RAFFLES UNIVERSITY

SCHOOL OF BASIC AND APPLIED SCIENCES
Department of Zoology
(Syllabus and Scheme of Studies w. e. f. 2022-25 onwards)
B. Sc. I Year (I Semester)

Schedule per week Lectures: 3
Examination Time: 3 Hrs **Maximum Marks: 50(20+30)**
Subject: Life and Diversity from Protozoa to Helminthes **Paper Code: ZOO-101**

Note: *Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words).* Answer to each part should not exceed 20 words. *Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1 - Phylum- Protozoa

(1) General characters and classification upto order level
(2) Biodiversity and economic importance of Protozoa
(3) Parasitic Protozoans: Life history, mode of infection and pathogenicity of *Entamoeba,Plasmodium, Trypanosoma, Leishmania* and *Giardia*

UNIT 2 - Phylum- Porifera

(1) General characters and classification up to order level
(2) Biodiversity and economic importance of Porifera
(3) Type study - *Sycon*
(4) Canal system in sponges
(5) Spicules in sponges

UNIT 3 - Phylum - Coelenterata

(1) General characters and classification up to order level
(2) Biodiversity, economic importance
(3) Type Study - *Obelia*
(4) Corals and coral reefs
(5) Polymorphism in Siphonophores

UNIT 4 - Helminths

(1) General characters and classification of Platyhelminthes
(2) General characters and classification of Aschelminthes
(3) Type study - *Fasciola hepatica* and *Ascaris*
(4) Helminths parasites: Brief account of life history, mode of infection and pathogenicity of *Schistosoma, Taenia, Ancylostoma, Trichinella, Wuchereria* and *Oxyuris*
(5) Parasitic adaptations

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Schedule per week Lectures: 3

Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**
Subject : Cell biology **Paper Code: ZOO-103**

Note: *Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words).* Answer to each part should not exceed 20 words. *Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1

1. Ultrastructure of different cell organelles of animal cell
2. Plasma Membrane: Fluid mosaic model, various modes of transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis.
3. Goigi complex: Structure, Associated enzymes and role of golgi-complex in animal cell

UNIT 2

1. Endoplasmic reticulum (ER): types, role of ER in protein synthesis and transportation in animal cell
2. Ribosomes: Types, biogenesis and role in protein synthesis.
3. Lysosomes: Structure, enzyme and their role; polymorphism

UNIT 3

1. Mitochondria: Mitochondrial DNA; as semiautonomous body, biogenesis, mitochondrial enzymes (only names), role of mitochondria
2. Cytoskeleton: Microtubules, microfilaments, centriole and basal body. Cilia and Flagella
3. Nucleus: Nuclear· membrane, nuclear lamina, nucleolus, fine structure of chromosomes, nucleosome concept and role of histones, euchromatin and heterochromatin, lampbrush and polytene chromosomes

UNIT 4

1. Mitosis and Meiosis (Cell reproduction).
2. Brief account of causes of cancer.
3. Microscopy: General principles of light, florescent and electron microscope.
4. Centrifugation techniques.

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B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time : 4 Hrs **Maximum Marks: 50(20+30)**
Subject :Zoology Lab-I **Paper Code : ZOO-105**

(A) Classification up to orders with ecological note and economic importance ofthe following animal:

Protozoa : Lamination of cultures of *Amoeba, Euglena* and *Paramecium;* Permanent prepared slides: *Amoeba, Euglena, Trypanosoma,Noctiluca, Eimeria, Paramecium* (binary fission and conjugation), *Opalina, Verticella, Balantidium, Nyctotherus,* radiolarian andformaniferan ooze. Parazoa (Porifera): Specimens: Sycon. *Grantia, Euplectella, Hyalonema, Spongilla,Euspongia* Coelenterata : Specimens: *Porpita, Valella, Physalia, Aurelia, Rhyzostoma,Metridium, Millipora, Alcyonium, Tubipora, Zoanthus, Madrepora, Favia, Fungia,* and *Astrea,*Permanent prepared slides: *Hydra* (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Sertularia, Plumularia, Tubularia, and Bougainvillea, Aurelia* (sense organs and stages of lifehistory) Platyhelminthes : Specimens: *Dugesia, Fasciola, Taenia, Echinococus,* Permannt prepared slides: *Miracidium, sporocyst, redia, cercaria,scolex* and *proglotttids; Taenia* (mature and gravid) Aschelminthes : Specimens: *Ascaris* (male & female), *Trichinella, Ancylostoma, Meloidogyne.*

