. - Birds: Adaptation from terrestrial to aerial mode of life. - Origin of Mammals- Special features of Monotremes and Marsupials. - Characteristics of other mammalian groups with special reference to primates.	8
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the origin of life from primordial chemical compounds to simple living forms. Describe the evolutionary transition from unicellularity to multicellular organisms with complex body plans. Explain the importance and principles of systematics and taxonomy. Differentiate species concepts and clades; Explain the significance of binomial and trinomial nomenclature. Discuss morphological and molecular classifications and their applications in evolutionary biology. Analyze evolutionary relationships among taxa using phylogenetics and cladistics; Explain terms like monophyly, paraphyly, apomorphy, plesiomorphy, and phenoplasticity. CO2: Describe the structural features and diversity among Protists. Explain the evolutionary transition from unicellular to metazoan life forms. Distinguish diploblastic and triploblastic organization and various types of body symmetries. Explain the types of body cavities: acoelomate, pseudocoelomate, and coelomate. Differentiate between protostomes and deuterostomes. Describe the structural features, diversity, and adaptations of sponges. Discuss the characteristics and evolutionary significance of Cnidarians, including polymorphism and coral reef formation. Explain the organization and adaptive radiation of acoelomate bilaterians such as flatworms.		

CO3: Identify key characteristics of Ecdysozoans and their representative groups. Describe the basic organization and adaptive radiation in pseudocoelomates (roundworms). Explain the body organization and evolutionary significance of arthropods including fossil arthropods. Explain the structural diversity in annelids and molluscs; analyze the disruption of bilateral symmetry in molluscs. Discuss the unique features of echinoderms and their phylogenetic link to chordates.

CO4: Trace the evolutionary history and affinities of primitive chordates. Describe the basic features and significance of hemichordates, urochordates, and cephalochordates. Explain the origin of vertebrates with a focus on cyclostomes. Explain the diversity and evolutionary adaptations of fishes, including the transition to terrestrial life. Describe the dual-mode life adaptations in amphibians and the significance of amniotic eggs in reptiles. Trace the evolutionary lineage from reptiles to birds and describe their aerial adaptations. Explain the origin and special features of mammals including monotremes, marsupials, and primates.

References:

Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.
 Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
 Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
 Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.
 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.
Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press

B.Sc.-II Sem-III : Minor Core : DSC2- P3: Practical based on DSC2-T3 and T4 (24MN37133) Cr 2	
Experiment	Title
1	Examples in Genetics based on Monohybrid ratio (05 examples)
2	Examples in Genetics based on Dihybrid ratio (05 examples)
3	Examples based on multiple alleles: Blood groups (03 examples)
4	Examples based on multiple alleles: Coat color in rabbit
5	Examples based on gene interactions (Complementary, Supplementary & Inhibitory interactions)
6	Pedigree analysis of some human inherited traits (05 examples)
7	Examples based on human genetic traits: Rolling tongue, free & attached ear lobes, hitchhiker's thumb. Widows Peak Hairline (01 example from each)
8	Study of phylogenetics trees and cladistics diagram:- with special reference to paraphyly, monophyly, apomorphy, plesiomorphy and phenoplasticity.
9	Study of Symmetries (Asymmetry, Bilateral, Radial, Spherical) and body cavities- Acoelomate, Pseudo coelomate, True Coelomate.
10	Study of diversity in Protists and acoelomate Metazoa - Protista- Paramecium •Sponges- Sycon •Cnidaria- Physalia
11	Study of diversity in pseudocoelomate- Platyhelminthes and Nematelminths :- Taenia, Ascaris, Fasciola

12	Study of diversity in coelomates- Annelida - Pheretima Arthropoda- Periplaneta Mollusca- Pila Echinodermata- Pentaceros
13	Study of Diversity in Protochordates - Balanoglossus, Herdmania, Branchiostoma
14	Study of Diversity in Chordates Petromyzon, Labeo • Hyla • Naja • Great Indian Bustard • Rattus
15	Study of animals in nature during a survey of a National Park or Forest area. (Visit to national park /wildlife sanctuaries). /Collection of five species (preferably invertebrates, insects) belonging to a clade. A project work on their generic identification, description and illustration with a note on their locality. Also the assessment of their relationship by constructing a cladogram using characters and character states/. Comparison of two species of birds belonging to same genus (Interspecific difference). /Comparison and weighting of characters of two birds belonging to same family but dissimilar genera. /Group discussion or Seminar presentation on one or two related topics from the list

