

**KAKATIYA UNIVERSITY**  
Under Graduate Courses (Under CBCS 2019 - 2022)  
**B.Sc. ZOOLOGY I Year**  
**SEMESTER – I**

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**ANIMAL DIVERSITY – INVERTEBRATES**  
**(Core Paper –I)**

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

### UNIT – I

#### 1.1 Protozoa

- 1.1.1 General Characters and Classification of Protozoa up to Orders with examples
- 1.1.2 Type Study – *Elphidium*
- 1.1.3 Locomotion and Reproduction
- 1.1.4 Epidemiology of Protozoan diseases – Amoebiasis, Giardiasis, Leishmaniasis, Malaria

#### 1.2 Porifera

- 1.2.1 General characters and Classification of Porifera up to Orders with examples
- 1.2.2 Type study - *Sycon*
- 1.2.3 Canal system in Sponges
- 1.2.4 Types of Cells and Spicules in Porifera.

### UNIT – II

#### 2.1 Cnidaria

- 2.1.1 General characters and Classification of Cnidaria up to classes with examples
- 2.1.2 Type study - *Obelia*
- 2.1.3 Polymorphism in Cnidarians with examples
- 2.1.4 Corals and Coral Reef formation

#### 2.2 Helminthes


- 2.2.1 General characters and Classification of **Platyhelminthes** up to classes with examples
- 2.2.2 Type study - *Schistosoma*
- 2.2.3 General characters and Classification of **Nemathelminthes** up to classes with examples
- 2.2.4 Type study – *Dracanculus*; Parasitic Adaptations in Helminthes

### UNIT– III

#### 3.1 Annelida

- 3.1.1 General characters and Classification of Annelida up to classes with examples
- 3.1.2 Type study – *Hirudinaria granulosa*
- 3.1.3 Evolutionary significance of Coelome and Coelomoducts and Metamerism
- 3.1.4 Economic Importance of Annelida (Polychaeta, Oligochaeta and Hirudinea)

  
**HEAD**  
Department Of Zoology  
University College  
Kakatiya University,  
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**Dr. G. SHAMITHA**  
Chairperson  
Board of Studies  
Department of Zoology & Sericulture Unit  
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### 3.2 Arthropoda

- 3.2.1 General characters; Classification of Arthropoda upto classes with examples
- 3.2.2 Type study – *Palaemon* (Prawn)
- 3.2.3 Crustacean Larvae; Insect metamorphosis; Useful and Harmful Insects
- 3.2.4 *Peripatus*- Structure and affinities

## UNIT – IV

### 4.1 Mollusca

- 4.1.1 General characters; Classification of Mollusca upto classes with examples
- 4.1.2 Type study - *Pila* (Snail)
- 4.1.3 Pearl formation; Torsion and Detorsion in Gastropods
- 4.1.4 Molluscs as Bio-indicators, Vectors and Pests; Economic importance

### 4.2 Echinodermata

- 4.2.1 General characters and Classification of Echinodermata upto classes with examples
- 4.2.2 Type study- *Star Fish*
- 4.2.3 Echinoderm larvae and their evolutionary significance
- 4.2.4 Autotomy, Regeneration and Symmetry of Echinoderms

### Suggested Readings:

1. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.
4. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., 'Invertebrate structure and Function' by ELBS.
6. P.S. Dhama and J.K. Dhama. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.
8. Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition”

