Paper Code - ZO 115

(2015 onwards)

ZOOLOGY – SEMESTER I

PAPER-I

NON-CHORDATA

Total teaching hours - 60 hours

Topics:

UNIT – I: INTRODUCTION **3 hrs**

1.1 Rules of Binomial nomenclature. A brief account of the criteria employed in classification: Organization, symmetry, Germ layers, Body cavity, Metamerism and Cephalization. 2hrs

1.2 Modern taxonomic methods. 1 hr

UNIT – II: PROTOZOA **7 hrs**

2.1. Distinguishing features and classification up to classes, with suitable examples. 1 hr

2.2 Nutrition in Protozoa- Holozoic, holophytic, mixotrophic, saprophytic and saprozoic. 1hr

2.3 Protozoan parasites-Occurrence, disease caused, mode of transmission, symptoms and preventive measures of

a) Entamoeba histolytica *b)Trypanosoma gambiense*

c) Leishmania donovoni *d) Cryptosporidium parvum*

Life cycle of *Plasmodium.* 3 hrs

2.4 Reproduction in Protozoa: a) Asexual reproduction – Binary fission, multiple fission

Sexual reproduction – Conjugation in *Paramecium caudatum* 2 hrs

UNIT – III: PORIFERA **8 hrs**

3.1	Distinguishing features and classification up to classes, with suitable examples.	1 hr
3.2	Histology of sponges with reference to *Sycon*.	1 hr
3.3	Skeleton in Sponges - Spicules and spongin fibres.	1 hr
3.4	Canal system –Types, canal system in *Sycon* and functions.	2hrs
3.5	Reproduction – Gemmule, formation of Amphiblastula larva.	2hrs
3.6	Regeneration in sponges.	1 hr

UNIT – IV: COELENTERATA **5 hrs**

4.1 Distinguishing features and classification up to classes, with suitable examples. 1 hr

4.2 Polymorphism in *Physalia* 2 hrs

4.3 Corals – Types of corals and theories of coral reef formation. 2 hrs

UNIT – V: PLATYHELMINTHES **4 hrs**

5.1. Distinguishing features and classification up to classes, with suitable examples. 1 hr

5.2 Parasitic adaptations in tapeworm. 1 hr

5.3 Regeneration in *Planaria* (*Dugesia*) - Child's axial gradient theory. 2hrs

UNIT - VI: NEMATODA **4 hrs**

6.1 Distinguishing features and classification up to classes, with suitable examples. 1 hr

6.2 Parasitic nematodes – Occurrence, mode of infection, disease caused and control measures of the following:

a) *Ancylostoma duodenale*, b) *Enterobis vermicularis*

c) *Wuchereria bancrofti* *d*) *Ascaris lumbricoides* 3hrs

UNIT VII ANNELIDA **6 hrs**

7.1 Distinguishing features and classification up to classes, with suitable examples. 1 hr

7.2 *Nereis* – a) Externals, structure of head and parapodium.

b) Trochophore larva and its phylogenetic significance 4 hrs

7.3 Vermiculture- an account of how to culture earthworms 1 hr

UNIT – VIII: ARTHROPODA **8 hrs**

8.1	Distinguishing features and classification up to classes, with suitable examples.	1 hr
8.2	Unique features and systematic position of *Peripatus*	2 hrs
8.3	*Penaeus* - externals and appendages.	2 hrs
8.5	Brief account of the externals and life history of *Drosophila melanogaster*	1 hr
8.6	Integrated pest management – biological and chemical methods	2 hrs

UNIT – IX: MOLLUSCA **8 hrs**

9.1 Distinguishing features and classification up to classes, with suitable examples. 1 hr

9.2 Freshwater mussel- externals, C.S. of shell, respiratory, digestive system and circulatory systems. 4 hrs

9.3 Structure and function of foot in – *Neopilina, Chaetoderma, Chiton, Mytilus, Pila, Aplysia, Dentalium* and *Octopus* 2 hrs

9.4 Brief account of Pearl culture, chank and lime industries 1 hr

UNIT – X: ECHINODERMATA **4 hrs**

10.1 Distinguishing features and classification up to classes, with suitable examples. 1hr

10.2 Star fish - Externals and water vascular system. 2 hrs

10.3 Bipinnaria larva and its phylogenetic significance 1hr

UNIT – XI: MINOR PHYLA **3 hrs**

11.1 List of minor phyla with examples, Salient features and affinities of Rotifera 3 hrs

Paper Code - ZO1P1

SEMESTER - I

ZOOLOGY PRACTICAL - I

NON CHORDATA

Total number of Practicals: **10 units**

PROTOZOA 1 unit

Observation of the following permanent slides:

Entamoeba, Vorticella, Foraminiferan ooze, *Paramecium* – wm/conjugation, *Euglena and Noctiluca*

Observation of live cultures of protozoans.

PORIFERA 1 unit

Sycon, Hyalonema, Euplectella

Slides: Spicules, and gemmule

COELENTERATA 1 unit

Hydra, Physalia, Velella, Porpita, Aurelia, Sea anemone, T.S of sea anemone and Ephyra larva,

Fungia, Astrea, Meandrina, Corallum rubrum, Gorgonia

PLATYHELMINTHES 1 unit

Planaria, Tape worm – w.m,scolex, Liver fluke – w.m., T.S. of liver fluke

NEMATODA 1 unit

Male roundworm, T.S. of male round worm, Female round worm, T.S. of female round worm

ANNELIDA 1 unit

*Nereis,*parapodia.*Heteronereis,Aphrodite,Arenicola,Sabella,Chaetopeterus* Trochophore larva, Earthwrom, T.S. passing through the typhlosolar region. Mount setae

ARTHROPODA 1 unit

Peripatus, Centipede, Millipede, Limulus (king crab),.

