

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-V
MAJOR COURSE - 1 (THEORY)
BS23MJ5ZO1
(IKS-Zoology)

Total Credit - 04

04 Lectures/Week

UNIT	TOPICS	CREDIT	HOURS
Unit-I	Ethnozoology and Indian Knowledge System (IKS) - Traditional uses of animals and animal products in rituals, folklore and daily life - Animals and animal products used in medicinal treatment - Ethical considerations, conservation implications, and modern perspectives - Indian Zoologists – Shalihotra, Palakapya, Sushruta, Charaka, Kautilya, Varahamihira, Hamsadeva, Ram Brahma Sanyal, C. R. Narayan Rao, Sunder Lal Hora, Salim Ali	1	15
Unit-II	Importance of Yoga and Pranayama in Wellness - Yoga Darshana, Samkhya Darshana, Vedanta Darshana - Ayurveda – Doshas, Dincharya and Ritucharya, Panchkarma, Naturopathy - Asanas, Pranayama, Kumbhaka, Mudra and Bandha - Exchange and Transport of Respiratory gases - Control of Respiration – Nervous control, Chemical stimuli and other factors	1	15
Unit-III	IKS, Origin of life and Evolution - Cosmology – Kalpas, Yugas and Manvantaras - Origin of Life (Fundamental Principles) – Hiranyagarbha, Panchamahabhutas, Brahman (Ultimate Reality), Purusha and Prakriti (Samkhya Philosophy), Nyaya-Vaisheshika Atomism - Evolution and Transformation of Forms – Dashavatara, Karma and Rebirth (Samsara) Gunas (Qualities of Prakriti), Subtle Body (Sukshma Sharira) - Darwinism and Neo-Darwinism - Convergent and Divergent evolution - Adaptive Radiation - Geological time scale - Origin and Evolution of Human	1	15

Unit-IV	IKS and Economic Zoology • Economic utility of animals in ancient India – Cattles, Ship, Goat, Horse, Elephant, Aquatic animals, Birds, Dogs • Dairy farming - Important breeds/species • Apiculture – Classification and Diversity of honeybees, Methods of Apiculture, Appliances of Apiary, Economic importance of Honey and Wax • Sericulture – Classification and Diversity of silkworm, Requirement for sericulture, Rearing of silkworm, Economic importance of silk	1	15
References: 1. The Knowledge Book: Key Concepts in Philosophy, Science and Culture by National Book Trust – This book provides an overview of various philosophical and cultural concepts, including some from Indian traditions, which could be used to contextualize zoological concepts. 2. Indian Zoology: Humane Approach by Ramesh Gupta – This book discusses zoology with a focus on ethical and humane treatment of animals, which could resonate with Indian philosophical perspectives. 3. Sastry JLN, Dravyaguna Vijnana, Vol-I, Chaukhambha Orientalia, Varanasi, 2005. 4. Sastry JLN, Dravyaguna Vijnana, Vol-II, Chaukhambha Orientalia, Varanasi), 2005. 5. Sharma PV. History of medicine in India, Chowkhamba Orientalia Varanasi. 6. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan. 7. Principles of Anatomy and Physiology, Tortora and Anagnostakos, HarperCollins College Publishers, 4th Edition. 8. Veer Bala Rastogi (2017) Organic Evolution. Med Tech. 9. Evolution. Futuyma, Douglas J. and Kirkpatrick Mark. (4th Edition) Sinauer. 10. Applied Zoology: N. Arumugam, T. Murugan, J. Johnson Rajeswar and R. Ram Prabu, Saras Publication. 11. Economic Zoology: G.S. Shukla and V.B. Upadhyay, Rastogi Publication.			

