B.Sc., BOTANY

First Year, I -Semester

Paper-I

Microbial Diversity and Lower Plants

DSC - 1A (4 hrs./week) **Credits- 4**

Theory Syllabus **(60 hours)**

UNIT – I **(15 hours)**

1) **Bacteria**: Structure, nutrition, reproduction and economic importance. Brief account of Archaebacteria, Actinomycetes and Mycoplasma with reference to little leaf of Brinjal and Papaya leaf curl

2) **Viruses**: Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro.

3) An outline of plant diseases of important crop plants caused by bacteria and their control with reference to Angular leaf spot of cotton and Bacterial blight of Rice.

UNIT-II **(15 hours)**

1) General characters, structure, reproduction and classification of algae (Fritsch)
2) **Cyanobacteria**: General characters, cell structure their significance as biofertilizers with special reference to Oscillatoria, Nostoc and Anabaena.
3) Structure and reproduction of the following:
   Chlorophyceae- Volvox, Oedogonium and Chara.
   Phaeophyceae- Ectocarpus
   Rhodophyceae- Polysiphonia.

UNIT-III **(15 hours)**

1) General characters and classification of fungi (Ainsworth).
2) Structure and reproduction of the following:
   (a) Mastigimycotina- Albugo
   (b) Zygomycotina- Mucor
   (c) Ascomycotina- Saccharomyces and Penicillium.
   (d) Basidiomycotina- Puccinia
   (e) Deuteromycotina- Cercospora.
3) Economic importance of lichens

UNIT-IV **(15 hours)**

1) **Bryophytes:** Structure, reproduction, life cycle and systematic position of Marchantia, Anthoceros and Polytrichum, Evolution of Sporophyte in Bryophytes.
2) **Pteridophytes**: Structure, reproduction, life cycle and systematic position of Rhynia, Lycopodium, Equisetum and Marsilea.
3) Stelar evolution, heterospory and seed habit in Pteridophytes.

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References:

1) Alexopolous, J. and W. M. Charles. 1988. Introduction to Mycology. Wiley Eastern, New Delhi.
2) Mckane, L. and K. Judy. 1996. Microbiology – Essentials and Applications. McGraw Hill, New York.
3) Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
4) Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
5) Sambamurthy, A. V. S. S. 2006. A Textbook of Plant Pathology. I. K. International Pvt. Ltd., New Delhi.
6) Sambamurthy, A. V. S. S. 2006. A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.
7) Sharma, O. P. 1992. Textbook of Thallophyta. McGraw Hill Publishing Co., New Delhi.
8) Thakur, A. K. and S. K. Bassi. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
9) Vashishta, B. R., A. K. Sinha and V. P. Singh. 2008. Botany for Degree Students: Algae. S. Chand& Company Ltd, New Delhi.
10) Vashishta, B. R. 1990. Botany for Degree Students: Fungi, S. Chand & Company Ltd, New Delhi.
11) Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
12) Watson, E. V. 1974. The structure and life of Bryophytes, B. I. Publications, New Delhi.
13) Pandey, B. P. 2006. College Botany, Vol. II: Pteridophyta, Gymnosperms and Palcobotany. S. Chand & Company Ltd, New Delhi.
14) Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany - Pteridophyta (Vascular Cryptogams). . Chand & Company Ltd, New Delhi.
15) Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
16) Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.
17) Thakur, A. K. and S. K. Bassi. 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.
18) Vashishta, B. R., A. K. Sinha and Adarsha Kumar. 2008. Botany for Degree Students: Bryophyta. S. Chand & Company Ltd, New Delhi.

Practical Syllabus

(45 hours)

1. Study of viruses and bacteria using electron micrographs (photographs).
2. Gram staining of Bacteria.
3. Study of symptoms of plant diseases caused by viruses, bacteria, Mycoplasma and fungi:
   Viruses: Tobacco mosaic
   Bacteria: Angular leaf spot of cotton and Rice tungro.
   Mycoplasma: Little leaf of Brinjal and Leaf curl of papaya
   Fungi: White rust on Crucifers, Rust on wheat & Tikka disease of Groundnut.
4. Vegetative and reproductive structures of the following taxa:
   Algae: Oscillatoria, Nostoc, Volvox, Oedogonium,Chara ,Ectocarpus and Polysiphonia.
   Fungi: Albugo, Mucor,Saccharomyces, Penicillium, Puccinia and Cercospora
5. Section cutting of diseased material infected by Fungi and identification of pathogens as per theory syllabus. White rust of Crucifers, Rust on wheat & Tikka disease of Groundnut.
6. Lichens: Different types of thalli and their external morphology
7. Examination of important microbial, fungal and algal products:
   Biofertilizers, protein capsules, antibiotics, mushrooms, Agar-agar etc.
8. Field visits to places of algal / microbial / fungal interest (e.g. Mushroom cultivation, water bodies).
9. Study of Morphology (vegetative and reproductive structures) and anatomy of the following Bryophytes: Marchantia, Anthoceros and Polytrichum.
10. Study of Morphology (vegetative and reproductive structures) and anatomy of the following Pteridophytes: Lycopodium, Equisetum and Marsilea.
11. Study of Anatomical features of Lycopodium stem, Equisetum stem and Marsilea petiole & rhizome by preparing double stained permanent mounts.

