HASSAN UNIVERSITY
HASSAN

B.Sc. SYLLABUS
2026-2027 ONWARDS

SUBJECT: ZOOLOGY

28th April, 2026

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FOR
UNDERGRADUATE COURSE

B.Sc., ZOOLOGY

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5. Smt. Leelavathi, N.K. — Member
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6. Dr. Nirupama — Member
   Assistant Professor
   Department of Zoology
   Sri. Adhichunchanagiri First Grade College, Chanarayapatna

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HASSAN UNIVERSITY

Syllabus for B.Sc. (SEP Scheme) 2026-27

SUBJECT: ZOOLOGY

OVERVIEW

Semester	Code	Course title	Theory (Credits	Tutorials	Practical (Credits)	Total Credits	Marks			
							C1	C2	C3	Total
I	DSC1A	Animal diversity-I (Non Chordata)	3	0		3	10	10	80	100
		Practical – I (Non Chordata)	-	-	2	2	5	5	40	50
II	DSC1B	Animal diversity-II (Chordata)	3	0		3	10	10	80	100
		Practical – II (Chordata)	-	-	2	2	5	5	40	50
III	DSC1C	Biochemistry and Physiology	3	0		3	10	10	80	100
		Practical – III (Biochemistry, Physiology)	-	-	2	2	5	5	40	50
	Elective-1	Histology	2	0	-	2	5	5	40	50
	Elective-2	Endocrinology	2	0	-	2	5	5	40	50
IV	DSC1D	Cell and Developmental Biology	3	0		3	10	10	80	100
		Practical –IV (Cell and Developmental Biology)	-	-	2	2	5	5	40	50
	Elective 1	Applied Zoology	2	0	-	2	5	5	40	50
	Compulsory paper	Skill Enhancement in Zoology	-	-	2	2	5	5	40	50
V	DSC1E	Paper-5 Genetics and Animal Biotechnology	3	0		3	10	10	80	100
		Paper-6 Ethology, Evolution And Biostatistics	3	0		3	10	10	80	100
		Practical –V (Genetics and Evolution)	-	-	2	2	5	5	40	50
	Compulsory paper	Skill Enhancement in Zoology	-	-	2	2	5	5	40	50
VI	DSC1F	Paper-7 Environmental Biology, Wildlife Management and Conservation	3	0		3	10	10	80	100
		Paper-8 Molecular Biology And Immunology	2	-	-	2	5	5	40	50
		Practical- VI Environmental biology, wildlife conservation and Molecular Biology	-	-	2	2	5	5	40	50
	Compulsory paper	Skill Enhancement in Zoology	-	-	2	2	5	5	40	50

Theory: C1: IA Assignment for 10 Marks; C2: IA Test for 10 Marks; C3: 80 marks (3 Hrs.)

Practical: C1: Assignment/ Report for 05 Marks, C2: IA Test for 05 Marks and C3: 40 Marks (3Hrs).

SYLLABUS FOR B. Sc., COURSE
SUBJECT: ZOOLOGY

I SEMESTER: ZOOLOGY

ANIMAL DIVERSITY-I (Non-chordata)

03 Credits 03 Hrs/ Week X 16 =48 Hrs.

***Note**: Salient features should be elaborated while giving general characteristics of each group. Local examples with common and scientific names from all groups to be mentioned. Some of the examples not found in India can be included because of taxonomic/phylogenic or other significance.*

UNIT I **16 Hrs.**

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. Plasmodium: Morphology, life cycle, pathogenicity and preventive measures of *Plasmodium vivax.*

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:- Obelia,
Structure of corallite, types of coral reefs, importance of corals.
Acnidaria: Salient features and systematic position of Ctenophora.

UNIT II **16 Hrs.**

Concept of coelom: Acoelom, Pseudocoelom, Eucoelom (Definition with examples).

Helminthes

Platyhelminthes: General characters and classification up to classes with examples; *Taenia solium* - Life cycle, pathogenicity and preventive measures.

Aschelminthes: General characters and examples; morphology, transmission, pathogenicity and preventive measures of *Ascaris.*

Pathogenic helminthes; (any two examples with disease caused-*Ancyclostoma* and *Wucheraria)*.
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;

Tubiculous worms- tubiculous adaptations in *Nereis* and *chaetopterus*.

