

JSS COLLEGE FOR WOMEN

(An Autonomous College of University of Mysore: Re-accredited by NAAC with 'A' grade of CGPA3.07)

Saraswathipuram, Mysuru-09



Revised-NEP

Bachelor of Science

Syllabus

Department of Zoology

2026-2027

Programme Outcomes

After successful completion of the Bachelor of zoology programe, students will be able to:

PO1: Scientific Knowledge and Critical Thinking-Apply Scientific principles and analytical thinking to understand, Investigate and solve problems in relevant areas of science.

PO2: Effective Communication- Communicate Scientific concepts, Experimental findings and technical information effectively through oral, written and digital media in English and any Indian language.

PO3: Use of Modern Tools and techniques- utilize modern laboratory instruments, computational tools, digital technologies and science software/platforms effectively for experimentation, data analysis and research.

PO4: Impact of Science on Society- To prepare competent human resource and to develop scientific attitude at local and global levels for social benefits.

PO5: Responsible Citizenship- Apply Scientific Knowledge for Societal development with awareness of constitution, fundamental rights and duties of citizens, public health and safety, Sustainable usage of natural resources, environmental protection and national priorities.

PO6: Ethics and Professional Responsibility- Demonstrate ethical conduct, biosafety practices, integrity and respect for diversity while working individually and collaboratively.

PO7: Communication and Leadership- Communicate scientific concepts effectively through oral, written and digital media, demonstrate leadership quality and work effectively in multidisciplinary teams.

PO8: Lifelong Learning, Innovation and Employability- Engage in lifelong learning, entrepreneurship and professional development to pursue higher education, research and careers in science and technology while contributing to national and global development.

Program Specific Outcomes

After successful completion of the Bachelor of zoology program, students will be able to:

PSO 1: To provide students with broad and balanced knowledge and Understanding of key concepts in chemistry.

PSO 2: To develop in students the ability to apply standard methodology to the solution of problems in chemistry.

PSO 3: To develop in students the ability to plan and carryout experiments independently and assess the significance of outcomes and to cater to the demands of chemical industries of well trained graduates.

PSO 4: To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible work ethics.

PSO 5: Understand fundamental concepts in plant science in the areas of reproductive biology, Taxonomy, anatomy, physiology and genetics.

PSO 6: Develop ecological awareness; understand diverse plant groups ranging from microbes to highly evolved plant groups, Angiosperms.

PSO 7: Understand plant life processes and evolutionary principles.

PSO 8: Execute experiments measuring plant growth regulators and physiological stress responses.

PSO 9: Develop proficiency in laboratory techniques, microscopy, specimen collection and identification, dissection, biological experimentation and data analysis for zoological studies.

PSO 10: Conduct scientific investigations, interpret biological data, prepare research reports and communicate scientific findings effectively through oral and written presentations.

PSO 11: Acquire skills necessary for employment and entrepreneurship in biotechnology, environmental management, wildlife conservation, fisheries, sericulture, apiculture and related life science sectors.

PSO 12: Analyze biological problems using scientific reasoning and apply appropriate methods to develop solutions related to animal biology, health and environmental issues.

FIRST Year Revised SEP Syllabus: Bsc for 2026-2027

Programme: BSC

Subject: Zoology

Semester	Course Code	Title	Theory/ Practical	Credit L:T:P	Hours /Week	CI E C1	CIE C2	SEE C3	Total Marks	Exam Duration in Hours
I	DSCIA	Animal diversity –I	3:0:0	03	03	10	10	80	100	3
		Animal diversity –I	0:0:2	02	04	05	05	40	50	3
II	DSCIB	Animal diversity –II	3:0:0	03	03	10	10	80	100	3
		Animal diversity –II	0:0:2	02	04	05	05	40	50	3
III	DSCIC	Biochemistry and physiology	3:0:0	03	03	10	10	80	100	3
		Biochemistry and physiology	0:0:2	02	04	05	05	40	50	3
IV	DSCID	Cell and developmental biology	3:0:0	03	03	10	10	80	100	3
		Cell and developmental biology	0:0:2	02	04	05	05	40	50	3
	ELECTIVE	Applied zoology	2:0:0	02	02	05	05	40	50	3
V	DSCIE-I	Genetics and animal biotechnology	3:0:0	03	03	10	10	80	100	3

Seme ster	Course Code	Title	Theory/ Practical	Credit L:T:P	Hours /Week	CI E C1	CIE C2	SEE C3	Total Mar ks	Exam Durati on in Hours
	DSCIE-I	Ethology, Evolution and Biostatistics	3:0:0	03	03	10	10	80	100	3
		Genetics and Evolution	0:0:2	02	04	05	05	40	50	3
	Compulsory paper	Skill enhancement in zoology	0:0:2	02	04	05	05	40	50	3
VI	DSICF-I	Environmental biology, wildlife management and conservation	3:0:0	03	03	10	10	80	100	3
	DSICF-II	Molecular Biology and Immunology	2:0:0	02	02	10	10	40	50	2
		Environmental biology, wildlife conservation And Molecular Biology	0:0:2	02	04	05	05	40	50	3

**Proposed Course content under Revised- New Education Policy
Year 2024- 25 for I Semester BSc Zoology**

Core Course Content

Program Name: BSC	Semester: I
Course Title: Animal diversity -I	
Course Code: DSCIA	No of credits: 03 (3:0:0)
Total Contact Hours: 48	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1 : Explain the general characters and classification of major invertebrate groups.
CO2 : Describe the morphology, anatomy, and organ systems of representative invertebrate groups through type studies.
CO3 : Analyze the diversity and comparative characteristics of non-chordate groups based on their classification and evolutionary relationships.
CO4: Apply ecological, molecular, and wildlife assessment techniques through field visits and laboratory experiments to analyze ecosystems, assess environmental quality, and promote biodiversity conservation.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	2	1	1	2	2
CO2	3	2	3	2	1	2	2	2
CO3	3	3	3	3	3	2	3	3
CO4	3	3	3	2	2	3	2	3

I SEMESTER: ZOOLOGY ANIMAL DIVERSITY- I(NON-Chordata) 3 Credits		03hr/week X 16=48hrs
Unit 1		
Biodiversity and its importance. Classification: Five kingdom concept, Biological nomenclature, Definition of a species, outlines of animal classification. Concept of Metazoa: Levels of organization - Cell, tissue, organ, organ system (Definition with examples). Protozoa: General characters and classification up to classes with examples; Locomotion (amoeboid, flagellar and ciliary - excluding theories) and reproduction (fission and conjugation) in protozoa. <i>Plasmodium</i>: Morphology, life cycle, pathogenicity and preventive measures of <i>Plasmodium vivax</i>. Porifera: General characters with classification up to classes with examples; Sponge spicules-types (microscleres in detail), Canal system (Ascon, Sycon, Leucon,) and larvae amphiblastula and parenchymula). Cnidaria: General characters and classification up to classes with examples; Polymorphism in Cnidaria:- <i>Obelia</i>, Structure of corallite, types of coral reefs, importance of corals. Acnidaria: Salient features and systematic position of Ctenophora.		16
Unit 2		
Concept of coelom: Acoelom, Pseudocoelom, Eucoelom (Definition with examples). Helminthes Platyhelminthes: General characters and classification up to classes with examples; <i>Taenia solium</i> - Life cycle, pathogenicity and preventive measures. Aschelminthes: General characters and examples; morphology, transmission, pathogenicity and preventive measures of <i>Ascaris</i>. Pathogenic helminthes: (any two examples with disease caused-<i>Ancylostoma</i> and <i>Wuchereria</i>). Parasitic adaptations in helminthes. Annelida: General characters and classification up to classes with examples. Type study: Pheretima- Morphology, setae, digestive, excretory (nephridium), nervous and reproductive system, Leech- Morphology and parasitic adaptations; Tubicolous worms- tubicolous adaptations in Nereis and chaetopterus.		16
Unit 3		
Onychophora: Salient features of <i>Peripatus</i> and systematic position of Onychophora. Arthropoda: General characters and classification up to classes with examples. Type study- Cockroach- Morphology, digestive, respiratory and nervous systems; Social organization in insects (Termite). Mollusca: General characters and classification with examples; Type study- Fresh water Mussel- morphology, digestive and nervous systems; Foot in mollusca.		16

