Scheme of Programme: Bachelor of Science in Life Sciences

Subject: Zoology

(Scheme UG A1: Undergraduate Programmes (Multidisciplinary)

Semester 1

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
CC-A1	Animal Diversity-I		3	-	2	3	-	1	4	25	50	5	20	100

Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
CC-A2	Animal Diversity-II		3	-	2	3	-	1	4	25	50	5	20	100

Semester 3

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
CC-A3	Cell and Molecular Biology		3	-	2	3	-	1	4	25	50	5	20	100

Semester 4

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
CC-A4	Biomolecules and Mammalian Physiology		3	-	2	3	-	1	4	25	50	5	20	100

Internship is to be done during summer break after 4th Semester, Marks will be added in 5th Semester.

Semester 5

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
CC-A5	Genetics and Developmental Biology		3	-	2	3	-	1	4	25	50	5	20	100

Semester 6

Course Code	Course Title	Course ID	L	T	P	L	T	P	Total Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
CC-A6	Ecology and Evolution		3	-	2	3	-	1	4	25	50	5	20	100

Semester 7; 8 (Honours) and Semester 8 (Honours with Research): Detailed Scheme will be prepared in due course of time.

Syllabus UG A1: Undergraduate Programmes (Multidisciplinary)

DISCIPLINE SPECIFIC CORE COURSE FOR B. Sc. LIFESCIENCE

ZOOLOGY: SEMESTER-I								
CourseType	**Course Code**	**Name of the Course**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
CC-A1 4 credits		**ANIMAL DIVERSITY-I**	**3**	**3**	**25**	**50**	**75**	**2 hrs.**
		Practical	**1**	**2**	**5**	**20**	**25**	**2 hrs.**

Level of the course: 100-199

Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)

Course Learning Outcomes (CLO)

1. Student will be able to describe unique characters and recognize life forms of phylum Protozoa and Porifera
2. Student will be able to describe unique characters and recognize life forms of phylum Coelenterata and Helminthes
3. Student will be able to describe unique characters and recognize life forms of phylum Annelida and Arthropoda
4. Student will be able to describe unique characters and recognize life forms of phylum Mollusca, Echinodermata and Hemichordates
5. Students will be capable of identifying the characters and classification of Non-Chordates

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Phylum Protozoa: General characters and classification up to order level. Parasitic protozoans: Life history, mode of infection and pathogenicity of *Entamoeba*, *Trypanosoma*, *Leishmania*, Life history of *Plasmodium* Phylum Porifera: General characters and classification up to order level; Biodiversity and Economic importance; Canal system in sponges, spicules in sponges	12
II	Phylum – Coelenterata: General characters and classification up to order level.Corals and coral reefs, Polymorphism in Siphonophores, Phylum – Platyhelminthes and Aschelminthes: General characters and classification up to order level, Life history of Liver Fluke (*Fasciola hepatica),* Life history of *Taenia solium,* Helminth parasites, their mode of infection and pathogenicity	11
III	Phylum – Annelida: General characters and classification up to order level, Metamerism in Annelids, Type study of *Pheretima posthuma* (Habitat, habits, digestive System, circulatorysystem, nervous system, reproductive system) Phylum – Arthropoda: General characters and classification up to order level, Mouth parts and appendages in insects, Ecological role of Insects	11

