



S. Z. S. P. Mandal's
Shri Pancham Khemraj Mahavidyalaya,
Sawantwadi-416510
(Autonomous)
Affiliated to University of Mumbai



Title of the Programme Science

B.Sc. (Zoology)

1. F.Y.B.Sc.	2023-2024
2. S.Y.B.Sc.	2024-2025
3. T.Y.B.Sc.	2025-2026

Syllabus for
Semester III
and
Semester IV

Reference: GR dated 16th May 2023 for Credit structure



University of Mumbai

S. Z.S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA

SAWANTWADI

(An Autonomous College)

DIST: SINDHUDURG- 416 510, MAHARASHTRA

DEPARTMENT OF ZOOLOGY

Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Course	S. Y. B. Sc. ZOOLOGY (MAJOR COURSE)
2.	Eligibility for Admission	FY BSc
3.	Passing Marks	40%
4.	Ordinance/Regulations (if any)	-
5.	No. of Years/Semesters	Two Semesters
6	Level	UG
7	Pattern	Semester (60:40)
8	Status	Revised
9	To be implemented from Academic Year	From Academic Year 2024-2025

Date: 10/03/2024

Signature
HoD,
Dept. of Zoology

S.Z.S.P. Mandal's
Shri Pancham Khemraj Mahavidyalaya, Sawantwadi
(Autonomous)

Sr. No.	Name	Category	Designation	Signature
1	Dr.Mrs Pratiksha Pradip Sawant	12.5 (1)	HoD/Chairman	
2	Dr. Ganesh Sambhu Margaj	12.5 (2)	Member	
3	Dr. Mrs Shalaka Ramesh Walawalkar		Member	
4	Miss. Ravina Chandrashekhar Gawas		Member	
5	Miss. Saba Ibrahim Naik		Member	
6	Miss. Santoshi Naresh Naik		Member	
7	Dr. Sunil. Madhukar Gaikwad		Member	
8	Dr. Manoj Maruti Ghughuskar	12.5 (3)	Member	
			Member	
9	Dr. Surekha Manoj Gupta		Member	
		12.5 (4)	Member	
			Member	
10	Dr. Narsinh L. Thakur		Member	
			Member	
		12.5(5)		
11	Dr. Darshana Subhash Korgaonkar	12.5 (6)	Member	
12	Mr.Mangesh Suhas Mangaonkar	12.5 (7)	Member	

Sr. No.	Headings	Particulars
1	Title of the Program	Science- Zoology
2	Eligibility	H.S.C. with Science Stream
3	Duration of the Programme	1- Certificate 2- Diploma 3- Degree 4- Degree (Hons)
4	Scheme of Examination	60 External : 40 Internal Separate passing in External and Internal examination
5	Standard of Passing	40.00%
6	Programme Academic Level	4.5 Certificate 5.0 Diploma 5.5 Degree 6.0 Degree (Hon.)
7	Pattern	Semester Pattern
8	Status	New
9	To Be Implemented from the academic year	4.5 Certificate 2023-2024 5.0 Diploma 2024-2025 5.5 Degree 2025-2026 6.0 Degree(Hon.) 2026-2027



S. Z. S. P. Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA SAWANTWADI
DIST: SINDHUDURG- 416 510, MAHARASHTRA

Syllabus for Approval Programme:-

S. Y. B. Sc. Major Zoology

w.e.f. Academic Year 2024-25

PREAMBLE:

S. P. K. Mahavidyalaya, Sawantwadi (Autonomous) believes in implementing several measures to bring equity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching- learning process, examination and evaluation techniques and ensuring the all-round development of learners.

The four-year course in B.Sc. Zoology has been designed to have a progressive and innovative curriculum in order to equip our learners to face the future challenges in the field of higher education. In semesters III and IV learners are introduced to the areas of Zoology such as Wonders of animal world, Instrumentation and Biotechnology, Non-chordates and nature studies, Hygiene and common diseases.

In semesters III and IV the course content is made more rigorous by introducing the details of each of the above area like Genetics, Animal physiology, Applied Zoology, Evolution, Scientific research, Cell biology, Biomolecules, Embryology, Reproduction, Dairy industry, Sericulture, aquaculture and Pollution. In semesters V and VI, course are designed to help in specialization in the core areas of Zoology such as Taxonomy, Invertebrate Zoology, Hematology and Immunology, Histology, Toxicology, Biostatistics, Osteology, Chick embryology, Chordate animals, Enzymology, Homeostasis, endocrinology, Tissue culture, Molecular biology, Genetic engineering, Wildlife management, and Zoogeography. The practical course has been designed to help the student have a firm grip on the theoretical concepts through relevant experiments in each course.

OBJECTIVES:

- To help learners in developing a scientific attitude through the Zoology curriculum that involves basic and core areas of Zoology along with the recent scientific and technological advancements in applied areas of Zoology. To enhance knowledge of Zoology through tutorials and seminars.
- To develop practical skills in Zoology using a range of activities such as projects, experimental Zoology, study tours, Field visits, industrial and research institutes visits.

- To inculcate a research attitude by involving learners in simple research projects review of research articles/papers, participation in scientific events etc.
- To help learners in developing analytical abilities and skills so as to address real world problems
- To help learners to plan a progressive and successful career in Zoology, education and industry.