Diversity in Molluscan shells and economic importance of Mollusca. Echinodermata: General characters and classification with examples; Type study:- Star fish-morphology and water-vascular system. Regenerative ability in invertebrates (Hydra, Planaria, Earthworm, Seaurchin) Symmetry in invertebrates.	
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Text Books

1. **R.L. Kotpal** – *Modern Textbook of Zoology: Invertebrates* (Rastogi Publications)
2. **E.L. Jordan & P.S. Verma** – *Invertebrate Zoology* (S. Chand Publications)
3. **Ruppert, Fox & Barnes** – *Invertebrate Zoology*
4. **A.J. Marshall & W.D. Williams** – *Textbook of Zoology: Invertebrates*
5. **P.S. Dhami & J.K. Dhami** – *Invertebrate Zoology*

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Activity / Field based Learning/ Project Based Learning/ / Problem Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	10
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	10
Total	20
Formative Assessment as per guidelines.	

I SEMESTER: ZOOLOGY
ANIMAL DIVERSITY - I (Non-chordate) Practical:

2 Credits

4 hrs/week x 16= 48 hrs

1. Study of Microscope (Simple and Compound).
2. Study of permanent slides of protozoa: Amoeba, Entamoeba, Polystomella, Euglena, Paramecium, Balantidium, Vorticella.
3. Porifera: Study of slides/specimens - Sycon, Spongilla, Euspongia, Sponge Gemmule, Monaxon spicules.
4. Cnidaria: Hydra, Physalia, Aurelia, Madrepora, Pennatula, Fungia.
5. Helminthes: Planaria, Fasciola, Taenia, Ascaris-male and female, Scolex of Taenia, T.S. of Taenia.
6. Annelida: Pheritima, Nereis, Chaetopterus, Aphrodite, Leech, T.S of Nereis.
7. Observation and mounting of Cnidarian colonies: Obelia, Sertularia, Bougainvillea, Campanularia, Pennaria (any two).
8. Onychophora: Peripatus. Arthropoda : Penaeus, Scolopendra, Spirostreptus, Palamnaeus, Aranea.
9. Field study: Observation of Arthropods in and around the college campus, identifying and recording in the practical record (Minimum five).
10. Study of Arthropodan pests: Periplaneta, Rhinoceros beetle.
Study of Arthropodan vectors: Mosquito and house fly.
Study of beneficial insects: Honey bee and butterfly.
11. Study and mounting of mouth parts of insects: Cockroach, Mosquito, house fly and honey bee (any two).
12. Cockroach: Study of digestive system and nervous system.
13. Earthworm: Study of digestive system and nervous system.
14. Mollusca: Chiton, Dentalium shell, Xancus shell, Aplysia, Unio, Octopus.
15. Echinodermata: Astropecten, Ophiothrix, Salmacis, Holothuria, Antedon and Pedicellaria of sea urchin.
Note: Dissection on availability of lab bred specimen

ANIMAL DIVERSITY - I (NON CHORDATA)
Scheme of Practical Examination

Duration 3 Hours

Max. Marks 40 Marks

- | | |
|---|---------|
| 1. Dissection: Flag labeling of the given display
(Cockroach: Digestive/ Nervous system.
Earth worm: Digestive/ Nervous system) | 10 M |
| 2. Mounting:
(cockroach/ Honey bee mouth part/ earth worm setae/
spicules/ coelenterate colony/ foraminiferan shells) | 5 M |
| 3. Identify the specimen/ slide A to C with reasons
(Protozoa to Echinodermata specimens/ slides) | 4x3=12M |
| 4. Identify and comment on spot D
(pest/ vector/ beneficial insects) | 3 M |
| 5. Practical record and viva | 10 M |

ANIMAL DIVERSITY - I (NON CHORDATA)

SCHEME OF VALUATION

1. Dissection and display-10M/ Flag labeling with diagram-10M
2. Mounting-04M, Identification-01M
3. Identification with classification-01M, Labeled diagram with reasons-03M
4. Identification -01M, Comments-02M
5. Record-07M, Viva-03M

**Proposed Course content under Revised- New Education Policy
Year 2024- 25 for II Semester BSc Zoology**

Core Course Content

Program Name: BSC	Semester: II
Course Title: Animal diversity -II	
Course Code: DSCIB	No of credits: 03 (3:0:0)
Total Contact Hours: 48	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1 : Explain the general characteristics and classification of vertebrates.
CO2 : Describe the morphology, anatomy, and organ systems of representative vertebrates through type studies.
CO3 : Apply the adaptations, migration patterns, and comparative anatomy of the brain, kidney, and heart among different vertebrate groups
CO4: Apply ecological, molecular, and wildlife assessment techniques through field visits and laboratory experiments to analyze ecosystems, assess environmental quality, and promote biodiversity conservation.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	2	1	1	2	2
CO2	3	2	3	2	1	2	2	2
CO3	3	2	3	3	3	2	2	3
CO4	3	3	3	3	3	3	3	3

II SEMESTER: ZOOLOGY ANIMAL DIVERSITY- II (Chordata) 3 Credits		03hr/week X 16=48hrs
Unit 1		
Chordata: General characters and classification up to classes with examples; concept of protochordata. Hemichordata: General characters, <i>Balanoglossus</i>- externals, Tornaria larva; Affinities of Hemichordata with Annelida, Echinodermata and Chordata. Cephalochordata: <i>Amphioxus</i>- externals, feeding mechanism, digestive and circulatory system. Urochordata: <i>Ascidia</i>- externals and brief description of internal morphology, larva and metamorphosis. Cyclostomata: Salient features of <i>Petromyzon</i>, Ammocoetes larva and its significance. Vertebrata: General characters and classification with examples. Pisces: General characteristics of fishes; Differences between Chondrichthyes and Osteichthyes; Type study: <i>Scoliodon</i>- Morphology, respiratory and lateral line systems; Scales in fishes, Salient features and discontinuous distribution of Dipnoi.		16
Unit 2		
Amphibia: General characters and classification up to orders, distinguishing features of living amphibians with suitable examples; Type study-Frog: Externals, digestive, respiratory. Reptilia: General characters and classification of living orders with suitable examples. Temporal fossae and arcades in reptiles and their significance; Poison apparatus, Key identification of poisonous and nonpoisonous snakes. Aves: General characters and classification up to sub classes, Distinctive features of Archaeornithes and Neornithes - Palaeognathae, Impennae and Neognathae with suitable examples; <i>Archaeopteryx</i>- evolutionary significance. Flight Adaptations in birds - morphological, anatomical and physiological; Bird migration-causes, types and advantages.		16
Unit 3		
☐ Mammalia: General characters and classification up to subclasses, Distinctive features of prototheria, metatheria and eutheria with important examples; Type study- Rabbit: Externals, digestive, respiratory. ☐ Important characters and distribution with examples - Primates, Chiroptera, Cetacea, Perissodactyla, Artiodactyla, Carnivora, Rodentia and Proboscidea, Dentition in mammals - tooth structure, types, specialization and dental formula in Carnivora (cat, dog), Rodentia (rat), Proboscidea (Elephant), Artiodactyla (Horse), Perissodactyla (Cow) and Primates (Man and Monkey). ☐ Comparative anatomy: Comparative anatomy of heart- Pisces (Shark), Amphibia (frog), Reptilia (Garden lizard), Aves (pigeon), Mammalia (man); Evolution of brain in vertebrates-brain of shark, frog, varanus, pigeon and man.		16