Practical Model Paper

Max. Marks: 25

Time : 3 hrs

1. Identify the given components **'A'&'B'** in the algal mixture .
   Describe with neat labeled diagrams & give reasons for the classifications. — 2 X 2 = 4M
2. Classify the given bacterial culture **'D'** using Gram – staining technique. — 3M
3. Take a thin transverse section of given diseased material **'E'**.
   Identify & describe the symptoms caused by the pathogen. — 4M
4. Identify the given specimens **'F', 'G' & 'H'** by giving reasons .
   (Fungal-1, Bacteria-1 & Viral-1) — 3 X 1 = 3M
5. Comment on the given slides **'I' & 'J'** (Algae-1, Fungi-1) — 2 X 2 = 4M
6. Identify the given specimen **'K' &** slide **'L'** (Bryophytes & Pteridophytes) — 2 X 2 = 4M
7. Record — 3M

B.Sc., BOTANY

First Year, II -Semester

Paper-II
Gymnosperms, Taxonomy of Angiosperms and Ecology

DSC-1B **Credits-4**

Theory Syllabus

UNIT-I

1) Gymnosperms: General characters, structure, reproduction and classification (Sporne's). Distribution and economic importance of Gymnosperms.
2) Morphology of vegetative and reproductive parts, systematic position and life cycle of Pinus and Gnetum,
3) Geological time scale Introduction to Palaeobotany, Types of fossils and fossilization, Importance of fossils.

(15 hours)

UNIT-II

1) Introduction: Principles of plant 4ystematic, Types of classification: Artificial, Natural and Phylogenetic; Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantl classification systems. An introduction to Angiosperm Phylogeny Group (APG).
2) Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy.
3) Nomenclature and Taxonomic resources: An introduction to ICN, Shenzhen code – a brief account. Herbarium: Concept, techniques and applications.

(15 hours)

UNIT-III

1) Systematic study and economic importance of plants belonging to the following families: Polypetalae Annonaceae, Capparidaceae, Rutaceae, Fabaceae (Faboideae/Papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae
2) Gamopetalae: Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae, Monochalmydeae: Amaranthaceae, Euphorbiaceae
3) Monocotyledons: Orchidaceae, Poaceae and Zingeberaceae.

(15 hours)

UNIT-IV

1. Component of eco system, energy flow, food chain and food webs.
2. Plants and environment, ecological adaptations of plants, Hydrophytes, Xerophytes and Mesophytes
3. Plant Succession serial stages, modification of environment, climax formation with reference to Hydrosere and Xerosere.

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Practical Syllabus (45 hours)

1. Study of viruses and bacteria using electron micrographs (photographs).
2. Gram staining of Bacteria.
3. Study of symptoms of plant diseases caused by viruses, bacteria, Mycoplasma and fungi:
   Viruses: Tobacco mosaic
   Bacteria: Angular leaf spot of cotton and Rice tungro.
   Mycoplasma: Little leaf of Brinjal and Leaf curl of papaya
   Fungi: White rust on Crucifers, Rust on wheat & Tikka disease of Groundnut.
4. Vegetative and reproductive structures of the following taxa:
   Algae: Oscillatoria, Nostoc, Volvox, Oedogonium,Chara ,Ectocarpus and Polysiphonia.
   Fungi: Albugo, Mucor,Saccharomyces, Penicillium, Puccinia and Cercospora
5. Section cutting of diseased material infected by Fungi and identification of pathogens as per theory syllabus. White rust of Crucifers, Rust on wheat & Tikka disease of Groundnut.
6. Lichens: Different types of thalli and their external morphology
7. Examination of important microbial, fungal and algal products:
   Biofertilizers, protein capsules, antibiotics, mushrooms, Agar-agar etc.
8. Field visits to places of algal / microbial / fungal interest (e.g. Mushroom cultivation, water bodies).
9. Study of Morphology (vegetative and reproductive structures) and anatomy of the following
   Bryophytes: Marchantia, Anthoceros and Polytrichum.
10. Study of Morphology (vegetative and reproductive structures) and anatomy of the following
    Pteridophytes: Lycopodium, Equisetum and Marsilea.
11. Study of Anatomical features of Lycopodium stem, Equisetum stem and Marsilea petiole & rhizome by preparing double stained permanent mounts.

Practical Model Paper

Max. Marks: 25

Time : 3 hrs

1. Identify the given components '**A**'&'**B**' in the algal mixture .
   Describe with neat labeled diagrams & give reasons for the classifications. 2 X 2 = 4M
2. Classify the given bacterial culture '**D**' using Gram – staining technique. 3M
3. Take a thin transverse section of given diseased material '**E**'.
   Identify & describe the symptoms caused by the pathogen. 4M
4. Identify the given specimens '**F**', '**G**' & '**H**' by giving reasons .
   (Fungal-1, Bacteria-1 & Viral-1) 3 X 1 = 3M
5. Comment on the given slides '**I**' & '**J**' (Algae-1, Fungi-1) 2 X 2 = 4M
6. Identify the given specimen '**K**' & slide '**L**' (Bryophytes & Pteridophytes) 2 X 2 = 4M
7. Record 3M

References:

1. Watson, E. V. 1974. The structure and life of Bryophytes, B. I. Publications, New Delhi.
2. Pandey, B. P. 2006. College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany. S. Chand & Company Ltd, New Delhi.
3. Sporne, K. R. 1965. Morphology of Gymnosperms. Hutchinson Co., Ltd., London.
4. Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany - Pteridophyta (Vascular Cryptogams). . Chand & Company Ltd, New Delhi.
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8. Vashishta, B. R., A. K. Sinha and Adarsha Kumar. 2008. Botany for Degree Students: Bryophyta. S. Chand & Company Ltd, New Delhi.
9. Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany for Degree Students: Gymnosperms. Chand & Company Ltd, New Delhi.
10. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
11. Pandey, B. P. 2007. Botany for Degree Students: Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd, New Delhi
12. Stace, C. A. 1989. Plant Taxonomy and Biostatistics (2nd Ed.). Edward Arnold, London.
13. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.
14. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
15. Davis, P. H. and V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
16. Heywood, V. H. 1965 . Plant Taxonomy. ELBS , London.
17. Heywood, V. H. and D. M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
18. Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
19. Michael, S. 1996, Ecology, Oxford University Press, London
20. Odum, E.P. 1983. Basics of Ecology, Saunder's International Students Edition, Philadelphia.
21. Sharma P.D. 1989. Elements of Ecology, Rastogi Publications, Meerut

Practical Syllabus (45 hours)

1. Study of Morphology (vegetative and reproductive structures) of the following taxa:
   Gymnosperms - Pinus and Gnetum.
2. Study of Anatomical features of Pinus needle and Gnetum stem by preparing double stained permanent mounts.
3. Fossil forms using permanent slides / photographs: Cycadeoidea.
   Systematic study of locally available plants belonging to the families prescribed in theory Syllabus (Minimum of one plant representative for each family)
4. Study of morphological and anatomical characteristics of locally available plant species (Eichhornia, Hydrilla, Pistia, Nymphaea, Asparagus, Opuntia, Euphorbia melii)
5. Demonstration of herbarium techniques.
6. Candidate has to submit at least 30 herbarium sheets.