DISSECTION 1 unit

Mounting of the appendages of prawn *(Penaeus)*

MOLLUSCA 1 unit

Nautilus, Pearl Oyster, Octopus, Sepia, Dentalium, Murex, Patella, Cyprea, Haliotes and Cuttle bone

ECHINODERMATA 1 unit

Star fish, Brittle star, Sea lily, Sea cucumber, Sea urchin, Cake urchin, Pedicellaria, Bipinnaria larva.

SCHEME FOR PRACTICAL

EXAMINATION PRACTICAL – I

NON CHORDATA

Duration: 3 Hours Max. Marks: 50 (to be reduced to 25)

Q. 1. Mounting of prawn appendages 5 x 2 =10

2. Identify and Classify giving reasons A – H 5X8= 40

Total	50

Paper Code - ZO 215

(2015 ONWARDS)

ZOOLOGY – SEMESTER II

PAPER II

CHORDATA

Total teaching hours - 60

UNIT – I: HEMICHORDATA AND PROTOCHORDATA 9 hrs

1.1 Hemichordata - Salient features of Hemichordates.

Balanoglossus – externals,Structure of Tornaria larva and its significance

1.2 Salient features of Chordates and classification

Origin of Chordates – A brief account of Echinoderm theory, Ascidian theory and Lophophorate theory. 3 hrs

1.3 Hemichordata - Salient features of Hemichordates.

Balanoglossus – externals,Structure of Tornaria larva and its significance 2 hrs

1.4 Cephalochordata - Salient features of Cephalochordates.

Amphioxus - externals and mode of feeding 2 hrs

1.5 Urochordata - Salient features of Urochordates

Ascidian – externals, ascidian tadpole and retrogressive metamorphosis 2 hrs

UNIT – II: AGNATHA 4 hrs

2.1 Theories regarding the origin of vertebrates – Branchiostome ancestry, *Balanoglossus*

ancestry an Salient features of Agnatha.

Classification up to classes, with suitable examples. 2 hrs

2.2 External features of *Petromyzon* 1 hr

2.3 Ammocoetus larva – Structure and its phylogenetic significance 1 hr

UNIT – III: PISCES **7 hrs**

3.1 General characters – with emphasis on the primary aquatic adaptations, classification up to orders, with suitable examples, Differences between cartilaginous & bony fishes 4 hrs

3.2 Pisciculture – rearing, breeding and preservation of fishes 2 hrs

3.3 Migration of fishes with reference to salmon and eel 1 hr

UNIT- IV: AMPHIBIA 16 hrs

4.1 General characters and classification up to living orders with examples, a brief account of the origin of amphibia 2 hrs

4.2 Frog – (*Rana* sp.) – A brief account of digestive, respiratory, circulatory, nervous, and urinogenital systems 12hrs

4.3 Neuro-endocrine control of metamorphosis in Amphibia 1 hr

4.4 Parental care in Amphibia – *Pipa, Gastrothecus, Alytes and Ichthyophis* 1hr

UNIT- V: REPTILIA **6 hrs**

5.1 General characters with special reference to terrestrial adaptations and classification of living orders with suitable examples. 2 hrs

5.2 A brief account of the Mesozoic Reptiles – Dinosaurs, Pterosaurs, Ichthyosaurs and Mammal-like reptiles 2 hrs

5.3 General adaptations in snakes including poison apparatus, venom, types and its effects

5.4 A brief account of some poisonous snakes of India : pit viper, cobra, krait and sea snake

2 hrs

UNIT – VI: AVES **8 hrs**

6.1 Adaptations for aerial mode of life – anatomical and physiological 2 hrs

6.2 Classification and unique features of modern birds 2 hr

6.3 Differences between Ratitae and Carinatae 1 hr

6.4 Migration: Types, factors controlling migration. Ringing and collar technique to determine the route of migration 2 hr

6.5 Brief account of *Archaeopteryx* 1 hr

UNIT- VII: MAMMALS **10 hrs**

7.1 Salient features of Mammals, classification up to orders, with suitable examples.

1hr

7.2 Origin of Mammals, Salient features of the following: Prototheria, Metatheria, Insectivora, Carnivora, Chiroptera, Perissodactyla, Artiodactyla, Cetacea and Proboscidea. Adaptive radiation as illustrated by changes in limb structure and types of locomotion. 7 hrs

7.3 Salient features of Primates. An outline classification of primates with examples

2 hrs

Paper Code ZO 2P1

SEMESTER – II

ZOOLOGY PRACTICAL – II

CHORDATA

Total Number of Practicals **10 units**

PROTOCHORDATES 1 unit

Amphioxus – entire, T.S. through pharynx and T.S. through intestine

Balanoglossus – entire, T.S. passing through proboscis

Ascidia, Ascidian tadpole,

AGNATHA 1 unit

Petromyzon, Myxine and *Ammocoetes* larva

FISHES 1 unit

Electric Ray, Saw fish,

Sucker fish, Globe fish, Eel- *Muraena, Hippocampus,* flat fish. Accessory respiratory organs in *Anabas, Clarius* and Saccobranchus.

