

M.Sc. Zoology Course Structure

(Semester, Course Code, Course title, Credits, Teaching, practical Hrs. Examination Hrs. and Marks)

Semester	Course Code & Title	No. of Credit Points	Teaching Hrs /Week	Exam. Hrs.	Internal Assessment Marks	Semester End Examination Marks	Total Marks
III	HCT 3.1: Developmental Biology	04	04	03	20	80	100
	HCT 3.2: Animal Physiology	04	04	03	20	80	100
	HCT 3.3: Ethology	04	04	03	20	80	100
	SCT 3.1a: Wild life Biology and Conservation OR SCT 3.1b: Entomology	04	04	03	20	80	100
	OET 3.1a: Reproduction and Development OR OET 3.1b: Diversity of Animals	02	02	02	10	40	50
	HCP 3.1: Practical based on HCT 3.1	02	04	03	10	40	50
	HCP 3.2: Practical based on HCT 3.2	02	04	03	10	40	50
	HCP 3.3: Practical based on HCT 3.3	02	04	03	10	40	50
	SCP 3.1a: Practical based on SCT 3.1a OR SCP 3.1b: Practical based on SCT 3.1b	02	04	03	10	40	50
	Total Marks (I to IV Semester) 2500 Credits =106						

SEMESTER- III

HCT-3.1: DEVELOPMENTAL BIOLOGY

Total: 64 Hrs

Unit-I: Introduction:

16 Hrs

Overview of development, Anatomical and experimental approach to developmental Biology: embryological origin of gene theory, Evidence for genomic equivalence. Nuclear transplantation experiments in frog and mammal- the concept of totipotency. Nucleo-cytoplasmic interactions during early development in Ameoba and Frog. Structure of the gametes- The sperm (structure of the sperm); the egg (cytoplasm and nucleus, cell membrane and extracellular envelope); recognition of egg and sperm. Fertilization-external fertilization in sea urchin (sperm attraction, acrosome reaction, recognition of cell's extracellular coat; fusion of egg and sperm cell membranes); Prevention of polyspermy (one egg, one sperm, the fast and slow block to polyspermy); Activation of egg metabolism(Signal transduction).

Unit-II: Development of axis formation in *Drosophila*:

16 Hrs

Genetic and molecular analysis of axis formation in *Drosophila*: Life cycle; Development of larva; Establishment of anterior, posterior, dorsal and ventral polarity; Role of maternal effect genes, segmentation genes and homeotic selector genes. Development of axis formation in amphibians: Mechanism of progressive determination of amphibian axis (specification of germ layers, dorsal-ventral and anterior-posterior axis); Hans Spemann and Hilde Mangold experiments on primary embryonic induction; Molecular mechanism of amphibian axis formation (the dorsal signal – part 1 Nieuwkoop center, part 2 β -catenin and part 3 synergizing with vegetal pole); Functions of the organizer; Induction of neural ectoderm and dorsal mesoderm; Regional specificity of neural induction along the anterior-posterior axis.

Unit-III: Cell differentiation and organogenesis:

16 Hrs

Development of somites - Somitogenesis; Differential cell proliferation in shaping organ primordia– Myogenesis– Determination of myotome, specification and differentiation by myogenic bHLH proteins, muscle cell fusion. Differentiation of neural tube - Primary and secondary neurulation, Differentiation of neural tube-anterior-posterior axis, dorso-ventral axis; Differentiation of erythrocytes-Hematopoiesis.

Unit-IV: Post-embryonic development:

16 Hrs

Metamorphosis in Amphibia- Morphological, biochemical changes and molecular mechanism of hormonal regulation; Regeneration in Hydra, Planaria and Salamander- Embryonic development; Teratology-Teratogens; Endocrine disruptors; Growth concept –isometric and allometric. Eco-Evo-Devo concept: Developmental plasticity (phenotypic plasticity, polyphenism); Mechanisms of evolutionary change (heterotypy, heterochrony, heterometry and heterotopy).