Practical Model Paper

Time : 3 hrs **Max. Marks:**

1. Prepare a mount of the given material ' **A** ' (Hydrophytes /Xerophytes)
   Draw diagram & give reasons for identification.
2. Prepare a double stained permanent mount of the given material ' **B** ' (Gymnosperms)
   Draw diagram & give reasons for identification.
3. Identify the given specimens **C & D** (Gymnosperms /Xerophytes) 2 X 4 =
4. Identify the given slides **E&F** (Gymnosperms /Xerophytes) 2 X 4 =
5. Technical description of the given plant twig ' A '
6. Herbarium
7. Record

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
Under Graduate Courses (Under CBCS 2020 – 2021 onwards)
B.Sc. BOTANY II Year
SEMESTER – III

PLANT ANATOMY AND EMBRYOLOGY

Theory:	4 Hours/Week;	Credits: 4	Marks: 100 (Internal: 20; External: 80)
Practical:	3 Hours/Week	Credits: 1	Marks: 25

UNIT – I

Meristems: Types, histological organization of shoot and root apices and theories.

1. Tissues and Tissue Systems: Simple, complex and special tissues.
2. Leaf: Ontogeny, diversity of internal structure; stomata and epidermal outgrowths.

UNIT –II

4. Stem and root anatomy: Vascular cambium - Formation and function.
5. Anomalous secondary growth of Stem -*Achyranthes, Boerhaavia, Bignonia, Dracaena;* Root— *Beta vulgaris.*
6. Wood structure: General account. Study of local timbers — Teak *(Tectona grandis),* Rosewood, *(Dalbergia latefolia),* Red sanders, *(Pterocarpus santalinus)* Nallamaddi *(Terminalia tomentosa)* and Neem *(Azadirachta indica).*

UNIT-III

7. History and importance of Embryology.
8. Another structure, Microsporogenesis and development of male gametophyte.
9. Ovule structure and types; Megasporogenesis; types and development of female gametophyte.

UNIT- IV

10. Pollen morphology, pollination and fertilization, Pollination Types, Pollen - pistil interaction, Double fertilization.
11. Seed - structure appendages and dispersal mechanisms.
12. Endosperm - Development and types. Embryo - development and types; Polyembryony and Apomixis -- an outline.

References:

1. Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.
2. Bhojwani, S. S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
3. M.R.Saxena- A textbook of Palynology.
4. Vashista- A textbook of Anatomy.
5. P.K.K.Nair- A textbook of Palynology.
6. Esau, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.
7. Johri, B. M. 1984. Embryology of Angiosperms. Springer-Verleg, Berlin.
8. Kapil, R. P. 1986. Pollination Biology. Inter India Publishers, New Delhi.
9. Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
10. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press

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B.Sc. BOTANY II Year
SEMESTER – III

PLANT ANATOMY AND EMBRYOLOGY PRACTICAL

1. Demonstration of double stain technique.
2. Preparation of double stained Permanent slides

   Primary structure: Root - *Cicer, Canna;* Stem — *Tridax, Sorghum*

   Secondary structure: Root — *Tridax* sp.; Stem —*Pongarnia*

   Anomalous secondary structure:

   Stem: *Achyranthes, Boerhavia, Bignonia, Dracaena*

   Root*: Beta vulgaris*
3. Stomatal types using epidermal peels (Dicots).
4. Structure of anther and microsporogenesis using permanent slides.
5. Structure of pollen grains using whole mounts - *Hibiscus, Acacia* and Grass).
6. Pollen viability test using Evans Blue — *Hibiscus*
7. Study of ovule types and developmental stages of embryo sac.
8. Structure of endosperm (nuclear and cellular); Developmental stages of dicot and monocot embryos using permanent slides.
9. Isolation and mounting of embryo (using *Cymopsis / Senna / Crotalaria)*

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

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B.Sc. BOTANY II Year

SEMESTER – IV

CELL BIOLOGY AND PLANT PHYSIOLOGY

Theory: 4 Hours/Week Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical: 3 Hours/Week Credits: 1 Marks: 25

UNIT I: Plant cell envelops: Ultra structure of cell wall, molecular organization of cell membranes.

1. Models of membrane structure, Functions, fluidity and Selective permeability of the membranes.
2. Cell Organelles: Structure and semiautonomous nature of Mitochondria and Chloroplast.
3. Structure and role of endoplamic reticulum, ribosomes, golgi complex, lysosomes, peroxisomes and glyoxisomes.

UNIT-II

Nucleus: Ultra structure, types and functions of DNA & RNA.

4. Chromosomes: Morphology, organization of DNA in a chromosome, Euchromatin and Heterochromatin, Karyotype. Special types of chromosomes: Lampbrush and Polytene chromosomes.
5. Extra nuclear genome: Mitochondrial DNA and Plastid DNA.. Plasmids.
8. Cell division: Cell and its regulation; mitosis, meiosis and their significance

UNIT- III

9. Plant -Water Relations: Physical properties of water, diffusion, imbibitions, osmosis; osmotic and pressure Potential, absorption and transport of water.
10. Mineral Nutrition: Essential macro and micro mineral nutrients, and symptoms of mineral deficiency.
11. Transpiration; Stomatal structure and movement. Mechanism of phloem transport. Mechanism of phloem transport.
12. Enzymes: Nomenclature, Characteristics, Classification and factors regulating enzyme activity.