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**SEMESTER – I**

**ANIMAL DIVERSITY - INVERTEBRATES**  
**(PRACTICAL)**

**Instruction: 3 hrs per week**  
**No. of Credits: 1**

- 1. Study of museum slides / specimens/models (Classification of animals up to orders)**
  - i) **Protozoa:** *Amoeba, Paramecium, Paramecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax*
  - ii) **Porifera:** *Sycon, Spongilla, Euspongia, Sycon- T.S & L.S, Spicules, Gemmule*
  - iii) **Coelenterata:** *Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula*
  - iv) **Platyhelminthes:** *Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium*
  - v) **Nemathelminthes:** *Ascaris (Male & Female), Dracunculus, Ancylostoma, Wuchereria*
  - vi) **Annelida:** *Nereis, Aphrodite, Chaetopterus, Hirudinaria, Trochophore larva*
  - vii) **Arthropoda:** *Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly.*
  - viii) **Mollusca:** *Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva*
  - ix) **Echinodermata:** *Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva*
- 2. Demonstration of dissection / dissected / virtual dissection:**  
**Prawn:** Appendages, Digestive system, Nervous system, Mounting of Statocyst
- 3. Laboratory Record work shall be submitted at the time of practical examination**
- 4. An “Animal album”** containing photographs, cut outs, with appropriate write up about the abovementioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.
- 5. Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals:**

1. Practical Zoology- Invertebrates by S.S.Lal
2. Practical Zoology – Invertebrates by P.S.Verma
3. Practical Zoology – Invertebrates by K.P.Kurl

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**SEMESTER – II**

**ANIMAL DIVERSITY – VERTEBRATES**  
**(Core Paper – II)**

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

**UNIT – I**

**1.1 Hemichordata**

- 1.1.1 General characters and Classification of Hemichordates upto classes with examples
- 1.1.2 *Balanoglossus*- Structure and affinities
- 1.1.3. Larval Significance (Tornaria)

**1.2. Protochordata**

- 1.2.1 General Characters and Classification of Chordates up to orders with examples
- 1.2.2 Salient features of Urochordata; Retrogressive metamorphosis in Urochordata
- 1.2.3 Salient features and affinities of Cephalochordata
- 1.2.4 General Characters of Cyclostomata; Comparison of *Petromyzon* and *Myxine*

**UNIT – II**

**2.1 Pisces**

- 2.1.1 General characters of and Classification of Pisces up to orders with examples
- 2.1.3 *Scoliodon*- Digestive, Respiratory, Circulatory and Nervous system
- 2.1.4 Types of Scales, Types of Fins
- 2.1.5 Migration in Fishes

**2.2 Amphibia**

- 2.2.1 General characters and Classification of Amphibians up to orders with examples.
- 2.2.2 *Rana tigrina*- Respiratory, Circulatory and Nervous systems
- 2.2.3 Parental care in Amphibians; Neoteny and Paedogenesis
- 2.2.4 Metamorphosis in Amphibians and its hormonal control

**Unit – III**

**3.1 Reptilia**

- 3.1.1 General characters and Classification of Reptilia up to orders with examples
- 3.1.2 *Calotes*- Digestive, Respiratory, Circulatory and Nervous systems
- 3.1.3 Temporal fossa in Reptiles and its evolutionary importance
- 3.1.4 Distinguished characters of Poisonous and Non-poisonous snakes

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### 3.2 Aves

- 3.2.1 General characters and Classification of Aves upto orders with examples.
- 3.2.2 *Columba livia*- Digestive, Respiratory, Circulatory and Nervous systems
- 3.2.3 Migration in Birds
- 3.2.4 Flight adaptation in Birds

### Unit – IV

#### 4.1 Mammalia

- 4.1.1 General characters and Classification of Mammalia upto orders with examples
- 4.1.2 *Rabbit*- Digestive, Respiratory, Circulatory and Nervous systems
- 4.1.3 Dentition in Mammals
- 4.1.4 Aquatic adaptations in Mammals

#### Suggested Readings:

1. **E.L. Jordan and P.S. Verma** 'Chordate Zoology' - S. Chand Publications.
2. **Mohan P. Arora**. 'Chordata – I, Himalaya Publishing House Pvt. Ltd.
3. **Marshal, Parker and Haswell** 'Text book of Vertebrates'. ELBS and McMillan, England.
4. **Alfred Sherwood Romer**. Thomas S. Pearson 'The Vertebrate Body, Sixth edition, CBS College Publishing, Saunders College Publishing
5. **George C. Kent, Robert K. Carr**. *Comparative Anatomy of the Vertebrates*, 9th ed. McGrawHill.
6. **Kenneth Kardong** *Vertebrates: Comparative Anatomy, Function and Evolution*, 4th ed, 'McGraw Hill.
7. **J.W. Young**, *The Life of Vertebrates*, 3rd ed, Oxford University press.
8. **Harvey Pough F, Christine M. Janis, B. Heiser**, *Vertebrate Life*, Pearson, 6th ed, Pearson Education Inc. 2002.