(B) Study of the following permanent stained preparations:
L.S. and TS.*Sycon;*gemmules, spicules and sponging fibres of*Sycon,*canalsystem of sponges, TS. *Hydra* (testis and ovary region). T.S. *Fasciola* (different regions). T.S. *Ascaris* (male and female). Temporary preparation of *Volvox, Paramecium,* Gemmules and spicules of *Sycon,* Preparation of permanent stained whole mounts of *Hydra, Obelia, Sertularia,Plumularia* and *Bougainvillea,* Pathogenic protozoans: Plasmodium, Giardia or as available, Pathogenic Helminthes: Ancylostma; Wuchereria or as available

(C) Cell biology and Genetics:
Cell division: Prepared slides of stages of mitosis and meiosis,Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain, Salivary gland and polytene chromosomes of *Drosophila*/*Chironomus,* Exercise based on mendel's law

(E) Project:

1. Parasitic adaptations (Protozoa to helminthes)
2. DNA: types, structure and its model preparation
3. Survey: Diversity of particular family/taxa in your surrounding area
4. Microscopy: principles and its significance
5. Staining techniques and their significance

Suggested readings

1. Barnes, RD. Invertebrate zoology. WG Saunders, Philadelphia.
2. P S Verma, E L Jordan. Invertebrate Zoology 25th Edition, 2001. S. Chand Publications, New Delhi.
3. Stephen A. Miller, John B. Harley, Zoology, 6th Edition 2005The McGraw-Hill Companies.
4. D. T. Anderson .Invertebrate Zoology. Second Edition, 1999 Oxford University Press

5. E. D. De Robertis,1987. Cell and Molecular Biology 8th Edition. Lippincott Williams & Wilkins
6. Benjamin A. Pierce. Genetics: A Conceptual Approach, 2014. W.H.Freeman & Co Ltd;
7. Janet Moore. An Introduction to the Invertebrates.2006. Cambridge University Press
8. Ahluwalia KB. Genetics. Wiley Eastern Ltd., New Delhi.
9. Jonathan, Slack. Genes. Oxford University Press, New Delhi.

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Department of Zoology
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B. Sc. I Year (II Semester)

Schedule per week Lectures: 3

Examination Time: 3 Hrs **Maximum Marks: 50(20+30)**
Subject : Life and Diversity of Annelida to Hemichordata **Paper Code : ZOO-102**

Note: *Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words).* Answer to each part should not exceed 20 words. *Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1- Phylum – Annelida

1. General characters and classification up to order level
2. Biodiversity and economic importance of Annelida
3. Type study - *Pheretima* (Earthworm)
4. Metamerism in Annelida
5. Trochophore larva:. Affinities, evolutionary significance

UNIT 2 - Phylum - Arthropoda

1. General characters and classification up to order level
2. Biodiversity and economic importance of insects
3. Type study – *Periplaneta*

UNIT 3- Phylum – Mollusca

1. General characters and classification up to order level
2. Biodiversity and economic importance
3. Type study - *Pila*
4. Torsion and detorsion in gastropoda
5. Respiration and foot

UNIT 4- Phylum - Echinodermata

1. General characters and classification up to order level
2. Biodiversity and economic importance
3. Type Study -*Asteries* (Sea Star)
4. Echinoderm larvae
5. Aristotle's Lantern

Phylum – Hemichordata

1. General characters and classification, Type study: *Balanoglossus*

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B. Sc. I Year (II Semester)

Schedule per week Lectures: 3
Examination Time : 3 Hrs Maximum Marks: 50(20+30)
Subject : Developmental Biology Paper Code : ZOO-104

Note: *Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark. Further examiner will be set two questions from each unit and the students will be required to attempt one question fromeach unit which will be of 6 marks each.*

UNIT 1

1. History and basic concepts : Historical review
2. Experimental Developmental Biology: Epigenesis, preformation, mosaic and regulativedevelopment
3. Branches and Significance of Developmental Biology

UNIT 2

1. Generalized structure of mammalian ovum & sperm, spermatogenesis and Oogenesis, different types of eggs, egg membranes.
2. Fertilization, parthenogenesis, changes in gametes, monospermy and polyspermy, planes and and patterns of cleavage.
3. Late Embryonic development: fate of germ layers, extra-embryonic membranes, implantation of embryo in humans, placenta structure, types and functions of placenta.