Text Books

1. **R.L. Kotpal** – *Modern Textbook of Zoology: Vertebrates* (Rastogi Publications)
2. **E.L. Jordan & P.S. Verma** – *Chordate Zoology* (S. Chand Publications)
3. **A.J. Marshall & W.D. Williams** – *Textbook of Zoology: Vertebrates*
4. **P.S. Dhami & J.K. Dhami** – *Chordate Zoology*
5. **Kent, G.C. & Carr, R.K.** – *Comparative Anatomy of the Vertebrates*
6. **Colbert, E.H., Morales, M. & Minkoff, E.C.** – *Colbert's Evolution of the Vertebrates*
7. **Young, J.Z.** – *The Life of Vertebrates*

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Activity / Field based Learning/ Project Based Learning/ / Problem Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	10
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	10
Total	20
Formative Assessment as per guidelines.	

II- SEMESTER: ZOOLOGY
ANIMAL DIVERSITY - II (chordate) Practical:

2 Credits
4 hrs/week x 16= 48 hrs

1. Hemichordata: *Balanoglossus*, T.S. through proboscis, collar, branchio-genital region.
Urochordata: *Ascidia*
2. Cephalochordata: *Amphioxus*, T.S. through pharynx and intestine
3. Cyclostomata: *Petromyzon*, Ammocoetes larva, *Myxine*.
4. Fishes: *Scoliodon*, *Zygaena*, *Pristis*, *Narcin*, *Trygon*, *Echeneis*, *Hippocampus*, *Anguilla*
5. Mounting: placoid, cycloid and ctenoid scales.
6. Amphibia: *Ichthyophis*, Salamander, Axolotl larva, *Rana*.
7. Reptilia: *Varanus*, *Chelone*, cobra, Viper, Krait, sea snake, Rat snake
8. Aves: Kingfisher, Parakeet, Woodpecker, Crow, Owl, Duck. Structure of a quill feather.
9. Mammalia: Rabbit, Rat, Bat, Loris.
10. Osteology: Skulls of Frog, Pigeon and Rabbit.
11. Osteology: Vertebrae (atlas, pro, amphi, and acoelous) of frog, Pigeon (atlas, heterocoelous and synsacrum) and Rabbit (atlas, axis and thoracic).
12. Osteology: Pectoral girdles and forelimb skeletons of Frog, Pigeon and Rabbit.
13. Pelvic girdles and hind-limbs of Frog, Pigeon and Rabbit.
14. Study of organ systems-Frog: Circulatory system (arterial and venous), Urinogenital system (Male and Female).
15. Study of organ systems-Rabbit: Circulatory system(arterial and venous); Urinogenital system (Male and Female).
16. Bird watching: Preparation and submission of checklist of birds in and around the college the campus/ near by places.

ANIMAL DIVERSITY - I (NON CHORDATA)
Scheme of Practical Examination

Duration 3 Hours

Max. Marks 40 Marks

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|--|---------|
| 1. Flag labeling of the given display:
(Frog: Arterial/ Venous system, Male / Female urino-genital system;/
Rabbit: Arterial/ Venous system; Male / Female urino-genital system). | 10 M |
| 2. Mounting:
(Placoid/ Ctenoid/ Cycloid Scales of fishes) | 5 M |
| 3. Identify the specimen/ slide A to C with reasons:
(Protochordata to mammalian specimens/ slides) | 3x3=09M |
| 4. Identify and comment on spot D and E:
(one Axial and one appendicular skeleton) | 3x2=6 M |
| 5. Practical Record and Viva: | 10 M |

ANIMAL DIVERSITY - I (NON CHORDATA)

SCHEME OF VALUATION

1. Flag labeling with diagram - 10M
2. Mounting - 04M, Identification - 01M
3. Identification with classification - 01M, Labeled diagram with reasons - 02M
4. Identification - 01M, Comments - 02M
5. Record - 07M, Viva - 03M

**Proposed Course content under Revised- New Education Policy
Year 2025- 26 for III Semester BSc Zoology**

Core Course Content

Program Name: BSC	Semester: III
Course Title: Biochemistry and Physiology	
Course Code: DSCIC	No of credits: 03 (3:0:0)
Total Contact Hours: 45	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO 1: Describe the structure and functions of biomolecules and enzymes.
CO 2: Explain the physiology of major organ systems and homeostasis.
CO 3: Apply biochemical and physiological principles to understand metabolism and body functions.
CO1: Apply biochemical and physiological laboratory techniques to analyze biomolecules, enzyme activities, blood, urine, and physiological parameters.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	1	1	1	1	2
CO2	3	2	1	2	2	1	1	2
CO3	3	2	3	3	3	2	2	3
CO4	3	3	3	2	3	3	3	3

III SEMESTER: ZOOLOGY BIOCHEMISTRY AND PHISOLOGY 3 Credits		03hr/week X 15=45hrs
Unit 1		
● Carbohydrates: General properties and classification. Biological importance of- Monosaccharides (glucose), Oligosaccharides (sucrose, maltose and lactose), Polysaccharides (homopolysaccharides-starch and heteropolysaccharides-heparin, glucuronic acid and hyaluronic acid). ● Proteins: General Properties of Proteins. Elementary classification of amino acids. Essential and Non-essential amino acids. Levels of organization in proteins (primary, secondary, tertiary and quaternary structure with hemoglobin as example). Biological importance of proteins. ● Lipids: Structure and Biological importance of - Saturated and Unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids and Steroids. Lipid profile in blood, LDL, VLDL and HDL. ● Enzymes: Nomenclature and classification. Properties of enzymes. Mechanism of enzyme action (induced fit theory). Clinical importance of enzymes.co-enzymes ● Nucleic acids: Biological importance of Nucleic acids – Structure of DNA (Watson and Crick model). Types of RNA and Clover leaf model of RNA. ● Vitamins: Sources, biological role and deficiency diseases of - Fat soluble (A, D, E, K) and Water soluble vitamins (B-complex and Vitamin C).		15
Unit 2		
● Homeostasis: Definition and significance of water, glucose and salt balance. ● Osmoregulation: Osmoconformers and osmoregulators. Osmoregulation in shark, marine and freshwater teleosts and terrestrial mammals (Kangaroo rat and Camel). ● Thermoregulation: Definition of ectotherm, endotherms, poikilotherms, Homeotherms and heterotherms. Physiology of temperature compensation in poikilotherms and homeotherms. A note on physiological changes during aestivation and hibernation. Causes of thermal deaths. ● Digestion: Hunger, appetite and satiety. Digestion and absorption of carbohydrates, proteins and lipids. Digestive hormones. ● Respiration: Physiology of respiration – exchange of gases; Transport of		15

