SYLLABUS

DEPARTMENT OF ZOOLOGY

KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

SEMESTER – I

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

2.1.1General 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)

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3.2Arthropoda

3.2.1 General characters; Classification of Arthropoda upto classes with examples
3.2.2Type study –***Palaemon***(Prawn*)*
3.2.3Crustacean 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
4.1.2Type 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***
4.2.3Echinoderm 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. Dhami and J.K. Dhami.**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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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

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, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoebahistolytica, 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, Fasciolahepatica, Fasciola*larval forms – Miracidium, Redia, Cercaria, *Echinococcusgranulosus, Taeniasolium, Schistosomahaematobium*

v) **Nemathelminthes:** *Ascaris(Male & Female), Drancunculus, Ancylostoma,Wuchereria*

vi) **Annelida:** *Nereis, Aphrodite, Chaetopteurs, 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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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

SEMESTER – II

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, Chemaeleon, 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:** *Ornithorthynchus, 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 Oscicles3. 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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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
4.1.3Dentition 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 CollegePublishing, 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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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY I Year

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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B.Sc. ZOOLOGY SYLLABUS UNDER CBCS
(With effect from 2016-2017)
III - SEMESTER
DSC-1C (Theory)
Animal Diversity- Vertebrates and Developmental Biology

Max. Marks: 80

UNIT – I

1.1 Salient features of Urochordata; Retrogressive metamorphosis and its significance in Urochordata.
1.2 Salient features and affinities of Cephalochordata.
1.3 General characters of Cyclostomata; Comparision of the *Petromyzon* and *Myxine.*
1.4 General characters and classification of Chordata upto orders with examples.
1.5 General characters and Classification of Fishes up to order level with examples; *Scoliodon* – Respiratory, Circulatory and Nervous system; Types of Scales and types of Fins.

UNIT – II

2.1 Amphibia General characters and Classification up to orders with examples.
2.2 Rana tigrina - Respiratory, Circulatory and Nervous system; Parental care in amphibia, Neotony.
2.3 General characters and Classification of Reptilia up to orders with examples; *Calotes* – Respiratory system, Circulatory and Nervous system.
2.4 Temporal fosse in reptiles and its evolutionary importance.
2.5 Distinguished characters of Poisonous and Non-poisonous snakes; Rhynchocephalia.

UNIT – III

3.1 Aves General characters and Classification up to orders with examples.
3.2 *Columba livia* -Digestive system, Circulatory systems, Respiratory system and Nervous system.
3.3 Migration in Birds; Flight adaptation in Birds
3.4 Mammalia General characters and Classification up to orders with examples; Rabbit –Digestive, Respiratory, Circulatory and Nervous system.
3.5 Dentition in mammals; Aquatic adaptations in Mammals.

UNIT – IV

4.1 Gametogenesis (Spermatogenesis and Oogenesis); Fertilization.
4.2 Types of eggs; Types of cleavages.
4.3 Development of Frog up to formation of primary germ layers.
4.4 Formation of Foetal membrane in chick embryo and their functions.
4.5 Types and functions of Placenta in mammals; Regeneration in Turbellaria and Lizards.

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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. McGraw Hill.
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.

ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER
ZOOLOGY (DSC-1D)
Cell and Molecular Biology, Genetics and Evolution

Max. Marks: 50

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. Evolution

1. Museum Study of Fossil animals: *Peripatus, Coelacanth Fish, Dipnoi fishes, Sphenodon, Archeopteryx*.
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

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

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

Suggested manuals

Manual of laboratory experiments in cell biology Edward, G.

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ZOOLOGY PRACTICAL SYLLABUS
III SEMESTER - ZOOLOGY
Animal Diversity- Vertebrates and Developmental Biology

Max. Marks: 50

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

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

Histology: T.S. of Liver, Pancreas, Kidney, Stomach, Intestine, Lungs Artery, Vein, Bone T.S., Spinal cord.

Osteology :

1. Rabbit – Axial skeleton system (bones of Skull and Vertebral Column)
2. Varanus, Pigeon and Rabbit – Appendicular skeleton system (bones of limbs and girdles)

Dissections of *Labeo/Tilapia*:

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

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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

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

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.

Computer aided virtual dissections.

Suggested manuals

1. **S.S.Lal,** Practical Zoology – Vertebrata
2. **P.S.Verma,** A manual of Practical Zoology – Chordata
3. **Freeman & Bracegirdle,** An atlas of embryology

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS
(With effect from 2016-2017)
IV - SEMESTER
DSC-1D (Theory)
Cell and Molecular Biology, Genetics, Evolution

Max. Marks: 80

UNIT – I

1.1 Cell theory; Differences of Prokaryotic and Eukaryotic cells.
1.2 Ultrastructure of animal cell; Structure and functions of plasma membrane proteins.
1.3 Structure and functions of cell organelles – Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus.
1.4 Chromosomes – Structure, types, giant chromosomes.
1.5 Cell Division - Mitosis, Meiosis; Cell cycle and its regulation.