Program Outcome: After successful completion of this programme learners will be able to

- Develop the knowledge of basic concepts of different branches of science required for postgraduate studies.
- Inculcate the skills useful in science laboratories for pursuing jobs in Industries.
- Introduce learners to the concepts useful for environment protection.
- Follow interdisciplinary approach for developing scientific temperament.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits.

Program Specific Outcome: After successful completion of this programme (Zoology) learners are able to

- Develop the knowledge of basic concepts in Zoology
- Inculcate the skills useful in Zoology laboratory.
- Introduce learners to the applied Zoology needs and concepts.
- Identify, formulate and analyze scientific problems and reach concrete solutions for societal benefits using various principles of Zoology.
- Acquire & explore essential skills to succeed in various zoology fields.
- Get a hold on higher educational opportunities like post-graduation in Zoology
- Pursue higher studies in interdisciplinary areas such as biochemistry, genetics, pathology.
- Explore research areas in Zoology and related fields.

Proposed Syllabus for CBCS

S. Y. B. Sc. Major Zoology

Structure of the Course:

The structure of major courses (with codes) for Semester -III and IV for S.Y. B.Sc.
(Zoology)

NEP-2020 is given below MAJOR SUBJECTS

Semester	Course Code	Course title	No of Credits	No of Lectures In Hours
III	S201ZOT (Major)	Fundamentals of Genetics, Chromosomes and Heredity, Nucleic acids	2	30
	S202 ZOT (Major)	Study of Nutrition and Excretion , Respiration and circulation, Control and coordination, Locomotion and Reproduction	2	30
	S203 ZOT (Major)	Ethology , Parasitology, Economic Zoology	2	30
	S204ZOP (Major)	Practical's based on Paper-I & II	2	60

Shri Pancham Khemraj Mahavidyalaya, Sawantwadi(Autouomous)
Proposed Second Year Curriculum as per NEP 2020
Department of Zoology
Proposed Structure for Major / Minor/OE/VSE/SEC/VEC/IKS/VEC

Semester	Paper Code		Paper Title(Unit)	Type	Credits
III (Level 4.5)	S201ZOT (Major)	I	Fundamentals of Genetics	Theory	2
		II	Chromosomes and Heredity	Theory	
		III	Nucleic acids	Theory	
	S202ZOT (Major)	I	Study of Nutrition and Excretion	Theory	2
		II	Study Respiration and circulation	Theory	
		III	Control and coordination, Locomotion and Reproduction	Theory	
	S203ZOT (Major)	I	Ethology	Theory	2
		II	Parasitology	Theory	
		III	Economic Zoology	Theory	
	S204ZOP (Major)		Practical	Practical	
	ZOVS02 (VSC)		Experimental Zoology-III	practical	2
	S205ZOT (Minor)	I	<u>Introduction to Phylum Chordata</u>	Theory	
		II	Classes – Pisces, Amphibia,	Theory	
		III	class –Reptilia, Aves and Mammals	Theory	

	S206ZOT (Minor)	I	Zoonoses	Theory	
		II	Epidemiology	Theory	
		III	Haematology	Theory	
IV (Level 4.5)	S207ZOT (Major)	I	Origin and evolution of Life,	Theory	2
		II	Population genetics and evolution,	Theory	
		III	Scientific Attitude methodology , writing and ethics	Theory	
	S208ZOT (Major)	I	Cell Biology,		
		II	Endo membrane System		
		III	Biomolecules		
	S209ZOT (Major)	I	Comparative Embryology,		
		II	Aspects of Human Reproduction,		
		III	Pollution and its effect on Organisms Change as Reproductive Health		
	S2101ZOP (Major)		Practicals	Practical	2
	S211ZOP (VSC)		Experimental Zoology-III	practical	2
	S212ZOT (Minor)	I	Origin and evolution of insects		
		II	Generalized structure, habit and habit		
		III	Insect pest control		

	S212ZOT (Minor)	I	Endocrinology and endocrine system		
		II	Pituitary ,Pineal and Thyroid gland		
		III	Parathyroid, Pancreas and adrenal glands		

Title of the Programme – S.Y.B.Sc. Zoology

Letter Grades and Grade points

Semester GPA/Program CGPA/Semester Program	Percentage of Marks	Alpha- sign / letter grade result
9.00-10.00	90.0-100	O (Outstanding)
8.00-<9.00	80.0-90.0	A+ (Excellent)
7.00-<8.00	70.0-80.0	A (Very Good)
6.00-<7.00	60.0-70.0	B+ (Good)
5.50-<6.00	55.0-60.0	B (Above Average)
5.00-<5.50	50.0-55.0	C (Average)
4.00-<5.00	40.0-50.0	P (Pass)
Below <4.00	Below 40.0	F (Fail)
AB (absent)		Absent

SYBSC Academic Year 2024-2025
NEP Syllabus Zoology

Paper - I Fundamentals of Genetics, Chromosomes and Heredity, Nucleic acids
COURSE CODE- (S201ZOT)

Sr. No	Unit Topic	Credit	No. of lecture allotted
	Fundamentals of Genetics, Chromosomes and Heredity, Nucleicacids	02	10
	Unit 1: Fundamentals of Genetics		
	Objectives : <ul style="list-style-type: none"> <i>To Introduce basic terms of genetics</i> <i>To study Mendelian principles of inheritance and other formspattern of inheritance</i> 		
	Desired outcomes : <ul style="list-style-type: none"> <i>Understand and apply the principles of inheritance.</i> <i>Understand the concept of multiple alleles.</i> 		
1.1	Introduction to genetics Definition, scope and importance of genetics. Classical and Modern concept of Gene (Cistron, muton, recon). Brief explanation of the following terms: Allele, wild type and mutant alleles, locus, dominant and recessive traits, homozygous andheterozygous, genotype and phenotype, genome		
1.2	Mendelian Genetics Mendelian Genetics: Monohybrid cross, Dihybrid cross, test cross, back cross, Mendel's laws of Inheritance, Mendelian traits in man.		