oxygen, oxygen dissociation curve-Bohr's effect. Transport of carbon dioxide – chloride shift, respiratory quotient; Types of respiration-(aerobic and anaerobic)-definition with examples. Cellular respiration: Glycolysis, Kerb's cycle, oxidative phosphorylation, energy budget.	
Unit 3	
● Circulation: Introduction to circulatory system. Structure and functions of human heart, regulation of heart beat, blood pressure, mechanism of blood clotting. Blood group system ● Nitrogen Excretion: Types of nitrogen excretion- Definition with examples for ammonotelism, ureotelism, uricotelism and gaunotelism- in relation to water economy. ● Ornithine cycle. Physiology of urine formation in man (Ultra filtration, Tubular reabsorption, Tubular secretion). ● Neurophysiology: Types of neurons. Structure of multipolar neuron and neuro-synapses. Membrane potentials (resting and action), Axonic conduction and synaptic transmission of nerve impulses. ● Muscle Physiology: Types of muscles- Morphological (Striated and non-striated) and functional (voluntary and involuntary muscle). Neuro-muscular junction. Structure and mechanism of contraction and relaxation of skeletal muscle-sliding filament theory. Contractile and regulatory proteins for muscle contraction.	15

Text Books

1. Principles of Biochemistry by Lehninger.
2. Animal Physiology by M. P. Arora.
3. Chordate Zoology and Animal Physiology by Jordan and Verma.
4. Comparative Animal Physiology by William Hoar.
5. Biochemistry by Harper.
6. Biochemistry by U. Sathyanarayana.
7. Book of Physiology by Guyton.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects

Formative Assessment for Theory	
Internal Assessment C1 (Test)	10
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	10
Total	20
Formative Assessment as per guidelines.	

III- SEMESTER: ZOOLOGY
BIOCHEMISTRY AND PHISOLOGY Practical:

2 Credits
4hrs/week 4 X 15=60 Hrs.

1. Qualitative analysis of Carbohydrates. (Any five tests)
 2. Qualitative analysis of Proteins. (Any four tests)
 3. Qualitative analysis of Lipids. (Any three tests)
 4. Estimation of proteins- Biuret method.
 5. Vitamins: Sources & Effects of Fat (A, D, E & K) and Water soluble vitamins (B complex & C).
 6. Salivary amylase activity on starch
 7. Dehydrogenase activity in milk.
 8. Detection of nitrogenous excretory wastes: Ammonia, urea and uric acid.
(Ammonia- Nessler's test, Urea- Urease test and Uric acid- Follin's test).
 9. Detection of abnormal excretion of glucose, albumin and creatinine.
(Glucose- Benedict's test, albumin- Heller's ring test, Creatinine- Jaffe's test).
 10. Blood typing- A, B, AB, O and Rh factors in given human blood samples using antisera.
 11. Preparation of haematin crystals.
 12. Study of Human Heart beat using Stethoscope-Demonstration.
 13. Study of Human Blood Pressure using Sphygmomanometer-Demonstration.
 14. Study of Total RBC count-Demonstration.
 15. Study of different types of WBC-Demonstration.
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BIOCHEMISTRY AND PHYSIOLOGY
SCHEME OF PRACTICAL EXAMINATION

Time: 3 Hrs

Max. Marks: 40

- | | |
|---|-------------|
| 1. Conduct any two tests for the given biomolecule and report.
(Practical 1 to 3). | 5 Marks |
| 2. Any one major physiology experiment.
(By lots from Practical's 6 to 9). | 8 Marks |
| 3. Any one minor physiology experiment.
(By lots from Practical's 10 & 11). | 5 Marks |
| 4. Identify and comment on spots:
A (Practical's 12 & 13)
B & C (Practical 5). | 4x3=12Marks |
| 5. Practical Record and Viva. | 10 Marks |
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SCHEME OF VALUATION

1. Principle and procedure -3 Marks; Result and inference - 2 Marks.
2. Principle and procedure - 2 Marks; Experiment - 4 Marks; Comments and importance - 2 Marks.
3. Principle and procedure- 2 Marks; Experiment and importance - 3 Marks.
4. Identification -1 Mark; Comments/sources and role - 3 Marks.
5. Practical Record – 7Marks and Viva – 3 Marks.

**Proposed Course content under Revised- New Education Policy
Year 2025- 26 for IV Semester BSc Zoology**

Core Course Content

Program Name: BSC	Semester: IV
Course Title: Cell biology and Developmental biology	
Course Code: DSCID	No of credits: 03 (3:0:0)
Total Contact Hours: 45	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO 1: Describe the structure and functions of cells, cell organelles, and the cell cycle..
CO 2: Explain the mechanisms of cell division, fertilization, embryonic development, and organogenesis.
CO 3: Apply the principles of cell and developmental biology to understand growth, differentiation, and developmental regulation.
CO4: Demonstrate practical skills in cell biology, cytogenetics, and developmental biology through microscopy, chromosome analysis, and the study of cell division and embryonic development.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	1	1	1	1	2
CO2	3	2	1	2	1	1	2	2
CO3	3	2	3	2	2	2	2	3
CO4	3	3	3	2	2	3	3	3

IV SEMESTER: ZOOLOGY CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY 3 Credits		03hr/week X 15=45hrs
Unit 1		
● The Cell: Ultrastructure of an animal cell. ● Membrane system: Plasma membrane: Ultrastructure – fluid mosaic model, functions. ● Occurrence, origin, ultrastructure and functions of: Endoplasmic reticulum, Golgi complex and Lysosome (polymorphism). ● Mitochondria: Morphology, distribution, ultra structure and significance. Mitochondria as semi- autonomous organelle. ● Ribosomes: Occurrence and distribution, structure and chemical composition, dissociation and reconstitution. ● Nucleus: Ultrastructure of nucleus, nuclear membrane, nucleoplasm and chromatin fibers. ● Nucleolus: Ultrastructure and functions. ● Chromosome: Morphology , ultrastructure (nucleosome model) Giant chromosomes – Polytene and Lamp brush chromosomes-structure. Chromosomal aberrations – Aneuploidy, deletion, duplication, inversion and translocation.		15
Unit 2		
● Cell division: Cell cycle. Mitosis: mitotic stages. ● Ultrastructure of centriole. Spindle fiber and its role in chromosome movements. Mitotic inhibitors. Significance of mitosis. ● Meiosis: Meiotic stages. Synaptonemal complex, crossing over and chiasmic formation, Significance of meiosis. ● Parthenogenesis: Natural parthenogenesis – arrhenotoky, thelytoky (amictic and apomictic) and cyclical parthenogenesis with examples. Significance of parthenogenesis. ● Gametogenesis: Spermatogenesis – formation of spermatids, spermatogenesis and Oogenesis. Types of eggs – based on quantity and distribution of yolk with examples. Egg membranes. Fertilization: Details of the process of fertilization with reference to sea urchin – approach of gametes, role of fertilizin and antifertilizin, activation, penetration, reaction of the egg and amphimixis. Monospermy and polyspermy (physiological and pathological). Significance of fertilization		15
Unit 3		
● Cleavage: Planes of cleavage – meridonal, vertical, equatorial and		15

latitudinal. • Types of cleavage – holoblastic, meroblastic, radial, spiral, discoidal and superficial types with examples. • Development of frog: Structure of frog's egg, Cleavage, blastula, gastrulation and neurulation. Fate maps in blastula. • Amniotes: Development of chick - Structure of hen's egg, cleavage, blastula, gastrulation, formation of primitive streak. • Foetal Membranes: Development, structure and functions of amnion, chorion, yolk sac and allantois. • Placenta: Histological and morphological classification with examples. Placental hormones. • Human Development: Structure of mature spermatozoan, Graafian follicle. Process of ovulation, fertilization, morula, blastocyst, implantation, gastrulation.	
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Text Books