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**SEMESTER – II**

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**ANIMAL DIVERSITY - VERTEBRATES**  
**(PRACTICAL)**

**Instruction: 3 hrs per week**

**No. of Credits: 1**

**I. Study of museum slides / specimens / models (Classification of animals up to orders)**

1. **Hemichordata:** *Balanoglossus, Tornmaria larva*
2. **Protochordata:** *Amphioxus, Amphioxus T.S. through pharynx*
3. **Cyclostomata:** *Petromyzon, Myxine, Ammocoetus larva*
4. **Pisces:** *Sphyrna, Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Auguilla, Protopterus, Scales: Placoid, Cycloid, Ctenoid*
5. **Amphibia:** *Ichthyophis, Amblystoma, Siren, Hyla, Rachophous, Bufo, Rana, Axolotal larva*
6. **Reptilia :** *Draco, Chamaeleon, Gecko, Uromastix, Vipera russeli, Naja, Bungarus, Enhydrina, Typhlops, Ptyas, Testudo, Trionyx, Crocodilus*
7. **Aves:** *Archaeopteryx, Passer, Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo, Collection and study of different types of feathers: Quill, Contour, Filoplume, Down*
8. **Mammalia:** *Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog;*
9. **Histology:** T.S. of Liver, Pancreas, Kidney, Stomach, Intestine, Lung, Artery, Vein, Bone T.S, Spinal Cord. T.S.

**II. Osteology:**

**Rabbit – Axial Skeleton** (Bones of Skull and Vertebral Column),

**Varanus, Pigeon and Rabbit - Appendicular skeleton** (Bones of Limbs and Girdles)

**III. Demonstration of dissection / dissected / virtual dissection: Labeo / Tilapia**

1. Digestive system
2. Brain, Weberian Oscicles
3. V, VII, IX, X cranial nerves

**IV. Laboratory Record work shall be submitted at the time of practical examination**

- V. An “Animal album”** containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

**VI. Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals:**

1. S.S.Lal, Practical Zoology – Vertebrata
2. P.S.Verma, A manual of Practical Zoology– Chordata

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**SEMESTER – III**

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**ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR**

<b>Theory</b>	<b>4 Hours/Week</b>	<b>4 Credit</b>	<b>Internal marks = 20</b>
<b>Practical</b>	<b>3 Hours/Week</b>	<b>1 Credit</b>	<b>External Marks = 80</b>

## **UNIT – I**

### **1.1 Digestion**

- 1.1.1 **Enzymes:** Definition, Classification, Inhibition, Regulation
- 1.1.2 Digestion of Carbohydrates, Proteins, Lipids and Cellulose
- 1.1.3 Absorption and Assimilation of digested food
- 1.1.4 Role of Gastrointestinal hormones in digestion

### **1.2 Excretion, Homeostasis and Osmoregulation**

- 1.2.1 Classification of Animals on the basis of excretory products: Ammonotelic, Ureotelic, and Uricotelic; Structure and function of Nephron
- 1.2.2 Urine formation and Counter current mechanism
- 1.2.3 Concept and Mechanism of Homeostasis
  - a) Hormone regulation of Blood Glucose levels in Human being
  - b) Water and Ionic Regulation by Marine and Fresh water Animals
  - c) Thermo regulation in Human being
- 1.2.4 Osmoregulation in Marine, Fresh and Brackish water Animals