	Exceptions to Mendelian Inheritance: Incomplete dominance, Co-dominance, Lethal alleles, Epistasis - Recessive, Double recessive, dominant and double dominant		
1.3	Multiple Alleles and Multiple Genes Concept of multiple alleles, Coat colour in rabbit, ABO and Rh blood group systems Polygenic inheritance with reference to skin colour and eye colour in man.		
	Unit: 2: Chromosomes and Heredity		
	Learning objectives: <ul style="list-style-type: none"> To familiarize the learners with the structure, types and classification of chromosomes. To introduce the concept of sex determination and its types, sex influenced and sex limited genes. 		
	Desired Outcomes: <ul style="list-style-type: none"> Learners would understand the structure and types of chromosomes. Learners would understand mechanisms of sex determination. 		
2.1	Chromosomes Types of chromosomes—Autosomes and Sex chromosomes Chromosome structure - Heterochromatin, Euchromatin Classification based on the position of centromere Endomitosis, Giant chromosomes- Polytene and Lamp brush chromosomes and significance of Balbiani rings		
2.2	Sex- determination Chromosomal Mechanisms: XX-XO, XX-XY, ZZ-ZW. Sex determination in honey bees- Haplodiploidy, Sex determination in <i>Drosophila</i> -Genic balance theory, intersex, gynandromorphs. Parthenogenesis. Role of environmental factors- Bonellia and Crocodile Barr bodies and Lyon hypothesis		
	Unit: 3 Nucleic acids	02	10
	Objectives: <ul style="list-style-type: none"> To introduce to the learners the classical experiments proving DNA as the genetic material. To make the learner understand the structure of nucleic acids and the concept of central dogma of molecular biology. 		
	Desired Outcomes: <ul style="list-style-type: none"> Learner would understand the importance of nucleic acids as genetic material 		

	<ul style="list-style-type: none"> <i>The learners would understand and appreciate the regulation of gene expressions</i> 		
3.1	Genetic material Griffith's transformation experiments, Avery-Macleod and McCarty, Hershey Chase experiment of Bacteriophage infection		
3.2	Chemical composition and structure of nucleic acids. Double helix nature of DNA, Solenoid model of DNA. Types of DNA – A, B, Z & H forms. DNA in Prokaryotes -chromosomal and plasmid. Extra nuclear DNA -mitochondria and chloroplast.		
3.3	RNA as a genetic material in viruses. Types of RNA: Structure and function		

Paper II

Study of Nutrition and Excretion , Respiration and circulation, Control and coordination, Locomotion and Reproduction
COURSE CODE- (S202ZOT)

Sr. No	Unit Topic	Credit	No. of lect. allott
	Study of Nutrition and Excretion , Respiration and circulation, Control and coordination, Locomotion and Reproduction		
	Unit: 1 Study of Nutrition and Excretion	02	10
	Objective : <ul style="list-style-type: none"> To introduce the concepts of physiology of nutrition, excretion and osmoregulation. To expose the learners to various nutritional apparatus, excretory and osmoregulatory structures in different classes of organisms. 		
	Desired Outcome : <ul style="list-style-type: none"> Learners would understand the increasing complexity of nutritional, excretory and 		

	<p>osmoregulatory physiology in evolutionary hierarchy.</p> <ul style="list-style-type: none"> Learners would be able to correlate the habit and habitat with nutritional, excretory and osmoregulatory structures 		
1.1	<ul style="list-style-type: none"> Comparative study of Nutritional Apparatus (structure and function): Amoeba, Hydra, Earthworm, Cockroach, Pigeon, Ruminants. 		
1.2	<ul style="list-style-type: none"> Comparative study of Excretory and Osmoregulatory structures and function <ol style="list-style-type: none"> Amoeba -contractile vacuoles Planaria -Flame cells Earthworm -Nephridia Cockroach-Malphigian tubules 		
1.3	Categorization of animals based on principle nitrogenous excretory products		
1.4	Structure of kidney, Uriniferous tubule		
	UNIT: 2 STUDY OF RESPIRATION AND CIRCULATION		
	<p>Objective :</p> <ul style="list-style-type: none"> To introduce the concepts of physiology of respiration and circulation To expose the learners to various respiratory and circulatory structures in different classes of organisms. 		
	<p>Desired Outcome:</p> <ul style="list-style-type: none"> Learners would understand the increasing complexity of respiratory and circulatory physiology in evolutionary hierarchy. Learners would be able to correlate the habit and habitat with respiratory and circulatory structures. 		
2.1	<p>Comparative study of Respiratory organs (structure and function)</p> <p>Earthworm, Spider, Rohu, Frog and Pigeon</p>		
2.2	Accessory respiratory structures: Anabas /Clarius		
2.3	Structure of lungs in man		
2.4	Comparative study of circulation: Open and closed - single and double .		
2.5	Types of circulating fluids- Water, coelomic fluid, haemolymph, lymph and blood.		