1. **P.S. Verma & V.K. Agarwal** – *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology* (S. Chand Publications)
2. **C.B. Powar** – *Cell Biology* (Himalaya Publishing House)
3. **De Robertis & De Robertis** – *Cell and Molecular Biology*
4. **Bruce Alberts et al.** – *Essential Cell Biology*
5. **Gilbert, S.F. & Barresi, M.J.F.** – *Developmental Biology*
6. **V.B. Rastogi** – *Developmental Biology*
7. **Balinsky, B.I.** – *An Introduction to Embryology*

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects

Formative Assessment for Theory	
Internal Assessment C1 (Test)	10
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	10
Total	20
Formative Assessment as per guidelines.	

ZOOLOGY: PRACTICAL - IV
CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY

Practicals Credits: 02

4 Hrs / Week X 15 = 60 Hrs.

1. Micrometry: Use of ocular and stage micrometers to measure cell and nuclear dimensions.
2. Study of mitotic stages using permanent slides of onion root tip.
3. Squash preparation of onion root tip to study stages of mitosis.
4. Study of meiotic stages using permanent slides of grasshopper testis.
5. Demonstration of squash preparation of grasshopper testis to study stages of meiosis.
6. Study of permanent slide of salivary gland chromosomes of *Drosophila*.
7. Study of permanent slide/ karyotype and ideogram of Human(Male and Female)
8. Preparation of karyotype from the given metaphase plate of *Drosophila* / Grasshopper.
9. Study of different types of eggs – Graafian follicle, frog's egg, hen's egg and insect egg.
10. Study of grasshopper, frog and mammalian sperms.
11. Frog: cleavage stages, blastula (section)
12. Frog: gastrula (yolk plug stage) and neurula (section).
13. Chick embryo: 18 and 24 hours (WM and sections).
14. Chick embryo: 36 and 48 hours (WM).
15. Study of Developmental stages in *Drosophila* – egg, larva, pupa and adult.

References

1. Comparative embryology by Huetner.
2. Cell Biology by C. B. Powar.
3. Cell Biology, Genetics, Evolution and Ecology by Jordan and Verma.
4. Cell Biology by De Robertis.
5. Developmental Biology by Scott, F. Gilbert.
6. Chordate Embryology by Verma and Agarwal.

SEMESTER - IV
CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY
SCHEME OF PRACTICAL EXAMINATION

Time: 3 Hrs.

Max. Marks: 40 Marks

1. Make a temporary squash preparation of the given material and demonstrate a stage of cell division. Write the procedure and comment on the stage with a diagram. 8 Marks
2. Prepare the karyotype of the given metaphase plate (*Drosophila* / grasshopper). **OR**
Measure the cell / nuclear diameter of the given material in the slide and report. 4 Marks
3. Identify with reasons the slides/spots:
A & B (From practical's 4, 6 & 15) 3 x 2 = 6 Marks
4. Identify and comment on the slide/spot:
C, D & E (From practical's 9 to 14) 4 x 3 = 12 Marks
5. Practical Record and Viva. 10 Marks

SCHEME OF VALUATION

1. Procedure & preparation – 5 Marks; Report with diagram - 3 Marks.
2. Allignment - 3 Marks; Definition & significance - 1 Mark.

OR

- Calibration – 2 Marks; Calculation & report - 2 Marks.
3. Identification – 1 Mark; Diagram with reason – 2 Marks.
 4. Identification – 1Mark; Diagram with comments - 3 Marks.
 6. 5. Practical Record – 7 Marks; Viva – 3 Marks

**Proposed Course content under Revised- New Education Policy
Year 2025- 26 for IV Semester BSc Zoology**

Core Course Content

Program Name: BSC	Semester: V
Course Title: APPLIED ZOOLOGY	
Course Code:	No of credits: 02 (2:0:0)
Total Contact Hours: 30	Duration of SEA/Exam: 03 Hours
Hours/Week: 02	
Formative Assessment Marks: 20	Summative Assess Marks:

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1: Explain the principles, scope, and importance of sericulture,vermiculture and apiculture as sustainable cottage industries
CO2: Describe the biology, life cycles, management practices, diseases, products, and economic importance of silkworms,vermiculture and honeybees .
CO3: Apply scientific principles and management techniques in sericulture, vermiculture and apiculture for sustainable production and rural entrepreneurship

CO PO MATRIX

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	3	1	1	1	2
CO2	3	2	3	3	1	2	2	3

**IV SEMESTER
ELECTIVE-1: APPLIED ZOOLOGY**

**Theory Credits: 02
2 x 15 = 30 Hrs.**

Unit-I. (15 Hrs.)

Sericulture: Introduction, scope and importance of Sericulture. Sericulture as a cottage industry. Morphology and life cycle of *Bombyx mori*. Diseases and preventive measures of silkworms (e.g. Protozoan, Fungal, Bacterial and Viral diseases of silkworms). Modern rearing techniques of mulberry silkworms up to cocoon stage. Non-mulberry silkworm cocoons.

Vermiculture –introduction and scope of vermiculture .morphology and reproductive system of earthworm. Different species of earthworm farming and management of vermiculture .composition of vermicompost . Difference between vermiculture and vermicompost. Benefits and importance of vermicompost and vermiwash

Unit-II. (15 Hrs.)

Apiculture: Introduction, scope and importance of apiculture. Bee keeping as a cottage industry. Honeybee species. Morphology of honeybees. Mouth parts modification for nectar collection, bee foraging. Artificial Bee rearing (Apiary) – Beekeeping equipment's. Selection of honeybee species for Apiculture. Honeybee diseases, enemies and their control and preventive measures. Products of apiculture industry and its uses (e.g. Honey, beeswax, propolis, pollen, etc.). Role of honeybees in pollination.

References

1. Applied Zoology by Pradip, V. Jabde.
2. Fundamentals of Applied Zoology by Dr. Shaheen Kurshid.
3. Applied Zoology by Saras Publications.

**Proposed Course content under Revised- New Education Policy
Year 2026- 27 for V Semester BSc Zoology**

Core Course Content

Program Name: BSC	Semester: V
Course Title: Genetics and Animal Biotechnology	
Course Code: DSCIE-I	No of credits: 03 (3:0:0)
Total Contact Hours: 48	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1: Explain the principles of genetics, heredity, and molecular genetics.
CO2: Describe gene manipulation techniques and applications of animal biotechnology.
CO3: Apply genetic and biotechnological tools in animal improvement, research, and healthcare.
CO4: Demonstrate practical skills in genetics, evolution, biostatistics, and animal adaptations through specimen identification, genetic analysis, and statistical calculations..