HCP 3.1: PRACTICAL COURSE IN DEVELOPMENTAL BIOLOGY BASED ON HCT-3.1

1. Study of life cycle of *Drosophila*: a) Egg b) I-Instar c) II-Instar d) III-Instar and c) Pupal stage
2. Study of *Drosophila* developmental mutants: a) Antennapedia b) Bithorax
3. Study of developmental stages and halteres in *Drosophila melanogaster*
4. Study of imaginal discs of *Drosophila*
5. Study of development and life cycle of mosquito.
6. Developmental stages in Sea urchin
 1. Study of early developmental stages in frog.
 2. Study of transverse sections of frog embryos and tadpoles
 3. Study of metamorphosis in frog (Gosner stages)
10. Study of different developmental stages of Chick embryo in whole mounts
11. Study of transverse sections of Chick embryos
12. Temporary mounting of Chick blastoderms, embryos of different developmental stages
13. Preparation of permanent slide of whole mount of Chick embryo
14. Observation of development of in-vivo cultured chick embryo by 'window method'
15. Any other practical depending on feasibility.

REFERENCE BOOKS RECOMMENDED:

1. Gilbert, S. F., Developmental Biology, 10th Ed. Sinauer Associates Inc. Massachusetts, USA, 2014.
2. Rao, V. Developmental Biology. A Modern Synthesis. Oxford and IBH Delhi, 1994.
3. Vasudeva Rao, Developmental Biology: A Modern Synthesis, Oxford & IBH, New Delhi, 1994.
4. Wolpert, L, Beddington, R Jessell, T. Lawrence P, Meyerowitz, E, Smith J. Principles of Development. Oxford University Press Oxford, 2001.

HCT-3.2: ANIMAL PHYSIOLOGY

Total: 64 Hrs

Unit-I: Introduction to physiology: 16 Hrs
History and central themes of Animal Physiology and its sub-disciplines. Physiology of respiration :The atmosphere, solubility of gases, respiratory organs in the vertebrates (gills and lungs); Respiratory mechanisms in aquatic (counter-current flow) and air-breathing fishes (lung fish, mud skipper, garpike, eel and electric eel), birds and mammals; Respiration in eggs; Exchange of O₂ and CO₂ and their transport; Oxygen dissociation curve (haemoglobin, myoglobin and foetal haemoglobin). Circulation: General principle, vertebrate circulation (fish to mammal), the physics of flow in tubes, Hemostasis. Blood: components and functions; acid-base balance regulation.

Unit-II: Temperature and osmoregulation: 16 Hrs
Temperature: Classification of animals based on thermal biology, Temperature relations of ectotherms (behavioural thermoregulation, physiological response to temperature change-acute, chronic and evolutionary changes, enzyme adaptation to temperature, super cooling, antifreeze compounds), heterotherms and endotherms (thermal neutral zone, temperatures below and above thermoneutrality-hypothermia, shivering and non-shivering thermogenesis, evaporative cooling – sweating, panting and gular fluttering); specialized metabolic states–torpor, hibernation, and aestivation.
Osmoregulation: Osmoregulation, Osmoregulators and Osmoconformers; Obligatory exchanges of ion and water; Osmoregulatory organs in vertebrates and invertebrates; Osmoregulation in aqueous and terrestrial animals.

Unit-III: Feeding, digestion and metabolism: 16 Hrs
Feeding methods (suspension and filter feeding); symbiosis with microbes (gut microbe); Physiology of digestion(carbohydrate, protein and lipid digestion) and absorption (hydrophilic and hydrophobic molecules), gastro-intestinal secretions, gastro-intestinal hormones (secretin, cholecystokinin and gastric inhibitory polypeptide);nutritional requirements (micro and macro), Vitamins. Enzymes: General properties, Regulation of metabolic reactions, Metabolic production of ATP; Efficiency of energy metabolism. Basal and standard metabolic rates: metabolic scaling-relation between metabolic rate and body size, allometry; energetics of food and growth.