UNIT III **16 Hrs.**

Onychophora: Salient features of *Peripatus* 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. 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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I SEMESTER: ZOOLOGY

Practical: ANIMAL DIVERSITY -I (Non-chordata) 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, Balantidum, 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, Companularia, Pennaria (any two)
8. Onychophora: Peripatus. Arthropoda : Panaeus, 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, Rhinicerous 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, Dentallium 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 specimens.

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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.

II SEMESTER: ZOOLOGY

ANIMAL DIVERSITY- II (Chordata)

3 Credits **03Hrs/Week X 16 = 48Hrs.**

UNIT I **16 Hrs.**

Chordata: General characters and classification up to classes with examples; concept of protochordata.
Hemichordata: General characters, Balanoglossus- externals, Tornaria larva; Affinities of Hemichordata with Annelida, Echinodermata and Chordata.
Cephalochordata: Amphioxus- externals, feeding mechanism, digestive system.
Urochordata: Ascidia- externals and brief description of internal morphology, larva and metamorphosis.
Cyclostomata: Salient features of Petromyzon, Ammocoetes larva and its significance.
Vertebrata**:** General characters and classification with examples.
Pisces: General characteristics of fishes; Differences between Chondrichthyes and Osteichthyes; Type study: *Scoliodon*- Morophology, respiratory and lateral line systems; Scales in fishes, Salient features and discontinuous distribution of Dipnoi.

UNIT II **16 hrs**

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; *Archaeopteryx*- evolutionary significance. Flight Adaptations in birds -morphological, anatomical and physiological; Bird migration-causes, types and advantages.

UNIT III **16 Hrs.**

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 Proboscidia; Dentition in mammals – tooth structure, types, specialization and dental formula in Carnivora (cat, dog), Rodentia (rat), Proboscidia (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.

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PRACTICAL: II SEMESTER: ZOOLOGY PRACTICAL

02 Credits **4 Hrs/Week x 16= 64 Hrs.**

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

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ANIMAL DIVERSITY - II (CHORDATA)
Scheme of Examination

Duration 3 Hours Max. Marks 40 Marks

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

ANIMAL DIVERSITY - II (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.

COMPULSORY FIELD VISIT / STUDY TOUR: A study tour, accompanied by teachers should be arranged for on the spot study of the bio-diversity.

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Theory Question paper pattern for Semester End examination (C3)

(Common to all semesters I to VI semester paper)

Duration: 3 Hours **Max. Marks: 80 Marks.**

I. Answer any FIVE of the following. 1x5=05.

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

II. Write short notes on any FIVE of the following. 3x 5= 15.

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

III. Write Explanatory note on any FIVE of the following. 6x 5= 30.

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

IV. Answer any THREE of the following. 10x3=30.

19.
20.
21.
22. Write note on the following.

a) Unit I 4 M
b) Unit II 3M
c) Unit III 3M

ZOOLOGY: III SEMESTER

BIOCHEMISTRY AND PHYSIOLOGY

Theory Credits: 03 **03 Hrs/ Week x 16 = 48 Hrs.**

Unit-I **16 Hrs.**

- **Carbohydrates:** General properties and classification. Biological importance of- Monosaccharaides (glucose), Oligosaccharides (sucrose, maltose and lactose), Polysaccharides (homopolysaccharides-starch and heteropolysaccharides-heparin, glucoronic 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.
- **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).

UNIT-II. **16 Hrs.**

- **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 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-III. 16 Hrs.

- **Circulation:** Introduction to circulatory system. Structure and functions of human heart, cardiac cycle, blood pressure, composition of blood, mechanism of blood clotting.
- **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 of skeletal muscle, mechanism of muscle -sliding filament theory. Contractile and regulatory proteins for muscle contraction.

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PRACTICAL – III

BIOCHEMISTRY AND PHYSIOLOGY

Practical Credits: 02 4Hrs/Week X 16 = 64 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.

References

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.

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.

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B.Sc., III SEMESTER

ELECTIVE - 1: HISTOLOGY

Theory Credits: 03 **3 x 15 = 45 Hrs.**

Unit–I. **15 Hrs.**

- Structure of Prokaryotic and Eukaryotic cells.
- Histology of different types of cells – Epithelial cell, Muscle cell, Nerve cell, Bone cell, Fat cell, Stem cell.
- Histology and types of Epithelial and Connective tissues.