UNIT – II

2.1 DNA (Deoxyribo Nucleic Acid) – Structure; DNA Replication.
2.2 RNA (Ribo Nucleic Acid) - Structure, types.
2.3 Protein Synthesis – Transcription and Translation.
2.4 Gene Expression – Genetic Code; operon concept.
2.5 Molecular Biology Techniques - Polymerase Chain Reaction, Electrophoresis

UNIT – III

3.1 Mendals laws of Inheritance and Non-Medelian Inheritance; Linkage and Crossing over.
3.2 Sex determination and sex-linked inheritance
3.3 Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy.
3.4.Gene mutations- Induced versus Spontaneous mutations.
3.5.Inborn errors of metabolism; One gene one enzyme, one gene one polypeptide theory.

UNIT – IV

4.1 Theories of evolution – Lamarckism and Neo-Lamarckism, Darwinism and Neo Darwinism, Modern synthetic theory.
4.2 Evidences of Evolution and Hardy Weinberg Law; Forces of Evolution – mutation, Gene flow, genetic drift, and natural selection.
4.3 Isolation – Pre-mating and post mating isolating mechanisms.
4.4 Speciation: Methods of speciation - Allopatric and sympatric.
4.5 Causes and Role of Extinction in Evolution.

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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. **Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).** *Evolution.* Cold Spring, Harbour Laboratory Press.
9. **Hall, B. K. and Hallgrimsson, B. (2008).** *Evolution.* IV Edition. Jones and Bartlett Publishers
10. **Campbell, N. A. and Reece J. B. (2011).** *Biology.* IX Edition, Pearson, Benjamin, Cummings.
11. **Douglas, J. Futuyma (1997).** *Evolutionary Biology.* Sinauer Associates.
12. **Minkoff, E. (1983).** *Evolutionary Biology.* Addison-Wesley.
13. **James D. Watson, Nancy H. Hopkins** *'Molecular Biology of the Gene'*
14. **Jan M. Savage.** *Evolution,* 2nd ed, Oxford and IBH Publishing Co., New Delhi.
15. **Gupta P.K.**, 'Genetics'

ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER
ZOOLOGY (DSC-1D)
Cell and Molecular Biology, Genetics and Evolution

Max. Marks: 50

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. Evolution

1. Museum Study of Fossil animals: *Peripatus, Coelacanth Fish, Dipnoi fishes, Sphenodon, Archeopteryx*.
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

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

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

Suggested manuals

Manual of laboratory experiments in cell biology Edward, G.

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KAKATIYA UNIVERSITY
U.G. ZOOLOGY (Under CBCS)
B.Sc. Final Year (DSC-1E)
SEMESTER – V

Physiology and Biochemistry (Theory)

Max. Marks:

UNIT – I

1.1 Digestion definition; extra and intracellular digestion; Digestion of Carbohydrates, Proteins, Lipids and Cellulose.
1.2 Absorption and Assimilation of digested food; Role of Gastrointestinal hormones in digestion
1.3 Definition of Respiration and Respiratory mechanisms – External, Internal and cellular, Respiratory Pigment, Transport of oxygen, Oxygen dissociation curves. Bohr's effect, Transport of CO_2 – Chloride shift, Regulation of respiration – nervous and chemical.
1.4 Types of circulation - Open and Closed circulation; Structure of Mammalian Heart, Types of hearts – Neurogenic and Myogenic.
1.5Heart function – Conduction and regulation of heart beat, Regulation of Heart rate – Tachycardia and Bradycardia, Blood Clotting mechanism

UNIT – II

2.1 Classification of Animals on the basis of excretory products- Ammonotelic, Uricotelic, Ureotelic
2.2 Structure and function of Nephron; Urine formation, Counter current mechanism.
2.3 Types of Muscles; Ultra structure of skeletal muscle fibre; Sliding Filament theory, muscle contraction mechanism and energetics.
2.4 Structure of Neuron- Nerve impulse - Resting potential and Action potential and Conduction of Nerve impulse
2.5 Synapse, types of synapses and Synaptic transmission.

UNIT – III

3.1 Endocrine glands - Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal glands and Pancreas
3.2 Hormone action and concept of Secondary messengers, Male and Female Hormones, Hormonal control of Menstrual cycle in humans.
3.3 Concept and mechanism of Homeostasis.
3.4 Osmoregulation - Water and ionic regulation by freshwater, brackish water and marine animals
3.5 Enzymes: Definition, Classification, Inhibition and Regulation.

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UNIT – IV

4.1. Carbohydrates**:** Classification and function of Carbohydrates
4.2. Carbohydrate metabolism - Glycolysis, Krebs cycle, , Electron transport and oxidative phosporelation.
4.3. Proteins**:** Classification of proteins based on functions and Chemical nature
4.4. Protein Metabolism - Transamination, Deamination and Urea Cycle
4.5. Lipids**:** Classifiation of Lipids, Lipid Metabolism - Fatty acid synthesis and Fatty acid oxidation.