Unit-IV: Muscle, movement and nervous system: 16 Hrs
Contractile proteins of muscle- actin and myosin; Mechanism of m u s c l e c o n t r a c t i o n , Sarcomere length-tension curve; Adaptations of muscle for various activities– jumping in frogs, swimming in fish and sound production in fish and snake and flight mechanism in insects. Nervous System: Structural organization and functions of nervous system and neuron Electrochemical, resting and action potential; Transmission of information within neuron, synaptic transmission (electrical and chemical); Neuromuscular junctions; Neurotransmitters.

HCP 3.2: PRACTICAL COURSE IN ANIMAL PHYSIOLOGY BASED ON HCT-3.2

1. Qualitative analysis of carbohydrates
2. Qualitative analysis of polysaccharides
3. Qualitative analysis of proteins
4. Qualitative analysis of lipids
5. Estimation of protein in different animal tissues
6. Estimation of glucose
7. Total count of RBC
8. Total count of WBC
9. Differential count of WBC
10. Estimation of blood clotting time
11. Estimation of hemoglobin
12. Estimation of cholesterol and triglycerides
13. Analysis of pathological contents of urine
14. Identification of adulterants
15. Any other practical depending on feasibility.

REFERENCE BOOKS RECOMMENDED:

1. Text Book of Medical Physiology, 13th Edition Guyton & Hall Saunders Publications.
2. Animal Physiology: Adaptations and Environment, Knut – Schmidh & Nielson. Cambridge University Press.
3. Medical Physiology, Boron & Boulpaep Elsevier Publications.
4. Biochemistry, 7th Edition, Berg Jm., Tymoczko JL., Strayer L.. W.H. Freeman Publications.
5. Lahniger's Principles of Biochemistry, 6th Edition. Michael M. Cox and David Nelson Macmillan Publishers.

HCT-3.3: ETHOLOGY

Total: 64 Hrs

- Unit-I:** **16 Hrs**
Introduction:
Approaches and methods for studying behavior; Proximate and ultimate causation, Ethograms. Reflexes and complex behaviours: Latency, after discharge, summation, warm up, fatigue, Inhibition and feedback control.
Instinctive behaviour:
Fixed action patterns, sign stimuli and release, types of sign stimuli.
Learning and imprinting: Definition, categories of learning, habituation, conditioning, latent learning, insight learning, social learning. Imprinting: Types of imprinting, imprinting as learning, functional aspects of imprinting.
- Unit-II:** **16 Hrs**
Development of behaviour:
Causes of behavioural changes during development, Development of bird song, Importance of early experience-critical period, Cultural transmission as a form of behavioural development.
Foraging and anti-predator behaviour:
Feeding strategies – search and selection of food, Anti-predator behaviour – avoiding detection through colour and markings (Mullarian mimicry), Warning colouration, Batesian mimicry.
- Unit-III:** **16 Hrs**
Biological communications:
Nature and functions of communications, forms and signals of communications- Visual, auditory, chemical communications.
Sexual behaviour:
Seasonality, isolation and territories with suitable examples, Sexual behaviour – Courtship behaviour, Pheromones in insects and mammals, Lee -Boot's effect, Whitten effect, Bruce effect, Coolidge effect, Castro Vandenberg effect. Courtship signals, Selected examples of courtship and mating behaviour, Courtship as conflict behaviour.
- Unit-IV:** **16 Hrs**
Social organisation:
Introduction, Advantages of grouping, Social organization in insects with special reference to ants and honeybees, Quasi social, semi social and eusocial, Social organisation in sub-human primates. Altruism.
Biological rhythms:
Types of rhythms, biological clocks and their significance.