Unit-II. **15 Hrs.**

- Structure and histoarchitecture of Mammalian Intestine.
- Structure and histoarchitecture of Mammalian Liver.
- Structure and histoarchitecture of Mammalian Lungs.
- Structure and histoarchitecture of Mammalian Kidney.
- Histopathology of- Gastric ulcers, Liver cirrhosis, Fibroid lungs, Emphyzema, Kidney stones.

Unit-III. **15 Hrs.**

- Structure and histoarchitecture of Mammalian Thyroid gland.
- Structure and histoarchitecture of Mammalian Adrenal gland.
- Structure and histoarchitecture of Mammalian Pancreas.
- Structure and histoarchitecture of Mammalian Testis.
- Structure and histoarchitecture of Mammalian Ovary.
- Histopathology of Goiter, Addisson's disease, Cushing's syndrome, PCOD.

References

1. Histology by H. E. Jordan.
2. Basic Histology by J. B. Long.
3. Text Book of Histology by L. P. Gartner.

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B.Sc., III SEMESTER

ELECTIVE – 2: ENDOCRINOLOGY

Theory Credits: 03 **3 x 15 = 45 Hrs.**

Unit-I. **15 Hrs.**

- Human endocrine system**:** Concept of autocrine, paracrine, juxtacrine, exocrine and endocrine organs.
- Types of hormones. Role of hormones in homeostasis.
- Neurohormones – hypothalamic releasing and inhibitory factors and their actions.

Unit-II. **15 Hrs.**

- Gross morphology and the role of hormones of Pituitary.
- Gross morphology and the role of hormones of Thyroid.
- Gross morphology and the role of hormones of Parathyroid.
- Gross morphology and the role of hormones of Adrenal gland.
- Gross morphology and the role of hormones of Pancreas.
- Gross morphology and the role of hormones of Pineal gland.
- Deficiency diseases of hormones: Dwarfism**,** Gigantism/Acromegaly, Exophthalmic goiter, Endophthalmic goiter, *Diabetis mellitus*, *Diabetis insipidus*, Addisson's disease, Cushing's syndrome.

Unit-III. **15 Hrs.**

- Hormones of Reproduction**:** FSH, LH, Estrogen, Progesterone, Testosterone.
- Hormonal dynamics in menstrual cycle, pregnancy and parturition.
- Environmental estrogens.
- Brief account of early onset of puberty vs. Food and lifestyle in both sexes.

References

1. Text book on Endocrinology by Williams.
2. Endocrinology by Harrisson.
3. Endocrinology by Hadley.
4. Test book on Endocrinology by Gayathri Prakash.

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B.Sc., IV SEMESTER

CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY

Theory Credits: 03 **3Hrs. / Week X 15 = 45 Hrs.**

UNIT-I. **15 Hrs.**

- **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.

UNIT-II. **15 Hrs.**

- **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.

UNIT-III. **15 Hrs.**

- **Cleavage:** Planes of cleavage – meridonal, vertical, equatorial and 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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PRACTICAL - IV

CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY

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.

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References

1. Comparative embryology by Hunter.
2. Cell Biology by C. B. Powar.
3. Cell Biology, Genetics, Evolution and Ecology by Jordan and Verma.
4. Cell Biology by De Roberti's.

5. Developmental Biology by Scott, F. Gilbert.
6. Chordate Embryology by Verma and Agarwal.
7. Developmental Biology-Principles and Concepts by Arora and Grover.

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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

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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.
5. Practical Record – 7 Marks; Viva – 3 Marks.

IV SEMESTER

ELECTIVE-1: APPLIED ZOOLOGY

Theory Credits: 03 **3 Hrs./Week x 16 = 48 Hrs.**

Unit-I. **16 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. Grainage and its importance.

Unit-II. **16 Hrs.**

Vermiculture: Introduction, scope and importance of vermiculture.

Morphology and reproduction of earthworm. Different species of earthworms used in vermiculture-Exotic and Indigenous species. Farming and management of vermiculture.

Composition of vermicompost. Differences between vermiculture and vermicomposting.

Composition of vermicompost. Predators of vermicompost. Benefits and importance of vermicompost and vermiwash. Vermiculture as a cottage industry**.**

Unit-III. 16 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.