	UNIT: 3 CONTROL AND COORDINATION, LOCOMOTION AND REPRODUCTION		10
	<ul style="list-style-type: none"> Objective : To introduce the concepts of physiology of control and coordination and locomotion and reproduction To expose the learners to various locomotory and reproductive structures in different classes of organisms 		
	<p>Desired Outcome:</p> <ul style="list-style-type: none"> Learners would understand the process of control and coordination by nervous and endocrine regulation. Learners would be fascinated by various locomotory structures found in the animal kingdom. Learners would be acquainted with various reproductive strategies present in animals. 		
3.1	<p>Control and coordination</p> <p>Irritability –Paramoecium , Nerve net in Hydra, Nerve ring and nerve cord in earthworm</p> <p>Types of neurons on the basis of structure and function</p> <p>Endocrine regulation: Hormones as chemical messengers, feedback mechanisms</p>		
3.2	<p>Movement and Locomotion</p> <p>Locomotory organs -structures and functions</p> <ol style="list-style-type: none"> Pseudopodia in Amoeba (sol gel theory), Cilia in Paramecium Wings and legs in Cockroach Tube feet in Starfish <p>Fins of fish</p>		
3.4	Structure of Striated muscle fibre in human and Sliding filament theory		
3.5	<p>Reproduction</p> <ol style="list-style-type: none"> Asexual Reproduction- Fission, fragmentation, gemmule formation, budding Sexual reproduction <ol style="list-style-type: none"> Gametogenesis Structure of male and female gametes in human Types of fertilization Oviparity, viviparity, ovo-viviparity 		

Paper III Ethology , Parasitology, Economic Zoology
COURSE CODE- (S203ZOT)

	Unit: 1 Ethology	Credit	Allotted lecture
	Objective: <ul style="list-style-type: none"> To equip learners with a sound knowledge of how animals interact with one another and their environment. To enable the learners to understand different behavioural patterns. 		
	Desired Outcome: <ul style="list-style-type: none"> <i>Learners would gain an insight into different types of animal behaviour and their role in biological adaptations.</i> <i>Learners would be sensitized to the feelings instrumental in social behavior</i> 		
1.1	Introduction to Parasitology and types of parasites Definitions: parasitism, host, parasite, vector-biological and mechanical Types of parasites- Ectoparasites, Endoparasite and their subtypes Parasitic adaptations in Ectoparasites and Endoparasites Types of hosts: intermediate and definitive, reservoir		
1.2	Morphology, life cycle, pathogenicity, control measures and treatment Head louse (<i>Pediculus humanus capitis</i>), Mite (<i>Sarcoptes scabiei</i>).		
	Unit 3 Economic Zoology		
	Objective: <ul style="list-style-type: none"> <i>To disseminate information on economic aspects of zoology like apiculture, vermiculture, dairy science.</i> <i>To encourage young learners for self employment</i> 		
	Desired Outcome: <ul style="list-style-type: none"> <i>Learners would gain knowledge on animals useful to mankind and the means to make the most of it.</i> <i>Learners would learn the modern techniques in animal husbandry.</i> 		

	<ul style="list-style-type: none"> Learners would be pursuing entrepreneurship as careers 		
2.1	APICULTURE Methods of bee keeping and management An introduction to different species of honey bees used in apiculture. Selection of flora and bees for apiculture. Advantages and disadvantages of traditional and modern methods of apiculture. Pests and Bee enemies- Wax moth, wasp, black ants, bee eaters, king crow and disease control		
2.2	Economic importance <ul style="list-style-type: none"> Honey- Production, Chemical composition and economic importance Bees wax- Economic importance. Role of honey bees in pollination 		
2.3	<ul style="list-style-type: none"> VERMICULTURE Rearing methods, management and economic importance An introduction to different species of earthworms used in vermiculture. Methods of vermiculture. Maintenance and harvesting Economic importance: advantages of vermiculture, demands for worms; market for vermicompost and entrepreneurship 	•	•

MAJOR PRACTICAL- I

COURSE CODE- (S204ZOP)

1	Extraction and detection of DNA
2	Extraction and detection of RNA.
3	Mounting of Barr bodies.
4	Study of polytene chromosome.
5	Study of mitosis- temporary squash preparation of Onion root tip

6	Detection of blood groups and Rh factor.
7	Problems in genetics a. Monohybrid/ Dihybrid cross b. X- linked inheritance c. Multiple alleles

1	Urine analysis—Normal and abnormal constituents
2	Detection of ammonia in water excreted by fish
3	Detection of uric acid from excreta of Birds
4	Study of striated and non- striated muscle fibre
5	Study of nutritional Apparatus (Amoeba, Hydra, Earthworm, Pigeon, Ruminant stomach)
6	Study of respiratory structures: a. Gills of Bony fish and Cartilaginous fish. b. Lungs of Frog c. Lungs of Mammal. d. Accessory respiratory structure in Anabas (Labyrinthine organ) e. Air sacs of Pigeon.
7	Study of locomotory organs (<i>Amoeba</i> , <i>Unio</i> , Cockroach, Starfish, Fish, and Birds)
8	Study of hearts (Cockroach, Shark, Frog, <i>Calotes</i> , Crocodile, Mammal)
9	Study of permanent slides on topic of Reproduction a. Sponge gemmules b. Hydra budding c. T.S. of mammalian testis d. T.S. of mammalian ovary

Minor Zoology

COURSE CODE- (S205ZOT)

Paper I

Sr. No	Unit Topic	Credit	No. of lect. allotted
	Unit I -Introduction to Phylum Chorda	2	10
	Objectives – ☐ To understand the origin and advancement of higher vertebrates. ☐ To understand general characters of different groups of higher vertebrates.		