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-V
MAJOR COURSE - 2 (THEORY)
BS23MJ5ZO2
(Animal Biochemistry and Metabolism)

Total Credit - 04

04 Lectures/Week

UNIT	TOPICS	CREDIT	HOURS
Unit-I	Carbohydrates • Introduction, Definition, Significance and classification • Monosaccharides – Definition, General formula, Classification up to Hexoses • Disaccharides – Definition and Classification. Structure of Maltose, Lactose, Cellobiose, Sucrose • Polysaccharides – Definition and classification based on structure and function a) Homopolysaccharides – Starch, Glycogen, Cellulose, Chitin b) Heteropolysaccharides – Hyaluronic acid, Chondroitin sulphate, Heparin	1	15
Unit-II	Protein • Introduction, Definition and Significance • Amino acids – Classification based on side chain/R group • Formation of peptide bond, N and C terminal • Types of chemical bonds in protein • Protein configuration – Primary, Secondary, Tertiary and Quaternary structure • Classification of proteins – Based upon shape, composition and solubility	1	15
Unit-III	Lipids • Introduction, Definition and Significance • Components – Alcohols and fatty acids • Types of fatty acids a) Saturated fatty acids – Butyric, Palmitic, Stearic and Arachidic acid b) Unsaturated fatty acids – Monoethenoid, Diethenoid, Triethenoid, Tetraethenoid • Classification of Lipids a) Simple lipids – Triglycerides, Waxes b) Compound lipids – Phospholipids: Phosphoglycerides – Lecithins, Cephalins, Plasmalogens c) Derived lipids – Steroids (Basic steroid nucleus and Cholesterol only)	1	15

Unit-IV	Metabolism of Carbphyrates, Proteins and Lipids • Glycolysis • Krebs cycle • ETS • HMP Shunt pathway • Gluconeogenesis • Deamination, Transamination and Decarboxylation • Urea synthesis • β-oxidation	1	15
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References:

1. Chordate Elementary Biochemistry, J. L. Jain, S. Chand & Company, Delhi.
2. Elementary Biochemistry, J. L. Jain, S. Chand & Company, Delhi
3. Harper's Biochemistry, Lange, McGraw-Hill.
4. Biochemistry, I. Stryer, Freeman.
5. Principles of Biochemistry, Lehninger, CBS Publications.

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-V
MAJOR COURSE = 3 - PRACTICAL-A
BS23MJ5ZO3
(Based on Major Course - 1)
(IKS-Zoology)

Total Credit - 04

LIST OF PRACTICALS

I. ETHNOZOOLOGY AND INDIAN KNOWLEDGE SYSTEM

1. To study traditional uses of animals and animal products in rituals, folklore and daily life.
2. To study animals and animal products used in medicinal treatment.

II. YOGA AND PRANAYAMA

1. To study various Asanas and their significance.
2. To study Pranayama and its significance.
3. Study by charts of: Respiratory muscles, Alveolar-capillary (respiratory) membrane, Exchange of the respiratory gases, Oxygen-haemoglobin dissociation curve.

III. ORIGIN OF LIFE AND EVOLUTION

1. To study origin of Life (Fundamental Principles).
2. To study Transformation of forms – Dashavatara.
3. To study convergent and divergent evolution.
4. To study evolution of human.

IV. IKS AND ECONOMIC ZOOLOGY

1. To study breeds of dairy farming.
2. To study species of honeybees used in apiculture.
3. To study species of silkworm used in sericulture.

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-V
MAJOR COURSE = 3 - PRACTICAL-B
BS23MJ5ZO3
(Based on Major Course - 2)
(Animal Biochemistry and Metabolism)

LIST OF PRACTICALS

I. DETECTION OF CARBOHYDRATES AND PROTEINS:

1. Monosaccharides - Glucose and Fructose.
2. Disaccharides - Lactose, Maltose and Sucrose.
3. Proteins - Albumin and Casein.

II. COLORIMETRIC ESTIMATION OF:

1. Glucose (Nelson-Somogyi method)
2. Proteins (Preparation of Std. Curve by Biuret method)
3. Cholesterol in Serum (Ferric chloride method)

III. ATOMIC MODELS OF:

1. Monosaccharides: Ribose, Arabinose, Ribulose, Glucose, Mannose, Galactose, Psicose, Fructose and Tagatose.
2. Disaccharides: Maltose, Lactose and Sucrose.
3. Amino acids: All amino acids except heterocyclic amino acids, Dipeptides (Gly-Ala, Gly-Val, Ala-Ser and Glu-Lys).
4. Fatty acids and Lipids: Glycerol, Butyric acid, Crotonic acid, Tributyrin, Lecithins, Cephalins and Plasmalogens.