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IV SEMESTER ZOOLOGY

COMPULSORY PAPER

SKILL ENHANCEMENT IN ZOOLOGY

Practical Syllabus Credits: 02 4Hrs/Week x 15 = 60 Hrs.

Unit-I. Apiculture

1. Morphology of honeybee and different castes of honey bee colony.
2. Different species of honey bee (*Apis dorsata*, *Apis florea*, *Apis mellifera*).
3. Adulteration tests to identify pure honey (Filter paper test, Chloride test, Match stick test, Iodine test).
4. Bee hive and various beekeeping equipment's (Hive, Frame, Bee box, Honey extraction unit, Hive cutting knife).

Unit-II. Sericulture

1. Morphology and life cycle of *Bombyx* mori.
2. Identification of Mulberry and Non-mulberry silk cocoons (Mulberry, Muga, Eri, Tassar).
3. Rearing and maintenance of silkworms. Equipment's- Rearing tray, Brush, Ant well, Leaf chopper, Wax sheet, Egg sheet).
4. Diseases and preventive measures of silkworms (Photographs of -Protozoan, Fungal, Bacterial and Viral).

5. Uzi fly as a pest.

Unit-III. Vermiculture

1. Morphology of earthworms (e.g. Eudrelus, Eosinia, Perionyx species).
2. Types of vermiculture (Bin culture, Pit culture, Pot culture).
3. Basic Concepts of Vermiculture & Vermicomposting: Water holding capacity of vermicompost.
4. Importance of vermicompost and vermiwash.
5. Predators of vermicompost: Rat, mice, ants, squirrels.

References

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

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IV SEMESTER

SKILL ENHANCEMENT IN ZOOLOGY

SCHEME FOR PRACTICAL EXAMINATION

1. Mount the mouthparts of honey bee. 5 Marks.
2. Identify the spot '**A'** and '**B'** and comment. (From practical's 4 & 7). 5 x 2 = 10Marks
3. Conduct any two tests to identify pure honey. (From practical 3). 5 x 2 = 10 Marks
4. Identify the spots '**C'** and '**D'** giving reasons. (From practical's 6 & 10). 5 x 2 = 10 Marks
5. Practical Record and Viva. 10Marks

SCHEME FOR VALUATION

1. Mounting. 5 Marks.
2. Identification -1Mark; Comments – 4 Marks.
3. Principle and procedure - 3Marks; Result and inference - 2Marks.
4. Identification with diagram – 2 Marks; Reasons - 3Marks.
5. Practical Record -7 Marks; Viva – 3 Marks.

B.Sc. V SEMESTER

PAPER V- GENETICS AND ANIMAL BIOTECHNOLOGY

Credits: 03 **3Hrs/ Week X 16 = 48 Hours**

UNIT I **16Hrs.**

Introduction to Genetics: Definition- Genotype and Phenotype, **Mendel's Laws,** Monohybrid and Dihybrid crosses, Back cross and Test cross.

Non-Mendelian inheritance: Incomplete dominance (*Mirabilis jalapa*), Cytoplasmic inheritance (ex: Kappa particles in *Paramecium*), Maternal inheritance (ex: Shell coiling in *Limnaea*).

Nature and Nurture: Definition. Experiments on *Potentillaglandulosa*, 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.

UNIT II **16Hrs.**

Linkage:: Definition**,** Linkage and crossing over in *Drosophila* -2 point test cross. Genetic maps-- Construction of genetic maps -3 point test cross in *Drosophila* (scec cv).

Sex linked inheritance: Sex linked inheritance in Drosophila (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 *Drosophila*. Gynandromorphs and Intersexes in *Drosophila,*Klinefelter's and Turner's Syndromes in man.Environmental and hormonal effects on determination of sex in *Bonellia*, 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, alkaptoneuria, albinism.

Human Genetics: Eugenics and Euphenics. Human genomics – meaning, advantages and disadvantages. Epigenetics.

Unit III 16Hrs

Animal tissue culture: Introduction, historyand importance.Cell Culture 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, Lamda 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,
Gene transfer techniques-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

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B.Sc., V –SEMESTER

PAPER VI- ETHOLOGY, EVOLUTIONAND BIOSTATISTICS

Credit=03 **03Hrs/ Week X 16= 48 Hrs**

Unit I **16Hrs.**

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**:** Salmonand 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.

Unit II **16Hrs.**

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; Fromcomparative 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).

Unit III. **16Hrs.**

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.