## **UNIT – II**

### **2.1 Respiration**

- 2.1.1 Definition of Respiration, Respiration mechanism, External, Internal and Cellular Respiration.
- 2.1.2 Respiratory Pigments; Transport of Oxygen, Oxygen dissociation curves, and Bohr's Effect;
- 2.1.3 Transport of Carbon dioxide, Chloride shift
- 2.1.4 Regulation of Respiration; Nervous and Chemical Mechanism

### **2.2 Circulation**

- 2.2.1 Types of Circulation Open and Closed; Structure of Mammalian Heart
- 2.2.2 Types of Hearts: Myogenic and Neurogenic
- 2.2.3 Heart functions - Conduction and Regulation of Heart beat, Regulation of Heart rate; ECG
- 2.2.4 Tachycardia and Bradycardia; Blood Clotting mechanism

## **UNIT – III**

### **3.1 Muscle Contraction**

- 3.1.1 Types of Muscles
- 3.1.2 Ultra structure of skeletal muscle fibre
- 3.1.3 Mechanism and Chemical changes during Muscle Contraction (Sliding filament theory)
- 3.1.4 Twitch Tetanus summation and Treppe fatigue

## 3.2 Nerve Impulse

3.2.1 Structure of Neuron

3.2.2 Nerve impulse - Resting potential, Threshold potential and Action potential, Conduction of Nerve impulse

3.2.3 Transmission of Nerve impulse

3.2.4 Synapse and Synaptic transmission; Neurotransmitters-EPSP, IPSP

## 3.3 Endocrine System

3.3.1 Endocrine glands - Structure, secretions and functions of Pituitary gland

3.3.2 Thyroid, Parathyroid, Adrenal glands and Pancreas

3.3.3 Hormone action and Concept of Secondary messengers

3.3.4 Male and Female Hormones; Hormonal control of Menstrual cycle in human beings

## UNIT – IV

### 4.1 Animal Behaviour

4.1.1 Types of Behaviour- Innate and Acquired; Instinctive and Motivated behaviour

4.1.2 Taxes, Reflexes, Tropisms

### 4.2 Learning and Memory

4.2.1 **Types of Learning:** Trial and Error Learning, Imprinting, Habituation

4.2.2 **Conditioning:** Classical Conditioning; Instrumental conditioning, Examples of Conditioning, Pavlov's Experiment

### 4.3 Social Behaviour and Communication

4.3.1 Social behaviour of insects (Dance language of honey bees) Colonial Existence of Bees and Termites; Pheromones

### 4.4 Biological Rhythms

4.4.1 Biological Clocks, Circadian Rhythms; solar and lunar Rhythms; Circannual Rhythms

## Suggested Readings:

1. **Gerard J. Tortora and Sandra Reynolds Garbowski** *Principles of Anatomy and Physiology*, Tenth Ed., John Wiley & Sons
2. **Arthur C. Guyton MD**, *A Text Book of Medical Physiology*, Eleventh ed., John E. Hall, Harcourt Asia Ltd.
3. **William F. Ganong**, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005
4. **Sherwood, Klandrof, Yanc**, *Animal Physiology*, Thompson Brooks/Coole, 2005.
5. **Sherwood, Klandrof, Yanc**, *Human Physiology*, Thompson Brooks/Coole, 2005.
6. **Knut Schmidt-Nielson**, *Animal Physiology*, 5th edition, Cambridge Low Price Edition.
7. **Roger Eckert and Randal**, *Animal Physiology*, 4th ed, Freeman Co, New York.
8. **Singh. H.R**, *Text Book of Animal Physiology and Biochemistry*
9. **Nagabhushanam**, *Comparative Animal Physiology*
10. **Veer Bal Rastogi**, *Text Book of Animal Physiology*
11. **Dasmann**, "Wild Life Biology"
12. **Reena Mathur**, "Animal Behaviour"
13. **Alocock**, "Animal Behaviour- an Evolutionary Approach"

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**B.Sc. ZOOLOGY II Year**  
**SEMESTER – III**