UNIT 3

1. Process of blastulation and fate-map construction in frog and chick.
2. Gastrulation in frog and chick upto the formation of three germinal layers.
3. Embryonic Induction (Primary organizers): Experimental evidences and characteristics, Neural Induction, role of grey crescent in neural induction, Regional specificity of primary inductor (organisers), Embryonic induction in different chordates
4. Chemical and genetic basis of neural induction

UNIT 4

1. Concepts of competence, determination and differentiation.
2. Repair and Regeneration: Concept, Degree of regenerative ability in non-chordates and chordates, categories and mechanism of regeneration, control of regeneration, factors affecting regeneration, physiological processes involved in regeneration.

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B. Sc. I Year (II Semester)

Subject : Zoology Lab-II **Paper Code : ZOO-106**

(A) Classification up to orders with ecological note and economic importance of the following group of animals:

1. Annelida Specimens: Pheretima, Heteronereis, Aphrodite, Chaetopterus, Arenicola, Tubifex and Pontobdella.
2. Arthropoda Specimens: Peripatus, Palaemon (Prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Poecilocerus (ak-hopper), Gryllus (cricket), Mantis (praying mantis),Cicada, Forticula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (honeybee), Bombyx (silk moth), Cimex (begbug), Pediculus (body louse). Millipedes, Scolopendra (centipedes), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab).
3. Mollusca Specimens: Mytilus, Ostrea, Cardium, Pholas, Solen (razor fish), Pecten, Holiotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium.
4. Echinodermata Specimens: Asterias, Echinus, Cucumara, Ophiothrix, Antedon and Asterophyton.
5. Hemichordata: Balanoglossus

(B) Study of the following permanent stained preparations:

1. T.S. Pheretima (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of Pheretima.
2. Trachea and mouthpmts of cockroach.
3. Statocyst of Palaemon.
4. Glochidium larva of Anodonta; radula and osphradium of Pila.
5. T.S. Star fish (arm)
6. T.S. Balanoglossus (through various regions)

(C) Demonstration by C. D.:

1. Mouth parts and trachea of Periplanata (cockroach), radula of Pila; pedicillarae of Asterias.
2. Setae of earthworm, and mouth parts of Honey bee, House fly and cockroach.

(D) Preparation of models of the different systems of the following animals:

1. Earthworm: Digestive, reproductive and nervous systems.
2. Grasshopper/ cockroach: Digestive, reproductive and nervous systems.
3. Pila: Pallial complex, digestive and nervous systems

(E) Embryology:

1. Histological slides of frog: cleavage, blastula, gastrula, neurula and tailbud stage
2. Chick developmental study (slides): 18 hrs, 21 hrs, 33 hrs, 72 hrs and 96 hrs of incubation, primitive streak stage in embryo and study of various foetal membranes in a 10-12 day old chick embryo.

Suggested readings:

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1. Barrington, EJW. Invertebrate structure and function. East West Press Pvt. Ltd. New Delhi.
2. Parker and Haswell. Text book of zoology: invertebrates. Vol. 1. Lowpriced textbook. The Macmillan press Ltd.
3. R. L. Kotpal Modern Text Book of Zoology: Invertebrates, 2009. Rastogi Publications
4. P S Verma, E L Jordan . Chordate Zoology, 2009. S. Chand Publications, New Delhi.
5. Scott F. Gilbert, Susan R. Singer.Developmental Biology, 2010. Sinauer Associates.
6. Balinsky, BI. An introduction to Embryology. Saunders, Philadelphia.
7. Lewis, Wolpert. Development Biology. Oxford University Press, Delhi.

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(Syllabus and Scheme of Studies w. e. f. 2017-20 onwards)
B. Sc. II Year (III Semester)

Schedule per week Lectures: 3

Examination Time: 3 Hrs **Maximum Marks: 50(20+30)**

Subject: Life and Diversity of Chordates **Paper Code: ZOO-201**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT-1

Chordates: General characteristics and classification, affinities and origin, Protochordates, Retrogressive metamorphosis, Agnatha: General features of living Agnatha and classification upto classes. Type study of Pteromyzon: Structure and life history

UNIT-2

Pisces: General features & Classification, Osmoregulation, migration and Parental care, Type study: Scoliodon

Amphibia: General features & Classification upto orders, Origin and evolution of terrestrial ectotherms/tetrapods, Parental care & paedomorphosis. Type study: Rana.