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	1	1	1	2	3
CO2	3	2	3	2	2	3	2	3
CO3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	2	3	3	3

V SEMESTER: ZOOLOGY PAPER-5 GENETICS AND ANIMAL BIOTECHNOLOGY 3 Credits		03hr/week X 16=48hrs
Unit 1		
Introduction to Genetics: Definition, Genotype and Phenotype, Mendel's Laws, Monohybrid and Dihybrid crosses, Back cross and Test cross. Non-Mendelian inheritance: Incomplete dominance (<i>Mirabilis jalapa</i>), Cytoplasmic inheritance (ex: Kappa particles in <i>Paramecium</i>), Maternal inheritance (ex: Shell coiling in <i>Limnaea</i>). Nature and Nurture: Definition, Experiments on <i>Drosophila melanogaster</i> , Himalayan albino rabbit and Human twins. Definition of norm of reaction, Homeostasis, Phenocopy, Penetrance and Expressivity with examples - Huntington's chorea, PTC. Interaction of genes: • Supplementary factors – 9 : 3 : 3 : 1 - comb pattern in fowls, • Epistasis – 13 : 3 - Plumage colour in Leghorn and Wyandotte, • Complementary factors – 9 : 7 - Flower colour in sweet peas. • Polygenic inheritance - Skin colour in man. • Lethal genes – Yellow coat colour in mice. • Multiple Alleles - ABO blood groups in man, Rh-factor, Pleiotropism.		16
Unit 2		
Linkage: Definition, Linkage and crossing over in <i>Drosophila</i> - 2 point test cross, Genetic maps-- Construction of genetic maps - 3 point test cross in <i>Drosophila</i> (sc ec cv). Sex linked inheritance: Sex linked inheritance in <i>Drosophila</i> (white eye colour) and man (Haemophilia and Colour blindness), Y-linked genes. Sex determination: Chromosomal basis of sex determination (XX-XY, XX-XO and ZZ-ZW). Primary and secondary Non-disjunction, Genic balance theory in <i>Drosophila</i> , Gynandromorphs and Intersexes in <i>Drosophila</i> , Klinefelter's and Turner's Syndromes in man. Environmental and hormonal effects on determination of sex in <i>Bonellia</i> , Free martin in cattle. Gene mutation: Definition, Disorders due to mutant genes in man: Brachydactyly, Sickle cell anaemia, Thalassemia. Mutagens: Physical and chemical agents, The ClB technique for detection of sex-linked recessive mutations. Inborn errors of metabolism: phenylketonuria, alkaptonuria, albinism. Human Genetics: Eugenics and Euphenics. Human genomics – meaning, advantages and disadvantages, Epigenetics.		16
Unit 3		
Animal tissue culture: Introduction, history and importance. Cell Culture		16

procedures. Recombinant DNA Technology: Introduction. Steps involved.

- **Genetic Engineering:** Nucleic acid modifying enzymes: Definitions, types (Restriction Enzymes and Ligases) and functions.
- **Animal tissue culture media:** Culture media containing naturally occurring ingredients, blood plasma, blood serum, serum-free media, tissue extracts, complex natural media, chemically defined media.
- **Gene cloning Vector:** Concept and applications of plasmids-pBR322, Lambda phage vectors, Cosmids, Production of Human Recombinant insulin, Hybridoma technology: Synthesis and applications of Monoclonal Antibodies Cloning-Sheep, Transgenic animal- Fish, Cow, Zebra fish, Bio vaccines.
- **Genetransfertechniques:** Physical, Chemical and Biological method (one from each). Gene silencing (Knock out and Knock in mouse). Gene Therapy (SCID).

References:

- B. Singh and S. K. Gautam – Textbook of Animal Biotechnology
 - K. Srivastava – Animal Biotechnology
 - Ashish S. Verma and Anchal Singh – Animal Biotechnology: Models in Discovery and Translation
 - Birbal Singh, Gorakh Mal, Sanjeev K. Gautam and Manishi Mukesh – Advances in Animal Biotechnology
 - R. Renaville and A. Burny – Biotechnology in Animal Husbandry
 - Robert H. Tamarin – Principles of Genetics
 - Peter J. Russell – iGenetics: A Molecular Approach
 - Benjamin A. Pierce – Genetics: A Conceptual Approach
 - T. A. Brown – Gene Cloning and DNA Analysis: An Introduction
 - James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick – Molecular Biology of the Gene
 - Singh & S.K. Gautam – Textbook of Animal Biotechnology
 - A.K. Srivastava – Animal Biotechnology
 - Robert H. Tamarin – Principles of Genetics
- ext Books

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects

Formative Assessment for Theory	
Internal Assessment C1 (Test)	10
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	10
Total	20
Formative Assessment as per guidelines.	

Program Name: BSC	Semester: V
Course Title: Ethology, Evolution and Biostatistics	
Course Code: DSCIE-II	No of credits: 03 (3:0:0)
Total Contact Hours: 48	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1: Explain the principles of animal behavior, evolution, and adaptation
CO2: Describe evolutionary mechanisms, animal behavioural patterns, and population genetics.
CO3: Apply basic biostatistical methods to collect analyze, and interpret biological data.
CO4: Demonstrate practical skills in genetics, evolution, biostatistics, and animal adaptations through specimen identification, genetic analysis, and statistical calculations..

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	2	1	1	2	2
CO2	3	2	2	2	2	1	2	3
CO3	3	3	3	2	2	2	2	3
CO4	3	3	3	2	2	3	3	3

V SEMESTER: ZOOLOGY PAPER- 6 ETHOLOGY, EVOLUTION AND BIOSTATISTICS 3 Credits		03hr/week X 16=48hrs
Unit 1		
Ethology- Definition of animal behavior with examples: Innate behavior - taxes, reflexes, instincts and motivation. Learned behavior- habituation, imprinting, conditioned reflexes and insight learning. Fish migration: Salmon and Eel. Bird migration: Advantages, Causes, Patterns, Mechanics and preparation for bird migration. Biological Clock: Circadian, Circannual and Circalunar rhythms. Role of pineal gland and hypothalamus in biological rhythms.		16
Unit 2		
Population genetics and Evolution: Mendelian population, gene pool and gene frequency, Hardy-Weinberg law – genetic equilibrium, Factors influencing allele frequency – natural selection, mutation, meiotic drive, migration, random genetic drift. Founder principle. Organic Evolution: Concept of Organic evolution, Lamarckism, Darwinism, Neo-Lamarckism, Neo-Darwinism, modern synthetic theory and molecular evolution. Evidences for organic evolution: Indirect evidences: From comparative morphology, and anatomy – homologous, analogous and vestigial organs. Physiology and biochemistry – enzymes, hormones, serology, amino acid sequence analysis, excretory product analysis. Embryological evidences. Connecting links (Peripatus, Neopilina, Neoceratodus, Archaeopteryx). Direct evidences from palaeontology – Nature, types of fossils, Brief account of Dinosaurs (Stegosaurus and Brontosaurus)..		16
Unit 3		
Biostatistics: Measures of central tendency: Mean, Median, Mode. Data summarizing: Frequency distribution, Graphical presentation - Line diagram, Pie diagram, Bar diagram and Histogram. Measures of dispersion: Range, Standard Deviation, Standard error, Variance. Tests of significance: F-test, t-test and Chi square test.		16

References:

- N. Tinbergen - The Study of Instinct
- John Alcock – Animal Behavior, An Evolutionary Approach
- Aubrey Manning and Marian Stamp Dawkins – An Introduction to Animal Behaviour

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Project

PRACTICAL-V

GENETICS, EVOLUTION AND BIOSTATISTICS

Credit-02

16 x 4 = 64 Hrs.