B.Sc.-II Sem-III : SEC: SEC2: Apiculture (24SE37131) Cr 2		Hours 30
	Learning Outcomes: - This course tells the students what tools and equipment will be needed, the main activities in the beekeepers . - To understand the prerequisite to get started in beekeeping. - To give idea of laws around beekeeping in Vancouver. - To give the idea of responsibilities of urban beekeepers. - To give the information about structure of honeybees ,diseases and enemy of honeybees and their body parts. - To describe the anatomy of bees and perspective of managing bees. - To describe the importance of wax and hives and bee	
Unit 1	Introduction to Apiculture - Beekeeping-Introduction and history and scope of bee keeping - Advantages of bee keeping - Systematics - Bee species - Bee morphology - Caste system - Identification of honey bees - Food of honey bees - Relationship between plants and bees - Honey comb. - Honey bee life cycle - Honey production in related to health problem	14
Unit 2	Bee keeping as an occupation - Rearing of bees Artificial Bee rearing - Newton hive(modern hives), Primitive hives - Beekeeping equipment's -comb frames, Comb foundation sheet, Drone excluder ,Queen excluder, Swarm trap, Smoker, Uncapping Knife, Bee veils, Honey extractor, Bee brush and feeders	6
Unit 3	The first step in beekeeping - Arranging an apiary- 1) Location of an apiary - Preparation of an apiary - Acquiring Honey bees-1. Catching a swarm 2.Package bees 3)A nucleus Colony 4) Care of newly captured colonies , - Bee products: Honey, Bees wax, Pollens, Royal Jelly, Propolis and Bee venom. - Bee Diseases and Enemies Control and preventive measures.	5

Unit 4	Bee chemistry and marketing • Composition of honey • Properties of honey • Adulterants of honey. • Honey market in India and Purity Specifications for honey.	5
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the history, scope, and significance of beekeeping as a practice. Identify the advantages of beekeeping in agriculture, economy, and health. Learn the classification and systematics of honey bees and identify various species. Describe bee morphology and caste system in a bee colony. Identify honey bee castes based on structure and role. Explain the food preferences of honey bees and their ecological relationship with plants. Describe the structure and function of honeycombs. Explain the life cycle of honey bees and their relevance to honey production and health. CO2: Explain the process of rearing bees and the use of both primitive and modern hives (e.g., Newton hive). Identify and describe the various tools and equipment used in beekeeping such as comb frames, smokers, swarm traps, and honey extractors. Recognize the role of each equipment piece in efficient and sustainable apiculture practices. CO3: Learn how to set up an apiary, including site selection and preparation. Explain the different methods of acquiring honey bees (e.g., catching swarms, package bees, nucleus colonies). Learn the care and management of newly acquired bee colonies. Identify and describe the main bee products: honey, beeswax, pollen, royal jelly, propolis, and bee venom. Explain common bee diseases and enemies and apply preventive and control measures. CO4: Explain the chemical composition and properties of honey. Identify common adulterants in honey and learn methods to detect them. Explore the honey market in India, including marketing strategies and purity standards. Recognize the significance of maintaining honey quality for health and trade purposes. References: 1. Abrol , D. P. (1997) Bees and Beekeeping. Kalyani Publisher, New Delhi. 173 2. Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi. 3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur. 4. Nagaraja, N. and Rajagopal , D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P Publisher, Chennai. 5. Dharamsing and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.		

B.Sc.-II Sem-IV : Major Core : DSC1- T7 : Principles of Ecology (24MJ37141) Cr 2		Hours 30
	Learning Outcomes: • This course will take students on a journey through the physical workings of the Earth, • The interactions between species and their environments. • The course highlights on some of the important aspects viz. growth and survival of populations and communities in different habitats, energy flow in the ecosystems, interactions between the communities	
Unit 1	Introduction to Ecology, Principles of Ecology and Animal Association Introduction to Ecology • Introduction and scope of ecology • Autecology and synecology Population Ecology • Brief idea about attributes of population: Density, natality, mortality, fecundity, survivorship curves Animal Associations- Brief idea and definitions • Intraspecific associations: Parental care, altruism, and Competition (food, mate, territory) • Interspecific associations: commensalism, mutualism, predation and parasitism	10