IV	Phylum - Mollusca: General characters and classification up to order level,Torsion and detorsion in Gastropoda, Respiration and foot in Mollusca Phylum – Echinodermata: General characters and classification up to order level, Type study of Asterias (Habitat, habits, external morphology, water vascular system, Circulatory System) Phylum Hemichordata: General characters of Hemichordates with examples	**11**
V Practical	Classification up to orders with ecological note and economic importance of the following animals: 1. Protozoa: Lamination of cultures of *Amoeba, Euglena* and *Paramecium;* permanent prepared slides: *Amoeba, Euglena, Trypanosoma, Paramecium* (binary fission and conjugation), *Opalina* 2. Parazoa (Porifera): *Sycon, Euplectella, Hyalonema, Euspongia* 3. Coelenterata: *Physalia, Aurelia, Metridium, Millipora, Tubipora, Madrepora, Favia, Fungia.* Permanent prepared slides: *Hydra* (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Aurelia* (sense organs and stages of life history). 4. Playhelminthes:*Fasciola, Taenia,* Permanent prepared slides: *Miracidium, Sporocyst, Redia, Cercaria, Scolex* and *Proglotttids of Taenia* (mature and gravid). 5. Aschelminthes: *Ascaris* (male and female), *Trichinella, Ancylostoma* 6. Annelida: *Pheretima, Heteronereis, Aphrodite, Chaetopterus, Tubifex* 7. Arthropoda: *Peripatus, Palaemon* (Prawn), *Lobster, Cancer* (crab), *Eupagurus* (hermit crab),*Cyclops, Daphnia, Periplaneta* (cockroach), *Schistocerca* (locust), *Poecilocerus* (ak-hopper), *Gryllus* (cricket), *Mantis* (praying mantis), *Cicada,* Dragon fly, termite queen, *Polistes* (wasp), *Apis* (honey bee), *Bombyx* (silk moth), *Millipede, Scolopendra* (centipede), *Palamnaeus* (scorpion), *Aranea* (spider), *Limulus* (king crab) 8. Mollusca: *Mytilus, Ostrea, Solen* (razor/Fish), *Pecten, Holiotis, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus* (complete and T.S.), *Chiton* and *Dentalium* 9. Echinodermata: *Asterias, Echinus, Cucumaia Antedon* and *Asterophyton* 10. Hemichordata: *Balanoglossus* Study of slides of Non-Chordates phyla; Staining of *Obelia* and *Sertularia*	**30**

Learning Resources

1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
2. Ayyar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.
3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut
6. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut
7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
8. Edward E. Ruppert, Robert D. Barnes (1994)· Invertebrate Zoology ; Saunders College Pub.

ZOOLOGY: SEMESTER-2								
Course Type	**Course Code**	**Name of the Course**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
CC-A2 4 credits		**Animal Diversity-II**	**3**	**3**	**25**	**50**	**75**	**2 hrs.**
		Practical	**1**	**2**	**5**	**20**	**25**	**2 hrs.**

Level of the course: 100-199

Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)

Course Learning Outcomes (CLO)

1. Student will be able to describe unique characters and recognize life functions of Protochordates
2. Student will be able to describe unique characters and recognize life functions of Pisces
3. Student will be able to describe unique characters and recognize life functions of Amphibians & Reptiles
4. Student will be able to describe unique characters and recognize life functions of Birds & Mammals
5. Students will be capable of identifying the characters and classification of Chordates

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	**Chordates**: Salient features of chordates; Origin and classification of chordates. Functional morphology of the types with examples emphasizing their biodiversity, economic importance and conservation measures where required. **Protochordates**: Urochordata: Classification and ecological significance; morphological features and affinities of Urochordata Cephalochordata: Classification and ecological significance; morphological features and affinities of Cephalochordata **Cyclostomes:** Classification and ecological significance; morphology and affinities	11
II	**Pisces**: General characters and classification of all phyla upto orders with examples emphasizing their biodiversity, economic importance and conservation measures where required. Type study of *Labeo rohita* Scales & Fins, Parental care in fishes, Migration in fishes.	11
III	**Amphibia**: General characters and Classification upto class level; Parental Care and Neoteny in Amphibia. Difference between frog and toad, Type study of *Rana* **Reptilia:** General characters and Classification upto classes; Extinct reptiles; poison apparatus in snakes, Difference between poisonous and non-poisonous snakes; Key for Identification of poisonous and non-poisonous snakes.	11
IV	**Aves:** General characters and Classifications upto classes. Flight/Aerial adaptation in birds, origin and types of Feathers; Migration in Birds. **Mammals:** General characters and classification up to classes; adaptive radiation in mammals; Dentition in mammals; Type study of rat.	12

V **Practical**	1. Classification upto orders, habit, habitats, external characters and economic importance (if any): • Protochordata: *Molqula, Doliolum, Olikopleura,* and *Amphioxus.* • Cyclostomata: *Myxine, Petromyzon* and *Ammocoetus larva.* • Chondrichthyes: *Zygaena, Pristis, Narcine* (electric ray), *Trygon, Rhinobatus, Raja* and *Chimaera.* • Osteichthyes: *Acipenser, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Diodon, Ostracion, Tetradon, Echinus, Solea* and *Polypterus.* Any of the Lung Fishes. • Amphibia: *Necturus, Proteus, Amphiuma, Salamandra, Ambystoma, Axolotl larva, Alytes, Bufo, Rana.* • Reptilia: *Hemidactylus, Calotes, Draco, Varanus, Chamaeleon, Typhlops, Python, Ptyas, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise). • Aves: *Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo,* • Mammalia: *Ornithorhynchus, Echidna, Didelphis, Macropus. Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus.* 2. Study of the skeleton of *Rana* (Frog), *Varanus,* Pigeon or Gallus and *Orcyctolagus*/rat. 3. Study of the following permanent slides: T.S. *Amphioxus* (through different regions).Histology of rat (compound tissues), different types of scales. 4. Make permanent stained preparations of the following: *Salpa,* Spicules, and Pharynx of *Herdmania, Amphioxus*, Cycloid scales 5. Field Visit to/ report on Protected areas/National Park/Wildlife Sanctuary, Zoological museum or Zoo 6. **Project report** on local birds	**30**