AMPHIBIANS 2 units

Bufo, Hyla, Amblystoma, Axolotl, Ichthyophis, Necturus, Salamander, Frog Endoskeleton (Skull, Vertebrae, Girdles and limb bones)

REPTILES 1 unit

Draco, Phrynosoma, Varanus, Turtle and Tortoise, poisonous snakes- Viper, cobra, krait and sea snake

BIRDS 1 unit

Endoskeleton (Skull, heterocoelous vertebrae, Sternum, Synsacrum) Beak and feet modifications of parrot, duck, eagle and crow

MAMMALS 3 units

Ant eater, *Loris*, Mongoose, hedge hog, bat

Lower jaw of rabbit, dog or cat, horse or cow, monkey or man Hairs, hoof, horns of cow or goat

SCHEME FOR PRACTICAL EXAMINATION

PRACTICAL – II

CHORDATA

Duration: 3 Hours Max. Marks: 50(to be reduced to 25)

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1. Identify, classify and comment on A - H	6 X 8 = 48
2. Comment on the lower jaw / epidermal derivative	2
Total	**50**

REFERENCE BOOKS

1) TEXT OF ZOOLOGY. Vol 1. By Parker and Haswell. CBS Publishers and distributors.

2) INVERTEBRATES STRUCTURE AND FUNCTION. By Barrington. ELBS

3) INVERTEBRATE ZOOLOGY. By Meclisten. Oxford Publishing house.

4) INVERTEBRATES. Vol.1. By Kotpal. Rastogi publications.

5) INVERTEBRATE ZOOLOGY. By Jordan and Verma. S Chand & Co.,

6) INVERTEBRATE ZOOLOGY. By Dhami & Dhami.

7) INVERTEBRATES. By Majpuria.

8) A MANUAL OF ZOOLOGY. Vol 1. By Ekambarnath Iyer and Anantha Krishnan

9) INVERTEBRATE ZOOLOGY Vol I - Vol VI. By L H Hyman McGraw Hill Book Company

10) INVERTEBRATE ZOOLOGY. By Barnes,Hault Saunders, 4th Edition.

11) ECONOMIC ZOOLOGY. By G.S. Hubhla & V.B. Upadhyoya

12) BIOLOGY OF ANIMALS. Vol 1. By Adhikari, Sinha and Ganguli. New central book agency, Calcutta.

13) BIOLOGY OF NON CHORDATES. By Nigam H.C. Naginchand S L and Co. Jallander.

Paper code ZO 315

(2015 onwards)

ZOOLOGY – SEMESTER III

PAPER III

HUMAN ANATOMY AND PHYSIOLOGY

(Part –1)

Total teaching hours – 60 hours

UNIT- I: SKELETAL SYSTEM — 15 hours

1.1 Concept of skeletal system and types of bones. Unique human characteristics. — 2 hrs

1.2 Axial skeleton: Skull – Salient features of the human skull, Facial and cranial bones. 3 hrs

1.3 Vertebral column – Vertebral column as a whole and its function, a brief account of the structure of Atlas, Axis, Typical Cervical, Seventh Cervical, Thoracic, Lumbar Vertebrae, Sacrum, Coccyx, Inter Vertebral Disc- Structure and Function, Slip Disc. 5 hrs

1.4 A brief account of the Sternum and ribs.

Appendicular skeleton: Scapula, Clavicle, Humerus, Radius and Ulna, Innominate Bone, Femur, Patella, Tibia and Fibula. 4 hrs

UNIT- II: DIGESTIVE SYSTEM **9 hours**

2.1 A detailed account of the digestive system including oral cavity. Gross structure of tongue. Structure of tooth and dentition. Alimentary canal and associated glands. 4 hrs

2.2 Digestive secretions and control of digestive secretions-Salivary, gastric, bile, Pancreatic and intestinal secretion. 2 hrs

2.3 Gastro intestinal disorders-, jaundice, hyper acidity, ulcers, cirrhosis of liver, role of microorganisms in digestion in ruminants and termites. 3 hrs

UNIT- III: CARDIO-VASCULAR SYSTEM **8 hrs**

3.1 Heart – External and Internal structure

3.2 Origin and conduction of the heart beat, Pace maker.

3.3 A brief account of the

Arterial and Venous system

1 hr

2 hrs

3 hrs

3.4 Disorders: Anemia, Leukemia, Ischemic heart diseases, Mitral stenosis, Hypertension, Angioplasty and Bypass surgery 2 hrs

UNIT- IV: RESPIRATORY SYSTEM **10 hours**

4.1 Anatomy of the Respiratory system

2 hrs

4.2 Respiratory pigments: Properties and types, hemoglobin, hemocyanin, hemoerythrin and Chlorocruorin, Respiratory quotient and its significance 2 hrs

4.3 Transport of respiratory gases: Carbon dioxide and oxygen, Hamburger's phenomenon. 2 hrs

4.4 Oxygen dissociation curve and its significance, factors that affect the curve

2 hrs

4.5 A brief account of Asthma, effects of smoking and Pneumonia.

2 hrs

UNIT- V: EXCRETORY SYSTEM **7 hours**

5.1 Types of nitrogenous wastes and their formation: Ammonia – deamination, Urea – Urea Ornithine cycle and Uric acid. 1 hr

5.2 Anatomy of the excretory system – including Gross internal structure of the Kidney, Composition of normal urine. Physiology of urine formation 3 hrs

5.3 Kidney stone formation: causes and treatment (lithotripsy), dialysis-types and importance, ketosis

3 hrs

UNIT- VI: REPRODUCTIVE SYSTEM **3 hours**

6.1 Anatomy of the female and male reproductive system.

3 hrs

UNIT- VII: OSMOREGULATION **8 hours**

7.1 Body fluids, types of body fluids, concept of internal environment and homeostasis, importance of maintaining homeostasis. A brief account of the factors of the internal environment that need to be maintained constant, account of feedback mechanism. 2 hrs