UNIT- IV

13. Photosynthesis: Photosynthetic pigments, Mechanism of photosynthetic electron transport and evolution of oxygen, Photophosphorylation . Carbon assimilation pathways: C3, C4 and CAM.
14. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle and electron transport system.
15. Nitrogen Metabolism: Biological nitrogen fixation
16. Physiological effects of Phytohormones: Auxins, gibberellins, cytokinins, ABA, ethylene and Brassinosteroids

References:

1. Sharma, A. K. and A. Sharma. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Harward Academic Publishers, Australia.
2. Shukla, R. S. and P. S. Chandel. 2007. Cytogenetics, Evolution, Biostatistics and Plant Breeding. S.Chand & Company Ltd., New Delhi.
3. Verma, P. S. and V. K. Agrawal. 2004. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd., New Delhi. 1. Hopkins, W. G. 1995.
4. Introduction to Plant Physiology. John Wiley & Sons Inc., New York, USA
5. Jain, J.L., S. Jain and Nitin Jain. 2008. Fundamentals of Biochemistry. S. Chand & Company Ltd., New Delhi.
6. Pandey, B. P. 2007. Botany for Degree Students: Plant Physiology, Biochemistry, Biotechnology, Ecology and Utilization of Plants. S. Chand & Company Ltd., New Delhi.
7. Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition), Wordsworth, Thomson Learning Inc.,USA.
8. Taiz, L. and E. Zeiger. 1998. Plant Physiology (2nd Ed.). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
9. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.

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KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

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B.Sc. BOTANY II Year

SEMESTER – IV

CELL BIOLOGY AND PLANT PHYSIOLOGY PRACTICAL

1. Demonstration of cytochemical methods: Fixation of plant material and nuclear staining for mitotic and meiotic studies.
2. Study of various stages of mitosis using cytological preparation of Onion root tips.
3. Study of various stages of meiosis using cytological preparation of onion flower buds.
4. Study of ultra structure of cell organelles using photographs. Chloroplast, Mitochondria, Nucleus, Ribosomes, Endoplasmic reticulum and Golgi complex.
5. Study of Special types of Chromosomes (Polytene chromosome and Lampbrush chromosomes-Permanent slide) ✓
6. Determination of osmotic potential of vacuolar sap by Plasmolytic method using leaves of *Rheodiscolor / Tradescantia.*
7. Determinion of rate of transpiration using Cobalt chloride method
8. Determination of stomatal frequency using leaf epidermal peelings / impressions
9. Determination of catalase activity using potato tubers by titration method
10. Separation of chloroplast pigments using paper chromatography technique
11. Estimation of protein by Biurette method
12. Mineral deficiency- Detail study of Micronutrients and Macro nutrients
13. Identification of C_3,C_4 and CAM plants.

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KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
UNDER GRADUATE COURSES (UNDER CBCS 2021 – 2022 ONWARDS)
B.SC. BOTANY III YEAR
SEMESTER – V

PAPER – V: (A) BIODIVERSITY & CONSERVATION
(DSE-1: ELECTIVE)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical 3 Hours/Week Credits: 1 Marks: 25

UNIT – I

1. Plant diversity and its scope: Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agro biodiversity and cultivated plant taxa, wild taxa.
2. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

UNIT-II

3. Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agro biodiversity, Projected scenario for biodiversity loss.
4. Management of Plant Biodiversity: Organizations associated with biodiversity, management- Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR.
5. Biodiversity legislation and conservation, Biodiversity information management and communication.

UNIT-III:

7. Conservation of Biodiversity: Conservation of genetic diversity, species diversityand ecosystem Diversity
8. Principles of conservation :*In -situ* and *Ex-situ* conservation. Sacred groove, Botanical garden, Biosphere reserves, Sanctuaries, National parks (*In-situ*) and Tissue culture, Gene / seed / pollen banks and Cryopreservation (*Ex-situ*).

UNIT-IV:

9. Role of plants in relation to Human Welfare; Importance of forestry, their utilization and commercial aspects, Avenue trees, Ornamental plants of India.
10. Alcoholic beverages through ages. Fruits and nuts, Important fruit crops and their commercial importance. Wood and its uses.

References:

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

2. Bharucha, E. 2005. Textbook of Environmental Studies for Undergraduate Courses. Universities Press (India) Private Limited, Hyderabad.

3. Odum, E. P. 1983. Basics of Ecology. Saunder's International Students Edition, Philadelphia.

4. Sharma, P. D. 1989. Elements of Ecology. Rastogi Publications, Meerut.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
UNDER GRADUATE COURSES (UNDER CBCS 2021 – 2022 ONWARDS)
B.SC. BOTANY III YEAR
SEMESTER – V

PAPER – V:: (A) BIODIVERSITY & CONSERVATION PRACTICAL
(DSE-1: ELECTIVE)