Practical Proper = 40 Marks;

Practical-IA = 10 Marks Total = 50 Marks

1. General morphology of *Drosophila* and Identification of wild (male & female).
2. Mounting of sex comb and wing of *Drosophila*.
3. Identification of different types of mutants in *Drosophila* – white eye, bar eye, sepia eye, vestigial wing and ebony body.
4. Genetic problems: Monohybrid inheritance - *Drosophila* example. Dihybrid inheritance - *Drosophila* example.
5. Complementary genes: Flower colour in sweet pea. Supplementary genes: Comb pattern in fowls. Epistasis: Plumage colour in fowls.
6. Sex linked inheritance: *Drosophila* and Man (One problems in each). Polygenes: Skin colour in [text cuts off]
7. Multiple alleles: ABO blood group in humans (Two problems)
8. Linkage: Two point test cross-two problems.
9. Calculation of allelic frequency using ABO blood group in humans
10. Calculation of allelic frequency, Tongue rolling, attached ear lobes in Humans.
11. & 12. Homologous organs: Serial homology in Crustacea – Appendages of Prawn, Forelimbs of vertebrates. Analogous organs-Wings of Bird and Butterfly, wings of Bat and Butterfly.
13. & 14. Study of aquatic adaptations – Shark and Turtle.
- Study of volant adaptations – Dragon fly, Exocoetus, Draco, Pigeon and Bat.
- Study of arboreal adaptations – Chamaeleon, Loris
15. Biostatistics problem; Mean, SD, SE, Chi Square test and t - Test (one from each).

16. Revisions

References:

- P. S. Verma and V. K. Agarwal – Genetics, Evolution and Biostatistics (Practical Manual)
- C. B. S. D. Prasad – Practical Zoology: Vertebrate and Genetics
- S. S. Lal – Practical Zoology: Invertebrates and Genetic

SCHEME OF PRACTICAL EXAMINATION

Time: 3 Hrs. | Max. marks: 40

1. Genetic problem (Monohybrid/ Dihybrid / Interaction of genes) - any one: (Sex linkage/Multiple genes/Multiple alleles) - any one: **4x2=08 Marks**
2. Identify the spot A with suitable reasons (Mutant): **03=marks**
3. Identify and comment on the evolutionary significance on the spot B (Expt. 11 & 12): **04=marks**
4. Mount the sex comb or wing (any one) of the Drosophila **03=marks**
5. Identify and comment on the adaptations of the spots C & D: **2x4=08marks**
6. Calculate the allelic frequency based on the given data/Biostatistics problem: **04=marks**
7. **Record + Viva** **7+3=marks**

SCHEME OF VALUATION FOR PRACTICAL VI

1. **Genetic problems:** 08 marks each
2. **Identification**—1 mark, **diagram**—1 mark, **explanation**—1 mark: **= 03 marks.**
3. **Identification**—1 mark, **diagram**—1 mark, **comment**—2 marks: **= 04 marks.**
4. **Mounting:** **=03 marks.**
5. **Identification**—1 mark, **adaptations**—3 marks: **2x4 = 08 marks.**
6. **Formula**—1 mark, **calculation**—2 marks, **Results**—1: **04 marks.**
7. **Record** 07 marks, **Viva** = 03 marks: **10 marks**

COMPULSORY PAPER
SKILL ENHANCEMENT IN ZOOLOGY

Course Outcomes (COs): Upon successful completion of this course, students will be able to:

CO1: Apply practical knowledge of apiculture, sericulture, and vermiculture through the identification of species, life cycles, equipment, products, diseases, and sustainable management practices..

Practical Syllabus Credits: 02
4hrs/week x 16 = 64 Hrs.

1. Morphology of honeybee and different castes of honey bee colony.
2. Different species of honey bee (*Apis dorsata*, *Apis florea*, *Apis mellifera*).
3. Mounting of mouth parts of honey bee.
4. Adulteration tests to identify pure honey (Filter paper test, Chloride test, Match stick test, Iodine test).
5. Bee hive and various beekeeping equipment's (Hive, Frame, Bee box, Honey extraction unit, Hive cutting knife).
6. Morphology and life cycle of *Bombyx mori*.
7. Identification of Mulberry and Non-mulberry silk cocoons (Mulberry, Muga, Eri, Tassar).
8. Rearing and maintenance of silkworms. Equipment - Rearing tray, Brush, Ant well, Leaf chopper, Wax sheet, Egg sheet).
9. Diseases and preventive measures of silkworms (Photographs of - Protozoan, Fungal, Bacterial and Virals).
10. Uzi fly as a pest.
11. Morphology of earthworms (e.g. *Eudrilus*, *Eisenia*, *Perionyx* species).
12. Types of vermiculture (Bin culture, Pit culture, Pot culture).
13. Basic Concepts of Vermiculture & Vermicomposting: Water holding capacity of Vermicompost.
14. Importance of Vermicompost and Vermiwash.
15. Predators of Vermicompost: Rat, mice, ants, squirrels.
16. Revisions.

References

- *Applied Zoology* by Pradip. V. Jabde
- *Fundamentals of Applied Zoology* by Dr. Shaheen Kurshid.
- *Applied Zoology* by Saras Publications

**Proposed Course content under Revised- New Education Policy
Year 2026- 27 for VI Semester BSc Zoology**

Core Course Content

Program Name: BSC	Semester: VI
Course Title: Environmental Biology ,Wildlife Managemenet and Conservation	
Course Code: DSCIF-I	No of credits: 03 (3:0:0)
Total Contact Hours: 48	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1: Explain the concepts of environmental biology, ecosystems, and biodiversity.
CO2: Describe environmental pollution, climate change, and their impacts on wildlife.
CO3: Apply wildlife management and conservation principles for sustainable biodiversity protection.
CO4: Demonstrate practical skills in ecology, environmental analysis, wildlife observation, and molecular biology through ecosystem studies, water quality assessment, specimen identification, and basic laboratory techniques

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	3	3	1	2	2
CO2	3	2	1	3	3	2	2	3
CO3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3

VI SEMESTER: ZOOLOGY PAPER-7 ENVIRONMENTAL BIOLOGY ,WILDLIFE MANAGEMENET AND CONSERVATION 3 CREDITS		03hr/week X 16=48hrs
Unit 1		
Introduction: Environmental Biology- definition. Ecological spectrum, Definitions of organisms, Environment and Biosphere. Sub- divisions of ecology-Based on Taxonomy and Habitat. Levels of Organization - Autecology and synecology with examples Ecological factors: Abiotic factors -Light, Temperature, soil and Water. Biotic factors – Interspecific and Intraspecific relationships: Positive interaction (Symbiosis) - commensalism, proto co-operation and mutualism. Negative interaction (Antagonism) – competition- Gause principle, predation, parasitism and antibiosis. Limiting factors - Liebig’s Law, Shelford’s Law and combined concept of limiting factors Biogeochemical cycles: Definition. Types-Gaseous type (Nitrogen cycle), Sedimentary type (Phosphorous cycle). Energy - Definition, Types of energy, laws of thermodynamics (I and II Laws)- and their applications. Energy flow with a diagram. Food chains: Definition, Types of food chains with examples and food webs with example. Ecological pyramids –number, biomass and energy with examples.		16
Unit 2		
Population and community ecology: -16Hrs Population ecology – Population attributes, Population density, natality and mortality; age distribution and population growth. Community ecology – communities, bioindicators Community structure – ecological determinants, ecological stratification, Ecotone and edge effect with examples. Ecological succession – General process, sere, seral stages and climax community. Ecosystems: Definition, Concept of an ecosystem. Fresh water ecosystem: Physico-chemical nature of fresh water. Lentic and lotic ecosystems. A pond as an ecosystem, Interaction between abiotic and biotic components. Marine ecosystem - Ecological characters, zonations, fauna and flora. Estuary as an ecotone. Terrestrial ecosystem - Physico-chemical nature, classification of Biomes - forest, grassland and desert (Environmental conditions, fauna and flora). Pollution: Definition and types of pollutions. Degradable and non degradable pollutants. Sources, effects and control of Air, Water, Soil and Noise pollution.		16