7.2 Homeostasis with reference to blood sugar, brief account of diabetics mellitus and types 2 hrs

7.3 Osmoregulation: meaning, osmoregulation in marine cartilaginous and bony fishes, osmoregulation in fresh water bony fishes. Water balance in camel and man. 4 hrs

Paper code ZO 3P1

ZOOLOGY – SEMESTER III

PRACTICAL – III

Human Anatomy and Physiology

Total number of Practicals **10 units**

HUMAN SKELETAL SYSTEM 3 units

- Skull
- Vertebrae – atlas, axis, typical cervical, 7th cervical vertebrae, thoracic vertebrae, Lumbar vertebrae, Sacrum and coccyx, ribs. 1 unit
- Scapula and clavicle, humerus, radius and ulna. 1 unit
- Innominate (os coxae or hip) bone, femur, tibia and fibula. 1 unit

PHYSIOLOGY 7 units

- Tests for ammonia, Urea and Uric acid. 1 unit
- Estimating the amount of salt lost or gained by the given animal (aquarium fish) in unit time when transferred from one medium to another. 1 unit

- Estimating the amount of oxygen consumed by the given animal (aquarium fish) in unit time. 1 unit

- Analysis of ascorbic acid in various biological sources 1 unit
- Analysis of urine albumin, sugar and ketone bodies 1 unit
- Estimation of creatinine in the urine sample 1 unit

Effects of various factors on salivary amylase activity 1 unit

SCHEME FOR PRACTICAL EXAMINATION

PRACTICAL – III Human Anatomy and Physiology

Duration: 3 Hours Max. Marks: 50 (Reduced to 25)

Q.	1.	Osteology (Human) (6 bones X 5 marks)	5 X 6 = 30
	2	Physiology	2 0

Paper Code ZO 401

(2015 onwards) ZOOLOGY

SEMESTER I V

PAPER – IV,

ANATOMY, PHYSIOLOGYAND

RESEARCH METHODOLOGY

Total teaching hours 60 hours

UNIT- I: SKIN AND ITS FUNCTION **3 hrs**

1.1 Structure of the human skin and its function, brief account of sweat and sebaceous glands. 3 hrs

UNIT- II: MUSCULAR SYSTEM **4 hrs**

2.1 Light microscope structure of muscle, Ultra structure of the skeletal muscle. Mechanism of muscle contraction and electrical activity in muscle.

2 hrs

2.2 Physico - chemical changes during muscle contraction, sliding filament hypothesis.

2 hrs

UNIT- III: THERMOREGULATION **7 hrs**

3.1 Influence of temperature on metabolic rate – concept of Q_{10}. 1 hr

3.2 Differences between poikilotherms and homeotherms, steno and eurythermal animals. Features of ectotherms, endotherms and heterotherms. Process of thermoregulation in endotherms, role of hypothalamus in thermoregulation

4 hrs

3.3 A brief account of hibernation, frostbite and heatstroke.

2 hrs

UNIT- IV: NERVOUS SYSTEM **11 hours**

4.1 Structure of a multipolar neuron.

1 hr

4.2 Nerve impulse, properties of nerve impulse, Origin and conduction of nerve impulse along the axon. 2 hrs

4.3 Synapse- definition, Synaptic transmission, Neurotransmitters, Factors affecting synaptic transmission.

2 hrs

4.4 Divisions of the central nervous system – Brain – meninges, ventricles of the brain, Cerebrospinal fluid and its function, a brief account of the anatomy of the human brain, the various lobes of the cerebrum and their function

4 hrs

4.5 Spinal cord – anatomy of the spinal cord, and spinal nerves, functions and reflex action. 2 hrs

UNIT- V: ORGANS OF SPECIAL SENSE **8 hours**

5.1 Eye - Structure of the eye and its associated structures and their functions. Physiology of vision.

2 hrs

5.2 A brief account of abnormalities of refraction (short sight and long sight) - causes and corrective measures.

2 hrs

5.3 Ear – structure of the ear, organ of corti, , mechanism of hearing and balance

4 hrs

UNIT- VI: ENDOCRINE SYSTEM **10 hours**

6.1 Differences between an exocrine and an endocrine gland, Neurosecretory cells.

1 hr

6.2 Pituitary: Gross structure**,** Anterior lobe of the pituitary - hormones secreted and their function, a brief account of the growth hormone, dwarfism, gigantism and acromegaly. Posterior lobe of the pituitary –

6.3 Neurohormones and their functions. Differences between diabetes mellitus and diabetes insipidus. 3 hrs

6.4 Islets of Langerhans: Hormones – Insulin, Glucagon and Stomatostatin, Functions

1 hr

6.5 Thyroid: function of thyroxin, A brief account of cretinism, myxoedema, goiter (simple and exopthalmic), Grave's disease. Calcitonin and its function. 3 hrs

6.6 Parathyroid: Structure and function, hypoparathyroidism and hyperparathyroidism 1 hr

6.7 Adrenals: Hormones secreted by cortex and medulla, and their functions.

1 hr

UNIT - VII: LYMPHATIC SYSTEM **4 hours**

7.1 Structure of the lymphatic system. Gross structure and function of spleen and thymus. Lymph nodes and function of lymphatic system 4 hrs

UNIT- VIII : COMPARATIVE ANATOMY **6 hours**

8.1 Evolutionary trends in the heart: Shark, frog, lizard, pigeon and rabbit. **8.2** Evolu

tionary trends in the excretory system: archinephros, pronephros, mesonephros and metanephros. Structure of mammalian kidney and uriniferous tubule. 2 hrs

2 hrs

8.3 Evolutionary trends in the structure of the brain of shark, frog, lizard, pigeon and rabbit.

2 hrs

UNIT- IX: RESEARCH METHODOLOGY AND BIOSTATISTICS 7 hours

9.1 Objectives of research, definition of basic and applied research, literature survey, field work and survey, indoor and outdoor data collection (table work and sampling techniques).