Learning Resources

1. R.L.Kotpal. Modern Textbook of Zoology
2. E.L. Jordan and Verma. Chordate Zoology.
3. Barrington, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.
4. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.
5. Kent, C.G. Comparative anatomy of vertebrates.
6. S.S. Lal. Practical Zoology Vertebrate

ZOOLOGY: SEMESTER-3								
Course Type	**Course Code**	**Name of theCourse**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
CC-A3 4 credits		**CELL AND MOLECULAR BIOLOGY**	**3**	**3**	**25**	**50**	**75**	**2 hrs.**
		Practical	**1**	**2**	**5**	**20**	**25**	**2 hrs.**

Level of the course: 100-199

Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)

Course Learning Outcomes (CLO)

1. Students would gain expertise in the ultrastructural information of animal cell besides the detailed views of the cell interior revealing the various events and actions of cell at the molecular level.
2. This course will help the students to understand the new discoveries about the structure and internal functioning of the cell due to technological improvements in cell and Molecular Biology
3. Students will be able to understand the concept of cell-division, DNA replication, mRNA and protein synthesis in the cell
4. Students will get a basic knowledge of
5. The course will help the students to increase powerful means of visualization in the field of cell biology and Molecular biology

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Plasma Membrane: Fluid mosaic model, transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis. Endoplasmic reticulum (ER): Types and its functions. Golgi complex: Structure and role of Golgi-complex in animal cell. Ultrastructure and functions of Nucleus: nucleolus, nucleosome concept and role of histones, fine structure of chromosomes, Euchromatin and heterochromatin, lampbrush chromosomes and polytene chromosomes.	12
II	Ribosomes: Types, and role in protein synthesis. Lysosomes: Structure, enzymes and their role; Mitochondria: Structure and role of mitochondria. Cytoskeleton: Microtubules, microfilaments, centriole and basal body, cilia and flagella	11
III	Cell division (Mitosis and meiosis) and cell cycle; DNA replication, Transcription and Translation	11
IV	Basic idea of Immunology, B and T cell and their role in immunity, Innate and Acquired immunity, MHC, antigen and antibody, Basic concept of Cancer	11

V **Practical**	1. Cell division: Prepared slides of stages of mitosis and meiosis. 2. Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain. 3. Study of Polytene/Lampbrush chromosome in the salivary glands of Drosophila/ Chironomus larva 4. Study of Barr body/Drumstick (Heterochromatin of X-chr.) in the buccal epithelium/ blood smear of females 5. Project/ Model Preparation: a) DNA: types, structure and its model preparation b) Staining techniques and their significance	**30**

Learning Resources

1. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.
2. Molecular Biology of the Cell, B. Alberts, D.Bray,J. Lewis,M.Raff,K. Roberts, and J.D. Watson. Garland Publishing Inc., New York.
3. Cell and molecular biology, Phillip Sheeler, Donald E. Bianchi Wiley,1987
4. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox, 8th ed. MacMillan Publishing Co. Uk.
5. Fundamental Immunology, William E. Paul, 7th ed. Lippincott Williams & Wilkins, Walter Kluwer.

SEMESTER-4								
Course Type	Course Code	Name of theCourse	Credit	Contact Hours/ Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
CC-A4 4 credits		Biomolecules and Mammalian Physiology	3	3	25	50	75	2 hrs.
		Practical	1	2	5	20	25	2 hrs.