UNIT-3

Reptiles: General features & Classification upto orders, Origin of reptiles skull types, Poisonous and non- poisonous snakes in India, Biting mechanism in snakes

Aves: General features & Classification upto orders. Origin of birds, Flight adaptations, Migration.

UNIT-4

Mammals: General features & Classification upto orders. Origin of mammals, dentition, Type study: Rat.

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B. Sc. II Year (III Semester)

Schedule per week Lectures: 3

Examination Time: 3 Hrs **Maximum Marks: 50(20+30)**

Subject: Mammalian Physiology-I **Paper Code : ZOO-203**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1

Digestion - Brief introduction to digestive system, Buccal digestion; salivary secretion and digestion, Gastric digestion; gastric secretion and digestion, Intestinal digestion; pancreatic secretion, bile juices and digestion and small intestine and digestion and absorption in large intestine

UNIT 2

Osmoregulation and excretion - Osmoregulation , Mammalian excretory system; excretory organs and major associated blood vessels, kidney structure, nephron structure, Urine formation; ultra filtration, selective re-absorption and tubular secretion, Counter current multiplier system

UNIT 3

Respiration - Respiratory organs, Breathing mechanism, Respiratory pigments; properties and functions, External and internal respiration, Transport of gases.

UNIT 4

Circulation – Origina and conduction of heart beat, cardiac cycle, electrocardiogram, Blood pressure, Working of mammalian heart, Blood composition and function, Mechanism of blood clotting

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B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time: 3 Hrs **Maximum Marks: 50(20+30)**

Subject : Zoology Lab-III **Paper Code : ZOO-205**

1. Classification upto orders, habit, habitats, external characters and economic importance (if any) of the following animals:-

Protochordata; Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura, andAmphioxus.

Cyclostomata; Myxine, Petromyzon and Ammocoetus larva.

Chondrichthyes;Zygaena, Pristis, Narcine (electric ray), Trygon, Rhinobatus, Raja andChimaera.

Osteichthyes; Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus,Syngnathus, Exocoetus, Anabas, Diodon, Ostraczion, Tetradon, Echinus,Lophius, Solea and Polypterus. Any of the Lung Fish

2. Preparation of models of the different systems of the following animals: Herdmania: General anatomy

Labeo (locally available fish): Digestive and reproductive systems: cranial nerves

3. Study of the skeleton of : Scoliodon, Labeo

4. Study of the prepared slides: Tornaria larva, T.S.Amphioxus(through differentregionds). Oikopleura, different types of scales

5. Make permanent stained preparations of the following:Salpa,Spicules, and Cycloid scales

6. Physiology practical; Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies), Use of respirometer, Haematein crystal preparation, Estimation of Hb, DLC of Man, RBC count, WBC count.

7. Project Report: Migration in fishes, faunal survey

8. Disaster Management Project Work: (Field Work, Case Studies.for details see the UGC Website

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B. Sc. I Year (I Semester)

Schedule per week Lectures: 3

Examination Time: 3 Hrs **Maximum Marks: 50(20+30)**
Subject: Genetics and Immunology **Paper Code: ZOO-202**

Note: *Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words).* Answer to each part should not exceed 20 words. *Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

Unit 1:

1. Basic principles of Heredity, basic idea on extensions and modifications of basic principles
2. Chromosomal theory of Inheritance.
3. Linkage and recombination : coupling and repulsion hypothesis, crossing over and chiasma formation
4. Multiple alleles, gene interactions (allelic and non-allelic)

UNIT II:

1. Variation; types, sources of variation.
2. Mutation; chromosome and gene mutations, implications of mutation
3. Sex linked Inheritance: Chromosomal system of sex determination, Haemophilia and Colour blindness in man, Eye colour in *Drosophila*, Non-disjunction of sex chromosomes in *Drosophila*

UNIT-III:

1. Human genetics: Human Karyotype, genetic counselling and testing, Chromosomal abnormalities involving autosomes and sex chromosomes, monozygotic and dizygotic twins, Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, Sickle-cell anaemia), DNA fingerprinting, genetic compatibility
2. Applied genetics; genetic engineering, implications, transgenic animals, eugenics, euthenics and euphenics.