IV. METABOLOSM OF CARBOHYDRATES, PROTEINS AND LIPIDS:

Study by charts of:

1. Glycolysis (EM Pathway) (structures required)
2. Krebs cycle (structures required)
3. HMP Shunt pathway (structures required)
4. Gluconeogenesis (structures not required)
5. Deamination (structures required)
6. Transamination (structures required)
7. Urea synthesis (structures required)
8. β -oxidation of saturated fatty acids (structures required)

SHRI GOVIND GURU UNIVERSITY, GODHRA

B.Sc. ZOOLOGY - SEMESTER-V

MINOR COURSE (THEORY)

BS23MN5ZO1

(Animal Diversity - Non-chordates and Chordates)

Total Credit - 04

04 Lectures/Week

UNIT	TOPICS	CREDIT	HOURS
Unit-I	Animal Diversity (Non-chordate) A. Type Study: <i>Pila globosa</i> (Indian apple snail) • Classification, Habit & Habitat, External Characters, Digestive System, Respiratory system, Circulatory system, Excretory system, Nervous system and Reproductive systems B. General topics • Shell in Mollusca • Foot in Mollusca • Torsion-Detorsion in Mollusca	1	15
Unit-II	Animal Diversity (Non-chordate) A. Type Study: <i>Asterias rubens</i> (Starfish) • Classification, Habit & Habitat, External Characters, Body wall, Digestive system, Water vascular system, Reproductive system B. General topics • Larval forms of Echinodermata • Minor Phyla: Phoronida, Brachiopoda, Echiuroidea	1	15
Unit-III	Animal Diversity (Chordate) A. Type Study: <i>Columba livia</i> (Pigeon) • Classification, Habit & Habitat, External characters, Digestive system, Respiratory system, Circulatory systems, Brain, Urinogenital system, Types of feathers. B. General topics • Birds are glorified Reptiles • Migration in Birds • Types of Beaks and Feet in Birds	1	15

Unit-IV	Animal Diversity (Chordate) A. Type Study: <i>Rattus rattus</i> (Rat) • External characters, Internal anatomy, Digestive system, Respiratory system, Heart, Arterial & Venous systems, Brain, Excretory and Reproductive system. B. General topics • Aquatic adaptations in Mammals • Dentition in Mammals • Derivatives of Mammalian skin	1	15
References: 1. Textbook of Vertebrates, R.L. Kotpal, Rastogi Publication, Meerut. 2. Chordate Zoology, P. S. Dhami, and J. K. Dhami, S. Chand & Co., Delhi. 3. Jordan E. L. and Verma P. S. Vertebrate Zoology, S. Chand publishing. New Delhi.			

SHRI GOVIND GURU UNIVERSITY, GODHRA

B.Sc. ZOOLOGY - SEMESTER-V

MINOR COURSE (Practical)

BS23MN5ZO2

(Animal Diversity - Non-chordates and Chordates)

Total Credit - 04

LIST OF PRACTICALS

I. ANIMAL DIVERSITY (Non-chordates):

A. Study of *Pila globosa* (Indian apple snail):

1. Digestive system
2. Circulatory system
3. Respiratory system
4. Nervous system
5. Reproductive system

B. Study of Shell (Chiton, Dentalium, Mytilus, Cypraea)

C. Study of Foot (Aplysia, Solen, Pearl oyster, Octopus)

II. ANIMAL DIVERSITY (Non-chordates):

A. Study of *Asterias rubens* (Starfish):

1. Digestive system
2. Water vascular system

B. Study of Echinoderm larvae (Bipinnaria, Brachiolaria, Echinopluteus, Ophiopluteus, Auricularia, Doliolaria)

III. ANIMAL DIVERSITY (Chordates):

A. Study of *Columba livia* (Pigeon):

1. Digestive system
2. Arterial system
3. Venous system
4. Brain
5. Urinogenital system
6. Air-sacs in Pigeon

B. Types of beaks and feet in birds

IV. ANIMAL DIVERSITY (Chordates):

A. Study of *Rattus rattus* (Rat):

1. Digestive system
2. Arterial system
3. Venous system
4. Brain
5. Reproductive system

B. Aquatic mammals (Dolphin, Whale, Walrus, Seal)

C. Dentition in mammals (Dental formula - Human, Cow, Elephant, Rat, Dog, Cat)

D. Derivatives of mammalian skin (Claw, Nail, Hoof, Horn and Hair)

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-VI
MAJOR COURSE - 1 (THEORY)
BS23MJ6ZO1
(Immunology, Physiology, Endocrinology and Histotechnology)