HCP 3.3: PRACTICAL COURSE IN ETHOLOGY BASED ON HCT-3.3

1. Imprinting.
2. Insight learning.
3. Classical conditioning.
4. Operant conditioning.
5. Courtship behavior;
 - a) Andean Flamingo b) Lesser Flamingo c) Peacock d) Mallard Duck e) Stickle Back Fish f) Giraffe.
6. Insight behavior /learning; a) Chimpanzee tool use b) Orangutan in rain c) Orangutan roof preparation.
7. Stereotyped behavior; a) Graylag goose /Imprinting b) Stickleback fish c) Herring gull.
8. Territorial Behavior; a) Common black bird b) Wood pecker.
9. Nesting Behavior; a) Bower bird b) Baya bird c) Tailor bird.
10. Honey bee Communication; a) Round dance b) Waggle dance.
11. To study the geo-taxis, photo-taxis, chemo-taxis and hydro-taxi of earthworms.
12. Sexual behaviour and pupation behaviour in *Drosophila*
13. Behaviour experiments in Rat/Captive Mice/Bruce mice and foraging experiments in Honeybees.
14. Trailing behaviour in ants
15. Any other practical depending on feasibility

REFERENCE BOOKS RECOMMENDED:

1. Manning A. and Dawkins M. An Introduction to Animal Behaviour- IV Ed., Cambridge Univ. Press, 1997.
2. Harjindra Singh, A Text Book of Animal Behaviour, 1st Edition, Anmol Publications 1990.
3. Krebs, J.R. and Davies, N.B. An Introduction to Behavioural Ecology, 3rd Edition, Blackwell Scientific Publications.
4. Reena Mathur, Animal Behaviour, 1st Edition, Vivek Rostogi for Rostogi and Company, 1996.
5. Ranga, M.M., Animal Behaviour, 1st Edition, Agro Botanical Publishers, 1994.
6. Vinod Kumar, Animal Behaviour, 1st Edition. Himalaya Publishing House, 1996.

SCT- 3.1a: WILDLIFE BIOLOGY AND CONSERVATION

Total: 64 Hrs
16 Hrs

Unit-I:

Wildlife studies:

Definition of wildlife, values of wildlife, significance and scope of wildlife conservation, wildlife distribution; Global distribution, Indian wild fauna, wildlife byproducts and trade, Ethical value, Scientific value, medicinal value, game and recreation value, ecological value, wildlife as natural resource in India.

Wildlife categories and causes of depletion:

IUCN Red list, Categories of wildlife; Extinct, Endangered, Threatened, Vulnerable, rare; data deficient categories. Causes of wildlife depletion: Degradation and destruction of natural habitats, Exploitation for commercial purposes, Deforestation, Agricultural expansion and grazing, Urbanization and industrialization, Forest fires. Human-wildlife conflicts.

Unit-II:

16 Hrs

Wildlife conservation:

Historical background, Need of conservation projects in India, Ex- situ & in-situ conservation. National parks, Wildlife sanctuaries, wildlife reserves, Biosphere reserves. National parks and wildlife sanctuaries in Karnataka. Umbrella species, flagship species based conservation programmes. Mitigation of human-wildlife conflicts.

Unit-III:

16 Hrs

People and conservation:

Traditional knowledge, Traditions & cultures, Women in conservation Traditional Societies (e.g. bedas, kadu kurubas, tribble peoples).

Role of NGOs in conservation: International NGOs; UNEP, GEF, WCS, Bird Life International Important NGOs in India & their contributions , WWF, ATREE, BNHS, WTI, Kalpavriksha etc. Important NGO movements, Chipko movement, Narmada Bachavo Aandholan, Pani Panchayats, Seed Movement etc. - 20 hrs

Unit-IV:

16 Hrs

International conventions on conservation:

Important International conventions & treaties on nature & conservation, India's role & contributions, Institutions and their role in conservation; Zoos, Natural history museums & collections, Zoological Survey of India, Botanical Survey of India, Forest Research Institute, Central Marine Fisheries Research Institute

Wildlife and legislation: Constitutional provisions, National and International guidelines and protocols.