UNIT IV:

Immunology - Innate and Acquired immunity, Antigen, Antibody, Humoral and cell-mediated immunity, Active and passive immunization, Blood groups and transfusions, tissue and organ transplants, Allergies, autoimmune diseases, immunodeficiency diseases.

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B. Sc. II Year (IV Semester)

Schedule per week Lectures: 3
Examination Time: 3 Hrs **Maximum Marks: 50(20+30)**
Subject: Mammalian Physiology-II **Paper Code: ZOO-204**

Note: *Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words).* Answer to each part should not exceed 20 words. *Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.*

UNIT 1- Muscle physiology

1. Ultra structure of smooth, striated and cardiac muscles
2. Muscle contraction
3. Simple twitch and fatigue

UNIT 2- Nerve physiology

1. Structure of neuron
2. Conduction of nerve impulse through axon
3. Neurotransmitters
4. Synapses; ultrastructure and function

UNIT 3 - Endocrinology

1. Endocrine system; definition of endocrine, paracrine and autocrine system, significance of endocrine and neuro-endocrine system
2. Pituitary gland; structure, hormones and their functions
3. Thyroid gland; structure, hormones and their functions
4. Adrenal gland; structure, hormones and their functions
5. Pancreas; islets of langerhans, structure, hormones and their functions

UNIT 4 -Physiology of reproduction

1. Hormonal control of male and female reproduction
2. Implantation
3. Parturition and lactation in mammals
4. Reproductive cycle; oestrous and menstrual cycles
5. Menopause in human

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B. Sc. II Year (IV Semester)

Schedule per week Lectures: 3
Examination Time: 4 Hrs **Maximum Marks: 50(20+30)**
Subject: Zoology Lab-IV **Paper Code: ZOO-206**

1. Classification up to orders, habit, habitats, external characters and economic importance (if any) of the following animals:-
   Amphibia: *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotle larva, Alytes, Bufo, Rana*
   Reptilia: *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise)
   Aves: *Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto* and *Alcedo,Halcyon*
   Mammalia: *Ornithorphynchus, Echidna, Didelphis, Macropus, Loris, Macaque,Hystrix, Funambulus, Telix, Panthera, Canis, Herpestes, Capra, Pteropus*
2. Preparation of models of the different systems of the following animals:
   Hemidactylus; Digestive, arterial, venous and urinogenital systemsRat :
   Digestive, arterial, venous and urinogenital systems
3. Study of the skeleton of*Rana*(Frog),*Varanus,*Pigeon or Gallus and*Orcyctolagus/*rat
4. Study of the following prepared slides: Histology of rat (compound tissues)
5. Study and collection of different types of feathers; Quill, Contour, Filoplume and Down feathers
6. Physiology practical; study of estrus cycle, ultrasound image of foetus, study of histological structure of major endocrine glands of mammals
7. Project Report: Survey of diversity, Parental care , Dentition in mammals, Migrationin birds

Suggested readings

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1. Bell JN and Davidson GH, Textbook of physiology and Biochemistry, ELBS.
2. Sastry, KV. Animal physiology & biochemistry. Rastogi publications, Meerut.
3. Taylor, DJ, Green, NPO, and Stout, GW. Biological Science. Cambridge lowprice edition. Cambridge University Press.
4. Schmidt-Nielsen. Animal physiology. Cambridge University Press.
1. David S. Goodsell The Machinery of Life, 2009. Springer-Verlag New York Inc.
2. Young JZ. The life of vertebrates, Osford University Press, London
5. Peter Holland. The Animal Kinggom. Oxford University Press, New Delhi.