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**ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR**  
**(PRACTICAL)**

**Instruction: 3 hrs per week**

**No. of Credits: 1**

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Qualitative tests for identification of ammonia, urea and uric acid  
(Nitrogenous excretory products)
3. Zonation of gut in Cockroaches
4. Study on effect of pH and Temperature on salivary amylase activity
5. Study of permanent histological sections of mammalian endocrinal glands: Pituitary, Thyroid, Pancreas, Adrenal gland
6. Estimation of Haemoglobin by Sahli's method
7. Estimation of Blood Clotting time
8. Estimation of total protein by Biuret's method
9. Estimation of unit metabolism of fish

- **Laboratory Record work shall be submitted at the time of practical examination**
- **Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals:**

**Tortora, G.J. and Derrickson, B.H. (2009).***Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.

**Widmaier, E.P., Raff, H. and Strang, K.T. (2008)** *Vander's Human Physiology*, XI Edition., McGraw Hill

**Guyton, A.C. and Hall, J.E. (2011).** *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company

**Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006).***Biochemistry*.VI Edition. W.H Freeman and Co.

**Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009).***Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.

**Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009).**

*Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

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**SEMESTER – IV**

**CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY**

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

**UNIT – I**

**1.1 Cell Biology**

- 1.1.1 Ultra structure of Animal cell
- 1.1.2 Structure (Fluid mosaic model) and Functions of Plasma membrane
- 1.1.3 Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Ribosomes, Lysosomes, Mitochondria and Nucleus
- 1.1.4 Chromosomes - Structure, types, Cell Division- Mitosis, Meiosis, Cell Cycle and its regulation.

**UNIT – II**

**2.1 Molecular Biology**

- 2.1.1 DNA (Deoxyribo Nucleic Acid) –Structure-RNA (Ribo Nucleic Acid)-Structure, types, DNA Replication
- 2.1.2 Protein Synthesis – Transcription, Translation.
- 2.1.3 Gene Expression - Genetic Code, Operon concept.
- 2.1.4 Molecular Biology Techniques – Polymerase Chain Reaction (PCR), Electrophoresis.

**UNIT – III**


**3.1 Genetics**


- 3.1.1 Mendel's laws of Inheritance and Non-Mendelian Inheritance , Linkage and Crossing over.
- 3.1.2 Sex determination and Sex-linked inheritance.
- 3.1.3 Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation; Aneuploidy and Polyploidy; Gene mutations- Induced versus Spontaneous mutations
- 3.1.4 Inborn errors of metabolism.

**UNIT – IV**

**4.1 Developmental Biology**

- 4.1.1 Gametogenesis (Spermatogenesis and Oogenesis), Fertilization, Types of eggs, Types of cleavages
- 4.1.2 Development of Frog upto the formation of primary germ layers
- 4.1.3 Formation of Foetal membrane in chick embryo and their functions
- 4.1.4 Types and functions of Placenta in Mammals, Regeneration in Turbellarians and Lizards

  
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**Suggested Readings:**

1. **Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell** '*Molecular Cell Biology*'  
W.H. Free man and company New York.
2. **Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008).** *Principles of Genetics*. VIII Edition.  
Wiley India.
- 3 **Snustad, D.P., Simmons, M.J. (2009).** *Principles of Genetics*. V Edition. John Wiley and  
Sons Inc.
- 4 **Klug, W.S., Cummings, M.R., Spencer, C.A. (2012).** *Concepts of Genetics*. X Edition.  
Benjamin Cummings.
5. **Russell, P. J. (2009).** *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
6. **Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.** *Introduction to Genetic  
Analysis*. IX Edition. W. H. Freeman and Co.
7. **Ridley, M. (2004).** *Evolution*. III Edition. Blackwell Publishing
8. **Campbell, N. A. and Reece J. B. (2011).** *Biology*. IX Edition, Pearson, Benjamin,  
Cummings.
9. **James D. Watson, Nancy H. Hopkins** '*Molecular Biology of the Gene*'
10. **Gupta P.K.,** 'Genetics'