	<ul style="list-style-type: none"> To classify vertebrates and to become able to understand the possible group of vertebrates observed in nature. 		
	Outcomes - <ul style="list-style-type: none"> The students will be able to understand, classify and identify the diversity of higher vertebrates. The students will be able to understand the complexity of higher vertebrates 		
	<u>Unit- I Introduction to Phylum Chordata</u>		
1.1	Origin & Ancestry of Chordates.		
1.2	Comparative account of fundamental characters of Chordates with Non Chordates		
1.3	Salient features and classification Phylum Chordata.		
	Unit –II Classes – Pisces, Amphibia,		
2.1	Salient features of Class Pisces with examples		
2.2	Salient feature of class Amphibia with examples		
	Unit –III class –Reptilia, Aves and Mammals		
3.1	Salient features of class Reptilia with example		
3.2	Salient features of class Aves with example		
3.3	Salient features of class Mammalia with example		

MINOR – II Medical Zoology
COURSE CODE- (S207ZOT)

Sr.	Unit Topic	Cre	Lectu
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No		dit	re
	Objective ☐ To enhance learners interpretation towards the importance of zoonotic disease and complex interactions among the various animals.		
	Course outcome ☐ Learner will able to detect various zoonotic disease which man acquires from other animal species		
	Unit - I Zoonoses	02	10L
1.1	Bacterial Zoonoses -anthrax, plague, zoonotic tuberculosis		
1.2	Viral zoonoses -Ebola virus, Rabies, Zoonotic coronaviruses		
1.3	Parasitic zoonoses - oxoplasmosis, Taeniasis/ Cysticerosis complex,Leishmaniasis		
1.4	Fungal zoonoses -Dermatophytosis, Histoplasmosis, Mucormycosis		
1.5	Rickettsial zoonoses (Tick borne spotted fever, Flea borne spotted fever,Mite borne spotted fever)		
2	Unit –II Epidemiology		10L
	Objective ☐ To introduce the basic principles and methods of epidemiology and demonstrate their broad applicability in public health.		
	Course Outcome Apply basic epidemiological methods and study designs. Analyze population-based perspective to examine disease and health-related events		
2.1	Introduction to epidemiology Definition, scope, and uses of epidemiology		

2.2	Epidemiology and public health Achievements in epidemiology		
2.3	Measuring health and disease Defining health and disease Measuring disease frequency		
2.3	Using available information to measure health and disease Death rates Morbidity		
	Unit –III Hematology		10L
	Objective To enable learner to diagnose and manage blood related disorders. To correlate the abnormality in the blood parameter with internal body condition.		
	Course Outcome Differentiate Red blood cells, white blood cells and platelet. Detect various human hematological disorders		
3.1	Blood composition		
3.2	Hematopoiesis, Erythropoiesis		
3.3	Genomic approaches to hematology, Pharmacogenomics and hematological diseases. Disorder of hematopoietic cell development		
3.4	Disorder of hematopoietic cell development Acquired disorders of red blood cells, white blood cells and platelet production.		

Open Elective-III

Subject –Sericulture

Sr. No	Unit Topic	Credit	No. of lect. allott
		02	
	Objectives –		
	Outcomes -		
1	<u>Unit- I An introduction to Sericulture</u>		10 L
1.1	An introduction to Sericulture, Study of different types of silk moths, their distribution, Taxonomic position and varieties of silk produced in India : Mulberry, Tassar, Eri and Muga silk moths		
1.2	External Morphology and life cycle of Bombyx mori.		
1.3	Cultivation of mulberry a) Varieties for cultivation, b) Rain fed and irrigated mulberry cultivation- Fertilizer schedule, Pruning methods and leaf yield.		
2	Unit –II Harvesting of Malberry		10L
2.1	a) Leaf plucking, b) Branch cutting, c) Whole shoot cutting. 01 1.5 Silk worm rearing : a) Varieties for rearing, b) Rearing house, c) Rearing techniques,		
3	Unit –III Preparation of cocoons for marketing.		10 L
3.1	Post harvest processing of cocoons : a) Stiffling, sorting, storage, deflossing and riddling, b) Cocoon cooking, reeling equipment and rereeling, washing and polishing. Biotechnological and biomedical applications of silk		
3.2	Major insect pests of agricultural importance Jowar stem borer, Red cotton bug, Brinjal fruit borer, Mango stem borer, Rice weevil, Pulse beetle,		