Unit 3	
Wildlife Conservation: Importance of wildlife, Ex-situ Conservation- Zoo, captive breeding, botanical garden and gene and sperm bank. In-situ conservation - National parks, Wildlife sanctuaries, biosphere reserve. Wildlife Protection Act 1972-Project tiger. Project Elephant. Red data book Values of wildlife, Causes and depletion of wildlife, Conservation strategies, and issues, concept of home range, wildlife corridors and territory. Animal census- tracing movement remote sensing and GIS.	16

Program Name: BSC	Semester: VI
Course Title: Molecular Biology and Immunology	
Course Code: DSCIF-II	No of credits: 03 (3:0:0)
Total Contact Hours: 48	Duration of SEA/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assess Marks: 80

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1 : Explain the principles of molecular biology gene expression, and protein synthesis.
CO2 : Explain molecular techniques ,immune responses, and the mechanisms of antigen–antibody interactions.
CO3 : Apply molecular and immunological techniques in disease diagnosis research, and biotechnology.
CO4: Demonstrate practical skills in ecology, environmental analysis, wildlife observation, and molecular biology through ecosystem studies, water quality assessment, specimen identification, and basic laboratory techniques

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	1	1	2	2
CO2	3	2	3	2	3	3	2	3
CO3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	2	3	3	3

VI SEMESTER: ZOOLOGY PAPER-8 MOLECULAR BIOLOGY AND IMMUNOLOGY 2 CREDITS		02hr/week X 16=32hrs
Unit 1		
Gene concept: Cistron, Recon and Muton, Test for allelism: Bar locus in <i>Drosophila</i> , Jumping genes (transposable elements- Maize) and Properties overlapping gene with example. Genetic code: deciphering the code, properties of genetic code,. Protein Synthesis: Transcription in prokaryotes: RNA polymerase, binding, initiation, elongation, termination. Post Transcriptional modification of mRNA-in Eukaryotes, addition of cap and tail, split genes and RNA splicing. Translation in Prokaryotes: Aminoacylation of tRNA, elongation, termination, Regulation of gene expression- Lac Operon model.		16
Unit 2		
Immune system: Introduction, Important organs of immune system-Bone marrow, Thymus, spleen, Lymph nodes, MHC molecules, Antigen, Antibody and its structure. T-Lymphocytes and B-Lymphocytes, their role in immune response. Auto immune diseases-Systemic Lupus Erythematosus, Scleroderma, Rheumatoid arthritis, Multiple sclerosis. AIDS – Structure of HIV, Causes, Symptoms, preventive measures and current status.		16

References:

- James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick – Molecular Biology of the Gene
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter – Molecular Biology of the Cell
- David P. Clark and Nanette J. Pazdernik – Molecular Biology
- Benjamin Lewin – Genes
- T. A. Brown – Gene Cloning and DNA Analysis: An Introduction
- Kuby (Thomas J. Kindt, Richard A. Goldsby and Barbara A. Osborne) – Kuby Immunology
- Ivan Roitt, Jonathan Brostoff and David Male – Immunology
- Abul K. Abbas, Andrew H. Lichtman and Shiv Pillai – Cellular and Molecular Immunology
- Ananthnarayan and Paniker – Textbook of Microbiology
- Satyanarayana U. – Biochemistry

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects

PRACTICAL-VI

ENVIRONMENTAL BIOLOGY ,WILDLIFE MANAGEMENET AND CONSERVATION

Credit-02

16 x 4 = 64 Hrs.

Practical Proper = 40 Marks;

Practical-IA = 10 MarksTotal = 50 Marks

1. Aquarium Ecosystem
2. & 3 - Study of Pond ecosystem
 - (a) Visit to a Pond to study ecological features—One visit.
 - (b) Relationships between components and processes-Biotic and Abiotic factors.
4. Collection of water samples from a sources-(Pond/River/ground water) and Record colour, pH, turbidity, temperature.
5. Estimation of Dissolved Oxygen in two water samples.
6. Estimation of free Carbon dioxide in two water samples.
7. Estimation of hardness of water.
8. Estimation of Chloride content of water.
9. Tracking of wild animals: Wild animal's pugmarks, hoof marks, pellet groups, scats, nest, antlers (Photo identification).
10. **Animal associations:**
 - Symbiosis: Mutualism – Termite &Trichonympha. (keep a Termite &Trichonympha Photo)
 - Commensalism – Echeneis& Shark.Proto co-operation – Hermit crab & Sea anemone.
11. Antagonism:-Parasitism -Head louse, Bedbug, Tick & mite. Predation- Snake and Frog.
12. Estimation of RNA by Orcinol method.
13. Isolation of DNA.
14. National park visit/Zoo/Animal RehabilitationCentre (report Submission/self-study report)

SCHEME OF PRACTICAL EXAMINATION

Time: 3 Hrs.
Max. marks: = 40

1. Comment on the interactions between abiotic & biotic components/factors in the Ecosystem setup in the laboratory/ Pond ecosystem -any one. **07 Marks.**
2. Estimate the amount of Dissolved oxygen/free carbon dioxide/Hardness/chloride Write the principle and record your comments. **07 Marks**
3. Isolation of DNA from given material / Estimation of RNA by Orcinol method. **07 Marks**
4. Identify, report on the spots **A & B, emphasising the type of association.** 2x3=**06marks**
5. Identify the spot '**C**', comment (Tracking of wild animals) **03 Marks**
6. Record + Viva **7+03=10 Marks**

SCHEME OF VALUATION FOR PRACTICAL VI

1. Ecosystem: Components (structure)-2 mark and processes (Function) -1 mark interactions (comment) -2 marks and diagram -2 marks **07 Marks.**
2. Procedure and principle-2 marks, experiment-2 marks, calculation and results, comments-3 marks **07 Marks**
3. Procedure and principle-2 marks, experiment-2 marks, Tabulation and results/ results, comments-3 marks **07 Marks**
4. Identification – 1 mark, comments – 2 marks **2x3=06 Marks**
5. Identification – 1 mark, comments – 2 marks **03 Marks**
6. Record + Viva **7+03=10Marks**

Theory Question paper pattern for Semester End examination (C3)

(Common to all semesters I to VI semester paper)

Duration: 3 Hours

Max. Marks 80 M.

I. Answer any FIVE of the following.

(1 X 5 = 05).

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

6. II. Write short notes on any FIVE of the following.

(3 X 5 = 15).

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

7. III. Write Explanatory note on any FIVE of the following.

(6X 5 = 30).

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

8. IV. Answer any THREE of the following.

(10 X3 = 30).

- 19.
- 20.
- 21.
- 22.

Theory Question paper pattern for Semester End examination (C3)
(only for elective and VI(P-8) semester paper)

Duration: 3 Hours

Max. Marks 40 M.

I. Write short notes on any FIVE of the following.

(2X 5 = 10).

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Write Explanatory note on any FIVE of the following

(6X 5 = 30)

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.