2 hrs

9.2 Analysis of data using basic biostatistics (mean, median, mode, standard deviation and standard error), computational analysis of data (histogram, pie chart).

2 hrs

9.3 Data interpretation (components of research report and use of tables and figures), presentation and report writing (writing of research article and report).

2 hrs

9.4 Intellectual property rights (IPR), patents, copy rights and project proposals.

1 hr

6 hours

Paper code ZO 4P1

ZOOLOGY - SEMESTER – IV

PRACTICAL – IV

ANATOMY AND PHYSIOLOGY II

Total number of Practicals **10 units**

PHYSIOLOGY **3units**

- Organic constituents of Protoplasm – tests for glucose, sucrose, starch and proteins.
- Effect of temperature on the heart beat of freshwater mussel.
- Estimating the amount of total glycogen in the muscle by anthrocin method

COMPARATIVE ANATOMY **3 units**

- Comparative study of the brain of shark, frog, bird and rat or any mammal **1unit**
- Comparative study of the heart of shark, frog,, bird and rat or any mammal **1 unit**
- Comparative study of the skin of fish, frog and mammal **1 unit**

MICROTECHNIQUE **2 unit**

- Principles and procedure involved in preparation of paraffin blocks of organs (block making), section cutting and staining technique.

- Staining and mounting of paraffin section.

- Statistical problems and Biodiversity indices – Simpsons method and Shannon Weiner method. 2 hrs

SCHEME FOR PRACTICAL EXAMINATION

PRACTICAL – I V

ANATOMY, PHYSIOLOGY AND RESEARCH METHODOLOGY

Duration: 3 Hours Max. Marks: 50 (Reduced to 25)

1. Physiology Experiment 20 marks

2. Comparative anatomy 15 marks

3. Staining of paraffin section and a question on microtechnique 10 marks

REFERENCE BOOKS

1. A TEXT BOOK OF PHYSIOLOGY by Emusiesmith, et al ELBS low priced edition 1988.
2. PHYSIOLOGY by Ganong, Appleton and Lange 1989.
3. CELL PHYSIOLOGY by Giese A.C. Saunder's, Toppan and Co. Japan, 1984.
4. ANIMAL PHYSIOLOGY by Schmidt Nielson, Cambridge Publishers.
5. HUMAN PHYSIOLOGY by Vander et al, MacGraw Hill Publ. 5^{th} Ed. 1991.
6. FOUNDATIONS OF ANATOMY AND PHYSIOLOGY by Ross and Wilson, ELBS and Churchhill Livingstone
7. TEXT BOOK OF ANIMAL PHYSIOLOGY by Nagabhushanam et al Oxford –IBH Publ. 2^{nd} ed.
8. A TEXT BOOK ON STATISTICS by Dr. N. Gurumani

Paper code ZO 5115

(2015 onwards)

ZOOLOGY- SEMESTER-V

PAPER-V

CELL BIOLOGY, MOLECULAR BIOLOGY AND IMMUNOLOGY

Total Teaching hours - 45 hours

PART A

UNIT - I: CELL ORGANELLES — 6 hours

1.1 Plasma membrane - Robertson model, Fluid mosaic model of Singer and Nicholson. 1 hr

1.2 Functions of Plasma membrane: Osmosis, Diffusion, Facilitated transport, carrier molecule concept and Active and passive transport. 1 hr

1.3 Structure and function - Mitochondria and Golgi complex, Endoplasmic reticulum, Ribosomes, Lysosomes

Mitochondria – structure and function

Golgi complex – structure and function

Endoplasmic reticulum – smooth ER, rough ER,structure and function

Ribosomes – structure and function

Lysosomes – structure and function

4 hrs

UNIT – III: CHROMOSOMES — 5 hours

3.1 Gross structure of chromosomes with a brief account of Nucleosome model. Types of chromosomes based on the position of Primary constriction. Autosomes and Allosomes. 2 hrs

3.2 Polytene chromosome in *Drosophila melanogaster* –Structure and significance 1 hr

3.3 Human Karyotype: Normal, Outlines of banding techniques: G, Q & R bandings. 2 hrs

UNIT - IV: CELL DIVISION — 10 hours

4.1 Cell cycle – Stages of Cell cycle. 1 hr

4.2 Numerical aberrations in chromosomes – Polyploidy and aneuploidy, 3 hrs

Structural aberrations in chromosomes – Deletion, Duplication, Translocation and Inversion.

4.3 Apoptosis - Definition, Significance with examples, comparison of apoptosis with necrosis, brief account of apoptosis on *Coenorhabditis elegans* (Molecular pathway) and consequences of

deregulated apoptosis. 2 hrs

4.4 Stem cells: Origin, types and applications. 1 hr

4.4 Cancer biology – definition, metastasis, types of cancer, general properties of cancer, cells, structural and metabolic variations in cancer cells and carcinogens. 3 hrs

PART B

UNIT – V: NUCLEIC ACIDS **8 hrs**

5.1 Chemicals composition and structure and types of DNA- Watson and Crick model and Chargaff's rule. 3hrs

5.2 DNA replication- Semi conservative type, (Meselson and Stahl expt.) - steps involved in activation, unwinding, formation of RNA primers, Okazaki fragments. 2 hrs