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Zoology

(Syllabus and Scheme of Studies w. e. f. 2017-20 onwards)

B. Sc. III Year (V Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**

Subject : Biochemistry **Paper Code : ZOO-301**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1

1. Carbohydrates: structure, function and significance
2. Oxidation of glucose through glycolysis, Kreb's cycle and oxidative phosphorylation,
3. Elementary knowledge of inter conversion of glycogen and glucose in liver
4. Role of insulin and glucagon

UNIT 2

1. Lipids: structure, function and significance
2. Beta-oxidative pathway of fatty acids
3. Essential and non essential fatty acids
4. Brief account of biosynthesis of triglycerides,
5. Phospholipids and steroids

UNIT 3

1. Proteins: structure, function and significance
2. Essential and non essential amino acids
3. Transformation of amino acids; deamination, transamination, decarboxylation
4. Synthesis of protein and urea
5. Fate of ammonia (ornithine cycle)
6. Fate of carbon skeleton
7. Enzymes; types and mechanism of action

UNIT 4

1. Vitamins; sources and deficiency
2. Minerals; sources and deficiency
3. Nucleic acid; nucleotides, Catabolism and biosynthesis of nucleotides

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B. Sc. III Year (V Semester)

Schedule per week Lectures: 3

Examination Time	**: 3 Hrs**	**Maximum Marks: 50(20+30)**
Subject	**: Ecology and Evolution**	**Paper Code : ZOO-303**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Answer to each part should not exceed 20 words. Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1 - Introduction to Ecology

1. Relevance of studying ecology, its history, autecology, synecology
2. Species; Sympatric, parapatric and Allopatric
3. Abiotic Factors; Laws of limiting factors; Liebig's law of minimum and Shelford's law of tolerance, brief account of light and temperature as limiting factors, soil types and soil erosion

UNIT 2 - Population ecology

1. Unitary and modular populations
2. Population density, dispersion and demography
3. Exponential and logistic growth model
4. Population Growth regulation: Intrinsic mechanism and extrinsic mechanism
5. Age structure pyramids for the human population

UNIT 3 - Community and Ecosystem

1. Community structure, diversity index, ecotone/edge effect, island equilibriummodel
2. Succession, stages of primary succession, climax community
3. Community's interactions; types with examples, Niche concept, Gause's principle of competitive exclusion with laboratory and field examples, Lotka Volterra Equation forprey predator interaction
4. Energy flow and chemical cycling through an ecosystem

UNIT 4 - Evolution

1. History of evolutionary thoughts
2. Natural selection, speciation
3. Variations, isolation and adaptations
4. Palaeontology; fossils, geological divisions of the earth's crust, imperfection of the geological record
5. Study of extinct forms; Dinosaurus, Archaeopteryx

SCHOOL OF BASIC AND APPLIED SCIENCES

Department of Zoology

(Syllabus and Scheme of Studies w. e. f. 2017-20 onwards)

B. Sc. III Year (V Semester)

Schedule per week Lectures: 6

Examination Time : 4 Hrs **Maximum Marks: 50(20+30)**

Subject : Zoology Lab-V **Paper Code : ZOO-305**

1. Study of an ecosystem; pond/lake/reservoir
2. Calculating Shannon index of biodiversity for fauna/flora of the campus
3. Evolutionary evidences and/or its demonstration through models/video/CD etc
4. Adaptive modifications in feet and beaks of birds
5. Evolutionary evidences of man and horse
6. Visit to a fossil park/Birbal Sahani Paleontological Institute in Lucknow
7. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.
8. Detection of proteins, carbohydrates and lipids in animal tissue food sample.
9. Demonstration of the principle of paper chromatography
10. Study of human salivary amylase activity: Effect of temperature, pH, Concentration
11. Project Report : radio carbon dating, fossil collection, population study of any fauna in the university campus and elsewhere

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B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**
Subject : Environmental Biology & Ethology **Paper Code : ZOO-302**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Further examiner will be set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1

1. Environment and its concepts, global environment, hydrosphere, lithosphere and atmosphere
2. Natural resources; present status and future needs, conservation and management of natural resources; renewable (forest, wildlife, water) and non renewable (soil, minerals and energy)
3. Wildlife conservation; vanishing and threatened animals and plants in Rajasthan, wildlife management efforts by Government and Non government organizations (including wildlife Acts)

UNIT 2

1. Environmental pollution; general outline and various types of pollution (water, air, and soil), Sources and remedies for noise, radiation, industrial chemicals, agrochemicals, insecticides, pesticides and household pollutants
2. Green house effect, ozone layer depletion, El-Nino and La-Nino effects, fallout effects of radiation, nuclear accidents
3. Basic concepts of bioaccumulation, biomagnification, biodegradation of pollutants