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**SEMESTER – IV**

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**CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY**  
**PRACTICAL**

**Instruction: 3 hrs per week**

**No. of Credits: 1**

**I. Cytology**

1. Preparation and Identification of slides of Mitotic divisions with onion root tips
2. Preparation and Identification of different stages of Meiosis in Grasshopper Testes
3. Identification and study of the following slides
  - i). Different stages of Mitosis and Meiosis
  - ii) Lamp brush and polytene chromosomes

**II. Genetics**

1. Problems on Genetics - Mendelian inheritance, Linkage and Crossing over, Sex linked inheritance

**III. Embryology**

1. Study of T.S. of Testis and Ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8, 16 cell stages); Morula, Blastula
3. Study of chick embryos of 18 hours, 24 hours, 33 hours and 48 hours of incubation

**IV. Laboratory Record work shall be submitted at the time of practical examination**

**V. An "Album" containing photographs, cut outs, with appropriate write-up about Genetics and Embryology**


- **Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals:**

1. Manual of laboratory experiments in Cell Biology by **Edward, G.**
2. Freeman and Bracegirdle – An Atlas of Embryology.

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**KAKATIYA UNIVERSITY**  
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**B.Sc. ZOOLOGY III Year**  
**SEMESTER – V**

**IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

**UNIT – I**

**1.1 Basics of Immune system**

- 1.1.1 Cells of the Immune system and the Lymphoid organs (Primary and Secondary)
- 1.1.2 First line of defences-physical and chemical barriers; second line of defences – inflammation and phagocytosis.
- 1.1.3 Types of Immunity- Inherent (Active and Passive) and Acquired Immunity (Active and Passive) Humoral and Cell mediated immunity.
- 1.1.4 Major Histocompatibility complex (MHC)- structure and function of class I and Class II proteins. Significance of MHC in organ transplantation; MHC restriction

**UNIT – II**

**2.1 Antibodies and Antigens and Immune system diseases**

- 2.1.1 Antibodies(Immunoglobulins) – Structure, functions and classification, antibody diversity, Monoclonal antibodies and applications
- 2.1.2 Antigens structure, antigenic determinants/epitopes, haptens, adjuvants and antigenicity.
- 2.1.3 Antigen-antibody reactions; Agglutination; Precipitation, Opsonization, Cytotoxicity
- 2.1.4 Hypersensitivity reactions.  
Autoimmunity and Immunodeficiency diseases.

**Unit – III**

**3.1 Animal Biotechnology and Genetically modified organisms**

- 3.1.1 Concept and Scope of Animal Biotechnology
- 3.1.2 Recombinant DNA Technology and its applications.
- 3.1.3 Cloning Vectors- Plasmids, Cosmids and shuttle vectors, Cloning methods(Cell, Animal and Gene cloning); Restriction enzymes and Ligases
- 3.1.4 Transgenesis – Methods of Transgenesis  
Production of Transgenic animals- Sheep and Fish

**Unit – IV**

**4.1 Applications of Biotechnology**

- 4.1.1 In vitro fertilization and embryo transfer
- 4.1.2 Hybridoma technology – concepts and applications
- 4.1.3 Stem cells- Types and their applications
- 4.1.4 Recombinant insulin and human growth hormone; Polymerase Chain Reaction (PCR)  
Animal Bioreactors- Concepts and Applications.

  
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### Suggested Readings:

1. Text Book of Immunology – Ivan Riott
2. Text Book of Immunology – C.V.Rao
3. Text Book of Immunology – Nandinin Shetty
4. Text Book of Immunology – Kubey
5. Culture of Animal Cells – R. Ian Freshney, Wiley Liss
6. Biotechnology – S. Mitra
7. Animal Cell Culture - Practical Approach – Ed. John. RW. Masters, Oxford
8. Biotechnology – B.D.Singh
9. Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNA Analysis*. II Edition, Academic Press, California, USA.
10. Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology - Principles and Applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.