Unit 2	Abiotic Factors and Mineral Cycles Abiotic Factors • Introductions & influence on animals: Temperature, light, water, humidity, soil, oxygen Mineral Cycles • Mineralization and recycling of nutrients: Hydrological cycle, Carbon, Nitrogen, Phosphate & Sulphur	4
Unit 3	Community and Applied Ecology Community characteristics: • Species richness, dominance, diversity, abundance. Applied Ecology : • Brief idea of Biodiversity hot-spots in India, IUCN Red list categorization. Study of some National Parks and Sanctuaries with one example of their brand animal.	6
Unit 4	Ecosystem General characteristics • Aquatic (freshwater ecosystem: lotic and lentic) • Terrestrial (forest, grassland and desert ecosystem). • Food chain, Food web, Energy flow, Ecological pyramids and their types.	10
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the definition, scope, and significance of ecology. Differentiate between autecology and synecology and their ecological relevance. Explain basic population attributes including density, natality, mortality, fecundity, and survivorship curves. Define and illustrate various animal associations. Distinguish between intraspecific associations such as parental care, altruism, and competition (food, mate, territory). Explain interspecific associations like commensalism, mutualism, predation, and parasitism with examples. CO2: Explain the role and impact of abiotic factors such as temperature, light, water, humidity, soil, and oxygen on animals. Explain the processes of mineralization and nutrient recycling in ecosystems. Describe major biogeochemical cycles: Hydrological, Carbon, Nitrogen, Phosphorus, and Sulphur cycles. CO3: Define and evaluate key characteristics of ecological communities: species richness, dominance, diversity, and abundance. Explain the importance of biodiversity and list major biodiversity hotspots in India. Explain IUCN Red List categorization and its role in conservation. Study major Indian national parks and sanctuaries, highlighting one representative species (brand animal) from each. CO4: Identify and describe the structure and functions of aquatic ecosystems, distinguishing between lotic (flowing water) and lentic (standing water) systems. Explain the characteristics and ecological roles of terrestrial ecosystems like forests, grasslands, and deserts. Explain food chains and food webs; explain energy flow in ecosystems. Identify types of ecological pyramids: number, biomass, and energy, and discuss their significance.		
References: 1. Ecology. II Edition. Colinviaux, P. A. (1993). Wiley, John and Sons, Inc. 2. Ecology. Krebs, C. J. (2001). VI Edition. Benjamin Cummings. 3. Fundamentals of Ecology. Odum, E.P., (2008). Indian Edition. Brooks/Cole 4. Ecology and field biology ,Robert Leo Smith ,Harper and Row publisher 5. Ecology. V, Ricklefs, R.E., (2000). Edition. Chiron Pres		

B.Sc.-II Sem-IV : Major Core : DSC1- P5: Practical based on DSC1-T7 (24MJ37142) Cr 2	
Experiment	Title
1	Study and construction of ecological pyramid from given data: Members of Pond ecosystem – Sponge, Nepa, Leech, Planaria, Hydra, Lymnea, Planorbis, Heron, Kingfisher, Cyclops, Daphnia, Tortoise , Diatoms Vallisneria, Hydrilla, Chara and Spirogyra. Study and construction of ecological pyramid from given data:

	Members of Grass land ecosystem – Grasshopper, Rat Snake, Grass, Herbs, Shrubs, Weeds, Vulture, Squirrel, Earthworm, Centipede, Scorpion, Rabbit and Indian Bustard, peacock. Study and construction of ecological pyramid from given data: Members of forest ecosystem –Cricket, stick insect, viper, Rat Snake, Grass, Herbs, Shrubs, Weeds, Trees, Owl, Squirrel, Earthworm, Centipede, Scorpion, Monkeys, Rabbit and Indian Bustard, Lion, Tiger, Hyna.
2	Calculation of Shannon-Weiner diversity index from the given data/ model.- 3 examples.
3	Study of Interspecific associations: commensalism, mutualism, predation and parasitism (with one examples from each)
4	Study of Mineralization and recycling of nutrients: Hydrological cycle, Carbon, Nitrogen, Phosphate & Sulphur
5	Water sampling method- Collection of Zooplanktons by using plankton net.
6	Counting of Zooplanktons by using Sedgewick-Rafter Counting Chamber.
7	Identification of Zooplankton from collected water sample.
8	Estimation of Dissolved Oxygen (Winkler's method) from given sample.
9	Estimation of pH of water from given sample.
10	Estimation of Total Hardness content from given sample.
11	Study of different National Parks and Sanctuaries with their respective brand animals.
12	Locate different national parks and sanctuaries on Indian Map.
13	Study Visit: Preparation of models, Report on a visit to National / Central / State institutes / Local water bodies / National Park / Biodiversity Park/Wild life sanctuary, Ecotourism, Trekking/Data collection of animal categorized in IUCN Red list from Maharashtra (India).