Level of the course: 100-199

Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)

Course Learning Outcomes (CLO)

During this course, students would be able to

- understand the basic structure and metabolic fate of carbohydrates, proteins and fats and understand the mechanics of enzyme action.
- Gain knowledge about the principles of physiology of both cells and organisms.
- Acquire appropriate understanding of functioning of each system and their regulation
- Perform some basic qualitative analytical test of some biomolecules

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	**Introduction to Biomolecules:** Introduction, classification, structure, function and general properties of Proteins, carbohydrates, fats and nucleic acids **Enzyme action and regulation** Mechanism of action (induced fit theory), Enzyme Kinetics (Michaelis Menten equation for single enzyme single substrate reactions), Enzyme inhibition and regulation.	12
II	**Physiology of Digestion:** Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids. Assimilation **Physiology of Respiration:** Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood, oxygen dissociation curve of hemoglobin, Bohr's effect, Hamburger's phenomenon (Chloride shift), control / regulation of respiration.	11
III	**Excretion:** Patterns of excretory products viz. Amonotelic, ureotlic uricotelic, ornithine cycle (Kreb's– Henseleit cycle) for urea formation in liver. Urine formation, counter-current mechanism of urine concentration, osmoregulation **Physiology of Circulation:** Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle, electrocardiogram, cardiac output, Composition and functions of blood & lymph; Mechanism of coagulation of blood, haempoiesis.	11
IV	**Neural Integration:** Nature, origin and propagation of nerve impulse along with medullated & non-medullated nerve fibre, conduction of nerve impulse across synapse. **Chemical integration of Endocrinology:** Structure and mechanism of hormone action; physiology of hypothalamus, pituitary, thyroid, parathyroid, adrenal, pancreas and gonads.	11

V Practical	1. Perform qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose and Starch) 2. Knowledge of daily requirement and deficiency disorders of macronutrients (Carbohydrates, Fats and proteins) and micronutrients like Iron, Zinc, Calcium, Magnesium etc. in the diet of children, young adults, pregnant/lactating and elderly. 3. Study of activity of salivary amylase under optimum conditions, effect of temperature, pH on activity of Salivary amylase 4. Preparation of Hematin crystals from dry or fresh blood 5. DLC from your own blood 6. Hb estimation from your own blood 7. Study the Use of respirometer/Kymograph	**30**

Learning Resources

1. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
2. Chatterjee C C , Human Physiology. 1992.
3. Guyton, Text book of Medical Physiology, 10th Ed. W B Saunders 23
4. Wood, D.W. Principles and Animal physiology,1968.

ZOOLOGY: SEMESTER-5								
Course Type	**Course Code**	**Name of the Course**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
CC-A5 4 credits		**Genetics and Developmental Biology**	**3**	**3**	**25**	**50**	**75**	**2 hrs.**
		Practical	**1**	**2**	**5**	**20**	**25**	**2 hrs.**

Level of the course: 100-199

Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)

Course Learning Outcomes (CLO)

By studying this course, students will be able to

- develop understanding of the basic patterns of inheritance.
- develop analytical skills and critical thinking through pedigree analysis
- Learn the mechanisms of mutations and harmful and beneficial effects of mutagens, which help evolve new species over time.
- grasp basic concepts of human chromosomal disorders
- learn the fundamental processes and roles of reproduction in animals,
- gain knowledge how the developmental stages are maintained and regulated.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Elements of Heredity and variations, the varieties of gene interactions, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, penetrance and expressivity, Epistasis, Phenocopy, Pleiotropy, Polygenic Inheritance, Linkage and recombination, crossing over, recombination frequency, Sex determination in *Drosophila* and human, Sex linked inheritance: Haemophilia and colour blindness in man, Extra chromosomal and cytoplasmic inheritance: i) Kappa particles in *Paramecium*. ii) Milk factor in mice Maternal effects: Shell coiling in *Limnaea*	12
II	Gene mutations: spontaneous and induced (chemical and radiations) mutations; chemical basis of mutations; transition, transversion, Chromosomal abnormalities involving autosomes and sex chromosomes : Structural chromosomal aberrations (deletion, duplication, inversion and translocation) and Numerical aberrations (autoploidy, euploidy and polyploidy in animals) Inborn errors of metabolism (Alkaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia	11
III	Gametogenesis: spermatogenesis and oogenesis; Structure of spermatozoon and ovum. Hormonal regulation of gametogenesis, ovulation, formation of corpus luteum. Fertilization: events and types, prevention of polyspermy, monozygotic and dizygotic twins. Parthenogenesis. Implantation and gestation, types and functions of placenta in mammals	11
IV	Types of eggs and patterns of cleavage, Blastulation, gastrulation and Fate maps in frog and chick Extra-embryonic membranes in chick; Concept of organizer and induction; Regeneration in invertebrates and vertebrates; Concept of Ageing	11