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
- Robert Trivers – Social Evolution.
- Charles Darwin – On the Origin of Species
- Douglas J. Futuyma and Mark Kirkpatrick – Evolution

- Monroe W. Strickberger – Evolution
- P. S. Verma and V. K. Agarwal – Biostatistics, Genetics and Evolution
- Jerrold H. Zar – Biostatistical Analysis
- Wayne W. Daniel and Chad L. Cross – Biostatistics: A Foundation for Analysis in the Health Sciences.

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B.Sc., V Semester

PRACTICAL: 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 (Oneproblems in each).Polygenes: Skin colour in Man.
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. **Homologous organs**: Serial homology in Crustacean – Appendages of Prawn, Forelimbs of vertebrates.
12. **Analogous organs**-Wings of Bird and Butterfly, wings of Bat and Butterfly.
13. Study of evolution of aquatic adaptations – Shark and Turtle.
14. Study of evolution of volant adaptations – Dragon fly, Exocoetus, Draco, Pigeon and Bat. Study of arboreal adaptations – Chamaeleon. Loris
15. Biostatics problem; Mean, SD, SE, Chi Square test and t- Test, Histogram/Bar diagram (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 Genetics
- Douglas J. Futuyma and Mark Kirkpatrick – Evolution
- Jerrold H. Zar – Biostatistical Analysis.

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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 =08Marks**
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 evolution of adaptations of the spots **C & D 2x4 = 08 Marks**
6. Calculate the allelic frequency based on the given data/Biostatics problem **04 Marks**
7. Record +Viva **07+03 Marks**

SCHEME OF VALUATION FOR PRACTICAL VI

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

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B.Sc., V Semester

COMPULSORY PAPER

SKILL ENHANCEMENT IN ZOOLOGY

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 (*Apisdorsata*, *Apisflorea*, *Apismellifera*).
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's- Rearing tray, Brush, Ant well, Leaf chopper, Wax sheet, Egg sheet).
9. Diseases and preventive measures of silkworms (Photographs of -Protozoan, Fungal, Bacterial and Viral).
10. Uzi fly as a pest.
11. Morphology of earthworms (e.g. Eudrelus, Eisinia, 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. Revsions

References

- Applied Zoology by Pradip, V. Jabde.
- Fundamentals of Applied Zoology by Dr. ShaheenKurshid.
- Applied Zoology by Saras Publications.

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B.Sc., V SEMESTER

SKILL ENHANCEMENT IN ZOOLOGY

Time: 3 Hrs. **Max. Marks: 40**

SCHEME FOR PRACTICAL EXAMINATION

1. Mount and comment the mouthparts of honey bee/ Calculate the water holding capacity of given sample 06 Marks.
2. Identify the spot '**A'** and '**B'** and comment. (From practical's 4 & 7). 4 x 2 = 08 Marks
3. Conduct any two tests to identify pure honey. (From practical 3). 4 x 2 = 08 Marks
4. Identify the spots '**C'** and '**D'** giving reasons. (From practical's 6 & 10). 4 x 2 = 08 Marks
5. Practical Record. 10Marks

SCHEME FOR VALUATION

1. Mounting- 04 marks , comment-02 marks/ Procedure 02 marks,
2. Experiment-02 marks and calculation 2 Marks.
3. Identification -1Mark; Comments – 3 Marks.
4. Principle and procedure –2 Marks; Result and inference - 2Marks.
5. Identification with diagram – 2 Marks; Reasons - 2Marks.
6. Practical Record -10 Marks.

B.Sc., VI SEMESTER

PAPER VII: ENVIRONMENTAL BIOLOGY, WILDLIFE MANAGEMENT AND CONSERVATION

Credits: 03 **3Hrs/ Week X16= 48 hours**

Theory IA= 20 marks Theory Exam= 80 marks Total = 100 Marks

UNIT I **16Hrs**

Introduction: Environmental Biology- definition.

Ecological spectrum, Definition and scope of ecology, 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.

UNIT II 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.

UNIT III **16 Hrs**

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.

References:

- P. S. Verma and V. K. Agarwal – Environmental Biology
- S. C. Santra – Environmental Science
- ErachBharucha – Textbook of Environmental Studies
- S. K. Agarwal – Environmental Biology
- Rajesh Gopal – Fundamentals of Wildlife Management
- VidyaSagar – Wildlife Ecology and Management
- Richard B. Primack – Essentials of Conservation Biology
- Michael J. Groom, Gary K. Meffe and C. Ronald Carroll – Principles of Conservation Biology
- George B. Schaller – Wildlife of the World.