UNIT 3

1. Impact of urbanization; development and distribution of urban centres, factors, problems and solutions of urbanization, brief idea of human population of India and Rajasthan
2. Space ecology; space ecosystem, space problems and their solutions, colonization

UNIT 4

1. Introduction and history of Ethology
2. Concepts of Ethology; fixed action pattern, sign stimulus, innate learning mechanism, motivation, imprinting and learning
3. Pheromones and their role in alarm spreading
4. Societies; characteristics and advantage with special reference to honey bee, and monkey
5. Biological rhythms and biological clocks
6. Methods of studying animal behaviour

RAFFLES UNIVERSITY

SCHOOL OF BASIC AND APPLIED SCIENCES
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B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3
Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**
Subject : Applied Zoology & Biostatistics **Paper Code : ZOO-304**

Note: Examiner will set nine questions and the students will be required to attempt five questions in all, Question number one is compulsory containing six short answer types' questions covering the entire syllabus and will be of 1 mark each (Answer to each question should not exceed 20 words). Further examiner will set two questions from each unit and the students will be required to attempt one question from each unit which will be of 6 marks each.

UNIT 1
Principles and practices of Vermiculture, Sericulture (including Ericulture), Lac culture, Apiculture, Prawn culture, Pisciculture, Pearlculture and Poultry keeping

UNIT 2
Pest; definition, types of pests, control (insecticides and plant protection appliances (like hand compression spray, hand rotating duster, bucket pump etc. and natural control),
Study of major crop pest; Jowar (stem borer, midge flies), cotton (red cotton bug, pink ballworm) etc.

UNIT 3
Introduction, scope and application of biostatistics
Scientific method, writing up an experiment, Hypothesis (null and alternative)
Basic concepts of statistics; presenting data (tabulations, graphical representation, frequency distributions, samples and populations

UNIT 4
Elementary statistical methods in biology; measures of central tendency (mean, mode, median), measures of dispersion (standard deviation, standard error, variance), correlation and regression

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B. Sc. III Year (VI Semester)

Schedule per week Lectures: 3

Examination Time : 3 Hrs **Maximum Marks: 50(20+30)**
Subject : Zoology Lab-VI **Paper Code : ZOO-306**

Environmental biology &Ethology

1. Chemical analysis of pond water for pH, alkalinity, acidity, dissolved oxygen,
2. Estimating water salinity in a given water sample/ TDS
3. Visiting nearby factory to study their control measures taken up for controlling varioustypes of pollution
4. Qualitative estimation of zooplankton in given sample of water
5. A visit to zoo/museum of natural history and wildlife sanctuary (where present0
6. Behavioural study in mammals/birds
7. Construction of frequency table, histograms, polygons and piecharts
8. Exercises on mean, mode and median, standard deviation, correlation and bar diagram.
9. Study of stored pests/agricultural pests
10. Project report:

a. Apiculture/Sericulture
b. Pollution control measures taken up by any industry
c. Hazardous waste treatment in your city

Suggested readings

1. Townsend C, Harper J and Michael Begon. Essentials of Ecology, Blackwell Science.
2. David, L, Nelson and Michael M Cox. Lehninger's principles of Biochemistry.
3. Bell JN and Davidson GH, Textbook of physiology and Biochemistry, ELBS.
4. Sastry, KV. Animal physiology & biochemistry. Rastogi publications, Meerut.
5. Taylor, DJ, Green, NPO, and Stout, GW. Biological Science. Cambridge low price edition.Cambridge University Press.
6. Gupta, PK. Environmental biology. Rastogi publications, Meertu.
7. Miller TG, Jr. environmental Science. Wordsworth publishing company.
8. Odum, EP. Fundamentals of ecology, WB Sanunders.
9. Chapman and Reiss. Ecology. Cambridge University Press.
10. Manning and Dawkins. An introduction to animal behavior. Cambridge University Press.
11. Mathur, R. Animal behavior. Rastogi publications, Meerut.
12. Frank and Althoen. Statistics. Cambridge University Press.
13. Wilson and Walker. Principles and techniques of practical biochemistry. Cambridge

University Press.
14. Harrison and de Mora. Introductory chemistry for the environmental science. Cambridge University Press.
15. Bailey. Statistical methods in biology. Cambridge University Press.
16. Brian & Deborah Charlesworth. Evolution. Oxford University Press.