B.Sc.-II Sem-IV : Major Core : DSC1- T8 : Histology and Animal Physiology: Controlling and Coordinating Systems (24MJ37143) Cr 2		Hours 30
	Learning Outcomes: - The course deals with various physiological functions in mammals. - The course highlights on some of the important aspects viz. tissues, histology of the mammalian organs, nervous and muscular system, Reproductive Physiology and cycle, In-vitro Fertilization and Endocrine System.	
Unit 1	Tissues, Histology - Structure, location, classification and functions of: epithelial tissue, connective tissue, muscular tissue and nervous tissue. - Study of Blood tissue –Types of blood cells (RBC,WBC ,Platelets , Plasma), functions of blood cells Histology of following mammalian organs i) Tooth ii) Salivary gland iii) Stomach iv) Ilium v) Pancreas vi) Liver vii) Testis viii) Ovary	10
Unit 2	Structure and function of neuron and muscle cell. Nerve cell: - Ultrastructure of neuron - Resting membrane Potential - Origin of action potential and it's propagation across the nerve fibre: Structure of Synapse and Synaptic transmission Muscle: - Types of muscles cells (smooth, Striated, cardiac) - Ultra structure of skeletal muscle - Molecular mechanism of muscle contraction.	7
Unit 3	Reproductive Physiology, Reproductive Cycle and Invitro Fertilization Reproductive Physiology - Pituitary gland- FSH and LH hormones - Male & female sex hormones	10

	Reproductive Cycle • Oestrous cycle and Menstrual cycle • Hormonal changes during pregnancy • Parturition and lactation. • Contraception methods: Physical, oral contraceptives pills, IUD, surgical methods. In-vitro Fertilization Technique of IVF and its applications	
Unit 4	Endocrine System • Structure and function of endocrine glands: Pituitary, Thyroid, Pancreas, Adrenal.	3
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the structure, classification, location, and functions of epithelial, connective, muscular, and nervous tissues. Identify the components of blood tissue including RBCs, WBCs, platelets, and plasma, and describe their structure and functions. Develop foundational knowledge of tissue biology relevant to physiological systems. CO2: Examine the microscopic structure and correlate the functional aspects of mammalian organs: Tooth, Salivary gland, Stomach, Ileum, Pancreas, Liver, Testis, Ovary, Gain skills in identifying histological features and understanding the physiology of key organs. CO3: Describe the ultrastructure of a neuron and Explain the resting membrane potential. Explain the generation and propagation of action potential, structure of synapse, and mechanism of synaptic transmission. Identify and differentiate types of muscle cells: smooth, striated, and cardiac. Explain the ultrastructure of skeletal muscle and the molecular basis of muscle contraction. CO4: Explain the role of pituitary hormones (FSH, LH) and sex hormones in reproductive processes. Compare the oestrous and menstrual cycles and describe hormonal regulation during pregnancy, parturition, and lactation. Discuss various contraceptive methods including physical barriers, oral contraceptives, IUDs, and surgical methods. Explain the process and applications of in-vitro fertilization (IVF) in reproductive medicine. Describe the structure and functions of major endocrine glands: Pituitary, Thyroid, Pancreas, Adrenal, Explain the hormonal control mechanisms and the role of endocrine glands in maintaining homeostasis. References: 1. Textbook of Medical Physiology, Guyton, A.C. & Hall, J.E. (2006). XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company 2. Principles of Anatomy & Physiology. Tortora, G.J. & Grabowski, S. (2006). XI Edition John Wiley & sons 3. De Fiore's Atlas of Histology with Functional correlations. Victor P. Eroschenko. (2008). XII Edition. Lippincott W. & Wilkins 4. Randall, D. et al. (2002) Eckert Animal Physiology (5th edition) Freeman. 5. Hill, R.W. et al. (2008) Animal Physiology (3rd edition) Sinaur Associates.		