1. Study on local biodiversity: Herbs, shrubs and trees; Seasonal, Annual, biennial and perennial plants.
2. Study of morphological characteristics of plant communities: Hydrophytes (*Eichhornia, Hydrilla, Pistia, Nymphaea, Vallisneria*), Xerophytes: (*Asparagus, Opuntia, Euphorbia milii, Casuarina, Calotropis*).
3. Assessment of biodiversity
   - i) Avenue trees: *Pongamiapinnata, Butea monosperma, Spathodea* sp., *Delonix regia, Jacaranda mimosifolia, Cassia fistula, Mimusopselengi, Acacia leucophloea,* and *Albizialebbeck.*
   - ii) Ornamental Plants: Any five locally available ornamental plants.
   - *iii)* Timber Value: *Acacianilotica, Tectonagrandis*and *Azardirachtaindica*
   - *iv)* Fruits: *Mangiferaindica*(Mango), *Ziziphusmauritiana, Psidium guajava*(Guava), *Annona squamosa*
   - v) Nuts: *Anacardiumoccidentale*(Cashew), *Terminalia catappa*(Badam)
   - *vi)* Beverages: *Madhucaindica*, *Camellia sinensis*(Tea),*Coffea arabica*(Coffee), *Borassusflabellifer*
     (Toddy palm) and *Caryotaurens*
   - *vii* Medicinal value: *Catharanthus roseus, Tinosporacordifolia*and *Phyllanthus emblica, Ocimumsp.*, and *Azardirachta indica*
4. Field trip: Collection of plants from the field, identification and preparation of Herbarium.

D. Calitha Ki

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
UNDER GRADUATE COURSES (UNDER CBCS 2021 – 2022 ONWARDS)
B.SC. BOTANY III YEAR
SEMESTER – V

PAPER – V: (B) ECONOMIC BOTANY
(DSE-1: ELECTIVE)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical 3 Hours/Week; Credits: 1 Marks: 25

UNIT - I

Origin of Cultivated Plants: Major plants introduction, Crop domestication and examples of crops / varieties

1. Vegetables: Nutritional and Commercial values of root crops, leafy and fruit vegetables.
2. Millets: Nutrient significance of Sorghum, Finger millet, Pearl millet, Foxtail millet.
3. Cereals: Rice, Wheat and maize - Origin, morphology and uses.

UNIT – II

4. Legumes: General account, importance to man and ecosystem.
5. Fruits and nuts: Commercial and nutritional value of South Indian fruits. Cashew nut, Almond and Walnut.
6. Sugars & Starches: Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.
7. Spices: Listing of important spices, part used, economic importance with special reference to fennel, saffron, clove and black pepper

UNIT – III

8. Beverages: Tea, Coffee (morphology, processing & uses)
9. Edible oils & Fats: General description, extraction, uses and health implications of groundnut, sunflower, coconut, linseed, and mustard.
10. Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.
11. Natural Rubber: Para-rubber - tapping, processing and uses.

UNIT – IV

12. Drug-yielding plants: Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*.
13. Tobacco processing, uses and health hazards
14. Timber plants: General account with special reference to teak and pine
15. Fibres: Classification based on the origin of fibres, extraction methods and uses of Cotton and Jute.

Suggested Readings

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.
4. B.P. Pandey (2007). Economic Botany, S. Chand & Company Ltd. New Delhi. 17/e.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

UNDER GRADUATE COURSES (UNDER CBCS 2021 – 2022 ONWARDS)

B.SC. BOTANY III YEAR

SEMESTER – V

PAPER – V:: (B) ECONOMIC BOTANY PRACTICAL

(DSE-1: ELECTIVE)

1. Study of economically important plants: Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests.
2. Identification and study on nutrient values of locally available vegetables, millets and cereals.
3. Study on nutrient values and commercial status of Cashew nut, Almond and Walnut.
4. Uses and health implications of groundnut, sunflower, coconut, linseed, Brassica and Coconut.
5. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests
6. Study of products of economic importance included unit wise.
7. Collection vegetable twigs and preparation of Herbarium.
8. Identification of starch granules.
9. Estimation of iodine number of different oils.
10. Quantitative estimation and comparative study of proteins in millets and cereals.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
UNDER GRADUATE COURSES (UNDER CBCS 2021 – 2022 ONWARDS)
B.SC. BOTANY III YEAR
SEMESTER – V

PAPER – V:: (C) SEED TECHNOLOGY
(DSE-1: ELECTIVE)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical 3 Hours/Week; Credits: 1 Marks: 25

UNIT- I

1. Seed: Structure and types. Seed development in cultivated plants, seed quality concept, importance of genetic purity of seed. Hybrid seed production and Heterosis.
2. Cross pollination, Emasculation, role of pollinators and their management.
3. Collection and storage of pollen for artificial pollination.

UNIT-II

4. Seed germination: Internal and external factors affecting germination.
5. Physiological processes during seed germination; seed respiration, breakdown and mobilization of stored seed reserves.
6. Seed dormancy: Types, causes and methods of breaking dormancy. Role of Phytochrome.

UNIT-III

7. Cultural practices and harvesting of Seed: Isolation, Sowing, Cultural practices, harvesting and threshing of the following crops: a) Rice b) Cotton c) Sunflower
8. Seed treatment to control seed borne disease –General account
9. Seed testing- Procedures of seed testing, seed testing laboratories and importance of seed testing.

UNIT-IV

10. Seed viability, factors affecting seed viability and genetic erosion.
11. Seed storage: Long term and short term storage. Orthodox and recalcitrant seeds. Packing of seeds – Principles, practices, bagging and labelling.
12. Seed banks- National, International and Millennium seed banks. Seed certification- History, Seed certification agency, Indian millennium, general and specific seed certification standard.