**SEM-IV
PAPER I**

	Unit 1: Origin and Evolution of Life	Credit	Lecture
	Objective: <input type="checkbox"/> <i>To impart scientific knowledge about how life originated on our planet</i>	02	10
	Desired outcomes: <input type="checkbox"/> <i>Learner will gain insights into the origin of life.</i> <input type="checkbox"/> <i>Learner will analyse and critically view the different theories of evolution.</i>		
1.1	Introduction <input type="checkbox"/> Origin of the Universe <input type="checkbox"/> Chemical evolution - Miller-Urey experiment, Haldane and Oparin theory <input type="checkbox"/> Origin of life <input type="checkbox"/> Origin of eukaryotic cell		
1.2	Evidences in favour of organic evolution <input type="checkbox"/> Evidences from geographical distribution, palaeontology, anatomy, embryology, physiology and genetics		
1.3	Theories of organic evolution <input type="checkbox"/> Theory of Lamarck <input type="checkbox"/> Theory of Darwin and Neo- Darwinism <input type="checkbox"/> Mutation Theory		
	Unit: 2: Population Genetics and Evolution		
	Objective: <input type="checkbox"/> <i>To develop an understanding of genetic variability within a population and learn as to how the change in the gene pool leads to evolution of species</i>		
	Desired outcomes: <input type="checkbox"/> <i>Learner would understand the forces that cause evolutionary changes in natural populations</i> <input type="checkbox"/> <i>Learner would comprehend the mechanisms of speciation</i> <input type="checkbox"/> <i>Learner will be able to distinguish between microevolution, macroevolution and megaevolution</i>		
2.1	Introduction to Population genetics <input type="checkbox"/> Definition <input type="checkbox"/> Brief explanation of the following terms: Population, Gene pool, Allele frequency, Genotype frequency, Phenotype frequency, Microevolution		
2.2	Population genetics		

	<input type="checkbox"/> Hardy- Weinberg Law <input type="checkbox"/> Factors that disrupt Hardy Weinberg equilibrium: Mutation, Migration (gene flow), Non-random mating (inbreeding, inbreeding depression, assortative mating(positive and negative), disassortative mating, Genetic drift (sampling error, fixation, bottleneck effect and founder effect)		
2.3	Evolutionary genetics Geological time scale Eras and periods- Azoic Era, Archaeozoic Era, proterozoic era, Palaeozoic era- Cambrian period, Ordovician Silurian period, Devonian period, Carboniferous period, Permian period, Mesozoic era- Triassic period, Jurassic period, Cretaceous period, Coenozoic era- Tertiary period, - Palaeocene Epoch, Eocene Epoch, Oligocene Epoch, Miocene Epoch, Pliocene Epoch Quaternary period. Recent Epoch		
	Unit: 3 Scientific Attitude Methodology, Scientific Writing and Ethics in Scientific Research		10
	Objective: <input type="checkbox"/> <i>To inculcate scientific temperament in the learner</i>		
	Desired outcome: <input type="checkbox"/> <i>The learner would develop qualities such as critical thinking and analysis</i> <input type="checkbox"/> <i>The learner will imbibe the skills of scientific communication and he/she will understand the ethical aspects of research</i>		
3.1	Process of science: <input type="checkbox"/> A dynamic approach to investigation: The Scientific method, Deductive reasoning and inductive reasoning, Critical thinking, Role of chance in scientific discovery (serendipity) <input type="checkbox"/> Scientific research: Definition, difference between method and methodology, characteristics, types <input type="checkbox"/> Steps in the Scientific method: Identification of research problem, formulation of research hypothesis, testing the hypothesis using experiments or surveys, preparing research/study design including methodology and execution (appropriate controls, sample size, technically sound, free from bias, repeat experiments for consistency), documentation of data, data analysis and interpretation, results and conclusions		
3.2	Scientific writing: <input type="checkbox"/> Structure and components of a research paper: preparation of manuscript for publication of research paper- title, authors and their affiliations, abstract, keywords and abbreviations, introduction,		

	material and methods, results, discussion, conclusions, acknowledgement, bibliography; figures, tables and their legends		
3.3	Writing a review paper <input type="checkbox"/> Structure and components of review <input type="checkbox"/> Report writing and types of report <input type="checkbox"/> Computer application: Plotting of graphs, Statistical analysis of data. Internet and its application in research-Literature survey, online submission of manuscript for publication		
3.4	Plagiarism		

Paper II

	Unit 1: Cell Biology	Credit	Lecture
	Objective: <input type="checkbox"/> <i>To study the structural and functional organization of cell with an emphasis on nucleus, plasma membrane and cytoskeleton</i>	02	10
	Desired outcome: <input type="checkbox"/> <i>Learner would acquire insight into the composition of the transport mechanisms adopted by the cell and its organelles for its maintenance and composition of cell</i>		
1.1	Introduction to cell biology <input type="checkbox"/> Definition and scope <input type="checkbox"/> Cell theory <input type="checkbox"/> Generalized prokaryotic, eukaryotic cell: size, shape and structure		
1.2	Nucleus <input type="checkbox"/> Size, shape, number and position <input type="checkbox"/> Structure and functions of interphase nucleus <input type="checkbox"/> Ultrastructure of nuclear membrane and pore complex <input type="checkbox"/> Nucleolus: general organization, chemical composition & functions <input type="checkbox"/> Nuclear sap/ nuclear matrix <input type="checkbox"/> Nucleocytoplasmic interactions		
1.3	Plasma membrane <input type="checkbox"/> Fluid Mosaic Model <input type="checkbox"/> Junctional complexes		
1.4	Transport across membrane <input type="checkbox"/> Diffusion and Osmosis <input type="checkbox"/> Transport: Passive and Active <input type="checkbox"/> Endocytosis and Exocytosis		
	Unit- II		10L
	Objective: <input type="checkbox"/> <i>To acquaint the learner with ultrastructure of cell organelles and their functions</i>		
	Desired outcome:		