B.Sc.-II Sem-IV : Major Core : DSC1- P6 : Practical based on DSC1-T8 (24MJ37144) Cr 2	
Experiment	Title
1	Observation and detail explanation of following tissue with reference to structure ,location and functions (with CD/Slide/Model/Chart). i) Epithelial ii) Connective iii) Muscular iv) Nervous
2	Study of histological structures (T.S./V.S.) - of Mammalian organs using permanent slides (Spotters): i) Tooth ii) Salivary gland iii) Stomach iv) Liver v) Kidney vi) Pancreas vii) Testis viii) Ovary
3	Study of ABO blood group system from given blood sample .
4	Erythrocyte sedimentation rate.(ESR)
5	Total count of RBC from a given blood sample by using Neubauer chamber.
6	Total count of WBC from a given blood sample by using Neubauer

	chamber.
7	Study of following abnormal urine constituents: Glucose, Bile, Blood and Albumin
8	Study of Oestrus cycle using CD/ Chart/Permanent slides.
9	Microtomy: Study of principle , procedure and mechanism of micro-technique for the preparation of permanent slides: a)Fixation of tissue b)Embedding wax and Preparation of blocks c)Gradient hydration and dehydration and staining with HE
10	Study of contraceptives : Oral contraceptives (pills),Intra -uterine device, Condom using chart/Photographs.
11	Study of the permanent slides/charts of endocrine glands: Pituitary, Thyroid, Pancreas, Adrenal.
12	Study visit: Preparation of models, Visit to wetlands, R&D labs, medical college, pathology laboratory and blood bank OR Preparation and submission of small project/ review on topics related to ecology, cell biology, biochemistry and physiology/Visit to IVF center.

B.Sc.-II Sem-IV : Minor Core : DSC2- T5 : Agrochemicals and Pest Management (24MN37141) Cr 2		Hours 30
	Learning Outcomes: - The course gives insight into the various types of biological pesticides used to control pest and also about their selective mode of action. - It also gives an account of eco-friendly biological pesticides.	
Unit 1	Concept of pest - Definition, classification of Pests Public health pests - Mosquito : Types,characters , Life cycle, diseases and control . - Human Lice: Life cycle, diseases and control measures - Sandfly: Life cycle, diseases and control measures	7
Unit 2	Agricultural pests (occurrence, Hosts complex, Life history and control) - Pests of Sugarcane- Sugarcane woolly aphid, White grubs ,bores, Pyrilla, Whitefly, mealybug, termites - Pests of major fruit crops- fruit borer, Bark eating caterpillar, The oriental fruit fly, fruit suckling moth and fruit borer - Pests Of Oil Seed Crops-Mustard sawfly, mustard aphid, cutworm, ground grub, castor semiloopers, ground nut aphid, ground nut stem borer, mustard aphid ,cutworm, ground nut grubs castor semiloopers, ground nut aphid, ground nut stem borer, mustard aphid, caster capsule borer, bhiar hairy caterpillar. - Pests of vegetables-Potato tuber moth, Brinjal shoot and fruit borer, Brinjal stem borer, cotton jassid, thrips ,pumpkin beetle, Hadda beetle, dimond back moth	10
Unit 3	Animal husbandry pests (Distribution, Hosts,characteristics,Host pest interaction Disease and control) Horseflies,Stableflies,The cattle louse.The cattle warble fly,The Screwworms,Ticks,Mites	3
Unit 4	Chemical Pesticides - Insecticides - Organophosphate: Parathion, Malathion, Schradan, Phorate, Thiometon, Monocotophos.	10

	• Carbamates- Carbaryl, • Synthetic pyrethroids • Miscellaneous insecticide- Pirate • Fumigants- Hydrogen cyanide, • Nematicides- DBCP, Ethylene dibromide, • Rodenticides- Zinc phosphide, • Molluscicides – copper sulphate, niclosamide, Metaldehyde	
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Define and classify different types of pests based on their impact on human health, agriculture, and animals. Describe the life cycle, types, and control measures of mosquitoes, human lice, and sandflies. Explain the vector role of public health pests and their involvement in spreading diseases like malaria, dengue, leishmaniasis, and typhus. Explain the importance of pest management in public health programs. CO2: Identify and describe major pests of sugarcane, including their life cycles, host plants, and control measures. Explain the biology and damage caused by pests of fruit crops, oil seed crops, and vegetables. Explain the host-pest interaction and integrated pest management (IPM) strategies in agriculture. Develop knowledge on economically significant pests like fruit borers, aphids, caterpillars, and whiteflies, and their management practices. CO3: Explain the distribution, host preferences, and characteristics of animal husbandry pests such as horseflies, stableflies, cattle lice, warble flies, screwworms, ticks, and mites. Explain the host–pest interaction and the economic and health impacts of these pests on livestock. Describe control strategies for minimizing the impact of pests on animal health and productivity. CO4: Explain the types and mode of action of various chemical pesticides including: Insecticides (Organophosphates, Carbamates, Synthetic Pyrethroids) Fumigants (e.g., Hydrogen cyanide), Nematicides (e.g., DBCP, Ethylene dibromide), Rodenticides (e.g., Zinc phosphide), Molluscicides (e.g., Copper sulphate, Metaldehyde), Explain the safe handling, environmental impact, and regulatory concerns related to pesticide use. Develop awareness on integrated chemical management practices for sustainable pest control.		
References: 1. Hill, D.S. (1983) Agricultural insect pests of the tropics and their control- Cambridge Univ. Press. 2. Atwal, A. S. (1979) Agricultural pests of India and south East Asia. 3. Dent, D. (2000) Insect pest management (2nd edition) CAB International. 4. Roberts, D.A. (1978) Fundamentals of Plant Pest Control. 5. De Bach, P. (1964) Biological Control of Insect Pests and Weeds, Chapman & Hall, New York. 6. Koul, O. and Dhaliwal, G.S. (2003) Phytochemical Biopesticides, Harwood Academic Publishers, Amsterdam. 7. Pedigo, L.P. (1996) Entomology and pest management, Prentice Hall, N. Delhi. 92		