  
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**B.Sc. ZOOLOGY III Year**  
**SEMESTER – V**

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**IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**  
**PRACTICAL**

Instruction: 3 hrs per week

No. of Credits: 1

**I. Immunology**

1. Identification of Blood grouping (Demonstration of Agglutination) using kit.
2. Demonstration of Precipitation (VDRL/RPR) using kit.
3. Histological study of Lymphoid organs -Spleen, Thymus, Lymph node, Bone marrow (through prepared slides).
4. Enumeration of Total RBC from a given blood sample.
5. Enumeration of Total WBC from a given blood sample.
6. Enumeration of Differential count of WBC from a given blood sample.

**II. Animal Biotechnology**

1. Study the following techniques through Photographs / Virtual Lab

- a) Identification of Vectors
- b) Identification of Transgenic animals
- c) DNA sequencing (Sanger's method)
- d) DNA finger printing
- e) Southern blotting
- f) Western blotting

2. PCR (demonstration) on site or of site demonstration.

- **Laboratory Record work shall be submitted at the time of practical examination**
- **Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals:**

1. A Hand Book of Practical Immunology – **Ivan Riott**
2. Animal Biotechnology – **P.K. Gupta.**
3. Immunology, VI Edition. W.H. Freeman and Company **Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006).**
4. Immunology, VII Edition, Mosby, Elsevier Publication **David, M., Jonathan, B., David, R. B. and Ivan R. (2006).**
5. Cellular and Molecular Immunology. V Edition. Saunders Publication, **Abbas, K. Abul and Lechtman H. Andrew (2003.)**

  
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**ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION**

Theory	4 Hours/Week	4 Credit	Internal marks = 20
Practical	3 Hours/Week	1 Credit	External Marks = 80

**UNIT – I**

**1.1 Ecology- I**

- 1.1.1 Ecosystem Structure and Functions; Types of Ecosystems – Aquatic and Terrestrial
- 1.1.2 Bio-geo chemical nutrient cycles - Nitrogen, Carbon, Phosphorus and Water
- 1.1.3 Energy flow in ecosystem
- 1.1.4 Food chain, food web and ecological pyramids
- 1.1.5 Animal Associations-Mutualism; Commensalism; Parasitism; Competition, Predation

**UNIT – II**

**2.1 Ecology – II**

- 2.1.1 Concept of Species, Population dynamics and Growth curves
- 2.1.2 Community Structure and dynamics and Ecological Succession
- 2.1.3 Ecological Adaptations
- 2.1.4 Environmental Pollution- Sources, Effect and Control measures of Air, Water, Soil and Noise Pollution
- 2.1.5 Wildlife conservation - National Parks and Sanctuaries of India, Endangered species; Biodiversity and Hotspots of Biodiversity in India.

**UNIT – III**

**3.1 Zoogeography**


- 3.1.1 Zoogeographical regions
- 3.1.2 Climatic and faunal peculiarities of Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions
- 3.1.3 Wallace line, Discontinuous distribution
- 3.1.4 Continental Drift

**Unit – IV**

**4.1. Evolution**

- 4.1.1 Theories of Evolution – Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism, Modern synthetic theory, Evidences of Evolution.
- 4.1.2 Forces of Evolution–Natural Selection, Genetic drift, Gene flow, Genetic load, Organic variations, Hardy Weinberg Equilibrium.
- 4.1.3 Isolation –Premating and post mating isolating mechanisms.
- 4.1.4 Speciation: Methods of Speciation - Allopatric and Sympatric; Causes and Role of Extinction in Evolution.