	<input type="checkbox"/> <i>Learner would appreciate the intricacy of endomembrane system.</i> <input type="checkbox"/> <i>Learner would understand the interlinking of endomembrane system for functioning of cell</i>		
2.1	Endoplasmic reticulum (ER): General morphology of endomembrane system, ultrastructure, types of ER and biogenesis of ER <input type="checkbox"/> Functions of Rough Endoplasmic Reticulum (RER) and Smooth Endoplasmic Reticulum (SER)		
2.2	Golgi complex: Ultrastructure of Golgi complex, functions of Golgi complex (
2.3	Lysosomes: Origin, occurrence, polymorphism and functions;		
2.4	Mitochondria: Ultrastructure, chemical composition, functions of mitochondria		
	Unit III		10L
	Objective: <input type="checkbox"/> <i>To give learner insight into the structure of biomolecules and their role in sustenance of life.</i>		
	Desired outcome: <input type="checkbox"/> <i>The learner will realize the importance of biomolecules and their clinical significance.</i>		
3.1	Biomolecules: Concept of micromolecules and macromolecules		
	Definition classification, properties and isomerism, glycosidic bond <input type="checkbox"/> Structure of Monosaccharides (glucose and fructose); Oligosaccharides (lactose and sucrose); Polysaccharides (cellulose, starch, glycogen and chitin)		
3.2	Amino Acids and Proteins: <input type="checkbox"/> Basic structure, classification of amino acids, <input type="checkbox"/> Essential and Non-essential amino acids, Peptide bond, <input type="checkbox"/> Types of proteins – Structural (collagen) and functional proteins (haemoglobin)		
3.3	Lipids: <input type="checkbox"/> Definition, classification of lipids with examples, ester linkage <input type="checkbox"/> Physical and chemical properties of lipids <input type="checkbox"/> Saturated and unsaturated fatty acids <input type="checkbox"/> Essential fatty acids; Triacylglycerols; Phospholipids (lecithin and cephalin); Steroids (cholesterol) <input type="checkbox"/> Biological role and clinical significance		

Paper-III
Comparative Embryology, Aspects of Human
Reproduction, Pollution and its effect on organisms

	UNIT 1: Comparative Embryology	Credit	Lectures
	Objective: <input type="checkbox"/> <i>To acquaint the learner with key concepts of embryology</i>	02	10 L
	Desired Outcome: <input type="checkbox"/> <i>Learner will be able to understand and compare the different types of eggs and sperms</i> <input type="checkbox"/> <i>Learner will be able to understand and compare the different pre- embryonic stages</i>		
	Types of Eggs- Based on amount and distribution of yolk		
	Structure and Types of Sperm		
	Types of Cleavages		
	Types of Blastulae		
	Types of Gastrulae		
	Coelom -Formation and types		
	UNIT 2: Aspects of Human Reproduction	Credit	Lectures
	Objectives: <input type="checkbox"/> <i>To acquaint the learners with different aspects of human reproduction.</i> <input type="checkbox"/> <i>To make them aware of the causes of infertility, techniques to overcome infertility and the concept of birth control</i>	02	10
	Desired Outcome: <input type="checkbox"/> <input type="checkbox"/> <i>Learners will able to understand human reproductive physiology</i> <input type="checkbox"/> <input type="checkbox"/> <i>Learners will become familiar with advances in ART and related ethical issues.</i>		
	Human reproductive system and hormonal regulation <input type="checkbox"/> <input type="checkbox"/> <i>Anatomy of human male and female reproductive system</i> <input type="checkbox"/> <input type="checkbox"/> <i>Hormonal regulation of reproduction and impact of age on reproduction - menopause and andropause</i>		
	Contraception & birth control <input type="checkbox"/> <input type="checkbox"/> <i>Difference between contraception and birth control</i> <input type="checkbox"/> <input type="checkbox"/> <i>Natural Methods: Abstinence, rhythm method, temperature method, cervical mucus or Billings method, coitus interruptus, lactation amenorrhea</i> <input type="checkbox"/> <input type="checkbox"/> <i>Artificial methods : Barrier methods, hormonal</i>		

	methods, intrauterine contraceptives, sterilization, termination, abortion		
	Unit 3: Reproductive Health	Credits	Lectures
	Objective: □ <i>To provide a Knowledge about infertility Invitro fertilization and reproductive technology</i>		10
	Desired Outcome: □ <i>The learners will be sensitized about the Infertiity Learners will able to understand reproductive technology</i>		
3.1	Infertility in Male: causes, diagnosis and management b. Infertility in Female: causes, diagnosis and management		
3.2	Assisted Reproductive Technology: Sperm bank. Frozen embryos. Intrauterine Transfer (IUT). Zygote Intrafallopian Tube Transfer (ZIFT) Gamete Intrafallopian Transfer (GIFT). Intracytoplasmic Sperm Injection (ICSI		
3.3	In vitro fertilization (IVF): Ovarian stimulation, Egg retrieval, Sperm retrieval, Fertilization and Embryo transfer		

Practical I

1	Study of population density by Line transect method & Quadrant method and calculate different diversity indices. a. Index of Dominance. b. Index of frequency. c. Rarity Index. d. Shannon Index. e. Index of species diversity
2	Study of Prokaryotic cells (bacteria) by Crystal violet staining technique.
3	Study of Eukaryotic cells (WBCs) from blood smear by Leishman's stain.