B.Sc.-II Sem-IV : Minor Core : DSC2- T6 : Biotechniques (24MN37142) Cr 2		Hours 30
	Learning Outcomes: • This is the only laboratory course taught independently of lecture courses. • It has full hands on approach to expose the students to modern techniques and methodologies. • The diverse techniques from microscopy to spectroscopy, calorimetry, chromatography etc. are included to make the student well versed with these protocols and methods.	
Unit 1	Microscopy and Microtomy Microscopy • Introduction to Microscopy. Magnification	4

	• Definition-Resolving Power, Limit of Resolution & Numerical aperture. • Types of microscopes • Principle, Structure and applications of - o Compound microscope - o Phase contrast microscope Microtomy • Tissue preparation, fixation (Aims of fixation, Types of fixation) , dehydration and block preparation, sectioning, staining, mounting.	2
Unit 2	UNIT II : Tools and techniques in Biochemistry and Physiology • Buffers • pH meter-Introduction , Principle of pH meter Measurement of pH • Chromatography-Principles of Chromatography , Types of chromatography- Paper chromatography, Thin layer Chromatography and ion-exchange chromatography • Colorimeter-Introduction , Beer-Lambert's Law. • Spectrometer - Introduction, Types of Spectroscopy, Ultraviolet spectroscopy and visible spectroscopy or spectrophotometry • Centrifugation - Ordinary Centrifuges- Introduction , principle , Structure and application of centrifuges, Types of Centrifuge , Methods of centrifugation- a)Differential Centrifugation b) Density gradient centrifugation • Ultracentrifuges-Principle , Structure and application of ultracentrifugation • Electrophoresis - Agarose gel Electrophoresis, Polyacrylamide Gel electrophoresis	18
Unit 3	Haematological Techniques • Blood cell count –Total count of RBCs, WBCs and • Differential count of WBCs and their significance.	2
Unit 4	Biotechnology • Introduction to PCR • Southern, Western and Northern Blotting. • Introduction to DNA Fingerprinting and it's applications	4
Course Outcomes: Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the principles of magnification, resolving power, numerical aperture, and limit of resolution. Identify different types of microscopes and explain the principle, structure, and application of compound and phase contrast microscopes. Explain the process of tissue preparation including fixation, dehydration, embedding, sectioning, staining, and mounting. Explain procedure basic practical knowledge of microtomy and histological slide preparation techniques. CO2: Explain the role and preparation of buffers in biochemical experiments. Describe the working principle and operation of a pH meter and its use in measuring pH. Explain the principles and applications of chromatographic techniques: paper chromatography, TLC, and ion-exchange chromatography. Explain the principle and application of colorimetry using Beer-Lambert's Law. Describe the principle and types of spectrophotometry (UV and visible) and their role in biochemical analysis. Explain the principle, structure, and applications of centrifuges and ultracentrifuges. Describe differential and density gradient centrifugation methods. Explain electrophoresis techniques – agarose gel and polyacrylamide gel electrophoresis – and their use in separation of biomolecules. CO3: Describe techniques for total RBC and WBC count and differential WBC count. Explain the physiological significance of blood cell counts and identification of various blood cells. CO4: Explain the principle, process, and applications of Polymerase Chain Reaction (PCR). Describe the principles and applications of blotting techniques: Southern, Western, and Northern blotting. Explain the concept and significance of DNA fingerprinting and its real-world applications in forensic science and genetics.		
References: 1. Boyer, R. (2000) Modern Experimental Biochemistry (3rd edition) Benjamin-Cummings. 2. Pearse, A.G.E. (1980-1993) Histochemistry - Theoretical and applied, Volume I-III, Churchill-Livingstones. 3. Plummer, D. (2017) An Introduction to Practical Biochemistry (3rd edition) McGraw Hill.		