Reference:

1. Agrawal, P. K. 1993. Hand Book of Seed Technology. Dept. of Agriculture and Cooperation. National Seed Corporation Ltd., New Delhi
2. Balasubramanian, D., C. F. A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman. 2004. Biotechnology. Universities Press (India) Private Limited, Hyderabad.
3. Bedell, Y. E. Seed Science and Technology. Indian Forest Species. Allied Publishers Limited, New Delhi.
4. Channarayappa. 2007. Molecular Biotechnology – Principles and Practices. Universities Press (India) Private Limited, Hyderabad.
5. Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
6. Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi
7. Edmond, J. B., T. L. Senn, F. S. Adrews and R. J. Halfacre. 1977..
8. Hartman, H. T. and D. E. Kestler. 1976. Plant Propagation: Principles and Practices. Prentice & Hall of India, New Delhi.
9. Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture – Basic and Applied. Universities Press (India) Private Limited, Hyderabad..
10. Ramawat, K. G. 2008. Plant Biotechnology. S. Chand & Company Ltd., New Delhi.
11. Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition), Wordsworth, Thomson Learning Inc., USA..
12. Tiwari, G. N. and R. K. Goal. Green House Technology – Fundamentals, Design, Modelling and Application. Narosa Publishing House, New Delhi.
13. Tunwar, N. S. and S. V. Singh. 1988. Indian Minimum Seed Certification Standards. The Central Seed Certification Board, Govt. of India, New Delhi.
14 Agrawal PK & Dadlani M. (Eds.). 1992. *Techniques in Seed Science and Technology*. South Asian Publ.
15. Baskin CC & Baskin JM. 1998. Seeds: Ecology, Biogeography and Evolution of Dormancy and Germination. Academic Press. Basra AS. 2006. Handbook of Seed Science and Technology. Food Product Press.
16. Bench ALR & Sanchez RA. 2004. *Handbook of Seed Physiology*. Food Product Press. Bewley JD & Black M. 1982. Physiology and Biochemistry of Seeds in Relation to Germination. Vols. I, II. Springer Verlag.
17. Bewley JD & Black M. 1985. Seed: Physiology of Seed Development and Germination. Plenum Press.
18. Copeland LO & Mc Donald MB. 1995. *Principles of Seed Science and Technology*. 3rd Ed. Chapman & Hall.
19. Khan AA. 1977. Physiology and Biochemistry of Seed Dormancy and Germination. North Holland Co.
20. Kigel J & Galili G. (Eds.). *Seed Development and Germination*. Marcel Dekker.
21. Murray DR. 1984. *Seed Physiology*. Vols. I, II. Academic Press. Sadasivam S & Manickam A. 1996. *Biochemical Methods*. 2nd Ed. New Age.

B. Lalitha Ki

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

Under Graduate Courses (Under CBCS 2021 – 2022 onwards)

B.SC. BOTANY III YEAR

SEMESTER – VI

PAPER-2A: PLANT MOLECULAR BIOLOGY

(DSE-2: ELECTIVE)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical: 3 Hours/Week Credits: 1 Marks: 25

UNIT- I

1. Nucleic acids: Carriers of genetic information, types of genetic material, DNA as the carrier of genetic information.
2. .Structures of DNA: Salient features and Types of DNA, Organization of DNA in Prokaryotes. Mitochondrial and chloroplast DNA.
3. .Structure of RNA: Structure and Types of RNA's (mRNA, rRNA and tRNA).

UNIT-II

4. Nucleosome, Chromatin structure- Euchromatin, Heterochromatin; Constitutive and Facultative heterochromatin.
5. Replication of DNA: Chemistry of DNA synthesis, general principles, Semi-conservative replication of DNA, replication of linear ds-DNA, replication of the 5'end of linear chromosome.
6. Central dogma and genetic code: Central Dogma (Adaptor hypothesis and discovery of mRNA template), salient features of Genetic code.

UNIT –III

7. Mechanism of Transcription: Transcription in prokaryotes and eukaryotes; Split genes-concept of introns and exons, removal of introns, eukaryotic mRNA processing (5' cap, 3' polyA tail).
8. RNA editing and mRNA transport.

UNIT -IV

9. Translation in prokaryotes: Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation.
10. Transcriptional regulation in prokaryotes, Regulation of lactose metabolism *(Lac* operon) and tryptophan *(Trp* operon) synthesis in *E.coli*.

B Lalitha

Suggested Readings

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, Joh Wiley & sons,India.8th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
6. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
7. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
8. Russell, P. J. (2010). iGenetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
9. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

Under Graduate Courses (Under CBCS 2021 – 2022 onwards)

B.SC. BOTANY III YEAR

SEMESTER – VI

PAPER-2A: PLANT MOLECULAR BIOLOGY PRACTICAL

(DSE-2: ELECTIVE)

1. Isolation of genomic DNA from E.Coli.
2. DNA isolation from cauliflower head./tomato fruit
3. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
4. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
5. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
6. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)
7. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.
8. Estimation of size of a DNA fragment after electrophoresis using DNA markers (through photographs).

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

Under Graduate Courses (Under CBCS 2021 – 2022 onwards)

B.SC. BOTANY III YEAR

SEMESTER – VI

PAPER-2B: TISSUE CULTURE AND BIOTECHNOLOGY

(DSE-2: ELECTIVE)

Theory:	4 Hours/Week;	Credits: 4	Marks: 100 (Internal: 20; External: 80)
Practical:	3 Hours/Week	Credits: 1	Marks: 25

UNIT - I

1. Tissue culture: Introduction, sterilization procedures, explants, culture media- composition and preparation; Nutrients and hormone requirements. Micropropagation.
2. Organ culture: Totipotency, Induction of callus, Shoot, leaf culture, Anther culture, Ovule and Embryo culture.
3. Callus culture and isolation and fusionof protoplast culture
4 Organogenesis, Somatic and Zygotic embryogenesis

UNIT- II

5. Applications of tissue culture: Production of pathogen free plants and stress resistant plants, somaclonal variants and synthetic seeds.
6. Induction of hairy roots and its applications in production of secondary metabolites.
7. Haploidy and triploids,Cryopreservation and Germplasm Conservation.
8 .Somatic hybrids and Cybrid

UNIT- III

9. Biotechnology: Introduction, history, scope and applications.
10. rDNA technology: Basic aspect of gene cloning, Enzymes used in gene cloning. Restriction enzymes, Ligases, Polymerases.
11. Gene cloning: Recombinant DNA, Bacterial Transformation and selection of recombinant clones, vectors- cloning vehicles (Plasmid, Cosmids, Bacteriophages, & Phasmids; Eukaryotic Vectors (YAC) Gene Construct; Applications of rDNA technology.