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B.Sc., VI –SEMESTER

PAPER VIII: MOLECULAR BIOLOGY AND IMMUNOLOGY

Credit=02 **02Hrs/ Week X 16 = 32 Hrs.**

Theory Exam= 40 Marks; Theory IA= 10 Marks; Total = 50 Marks

UNIT I **16 Hrs**

Gene concept: Cistron, Recon and Muton, Test for allelism: Bar locus in *Drosophila*, 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.

Translationin Prokaryotes: Aminoacylation of tRNA, elongation, termination, Regulation of gene expression- Lac Operon model.

UNIT II **16 Hrs**

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, Sedormidpurpura, Rheumatoid arthritis, Multiple sclerosis. AIDS – Structure of HIV, Causes, Symptoms, preventive measures and current status.

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

B.Sc., VI Semester

PRACTICAL – VI: ENVIRONMENTAL BIOLOGY, WILDLIFE CONSERVATION AND MOLECULAR BIOLOGY

Credits: 02 **16 X 4= 64 Hrs.**

Practical Proper =40 Marks; Practical-IA = 10 Marks Total = 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 & 11 Animal associations:
Symbiosis: Mutualism – Termite &Trichonympha. (Keep a Termite & Trichonympha Photo) Commensalism – Echeneis & Shark. Proto co-operation – Hermit crab & Sea anemone.

12. Antagonism:-Parasitism -Head louse, Bedbug, Tick & mite.
Predation- Snake and Frog.
13. Estimation of RNA by Orcinol method.
14. Isolation of DNA**.**
15. National park visit/Zoo/Animal Rehabilitation Centre (report Submission/self-study report)

References:

- P. S. Verma and V. K. Agarwal – Practical Zoology
- S. S. Lal – Practical Zoology
- S. C. Santra – Environmental Science: Practical and Field Methods
- Rajesh Gopal – Fundamentals of Wildlife Management
- Keith Wilson and John Walker – Principles and Techniques of Biochemistry and Molecular Biology
- Benjamin Lewin – Genes.

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B.Sc., VI Semester

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, emphasizing** 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**

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VI SEMESTER ZOOLOGY COMPULSORY PAPER

Credits: 02 SKILL ENHANCEMENT IN ZOOLOGY

Practical Syllabus **4Hrs/Week x 16 = 64Hrs**

1. Morphology of honeybee and different castes of honey bee colony.
2. Different species of honey bee (*Apisdorsata*, *Apisflorea*, *Apismellifera*).
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's- Rearing tray, Brush, Ant well, Leaf chopper, Wax sheet, Egg sheet).
9. Diseases and preventive measures of silkworms (Photographs of -Protozoan, Fungal, Bacterial and Viral).
10. Uzi fly as a pest.
11. Morphology of earthworms (e.g. Eudrelus, Eosinia, 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. ShaheenKurshid.
- Applied Zoology by Saras Publications.

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B.Sc., VI SEMESTER

SKILL ENHANCEMENT IN ZOOLOGY

Time: 3 Hrs. **Max. Marks: =40**

SCHEME FOR PRACTICAL EXAMINATION

1. Mount and comment the mouthparts of honey bee/ Calculate the water holding capacity of given sample. 06 Marks
2. Identify the spot '**A'** and '**B'** and comment. (From practical's 4 & 7). 4 x 2 = 08 Marks
3. Conduct any two tests to identify pure honey. (From practical 3). 4 x 2 = 08 Marks
4. Identify the spots '**C'** and '**D'** giving reasons. (From practical's 6 & 10). 4 x 2 = 08 Marks
5. Practical Record. 10Marks

SCHEME FOR VALUATION

1. Mounting- 04 marks, comment-02 marks/ Procedure 02 marks
2. Experiment-02 marks and calculation 2 Marks.
3. Identification -1Mark; Comments – 3 Marks.
4. Principle and procedure –2 Marks; Result and inference - 2Marks.
5. Identification with diagram – 2 Marks; Reasons - 2Marks.
6. Practical Record -10 Marks.

Note: Students should study the SEC Practical in either IV/ V/V

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