4. Wilson, K. and Walker, J. (2010) Experimental Biochemistry, Cambridge.
 5. Biotechniques -N.Arumugam and V.Kumaresan ,Saras publication
 6. Biochemistry Dr.N. Arumugam,Dulsy Fatima,L.M .Narayanan,Prof. K.Nallisingam,Dr.R.P Meyyan Pillai ,Prof.S.Prasannakumar , Saras publication

B.Sc.-II Sem-IV : Minor Core : DSC2- P4: Practical based on DSC2-T5 and T6 (24MN37143) Cr 2	
Experiment	Title
1	Study of Pests of Sugarcane- Sugarcane woolly aphid, White grubs ,bores, Pyrilla
2	Pests of major fruit crops- fruit borer, Bark eating caterpillar, The oriental fruit fly, fruit suckling moth and fruit borer
3	Study of Pests Of Oil Seed Crops-Mustard sawfly, ground grub, castor semiloopers, ground nut aphid, ground nut stem borer, caterpillar.
4	Study of Pests of vegetables-Potato tuber moth, Brinjal shoot and fruit borer, Brinjal stem borer, cotton jassid
5	Study of Animal husbandry pests (Distribution, Hosts, characteristics, Host pest interaction Disease and control) The cattle louse, The cattle warble fly, The Screwworms, Ticks, Mites Mosquito : Anopheles, Culex, Aedes- Morphology, diseases and control. Mosquito control measures- Physical, Chemical, Biological
6	Study of Chemical Pesticides - Insecticides, Nematicides, Rodenticides and Molluscicides
7	Field trips/ Field trips to bio-control laboratories – IARI, CWC, FCI.
8	Preparation of buffer solutions of pH- 4.0, 07 and 10
9	Study of pH meter and measurement of pH of different samples
10	Study of paper chromatography and isolation of amino acid samples from given mixture
11	Study of Colorimeter and estimation of protein concentration from the given sample by suitable method
12	Colorimetric estimation of glucose concentration from the given sample by DNS method
13	Study of Centrifugation and isolation of cell constituents
14	Study of WBCs (leucocytes) by blood smear staining technique and their identification
15	Study of Neubauer chamber for RBC cell count

B.Sc.-II Sem-IV : SEC : SEC3 Sericulture (24SE37141) Cr 2		Hours 30
	Learning Outcomes: Understand concepts of sericulture industry and demonstrate interdisciplinary skills acquired in mulberry plant cultivation, silkworm rearing, diagnosis of diseases and pest of mulberry and silkworm and their prevention and its relevance in Seri-farmers livelihood.	

	• Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises. • Apply demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of sericulture.	
Unit 1	Silkworm Life cycle of silkworm • The silkworms. Its morphological characteristics, Types silkworm- Mulberry, Tasar, Eri, Muga • Selection of mulberry variety and establishment of mulberry garden • Spinning, harvesting and storage of cocoons	10
Unit 2	Rearing house and rearing appliances • Non recurring (General)- Disinfection mask, Sprayer for disinfection, Room heater, Water air cooler, Kerosene blow lap, Wet and dry thermometer, 6" forceps • Non-recurring (specific)- Egg transportation box, Egg incubation chamber, Loose egg incubation frame, Black box, Chawki rearing trays, Rearing bottom stand, Feeding Stand, Ant wells, Leaf chopping board, Leaf chopping knife, Leaf mat, Bed cleaning nets, Earthen pot, Litter basket, Late age rearing trays, Rearing stand, Shoot rearing rack, Chandrika, Plastic basin, Buckets, Mug. Plastic box, Foam pads, Foot rugs, Leaf chamber for late age, Leaf basket, Cleaning nets, Recurring Paraffin paper, Formalin, Bleaching powder, Lime powder, Bed disinfectants, Slides and cover slips, Gunny cloth, Cora cloth. .	10
Unit 3	Silkworm rearing technology and Types of Mountages • Early age and Late age rearing, Selection of silkworm races/breeds for rearing. • Incubation- definition, requirement of environmental conditions, incubation devices; • Identification of stages of development • Black boxing and its importance	6
Unit 4	Diseases of silkworm and Disinfectants . (Silkworm diseases causative agents, symptoms, transmission prevention and control • Protozoan Bacterial Viral, Fungal diseases Disinfectants • Formalin, bleaching powder RKO.	4
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the morphology and classification of silkworms (Mulberry, Tasar, Eri, Muga). Explain the complete life cycle of silkworms from egg to moth. Identify and select suitable mulberry varieties and Explain the procedure for establishing a mulberry garden. Explain the techniques involved in spinning, harvesting, and storage of cocoons. CO2: Identify and describe the structure and purpose of a silkworm rearing house. Explain with non-recurring (general and specific) appliances used in silkworm rearing. Explain the usage of equipment like sprayers, thermometers, disinfection masks, rearing trays, chawki stands, feeding stands, and leaf chopping tools. CO3: Differentiate between early age and late age silkworm rearing techniques. Explain criteria for selecting suitable silkworm races/breeds for rearing. Explain the process and environmental requirements of incubation. Identify the stages of silkworm development and Explain the role of black boxing in uniform hatching. Explain different types of mountages used in cocoon spinning. CO4: Identify major silkworm diseases (Protozoan, Bacterial, Viral, Fungal) along with their causative agents, symptoms, and modes of transmission. Explain preventive and control measures for silkworm diseases. Explain the types and applications of disinfectants such as formalin, bleaching powder, and RKO in disease management and hygiene maintenance.		
References: 1. Manual on sericulture (1976). Rome : Food and Agriculture Organization of the United Nations, Agricultural Services Division. 2. Ullal, S.R. and . Narasimhanna, M.N. (1987) Handbook of Practical Sericulture: CSB, Bangalore 3. Silkworm Rearing and Disease of Silkworm (1956) Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore		

4. Jolly, M. S. (1986) Appropriate Sericultural Techniques; Ed., Director, CSR & TI, Mysore.
5. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1 (1972) Fuzi Pub. Co. Ltd., Tokyo, Japan.
6. Narasimhanna, M. N. (1988) Manual of Silkworm Egg Production; CSB, Bangalore.
7. Sengupta, K. (1989) A Guide for Bivoltine Sericulture. CSR & TI, Mysore

B.Sc.-II Sem-IV : FP1 : Field Project in Zoology-I (24FP37141) Cr 2		Hours 60
	Learning Outcomes: To develop ability to identify real life challenges faced by society and devise hypothesis to answer these challenges. To prepare methodology to explicitly work on the identified problems in scientific way. To collect field and laboratory based data, compile, organize, analyze and interpret the data. To prepare a scientific document as a policy document based on primary field generated data for innovative solutions.	
	GUIDELINE TO CARRY OUT PROJECTWORK The field based learning project attempts to provide opportunities for students to understand the different socio-economic contexts and observe situations in rural, urban, sub-urban and peri-urban locales. The students is supposed to identify local, regional problems in their respective areas of subject and work under the supervision of faculty mentor to grasp the issues, challenges of the question in a scientific manner.	
Unit 1	Basic structure of society, key definitions of problem area, analysis of preliminary data.	15
Unit 2	Classroom work: Correspondence (if any) ,formats for data collection, interactions and liaising.	05
Unit 3	Field work and data collection.	20
Unit 4	Data organization, analysis and report preparation.	15
Unit 5	Feedback to community	05
Course Outcomes: Upon successful completion of the course, students will be able to: CO1: Explain the basic structure and functioning of society including social institutions and dynamics. Define and explain key terms and concepts related to social problems and community issues. Identify and analyze preliminary data to determine areas of concern within the community. Develop the ability to frame a researchable problem based on initial observations and background research. CO2: Classroom Preparation and Correspondence Learn the format and content of official correspondence required for field-based studies. Prepare data collection tools such as questionnaires, interview schedules, and observation formats. Build skills in planning and coordinating field visits, including liaising with authorities and community members. Practice drafting professional communication for institutional and community engagement. CO3: Apply data collection methods in the field through direct interaction with community members.		
Evaluation of	CA- 1)Field Dairy/Book 2) Field observation brief report SEE - 1) (PPT) Presentation 2) Project Repot 3) Viva voce	

Signature :

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