SCP-3.1a: PRACTICAL COURSE IN WILDLIFE BIOLOGY AND CONSERVATION BASED ON THE SCT- 3.1a

1. Importance and scope of biodiversity
2. Methods of biodiversity study
3. Study of bio-geographical realms.
4. Biodiversity hotspots of the World.
5. Wildlife sanctuaries, National parks and Wetlands of India.
6. Wildlife sanctuaries of Karnataka
7. Critical studies on endangered, endemic, vulnerable, exotic, extinct species of India.
8. Critical studies on endangered and extinct species of World
9. On a phyto-geopgrahic map of India locate & demarcate major sanctuaries / national parks.
10. Identify and describe false colour images of land use patterns from a satellite image; City, reservoir, forest, agricultural land, sea-shore.
11. Using photographs / paintings / coloured drawings identify and study distribution and ecological role of Endangered species of India
12. Using photographs / paintings / coloured drawings identify and study distribution and ecological role of Endemic species of Western ghats .
13. Using photographs / paintings / coloured drawings identify and study the extinct species of globe.
14. Determination of species diversity by Shannon-Weiner Index
15. Determination of species diversity by Simpson's index
16. Visit to a wildlife sanctuary, zoo/natural history Museum and submission of a report.
17. Audio-visual programmes.
18. Any other practical depending upon feasibility.

REFERENCE BOOKS RECOMMENDED:

1. Ali, S. and Ripley S.D. Hand Book of Birds of India and Pakistan, Oxford University, 1969.
2. Chatrath, K.J.S. Wetlands of India, Ashish Publishing House, New Delhi, 1992.
3. Heywood, V.H. (Eds). Golbal Biodiversity Published for UN Environmental Programme, Cambridge University Press, 1995.
4. Hosetti, B.B. Concepts in Wildlife Management, Daya Publishing House, Delhi, 1996.
5. Hosetti, B.B. and Venkateshwarlu M. Wildlife Trends in Biodiversity Conservation and Management, Daya publishing House, Delhi-35, India, 2001.
6. Hosetti, B.B. Glimpses of Biodiversity, Daya Publishing House, Delhi-35, India, 2002.
7. Stiling, P. Ecology: Theories and Applications IV Ed. Prentice Hall of India Pvt. Ltd., New Delhi-110 001 2002.
8. Khanna, D.R. and P.R.Yadav. Biology of Birds, Discovery Publishing House, New Delhi 110 002, 2005.
9. Sharma, B.B. High Altitude Wildlife of India, IBH Publ. House New Delhi, 1994.
10. Ganguly, G. Sinclair and R.E. Anthony, Wildlife Ecology and Management, Blackwell Scientific Publ. Bostan, 1994.
11. Negi, S.S. Hand Book of National Parks, Wildlife Sanctuaries and Biosphere Reserves in India. Indus Publ., New Delhi, 2002.

SCT- 3.1b: ENTOMOLOGY

Total: 64 Hrs

Unit-I: 16 Hrs

Morphology of insects:

External features and their articulation. Comparative study of head-antennae, mouth parts, thorax - legs, wings, abdominal appendages, genitalia. Taxonomy - historical development of classification of insects, Basis of insect classification, Classification of insects up to orders.

Insect physiology:

General structure and functions. Digestive system, Excretory system, Nerve system, Reproductive system, Respiratory system and Endocrine system.

Metamorphosis, Sense organs, Light producing organs and Bio chemistry of Light production.

Unit-II: 16 Hrs

Insect-plant interactions:

Theory of co-evolution, role of allelo-chemicals in host plant mediation, host plant selection by phytophagous insects, establishment of insect population on a plant surface.

Agricultural entomology:

Pests - definition and its ecology, features responsible for evolutionary success of insect species, factors responsible for achieving the status of pest. Pest of major crops (adaptations and control) Cereals: Rice & Maize. Oil seeds: Sun flower & Groundnut. Vegetable crops: Brinjal and Ladies finger. Miscellaneous: Sugarcane, Cotton and Coconut.