UNIT - IV:

10. Gene Libraries: construction of genomic and cDNA libraries, Polymerase Chain Reaction (PCR) and its applications.
11. Methods of gene transfer-*Agrobacterium* mediated Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment.

12. Application of transgenics in improvement of crop productivity and quality traits. Pest resistant transgenic crops (Bt-cotton & Bt-brinjal); herbicide resistant plants (Roundup Ready soybean); crops with quality traits (Flavr Savr tomato, Golden rice).

References:

1. Balasubramanian, D., C. F. A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman. 2004.
2. Biotechnology. Universities Press (India) Private Limited, Hyderabad.
3. Channarayappa. 2007. Molecular Biotechnology – Principles and Practices. Universities Press (India) Private Limited, Hyderabad.
4. Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
5. Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi
6. Edmond, J. B., T. L. Senn, F. S. Adrews and R. J. Halfacre. 1977..
7. Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture – Basic and Applied. Universities Press (India). Private Limited, Hyderabad..
8. Ramawat, K. G. 2008. Plant Biotechnology. S. Chand & Company Ltd., New Delhi.
9. Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition), Wordsworth, Thomson Learning Inc., USA.
10. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
12. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
13. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
14. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K.5th edition.
15. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

Under Graduate Courses (Under CBCS 2021 – 2022 onwards)

B.SC. BOTANY III YEAR

SEMESTER – VI

PAPER-2B: TISSUE CULTURE AND BIOTECHNOLOGY PRACTICAL

(DSE-2: ELECTIVE)

Major Experiments

1. Isolation of plant DNA (Tomato)
2. Production of synthetic seeds /Encapsulation of embryo
3. Preparation of plant tissue culture medium - MS medium
4. Isolation of protoplasts.

Minor Experiments

1. Callus induction
2. Demonstration of Micropropagation/multiple shoots
3. Anther culture
4. PCR – Demonstration
5. Study of biotechnology products: Samples of antibiotics and vaccines
6. Photographs of Gene transfer methods.
7. Instruments used in Biotechnology lab- Autoclave, Laminar air flow, Hot air oven and Incubator.
8. Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of tobacco, *Datura*, *Brassica* etc.

Spotting

1. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
2. Study of methods of gene transfer through photographs: *Agrobacterium*-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
3. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
4. Restriction digestion and gel electrophoresis of plasmid DNA.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

Under Graduate Courses (Under CBCS 2021 – 2022 onwards)

B.SC. BOTANY III YEAR

SEMESTER – VI

PAPER-2C: ANALYTICAL TECHNIQUES IN PLANT SCIENCES

(DSE-2: ELECTIVE)

Theory:	4 Hours/Week;	Credits: 4	Marks: 100 (Internal: 20; External: 80)
Practical:	3 Hours/Week	Credits: 1	Marks: 25

Unit -I

1. Imaging and related techniques: Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy.
2. Use of fluorochromes: Fluorescence-activated cell sorting (FACS); Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting.
3. Transmission and Scanning electron microscopy - sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit II:

4. Cell fractionation: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, , analytical centrifugation, ultracentrifugation, marker enzymes.
5. Radioisotopes: Use in biological research, auto-radiography, pulse chase experiment.
6. Spectrophotometry: Principle and its application in biological research.

Unit –III

7. Chromatography: Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion exchange chromatography; Molecular sieve chromatography; Affinity chromatography.
8. Characterization of proteins and nucleic acids: Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids;
9. Electrophoresis: PAGE, SDS-PAGE

Unit IV:

10. Biostatistics: Statistics, , population, samples, parameters;
11. Representation of Data: Tabular, Graphical; Measures of central tendency:
12. Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

Suggested Readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGrawHill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA

Under Graduate Courses (Under CBCS 2021 – 2022 onwards)

B.SC. BOTANY III YEAR

SEMESTER – VI

PAPER-2C: ANALYTICAL TECHNIQUES IN PLANT SCIENCES PRACTICALS

(DSE-2: ELECTIVE)

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

CURRICULUM FOR

B.Sc Life Science Subject:

FOOD & NUTRUTION

IN UNDER GRADUATE DEGREE PROGRAMME CBCS SYLLABUS

WITH EFFECT FROM
ACADEMIC YEAR 2020-2021

KAKATIYA UNIVERSITY
WARANGAL, TELANGANA STATE, INDIA

KAKATIYA UNIVERSITY - TELANGANA

-21 onwards)

B.Sc. FOOD & NUTRITION Syllabus, Kakatiya University, Warangal
CBCS pattern in Semester System (w.e. from 2020-21)

SEMESTER PATTERN

Year	Sem	Code	Course Title	Course Type	HPW	Credits
FIRST	I	BS 104	Introduction to Foods & Nutrition	DSC - 1A	4T+2P=6	4+1=5
	II	BS 204	Nutritional Biochemistry and Human Physiology	DSC -1B	4T+2P=6	4+1=5
SECOND	III	BS 305	Normal and Therapeutic Nutrition	DSC- 1C	4T+2P=6	4+1=5
	IV	BS 405	Diet in Disease	DSC- 1D	4T+2P=6	4+1=5
THIRD	V	BS 504	A- Clinical Dietetics	DSE-1E	4T+2P=6	4+1=5
		BS 505	B- Diet Therapy	DSE-2E		
	VI	BS 604	A-Public Health Nutrition	DSE-1F	4T+2P=6	4+1=5
		BS 605	B-Community Nutrition	DSE-2F		
		BS 603	Project Work/Optional		4	4

Dr. Estari Mamidala
Chairman
Board of Studies in Zoology
Department of Zoology
Kakatiya University
Warangal-506009