5.3 DNA amplification through PCR technique [thermocycler] and its applications. 1 hr

5.4 RNA - Types of RNA - viral RNA, t RNA, mRNA and rRNA. 2 hrs

UNIT – VI: GENETIC CODE **6 hours**

6.1 Triplet codon, code characteristics – degeneracy and Wobble hypothesis. 3 hrs

6.2 Protein synthesis – transcription, translation and chain elongation. 3 hrs

PART C

UNIT – VII: IMMUNOLOGY **10 hours**

7.1 Immunity- Innate and acquired with suitable examples. 1 hr

7.2 Components of Immune system – B, T – lymphocytes and Macrophages 1 hr

7.3 Antigens and antibodies – Types of antigens. Structure of Antibody, different types of antibodies-

IgG, IgA, IgM, IgE and IgD

Antigen – Antibody reactions – Agglutination, precipitation, flocculation, complement fixation and opsonization. 2 hrs

7.4 Production of monoclonal antibodies by Hybridoma technique. Its applications in the medical field 1hr

7.5 Hypersensitivity- Anaphylactic, cytotoxic, immune complex mediated, cell mediated and stimulatory 1 hr

7.6 Autoimmune diseases- Definition and causes. Example- Multiple sclerosis, Arthritis, Lupus erythematosus. 1 hr

7.7 AIDS – Structure of HIV , causes, preventive measures ELISA Test. 1 hr

7.8 Transplantation – Autograft , Syngraft, Allograft, and Xenograft.

7.9 Organ transplantation, graft rejection, immuno suppressors, plastic surgery and Cornea grafting. 2 hrs

Paper code ZO 5P1

ZOOLOGY- SEMESTER V

PRACTICAL – V

CELL BIOLOGY, MOLECULAR BIOLOGY AND IMMUNOLOGY

Total number of Units **10 Units**

1. Squash preparation

1) Onion root tips for mitosis. **1 unit**

2) Grass hopper testes for meiosis. **1 unit**

Mounting of salivary gland chromosome in Drosophila larvae

3. Extraction of DNA from liver and buccal cells. **1 unit**
4. Estimation of DNA from Liver by Diphenylamine method. **1unit**
5. Estimation of RNA by Orcinol method. **1 unit**
6. PCR technique – demonstration only. **1 unit**
7. Micrometry. **1 unit**
8. Blood grouping: Antigen and antibody reaction. **1 unit**
9. Study of Blood smear for different types of blood cells. Differential counting of blood cells by hemocytometer.

1 unit

SCHEME FOR PRACTICAL EXAMINATION

PRACTICAL V

CELL BIOLOGY, MOLECULAR BIOLOGY AND IMMUNOLOGY

Duration -3 hours Max. Marks-50 (Reduced to 25)

Q.1. Preparation of a temporary squash of onion root tips/grass hopper testes and Identification of a stage. 10 + 5 Marks

Q.2. Extraction of DNA 10 Marks

Q.3. Identification of Blood groups. Comment on Antigen and antibody reaction. 10 Marks

Q.4. Micrometry. 5 Marks

Paper code ZO 5212

(2015 onwards)

ZOOLOGY SEMESTER V

Paper VI

ECOLOGY, WILD LIFE AND ANIMAL BEHAVIOR

Total Teaching hours - 45 hours

UNIT - I: HABITAT **7 hours**

1.1 Concept of habitat and niche - differences between microhabitat & macro habitat. 3 hrs

1.2 Marine habitat - zonation of the sea and ecological classification of marine biota. 2 hrs

1.3 Freshwater habitat-lentic & lotic systems & ecological classification of freshwater biota (eg., pond ecosystem). 2 hrs

UNIT – II: ENERGY FLOW IN ECOSYSTEMS **8 hours**

2.1 Energy flow in an ecosystem and laws of thermodynamics. Food chain and food web. 4 hrs

2.2 Concept of productivity – primary & secondary productivity & their measurements. 2 hrs

2.3 Ecological pyramids of number, biomass and energy 2 hrs

UNIT – III: ECOLOGICAL FACTORS **10 hours**

3.1 Abiotic factors.

a) Light- distribution in water and land, effect of light on plant and animals photoperiodism and bioluminescence.

b) Temperature- thermal stratification, cyclomorphosis & adaptations to extreme temperatures. 4 hrs

3.2 Biotic factors – producers, consumers and decomposers.

Animal associations - mutualism. Commensalisms, parasitism, predation and Competition with relevant

examples. 4 hrs

3.3 Limiting factors – Liebig's law of minimum and Shelford's law of tolerance. 2 hrs

UNIT – IV: POPULATION ECOLOGY **6 hours**

4.1 Concept of density, natality, mortality. 2 hrs

4.2 Population growth curves- sigmoid and J -shaped curves. Concept of biotic potential and environmental resistance. 2 hrs

4.3 Pollution - water and air pollution, green house effect and global warming, Ecotoxicology and bioremediation 2 hrs

UNIT – V: WILD LIFE AND CONSERVATION **4 hours**

5.1 A brief account of protected areas of wild life. Ex – Sanctuaries, national parks .Chipko and Appiko movements. Endangered species and red data book. Biodiversity hotspots in India

UNIT – VI: ANIMAL BEHAVIOUR **10 hours**

6.1 Introduction to animal behavior, aims and objectives. 1 hr

6.2 Stereotyped behaviors-taxis, kinesis, reflexes & instincts with suitable examples. 2 hrs

6.3 Learning- imprinting, habituation, trial and error learning. 2 hrs

6.4 Animal communication– functions of signals, odours, sound and light. 2 hrs

6.5 Social behavior in primates - Monkeys 1 hr

6.6 Modern techniques involved in study of animal behavior 1 hr

6.7 Biological clock in animals 1 hr

Paper code - ZO 5P1 ZOOLOGY

SEMESTER - V

Practical VI

ECOLOGY, WILD LIFE AND ANIMAL BEHAVIOUR

Total number of practicals - 10 units

I) ANALYSIS OF WATER — 5 units

1. Estimation of salinity.
2. Estimation of dissolved oxygen.
3. Estimation of organic matter.
4. Determination of pH by pH meter.
5. Soil analysis

II) ECOLOGICAL ADAPTATIONS — 4 units

1. Tubiculous worms- sabella, arenicola and chaetopterus.
2. Burrowing forms - dentalium , amphioxus and balanoglossus.
3. Sedentary forms - sea anemone, balanus and ascidian.
4. Colonial forms – physalia, honey bees and termites.