Unit-III: 16 Hrs

Insects and sociality:

Group of social insects and their social life, evolution of sociality, social organization and social behaviour - Honeybees, Ants, Termites and Wasps.

Integrated pest management (IPM):

History, different phases of pest control, Quarantine, Physical, Cultural, Chemical, Biological control and, genetic and biotechnological methods of control. Pheromones- production and their use in pest surveillance and management.

Unit-IV: 16 Hrs

Forensic entomology:

Introduction, forensically important insects, collection of data from cadaver site, interpretation of data for predicting time and cause of death.

Veterinary and forest entomology:

Common insects attacking humans and domestic animals; their life history, mode of attack, type of injury or infection, treatment and control especially with reference to house fly, blow flies, blood sucking insects. Insect pests of timber and forest products.

SCP-3.1b: PRACTICAL COURSE IN ENTOMOLOGY BASED ON THE SCT- 3.1b

1. Methods of collection and preservation of insects including immature stages.
2. External features of grasshopper/blister beetle.
3. Types of insect antennae, mouth parts and legs.
4. Wing venation, types of wings and wing coupling apparatus.
5. Types of insect larvae and pupae.
6. Dissection of digestive system in insects (cockroach).
7. Dissection of male and female reproductive systems in insects (cockroach).
8. Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera.
9. Study of characters of orders Thysanoptera, Hemiptera, Lepidoptera, Neuroptera.
10. Study of characters of orders Coleoptera, Hymenoptera and Diptera and their families of agricultural importance.
11. Identification and anatomical studies of major vector species of *Anopheles*, *Culex* and *Aedes*.
12. Study of common insects and their significance.
13. Insecticides and their formulations.
14. Pesticide appliances and their maintenance.
15. Sampling techniques for estimation of insect population and damage.
16. Any other practical depending on feasibility.

REFERENCE BOOKS RECOMMENDED:

1. Awasti V.B. Introduction to General Entomology, 3rd Ed. Scientific publication (India), Jodhpur, 2009.
2. Awasti V.B. Agricultural Insect Pests and Their Control. Scientific publishers (India) Jodhpur, 2007.
3. Beranays, E. A and Chapman, R.F. Host Selection By Phytophagous Insects. Chapman & Hall Cambridge University, New York, USA, 2006.
4. Chapman R.F. The Insects: Structure and Function. 5th Edition, Cambridge University Press, 1998.
5. Dhaliwal G.S. Ramsingh and B.S. Chillar. Essentials of Agricultural Entomology. Kalyani Publishers, New Delhi, 2006.
6. Gullan, P.J. and Cranston, P. The Insects: An Outline of Entomology. 4th Edn., Wiley : Blackwell Press, 2010.
7. Kerkut G.A. and Gilbert L.I. Comprehensive Insect Physiology, Biochemistry and Pharmacology, vol. I-XIII. Pergamon Press. Oxford and New York, 1985.
8. Pedigo, L. Entomology and Pest Management, 6th Edt., Prentice - Hall, Upper Saddle River, New Jersey, 2009.
9. P.W. Price et. al., Insects Ecology-Behaviour, Population and Communities. Cambridge University Press, 2011.
10. Turner R.B. Analytical Biochemistry of Insects. Elsevier Scientific Publishing Co., Amsterdam, 1977.
11. Wall R. and Shearer D. Veterinary Entomology: Arthropod Ecto-parasites of Veterinary Importance. Chapman & Hall. USA, 1997.
12. Wigglesworth V.B. The Principles of Insect Physiology. English Language Book Society and Methaune & Co., Ltd., 1965.