4	Identification and study of fossils a. Arthropods : Trilobite b. Mollusca: Ammonite c. Aves : Archaeopteryx
5	Identification of a) Allopatric speciation (Cyprinodon species) b) Sympatric speciation.(hawthorn fly and apple maggot fly) c) Parapatric speciation. (Snail)
6	Bibliography/ Abstract writing.
7	Preparation of Power point presentation

Practical II

1	Study of permeability of cell through plasma membrane (Osmosis in blood cells).
2	Measurement of cell diameter by occulometer (by using permanent slide)
3	Qualitative tests for carbohydrates (Molisch's test, Benedicts test, Barfoed's test, Anthrone test)
4	Qualitative tests for protein (Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test)
5	Qualitative test for lipids (solubility test, Sudan III test)
6	Study of rancidity of lipid by titrimetric method.
7	Ultra structure of cell organelles – (Electron micrographs) a. Nucleus b. Endoplasmic reticulum (Smooth and rough) c. Mitochondria. d. Golgi apparatus e. Lysosomes

Sem IV Minor Paper I Entomology Insect origin and Systematics

Unit I	Origin and evolution of insects	Credit	Lecture
1.1	Introduction, Origin of insects, Evolution, Evolutionary history, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous, Paleogene, Neogene, Phylogeny, Summar	02	10
1.2	Insect classification – class and upto order Introduction, Historical basis of Insect classification, Phylogeny of Arthropoda and Hexapoda, Introduction to Primitive Insects, Construction of Dichotomous key for identification		
Unit II	Generalized structure, habit and habit		
	Generalized structure, habit and habitat of the following Orders with examples Thysanura, Collembola, Isoptera,		10
	Generalized structure, habit and habitat of the following Orders with examples, Phthiraptera, Orthoptera, Heteroptera, Homoptera		
	Generalized structure, habit and habitat of the following Orders with examples Coleoptera Hymenoptera, Diptera		
Unit III	Insect Pest Control:		10
3.1	Natural Control - Introduction, Applied control, Cultural control: Agronomic practices, Crop rotation, Tillage practice, Planting/harvesting date manipulation, Sowing/plant density, Inter cropping, Trap cropping and irrigation		
3.2	Chemical control - Introduction, Formulations and Insecticide Toxicity		

	Botanical Pesticide, Pyrethrins,, Nicotine, Neem, Organochlorines, Organophosphates, Carbonates, Pyrethroids, Neonicotinoids Growth Regulators (IGR), Juvenoids, Ecdysoids, Antihormones, Chitin inhibitors,		
3.3	Biological control- Introduction, Parasites, Parasitoids, Predators, Methods for using biocontrol agents, Classical biological control, Microbial control (virus, bacteria and fungi), Behavioral control, Types of pheromones, Uses of pheromones in pest management (monitoring, mass trapping and mating disruption), Genetic and biotechnological control, Insect attractants, repellents and antifeedants, Summary		

Minor Paper II Genral Endocrinology Hormones and Disorder

		Credit	lecture
	Objective: <input type="checkbox"/> <input type="checkbox"/> To provide a Knowledge about endocrine glands their hormones functions and disorder Desired Outcome: <input type="checkbox"/> <input type="checkbox"/> Learner will be able to understand the role of hormones in physiology, pathological conditions and mportance of hormones for maintenance of good health	O2	
	Unit 1 -Endocrinology and endocrine system		10
1.1	Introduction to endocrinology and endocrine system		
1.2	Classification of hormone		
1.3	Hormones effects on behaviour and immunity		
1.4	reproductive hormones in spermatogenesis and oogenesis		
	Unit 2 Pituitary ,Pineal and Thyroid gland		10
2.1	Pituitary gland: histological structure and function Hormones and mechanism of action. Autoimmune disorder		
2.2	Pineal gland: histological structure and function Hormones and mechanism of action. Autoimmune disorder		

	Role of pineal gland in stress		
2.3	Thyroid gland: histological structure and function Hormones and mechanism of action. Autoimmune disorder		
	Unit 3 Parathyroid, Pancreas and adrenal glands		10
3.1	Parathyroid gland: histological structure and function Hormones and mechanism of action. Autoimmune disorder		
3.2	Pancreas: histological structure and function Hormones and mechanism of action Hormonal disorder		
3.3	Adrenal gland: histological structure and function Hormones and mechanism of action. Hormonal disorder		

OE Ecosystem and Natural Resources

	UNIT 1: ECOSYSTEMS	credit	Lecture
	Objectives	02	10
	Course Outcomes		
	Concept of an ecosystem , Understanding ecosystems Structure and functions of an ecosystem Producers, consumers and decomposers Energy flow in the ecosystem The water cycle The Carbon cycle The Oxygen cycle The Nitrogen cycle		
	UNIT 2: Types ECOSYSTEMS		10
	Objectives		
	Course Outcomes		
	Food chains, Food webs and Ecological pyramids Introduction, Types, Characteristic features, Structure and functions Forest ecosystem Grassland ecosystem		

	Desert ecosystem Aquatic ecosystems (ponds, lakes, streams, rivers, estuaries, oceans)		
	UNIT 3: NATURAL RESOURCES		10
	Objectives		
	Course Outcomes		
3.1	INTRODUCTION Renewable and Non-renewable Resources Non-renewable resources Renewable resources		
3.2	Forest Resources: Use and over-exploitation, deforestation Timber extraction, mining, dams and their effects on forests and tribal people		
3.3	.Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water		
3.3	Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources,		
3.5	Food Resources: World food problems, Changes in land use by agriculture and grazing, Effects of modern agriculture, Fertilizer/ pesticide problems,		

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