5. Parasitism- tapeworm, sacculina on crab.
6. Facultative mutualism- hermit crab with sea anemone.
7. Mimicry and camouflage- stick insect, leaf insect and chameleon.

III) ANIMAL BEHAVIOUR 1 unit

1. Field visit: Study of animal behavior, a documentary for the same to be presented

Biodiversity indices using Shannon Weiner method and Simpson's method

SCHEME FOR PRACTICAL EXAMINATION

Practical VI

ECOLOGY, WILD LIFE AND ANIMAL BEHAVIOR

Duration 3 hours Max Marks 50 (Reduced to 25)

1. Ecology experiment	15
2. Adaptation	25
3. Project	5
4. Biodiversity indices	5

Paper Code ZO 6112

(2015 onwards)

ZOOLOGY - SEMESTER VI

Paper VII

HISTOLOGY, GENETICS AND BIOTECHNOLOGY

Total Teaching hours - 45 hours

UNIT- I: HISTOLOGY OF MAMMALIAN ORGANS **12 hours**

Tongue, stomach, small intestine, liver, pancreas, kidney, spleen, thyroid, adrenals, pituitary, testes and ovary.

UNIT – II: MENDELISM **4 hours**

2.1 A brief account of Mendel's contribution to genetics. 1 hr

2.2 Mendelian laws of inheritance - law of segregation, law of independent assortment, test cross and problems. 3 hrs

UNIT – III: DEVIATIONS FROM MENDELISM **7 hours**

3.1 Incomplete dominance. 1 hr

3.2 Interaction of genes - combs in fowls and problems. 2 hrs

3.3 Epistasis - plumage in white leghorn and whiteplymouth breed of fowls. 1 hr

3.4 Polygenic inheritance - skin colour in man. 1 hr

3.5 Multiple alleles - ABO blood groups in man, Rh factor, blood transfusion, applications and problems. 2 hrs

UNIT – IV: LINKAGE AND CROSSING OVER **5 hours**

4.1 Linkage in drosophila - grey body and vestigeal wings. 1 hr

4.2 Crossing over- mechanism of crossing over and theories. 2 hrs

4.3 Sex linkage – hemophilia, colour blindness and eye colour in Drosophila &

problems. 2 hrs

UNIT – V: GENETIC DETERMINATION OF SEX **4 hours**

5.1 XX-XY, XX-XO, ZZ-ZW and ZZ-ZO types. Barr body. 1 hr

5.2 Genic balance theory of Bridges, gynandromophs and free martins. 1 hr

5.3 Autosomal non disjunction down syndrome and cri-du-chat syndrome. 1 hr

5.4 Sex chromosomal non disfunction-Turner's syndrome, Klinefelter's syndrome and XYY complement.

5.5 Autosomal non disjunction- Down syndrome 1 hr

UNIT – VI: MUTATIONS **2 hours**

6.1 Spontaneous and induced mutations. 1 hr

6.2 ClB method of detecting sex linked lethal mutations, mutagens. 1 hr

UNIT – VII: REGULATION OF GENE ACTION **2 hours**

Operon concept - inducible and repressible operons and lac operon.

UNIT – VIII: GENETIC DISEASES **2 hours**

8.1 Inborn errors of metabolism-Phenylketonuria, alkaptonuria, albinism and sickle-cell anaemia, thalassemia and galactosemia 1 hr

8.2 Eugenics – positive and negative eugenics

8.3 Protein therapy, gene therapy and genetic counselling. 1 hr

UNIT – IX: BIOTECHNOLOGY **7 hours**

9.1 Tools in genetic engineering - restriction endonucleases type I, II and III, ligases, DNA polymerases, reverse transcriptase. 2 hrs

Vectors- Plasmids, cosmids, phagmids, bacteciophages, cloning host. 2 hrs

9.2 Recombinant DNA technology for the production of human insulin, Transgenic animals. 2 hrs

9.3 Bioinformatics and its application 1 hr

Subject code ZO 6P1

ZOOLOGY

SEMESTER- VI

Practical VI

HISTOLOGY AND GENETICS

Total number of practicals - 10 units

1. Histology of mammalian organs- tongue, stomach, small intestine, liver, pancreas, spleen, kidney, thyroid, adrenals, pituitary, testes and ovary. **5 units**
2. Genetic problems - monohybrid and dihybrid cross.

   Sex linkage- eye colour in drosophila,Colour blindness in man.