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 Scmidt-Nielson,** *Animal Physiology*, 5th ed, 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

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SEMESTER – V

Physiology and Biochemistry (Practical)

Max. Marks: 25

1. Qualitative tests for identification of carbohydrates, proteins and lipids.
2. Qualitative tests for identification of ammonia, urea and uric acid (Nitrogenous excretory products)
3. Effect of pH and Temperature on salivary amylase activity.
4. Study of permanent histological sections of Mammalian Endocrine glands - pituitary, thyroid, pancreas, adrenal gland.
5. Estimation of Haemoglobin by Sahlis method.
6. Estimation of total protein by Lowry's method.
7. Estimation of unit Oxygen consumption of fish with reference to body weight.

- **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). T*extbook 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 – VI

Immunology and Animal Biotechnology (Theory)

Max. Marks: 60

UNIT – I

1.1. Basic concepts of immunology. Cells of immune system Primary and secondary Organs of immune system
1.2 Types of Immunity – Innate and acquired
1.3. Basic properties of antigens. Structure, function and types of an antibody.
1.4. B and T cell epitopes, haptens, adjuvants Antigen-antibody reactions,
1.5 T-Cell and B-Cell activation Monoclonal antibodies and their production

UNIT – II

2.1 Structure and functions of major histocompatibility complex.
2.2 Basic properties and functions of Cytokines, Interferons and complement proteins
2.3 Humoral and Cell mediated immunity.
2.4 Types of hyper sensitivity.
2.5Concepts of autoimmunity and immunodeficiency. Introduction to Vaccines and types of Vaccines

UNIT – III

3.1.Concept and Scope of Animal Biotechnology.
3.2 Cloning vectors - Plasmids, Cosmids, Lambda bacteriophage,YAC,
3.3 Cloning- Cloning methods (Cell, Animal and Gene cloning)
3.4 Animal Cell culture - Equipment and materials for animal cell culture
3.5 Applications of cell culture techniques

UNIT – IV

4.1 Recombinant DNA technology and its applications
4.2 Transgenesis – Methods of Transgenesis.
4.3 Production of Transgenic animals
4.4 Application of Transgenic animals in Biotechnology.
4.5 Stem cells –types and their applications

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SEMESTER – VI

Immunology and Animal Biotechnology (Practical)

Max. Marks: 25

I. Immunology

1 .Identification of Blood groups
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Enumeration of RBC & WBC from a given blood sample
4. Enumeration of Differential count of WBC from a given blood sample
5. Demonstration of
   a. ELISA , b. Immunoclectrophoresis
6. Identification of Autoimmune disease through charts.

II. Animal Biotechnology

1. Study the following techniques through photographs / virtual lab
   a. Southern blotting
   b. Western blotting
   c. DNA sequencing (Sanger's method)
   d. DNA finger printing
   e. Identification of Vectors
   f. Identification of Transgenic animals
2. PCR demonstration /virtual lab

- **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:

Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

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SEMESTER – VI

Elective Paper – VIII

B) Aquatic Biology (Theory)

Max. Marks: 60

UNIT – I

1.1 Brief introduction of the aquatic biomes
1.2 Freshwater ecosystem (lakes, wetlands, streams and rivers), Estuaries, intertidal zones.
1.3 Oceanic pelagic zone, marine benthic zone.
1.4 Coral reefs

UNIT – II

2.1 Lakes Origin and classification of lakes, Lake as an Ecosystem, Lake morphometry,
2.2 Physico-chemical Characteristics of fresh water bodies: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity: dissolved gases (Oxygen, Carbon dioxide).
2.3 Nutrient Cycles and Lakes- Nitrogen, Sulphur and Phosphorous.
2.4 Streams: Different stages of stream development, Physico-chemical environment, adaptation of hill-stream fishes.

UNIT – III

3.1 Salinity and density of sea water,
3.2 Continental shelf,
3.3 Adaptation of deep sea organisms.
3.4. Sea weeds.

UNIT – IV

4.1 Aquatic pollution - Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills,
4.2 Eutrophication
4.3 Management and conservation
4.4 Water pollution acts of India, Sewage treatment and water quality assessment - BOD and COD.

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SEMESTER – VI

Elective Paper – VIII

B) AQUATIC BIOLOGY (Practical)

Max.Marks:25

PRACTICAL

1. Study of the topography of a lake
2. Physico-Chemical and biological analysis of a lake
   Physico-Chemical analysis of water - O2, CO2, BOD, COD
   Biological– Zooplanktons – Identification and population density of Zooplanktons of a lake
3. Determination of - Turbidity / transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake / water body.
4. Instruments used in limnology (sacchi disc, van dorn bottle, conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant / Marine bio-reserve/Fisheries Institutes.

Suggested Readings:

1. Ananthakrishnan : Bioresources Ecology 3rd Edition
2. Goldman – Limnology, 2nd Edition
3. Odum and Barrett – Fundamentals of Ecology, 5th Edition\
4. Pawlowski: Physicochemical Methods for water and Wastewater Treatment, 1st Edition
5. Wetzel: Limnology, 3rd edition
6. Trivedi and Goyal: Chemical and biological methods for water pollution studies
7. Welch: Limnology Vols.I-II

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