  
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### Suggested Readings:

1. Ecology – Himalaya Publishing company – M.P Arora
2. Environmental Biology – P.D. Sharma
3. Environmental Ecology – P.R. Trivedi and Gurdeep Raj
4. Indian Wildlife Threats and Prervation – Buddhadev Sharma and Te Kumar
5. Ecology-Principles and Application II Edn. Cambridge Univ Press, London, Champan. JL and Re.iss MJ.
6. Environmental Studies, TATA McGraw Hill Com. New Delhi, Benny Joseph.
7. Fundamentals of Ecology Third Edn., Nataraj Publishers, Dehradun, Eugene.P. Odum.
8. Ecology and Animal Distribution, Veea Bala Rastogi.
9. Text Book of Ecology and Environment, P.K. Gupta.
10. Ecology and Wildlife Biology, Bhatnagar and Bansal.
11. Evolution 3<sup>rd</sup> Edn. Blackwell Publishing, Ridley, M (2004).
12. Evolutionary Biology, Addison –Wesley; Minkoff,E(1983).
13. *Evolution*. Cold Spring, Harbour Laboratory Press Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).
14. *Evolution*. IV Edition. Jones and Bartlett Publishers; Hall, B. K. and Hallgrimsson, B. (2008).
15. *Evolution*, 2nd Edn, Oxford and IBH Publishing Co., New Delhi, Jan M. Savage.

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**SEMESTER – VI**

**ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION  
PRACTICAL**

**Instruction: 3 hrs per week**  
**No. of Credits: 1**

**Ecology**

1. Determination of pH of Soil and Water.
2. Estimation of Salinity (Chlorides) of water in given samples.
3. Estimation of Carbonates and Bicarbonates in the given water samples.
4. Estimation of dissolved Oxygen of Pond water, sewage, effluents.
5. Identification of Zooplankton from different water bodies.
6. Study of Pond Ecosystem / Local polluted site – Report submission.

**Zoogeography**


1. Study of at least 3 endangered or threatened wild animals of India through photographs/specimens/models
2. Field visit to Zoo Park to study the management, behavior and enumeration of wild animals.
3. Identification of Zoogeographical realms from the Map and identify specific fauna of respective regions.


**Evolution**

1. Museum Study of fossil animals: **Peripatus; Coelacanth fish, Dipnoi fishes; Sphenodon; Archaeopteryx.**
  2. Study of homology and analogy from suitable specimens and pictures
  3. Problems on Hardy-Weinberg Law
  4. Macroevolution using Darwin finches (pictures)
- **Laboratory Record work shall be submitted at the time of practical examination**
  - **Computer aided techniques should be adopted as per UGC guide lines.**

**Suggested manuals:**

1. Ecology Student Lab Manual, Biology Labs – Robert Desharnais, Jeffrey Bell.
2. Ecology Lab manual – Darrell S Vodopich.

  
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**B.Sc. Under CBCS System wef A.Y: 2021-22**

**Third Year : : Semester - V**

**GENERIC ELECTIVE (Common to all students)**

**WATER RESOURCES MANAGEMENT**

(4 hrs/week) (Taught by ant Science Dept) (Credits:4) (Marks:100)

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**UNIT-I:**

Introduction to water resources management, different types of water resources, water resources and its importance, Global distribution of water. Hydrological cycle, Conservation of water, recycling of water.

**Unit-II:**

Rain water harvesting, methods of roof top rain water harvesting in urban setting: Direct method - Storing rain water in tanks for direct use; indirect methods - Recharge pits, bore wells/dug wells, Recharge trenches. Over use of surface and ground water and control measures.

**UNIT-III:**

Importance of water shed and water shed management, Rain water harvesting in rural setting: Check dams, percolation tanks, gabion structure, continuous contour trenches, staggered contour trenches, farm ponds. Surface water and ground water pollution, control measures.

**UNIT-IV :**

Mission Bhagiratha: Telangana government water grid project for drinking water supply - aims and objectives and method of implementation. Mission Kakatiya: Telangana government project for the restoration of minor irrigation tanks, aims and objectives and method of implementation.

**Text books:**

- 1) Water Resources, Conservation and Management by Chatterjee, S.N.
- 2) Groundwater hydrology by Todd
- 3) Watershed management by J.V.S.Murthy
- 4) Applied Hydrogeology by Fetter.