   Blood groups - ABO blood groups in man. **1 unit**
3. Preparation of Buccal smear for barr body. **1 unit**
4. Drosophila culture and Life history. **1 unit**
5. Mounting of Sex comb in Drosophila. **1 unit**
6. Drosophila - male and female identification, sex count and mutants(white eye, yellow body,

bar eye, vestigial wings and ebony body.) **1 unit**

SCHEME FOR PRACTICAL EXAMINATION

Practical VII

HISTOLOGY AND GENETICS

Duration 3 Hours Max Marks 50 (Reduced to 25)

I. Identification of three histology slides (A to F) (5 X 6 = 30)

II. A problem in genetics (Monohybrid, dihybrid, sex linkage or groups, 2 problems) 10

III. Mutant identification of any 2. 10

Paper Code - ZO 6215

(2015 onwards)

ZOOLOGY SEMESTER-VI

PAPER – VIII

Developmental Biology and Evolution

Total teaching hours– 45 hours

Part A- Developmental Biology **25 hours**

UNIT - I: INTRODUCTION **1 hour**

1.1 Theories of development – Preformation theory, Epigenetic theory and Von Baers theory.

UNIT - II: CLEAVAGE **5 hours**

2.1 Egg & Cleavage – Types of eggs- based on distribution and quantity of yolk with suitable examples. Cleavage – Types of cleavage planes, patterns of cleavage, types of cleavages, influence of yolk on the process of cleavage, types based on the amount of yolk with examples. 2 hrs

2.2 Cleavage patterns in Amphioxus, frog and chick. 2 hrs

2.3 Structure and evolution of a cledoic egg with chick's egg as an example. 1 hr

UNIT - III: BLASTULA AND BLASTULATION **3 Hours**

3.1 Blastulation in Amphioxus, frog and chick. 2 hrs

3.2 Comparative account of the blastula of Amphioxus, Frog and chick. 1 hr

UNIT - IV: GASTRULATION **3 Hours**

4.1 Gastrulation in Amphioxus, frog and chick.

UNIT - V: ORGANOGENESIS **5 Hours**

5.1 Neurulation, chordagenesis and mesogenesis with reference to frog. 2 hrs

5.2 Organizer phenomena – Definition of organizer, potencies of the dorsal lip of the blastopore of amphibian gastrula, experiments of Spemann and Mangold.

2 hrs

5.3 Induction – chemical nature of the organizer – parts of the organizer and theories of the organizer phenomenon. 1 hr

UNIT - VI: EXTRAEMBRYONIC MEMBRANES **4 Hours**

6.1 Extraembryonic membranes of chick: Formation, structure and function of Yolk sac, Amnion, chorion and Allantois. 2 hrs

6.2 Placenta: Yolk sac placenta, Allantoic placenta – structure and function of placenta. Morphological and histological classification of placenta with examples. Placental hormones and their functions. 2 hrs

UNIT - VII: DEVELOPMENT IN HUMAN BEINGS **4 Hours.**

7.1 Role of hormones in development: Gonadrotrophins – hormones secreted by testes and ovaries. 1 hr

7.2 Menstrual Cycle and their hormonal control. 1 hr

7.3 Process of fertilization, blastocyst formation, and implantation. 2 hrs

Part B - EVOLUTION **20 hours**

UNIT - I: THEORIES OF ORGANIC EVOLUTION **6 hours**

1.1 Lamarckism and Neo-Lamarckism. 2 hrs

1.2 Critical account of Darwinism. 1 hr

1.3 Neo-Darwinism: Hardy-Weinberg law of genetic equilibrium, elementary forces of evolution- gene mutation, gene flow, genetic drift, natural selection and isolation. 3 hrs

UNIT II: EVIDENCES IN SUPPORT OF ORGANIC EVOLUTION **9 hours**

2.1 Anatomical, morphological, serological and embryological. 2 hrs

2.2 Palaentological evidences: Fossils: definition, importance, formation and types of fossils. 1 hr

Dating of fossils: Uranium- lead method, potassium – argon method, radio Carbon method. 2 hrs

2.3 Geological time scale: Eras, periods and epochs with major fauna of each period. 2 hrs

2.4 A brief account of continental drift, evidences in favour of continental drift, causes for discontinuous distribution,Isolatimg mechanisms mechanisms and speciation.

2 hrs

UNIT - III: EVOLUTION OF HORSE **2 hours**

3.1 Hyracotherium, Mesohippus, Merichippus and Equus.

UNIT - IV: EVOLUTION OF MODERN MAN **3 hours**

4.1 Australopithecus, Ramapithecus, Java man, Peking man, Neanderthal man, Cromagnon

Paper code ZO 6P2

ZOOLOGY

SEMESTER – VI

PRACTICAL – VIII

Developmental Biology and Evolution

Total number of practicals **10 units**

I: **Frog:** Study of cleavage, blastula, gastrula and neurula. **2 units**

II: **Chick**: Study of 18, 24, 32 & 48 hours chick embryo **1 unit**

III: T.S. of fallopian tube, T.S. of Uterus. **1 unit**

IV: Placenta: Morphological types. Cotyledonary type in sheep, Discoidal type in humans **1 unit**

V: Placenta: Histological types **1 unit**

VI: Temporary mounting techniques: Whole mount preparation of fish Scales, coelenterate colony. **1 unit**

VII: Study of homologous organs – Ex. Fore limbs of frog and bird

Mouthparts of cockroach and mosquito.

Mounting of mouthparts of Mosquito, cockroach, honey bee.

1 unit

VIII: Serial Homology: Appendages of Prawn. **1 unit**

IX: Study of Vestigial organs: Appendix, Coccyx, molar tooth.

X: Study of fossils. **1 unit**

Scheme of Practical Examination:

Time: 3 Hours **Max. Marks: 50 (Reduced to 25)**

Q no. 1: Embryology: Identification of slides & specimens. 6 spotters **6 X 5 = 30**

Q no. 2: Whole mount preparation **10**

Q no. 3: Evolution: Identification of two fossils. **10**