Total Credit - 04

04 Lectures/Week

UNIT	TOPICS	CREDIT	HOURS
Unit-I	Immunology • IKS perspectives on classification of immunity: <i>Sahaja</i> (Innate), <i>Kalaja</i> (Acquired), and <i>Yuktikrita</i> (Artificial) • Lymphoid organs : (Primary and secondary) - Thymus, Bone Marrow, Lymph nodes, Spleen, Lymphatic nodules • Antigens/Immunogens: Definition and Characteristics • Antibodies/Immunoglobulins: Definition, Structure and Classes • Cellular & Humoral Immunity: - Formation of T cells & B cells - T cells & Cellular Immunity - B cells & Humoral Immunity - Monoclonal antibodies • Disorders, Homeostatic Imbalances: - Hypersensitivity (Allergy) - Tissue rejection - Autoimmune diseases - AIDS	1	15
Unit-II	Human Physiology – Muscle Contraction and Reproduction A. Muscle Contraction: • T.S. of a skeletal muscle • Histology of a striated muscle fibre • Motor unit, Neuro-muscular junction • Mechanism of muscle contraction and relaxation • Traditional dietary and lifestyle practices for muscle health and recovery B. Reproduction: • Spermatogenesis and Oogenesis • Menstrual cycle • Menopause • Factors influencing healthy reproductive cycles: Nutrition, Lifestyle, Emotional states, and Exercise (as described in Ayurveda and folk medicine)	1	15

Unit-III	Endocrinology • Indigenous classification and understanding of hormones (Dhatus, Upadhatus, Rasayana) • Histological structure, Hormones and Functions of: - Pituitary gland, - Thyroid gland, - Parathyroid gland, - Adrenal gland, - Pancreas, - Testis - Ovary	1	15
Unit-IV	Histological Techniques • Preparation and storage of tissue samples using indigenous preservatives (e.g. herbal extracts, honey, oils, ash) • Histological techniques for preparation of permanent slides (section) • Fixation and fixatives: Purpose of fixation, Commonly used chemical fixatives (Acetic acid, Potassium dichromate, Enthanol, Formaldehyde, Bouin's fixative) • Dehydration • Embedding • Sectioning by ordinary (rotary) microtome • Stains and staining procedures for light microscopy	1	15
References: 1. The Immunology, Kuby, Goldsby, Osborne and Thomas, W.H. Freeman and Company. 2. Principles of Anatomy and Physiology, Tortora and Anagnostakos, HarperCollins College Publishers. 3. Animal Physiology and Related Biochemistry, H. R. Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar. 4. Textbook of Animal Physiology, A. K. Berry, Emkay Pub., New Delhi. 5. Handbook of Basic Microtechnique, Peter Gray, McGraw-Hill Book Company.			

SHRI GOVIND GURU UNIVERSITY, GODHRA

B.Sc. ZOOLOGY - SEMESTER-VI

MAJOR COURSE - 2 (THEORY)

BS23MJ6ZO2

(Zoogeography, Toxicology, Molecular Biology & Developmental Biology)