V **Practical**	1. Simulation exercises using beads or seeds to study the monohybrid and dihybrid cross and various gene interactions: 9:3:4; 12:3:1; 9:7; 9:3:3:1 (comb shapes in roosters) 2. Pedigree analysis of Autosomal Dominant trait, Autosomal recessive trait, X-linked Dominant traits, X-linked recessive traits, Y-linked traits and mitochondrial traits. 3. Study of Human Karyotypes, karyotypes of Human chromosomal disorders 4. To study the various developmental stages of life cycle of Frog with the help of slides/charts/videos 5. To study various developmental stages of chick embryo with the help of the permanent slides/charts/videos 6. Project on Epigenetic, Eugenics, Euthenics and Euphenics.	**30**

Learning Resources

1. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons In.
2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cumming
3. Peter, J. Russell. (2009), iGenetics: A molecular approach. 3rd Edition. Benjamin Cumming
4. Barresi, M. J. F., and Gilbert, S. (2020). Developmental Biology (12th edition). Sinauer Associates, Inc.
5. Sadler, S. L. (2019). Langman's Medical Embryology (13th edition). Wolters Kluwer India Pvt. Ltd.
6. Sastry, K. V., and Shukla, V. (2018). Developmental Biology (2nd edition). Rastogi Publications.

ZOOLOGY: SEMESTER-6								
Course Type	**Course Code**	**Name of the Course**	**Credit**	**Contact Hours/ Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
CC-A6 4 credits		**Ecology and Evolution**	**3**	**3**	**25**	**50**	**75**	**2 hrs.**
		Practical	**1**	**2**	**5**	**20**	**25**	**2 hrs.**

Level of the course: 100-199

Pre-requisite for the course (if any): Biology as a Subject at 4.0 Level (Class XII)

Course Learning Outcomes (CLO)

By learning this course, students will be able to-

- gain knowledge about the origin of life on earth and evolution of animals
- learn the basic concept of ecosystem and its functioning
- gain knowledge on how the animals interact with the ecosystem.
- Learn about causes and effects of environment pollution and natural and man-made disasters

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	**Basic concepts of ecology:** Definition, significance. Concepts of habitat and ecological niche. Factors affecting environment: Abiotic factors (light-intensity, quality and duration), temperature, humidity, topography; edaphic factors; biotic factors	**12**
II	**Ecosystem:** Concept, components, properties and functions; Ecological energetics and energy flow-food chain, food web, trophic structure; ecological pyramids concept of productivity. Major ecosystems of world, threats to the ecosystems and biodiversity; biodiversity conservation **Biogeochemical cycles:** Concept, reservoir pool, gaseous cycles and sedimentary cycles. **Population:** Growth and regulation	**11**
III	Origin of life on Earth; Concept and evidences of organic evolution; Theories of organic evolution; Concept of microevolution and concept of species	**11**
IV	Concept of macro-and mega-evolution. Concept of Geological Time-scale Phylogeny of horse. Evolution of man	**11**
V Practical	1. Evolutionary evidences and/or its demonstration through models/video/CD etc and preparation of working models of the different systems of the following animals: - -Adaptive modifications in feet and beaks of birds- -Evolutionary evidences of man and Horse 2. Chemical analysis of pond water and soil for pH, 3. Chemical analysis of pond water and soil for dissolved oxygen, 4. Chemical analysis of pond water and soil for free CO_2 and nitrates, 5. Chemical analysis of pond water and soil for phosphates and chlorides	**30**

	6. Project on Environment Pollution/Disaster management	

Learning Resources

1. Odum, E.P. (2005). Fundamentals of Ecology. New Delhi, India: Cengage Learning India Pvt. Ltd., 5th edition.
2. Sharma, P.D. (2010). Ecology and Environment. Meerut, India: Rastogi Publications. 8th edition.
3. Singh, J.S., Singh, S.P., Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. New Delhi, India: S. Chand
4. Futuyma, D. J. (2017). Evolution (4th edition). Sinauer Associates Inc.
5. Hall, B. K., and Hallgrimsson, B. (2013). Strickberger's Evolution (5th edition). Jones and Bartlett Publishers.
6. Mathur, R., and Singh, S. P. (2008). Evolution and Behaviour. Rastogi Publications, Meerut, India.