OET- 3.1a: REPRODUCTION AND DEVELOPMENT

Total: 32 Hrs

Unit- I: Reproductive biology:

16 Hrs

Histo-architecture of testis, Spermatogenesis and its hormonal regulation, Male accessory reproductive organs: Epididymis, Vas deferens, Seminal vesicle, Prostate gland, Cowper's gland. Histo-architecture of ovary, Oogenesis and its hormonal regulation. Female accessory reproductive organs: Uterus, fallopian tube. Male and female gametes (sperm and Ova); Fertilization; Implantation; Placenta. Pregnancy and Lactation. Fertility control in male and female. Infertility; Assisted reproductive techniques; IVF, GIFT, ZIFT, Surrogate mother.

Unit-II: Developmental biology:

16 Hrs

Overview of how the modern era of developmental biology emerged through multidisciplinary approaches. Stages of development- zygote, blastula, gastrula, neurula. Cell fate & commitment – potency- concept of embryonic stem cells, lineages of three germ layers, fate map. Post-Embryonic Development: Regeneration in Hydra and Planaria; Teratology-Teratogens; Endocrine disruptors; Developmental plasticity.

REFERENCE BOOKS RECOMMENDED:

1. Hogarth, P. J. Biology of Reproduction. Blakie Glasgow, U. K., 1978.
2. Knobil, E and Neil J. D. The Physiology of Reproduction. Vol. I & II. Raven Press, N. Y. 1994.
3. Balinsky, B.I., An Introduction to Embryology. W.B.Saunders Company, 1965.
4. Gilbert, S. F., Developmental Biology, 10th Ed. Sinauer Associates Inc. Massachusetts, USA, 2014.
5. Rao, V. Developmental Biology. A Modern Synthesis. Oxford and IBH Delhi, 1994.
6. Vasudeva Rao, Developmental Biology: A Modern Synthesis, Oxford & IBH, New Delhi, 1994.
7. Wolpert, L, Beddington, R Jessell, T. Lawrence P, Meyerowitz, E, Smith J. Principles of Development. Oxford University Press Oxford, 2001.
8. Adashi et al: Reproductive Endocrinology, Surgery and Technology. Lippincott-Raven Publishers, 1996.
9. Findlay, J.K.: Molecular Biology of the Female Reproductive System. Academic Press, San Diego, 1994.

OET- 3.1b: DIVERSITY OF ANIMALS

Total: 32 Hrs

UNIT-I: Non-chordates:

16 Hrs

Classification of Animal Kingdom; General characters and classification of Non-chordates; Protozoa, Porifera, Coelenterate, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca and Echinodermata with suitable examples.

Unit-II: Chordates:

16 Hrs

Fundamental characters and classification of chordates; General Characters and classification of Protochordates, Cyclostomata and Vertebrates; fishes, amphibians, reptiles, aves and mammals with suitable examples.

REFERENCE BOOKS RECOMMENDED:

1. Barnes R. D. Invertebrates Zoology 6th Edn. Brooks Cole; 6th edition 1993.
2. Hyman L.H. The Invertebrata, Vol. I to VI, 1940.
3. Carter, G. S. A. General Zoology of Invertebrates 2nd endn. Wick and Jackson Ltd., London, 1946.
4. Borrardile, L.A. The Invertebrata. 2nd Endn. Cambridge University Press,1955.
5. Barrington, E. J. W. Invertebrate Structure and Functions. English Language. Book Society, 1969.
6. Jolie, M. Chordate Morphology. East West Press. 1968
7. Romer, A.S. Vertebrate Body.1976.
8. Young, J.Z .The Life of Vertebrates, III Edition. Oxford university Press,(2004.
9. Pough H. Vertebrate Life, VIII Edition, Pearson International, 2006.
10. R. L. Kotpal- Invertebrate Zoology, Vertebrate Zoology,2008
11. P.S. Dhami and J. K. Dhami Practical Zoology, 2000
12. S. Chand and co New Delhi. Invertebrate Zoology, 8th Edition, Holt Saunders International Edition,2006.