Total Credit - 04

04 Lectures/Week

UNIT	TOPICS	CREDIT	HOURS
Unit-I	Zoogeography • Continental drift Theory • Discontinuous distribution of animals with examples. • Wallace's and Weber's lines- Significance in biogeography. • Brief account of Zoogeographical realms with reference to mammalian fauna - Palaearctic region - Nearctic region - Neotropical region - Ethiopian region - Oriental region - Australian region	1	15
Unit-II	Toxicology • Introduction, definition of toxicology, toxicity, toxicants and xenobiotics • Areas of toxicology: Mechanistic, Regulatory, Forensic, Clinical and Environmental • Classification of Toxicants: Corrosives, Irritants, Neurotics and Cardiac poisons • Types of toxicity: Acute, Subacute, Chronic • Factors affecting Toxicology: Size of animal, age, sex, species, strain, feed and feeding, changes in internal environment, habitually used drugs, route and rate of administration, environment and plasma-protein binding • Entry of toxicants into the animals' body: Gastro-intestinal route, skin, lungs, parenteral administration	1	15
Unit-III	Cytological and Molecular Biology techniques • Centrifugation – Low speed and Ultra centrifugation (Differential, Density Gradient) • Paper Chromatography (Ascending and Descending) • PAGE - Tube Gel electrophoresis • Karyotyping • Southern blotting and Northern blotting • PCR (Polymerase Chain Reaction) • DNA Fingerprinting	1	15

Unit-IV	Developmental Biology • Types of eggs depending upon the quantity of yolk (Microlecithal / Oligolecithal, Mesolecithal and Polylecithal / Macrolecithal / Megalecithal) • Types of eggs depending upon the distribution of yolk. (Homolecithal/Isolecithal, Centrolecithal and Telolecithal) • Patterns of cleavage - radial, spiral (dextral, sinistral), bilateral, incomplete/meroblastic and complete/holoblastic • Embryology of Chick (up to 72 hours): - Structure of a hen's unfertilized egg - Fertilization, cleavage, blastulation, gastrulation - Development of brain up to 72 hrs - Development of heart up to 72 hr - Flexion & Torsion - Extra-embryonic membranes - Diagrams of 21 hr, 33 hr, 48 hr and 72 hr old chick embryos - Types of Placentation in mammals (histological)	1	15
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References:

1. Darlington, P. J., Jr. (1957). Zoogeography: The geographical distribution of animals. John Wiley & Sons.
2. Mani, M. S. (Ed.). (1974). Ecology and biogeography in India. Dr. W. Junk Publishers.
3. Fundamentals of Toxicology, Pandey, Shukla and Trivedi, New Central Book Agency (P) Ltd., Kolkata.
4. Modern Toxicology. Volumes 1-3, P. K.Gupta and D. K. Salunkhe, Metropolitan Book Co. Pvt. Ltd., New Delhi.
5. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, P. S. Verma, V. K. Agrawal, S. Chand Co. New Delhi
6. Cell Biology, C. B. Power, Himalaya Publishing House.
7. Cellular and Molecular Biology, De Robertis and De Robertis, Saunders Pub.
8. Gilbert, S. F. (2010). Developmental biology (9th ed.). Sinauer Associates, Sunderland.
9. Introduction of Embryology, Balinsky, CBS College Publishers.
10. Developmental Biology, T. Subramanayam, Narosa Publishing House.
11. Developmental Biology, V. B. Rastogi, Rastogi Publications, Meerut.

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-VI
MAJOR COURSE = 3 - PRACTICAL-A
BS23MJ6ZO3
(Based on Major Course - 1)
(Immunology, Physiology, Endocrinology and Histotechnology)

Total Credit - 04

LIST OF PRACTICALS

I. IMMUNOLOGY

▪ **Study by Slides/Charts**

1. T.S. through lymph node.
2. T.S. through spleen.
3. T.S. through thymus.
4. Structure of antibody.

II. PHYSIOLOGY – MUSCLE CONTRACTION AND REPRODUCTION

▪ **Study by Charts**

1. T.S. of striated muscle.
2. Ultrastructure of sarcomere.
3. Neuro-muscular junction.
4. Menstrual cycle

III. ENDOCRINOLOGY

▪ **To study histology of following endocrine glands by charts/permanent slides**

1. Pituitary gland
2. Thyroid gland
3. Parathyroid gland
4. Adrenal gland
5. Pancreas
6. Testis
7. Ovary

IV. HISTOLOGICAL TECHNIQUES

1. To study preparation of permanent slides.
2. To study preparation of whole mounts.
3. To study staining methods by passing permanent slides (2 W.M. and 2 histology / 4 W.M.)

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-VI
MAJOR COURSE – 3 - PRACTICAL-B
BS23MJ6ZO3
(Based on Major Course - 2)
(Zoogeography, Toxicology, Molecular Biology & Developmental Biology)

LIST OF PRACTICALS

I. ZOOGEOGRAPHY:

1. To study discontinuous distribution of animals with examples.
2. To study different zoogeographical realms with charts as per theory paper.

II. TOXICOLOGY:

3. To study LD₅₀ through chart.
4. To study LC₅₀ through chart.

III. MOLECULAR BIOLOGY:

1. Study of Ascending Paper Chromatography
2. Human Karyotyping (preparation of chart only) - Normal man, Normal woman, Down syndrome, Turner syndrome.

IV. DEVELOPMENTAL BIOLOGY:

Study by charts of:

1. To study types of eggs through charts
 - a. Depending upon the quantity of yolk (Microlecithal/Oligolecithal, Mesolecithal and Polylecithal/Macrolecithal/Megalecithal)
 - b. Depending upon the distribution of yolk. (Homolecithal/Isolecithal, Centrolecithal and Telolecithal)
2. To study chick embryo of 21 hrs, 33 hrs, 48 hrs and 72 hrs by charts/models
3. To study types of placentation in mammals through charts (histological aspect)

SHRI GOVIND GURU UNIVERSITY, GODHRA
B.Sc. ZOOLOGY - SEMESTER-VI
MINOR COURSE (THEORY)
BS23MN6ZO1
(Animal Behaviour and Zoogeography)

Total Credit - 02

02 Lectures/Week

UNIT	TOPICS	CREDIT	HOURS
Unit-I	Animal Behaviour • Introduction to Ethology • Types of Learning: (a) Imprinting (b) Habituation (c) Classical conditioning (E.g. Pavlov's experiment) (d) Instrumental conditioning • Reproductive behaviour patterns ○ <i>Mating systems</i>: Monogamy, Promiscuity, Polygyny, Polyandry ○ <i>Courtship</i>: - Introduction and requirement - Mechanism of courtship (mate finding, persuasion, synchronization, reproductive isolation) - Courtship and mating in scorpions and fish (three spined stickleback) • Biological Rhythms: ○ Circadian, Circalunar and Circannual Rhythms and Biological clocks	1	15
Unit-II	Zoogeography • Continental drift Theory • Discontinuous distribution of animals with examples. • Wallace's and Weber's lines- Significance in biogeography. • Brief account of Zoogeographical realms with reference to mammalian fauna - Palearctic region - Nearctic region - Neotropical region - Ethiopian region - Oriental region - Australian region	1	15

References:

1. Animal Behaviour, Mohan P. Arora, Himalaya Publishing House.
2. Essentials of Behaviour, P. J. B. Slater, Cambridge Univ. Press.
3. An Introduction to Animal Behaviour, Manning, Addition Wesley.
4. Darlington, P. J., Jr. (1957). Zoogeography: The geographical distribution of animals. John Wiley & Sons.
5. Mani, M. S. (Ed.). (1974). Ecology and biogeography in India. Dr. W. Junk Publishers

SHRI GOVIND GURU UNIVERSITY, GODHRA

B.Sc. ZOOLOGY - SEMESTER-VI

MINOR COURSE (Practical)

BS23MN6ZO1

(Animal Behaviour and Zoogeography)

Total Credit - 02

LIST OF PRACTICALS

I. ANIMAL BEHAVIOUR:

1. To study types of Learning through charts.
 - A. Imprinting
 - B. Habituation
 - C. Classical conditioning (E.g. Pavlov's experiment)
 - D. Instrumental conditioning
2. To study courtship behaviour in Scorpions through chart.
3. To study courtship behaviour in Three-spined Stickle back through chart.
4. To study human behaviour by trial and error.
5. To study effect of Task 1 and Task 2 through the process of trial and error by performing maze learning.

II. ZOOGEOGRAPHY:

1. To study different zoogeographical realms with reference to mammalian fauna through charts as per theory paper.
 - A. Palaearctic region
 - B. Nearctic region
 - C. Neotropical region
 - D. Ethiopian region
 - E. Oriental region
 - F. Australian region