B.Sc. FOOD & NUTRITION
– WARANGAL
Under Graduate Courses (Under CBCS 2020
B. Sc. I YEAR - SEMESTER - I

PAPER-I: INTRODUCTION TO FOODS & NUTRITION (Theory)

Theory: **4 hrs/week;** **Credits : 4** **Marks : 100 (Internal-20, External-80)**
Practical: **3 hrs/week;** **Credits : 1** **Marks : 25**

UNIT I: INTRODUCTION TO FOOD GROUPS, CEREALS & MILLETS & PURE CARBOHYDRATES

1.1 Definition- Food, nutrition, nutrients; food groups based on functions, origin and nutritive value; Food guide pyramid, balanced diet
1.2 Cereals and Millets - Composition, nutritive value and nutrient losses during processing; breakfast cereals
1.3 Sugars - Types of sugars and stages of sugar cookery
1.4 Jaggery - Manufacture and stages of jaggery cookery

UNIT II : PULSES & LEGUMES, NUTS & OIL SEEDS AND FATS & OILS

2.1 Pulses & Legumes - Composition, nutritive value, nutrient losses during processing, importance of germination and malting; anti nutritional factors
2.2 Nuts & Oilseeds – Nutritive value, toxins and role in cookery
2.3 Fats & Oils – Composition, nutritive value, properties- physical and chemical, functions of oils and fat in foods
2.4 Rancidity of Oils- Types and prevention

UNIT III: VEGETABLES, FRUITS & FOOD PRESERVATION

3.1 Vegetables - Classification, composition and nutritive value, changes during cooking, loss of nutrients during cooking, storage, factors affecting storage
3.2 Fruits - Classification, composition, nutritive value, storage and ripening
3.3 Enzymatic browning and its prevention

3.4 Food preservation – principles, methods- dehydration, low temperature, high temperature and preservatives.

UNIT IV: ANIMAL FOODS AND FOOD ADULTERATION

4.1 Milk- Composition, nutritive value, fermented and non-fermented milk products
4.2 Egg - Composition, nutritive value and quality ; poultry- Classification, composition and nutritive value
4.3 Meat -Nutritive Value and changes during cooking; fish - classification, composition and nutritive value
4.4 Food Adulteration- intentional and incidental

Books Recommended: Text Books

- Srilakshmi B- Food Science, 5th Edition, New Age International Publishers, New Delhi – 110002, 2011. Reference Books
- Shakuntala Manay N - Food Facts and Principles, New Age International Publishers, New Delhi – 110002, 2005.
- Norman Potter N -Food Science, CBS Publishers and Distributors, New Delhi – 110002, 2007.

B.Sc. FOOD & NUTRITION KAKATIYA UNIVERSITY – WARANGAL - TELANGANA

Under Graduate Courses (Under CBCS 2020-21 onwards)

B. Sc. I YEAR - SEMESTER - I

PAPER-I: INTRODUCTION TO FOODS & NUTRITION (Practical)

I. Standardization, Preparation and Nutritive value calculation of the recipes based on the following food group and combination
   1. Cereal, millet and malting of grains
   2. Pulse, germination of grains
   3. Cereal-pulse combination
   4. Stages of sugar cookery, preparation with jiggery

II. Methods of Preservation of
   5. Fruits- Squashes and jams
   6. Vegetables by Pickling

III. 7. Determination of quality of an egg

IV. Detection of Adulterants
   8. Water, urea and starch in milk

9. Hydrogenated fat in ghee and butter
10. Identification of food colours and textile colours

Books Recommended:

- Srilakshmi B- Food Science, 5th Edition, New Age International Publishers, New Delhi – 110002, 2011.
- Longvah T. , Ananthan R. , Bhaskarachary K. and Venkaiah K. Indian Food Composition Table, National Institute of Nutrition, Tarnaka, 2017.

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ViswambharaEducationalSociety

VAAGDEVI DEGREE & P.G.COLLEGE

Kishanapura, Hanamkonda, T.S

(Approvedby A.I.C.T.E.,NewDelhi, Affiliatedto Kakatiya University & TSCHE)

DEPARTMENT OF BSc. NUTRITION & DIETETICS

1	B.SC	INTRODUCTION TO NUTRITION & DIETETICS
2	B.SC	NUTRITIONAL BIOCHEMISTRY AND HUMAN PHYSIOLOGY
3	B.SC	NORMAL AND THERAPEUTIC NUTRITION
4	B.SC	DIET IN DISEASE
5	B.SC	A- CLINICAL DIETETICS B- DIET THERAPY
6	B.SC	A- PUBLIC HEALTH NUTRITION B- COMMUNITY NUTRITION PROJECT WORK/OPTIIONAL

Dr A. Sheshachalam
PRINCIPAL
Principal
Vaagdevi Degree & P.G. Colle...
Kishanpura, Hanamkonda

CURRICULUM FOR
B.Sc Life Science Subject:

NUTRITION & DIETETICS

IN UNDER GRADUATE DEGREE PROGRAMME CBCS SYLLABUS

WITH EFFECT FROM
ACADEMIC YEAR 2020-2021

KAKATIYA UNIVERSITY
WARANGAL, TELANGANA STATE, INDIA

B.Sc. NUTRITION & DIETETICS Syllabus, Kakatiya University, Warangal
CBCS pattern in Semester System (w.e. from 2020-21)

SEMESTER PATTERN

Year	Sem	Code	Course Title	Course Type	HPW	Credits
FIRST	I	BS 104	Introduction to Nutrition & Dietetics	DSC - 1A	4T+2P=6	4+1=5
	II	BS 204	Nutritional Biochemistry and Human Physiology	DSC -1B	4T+2P=6	4+1=5
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		BS 605	B-Community Nutrition	DSE-2F		
		BS 603	Project Work/Optional		4	4

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B.Sc. NUTRITION & DIETETICS
KAKATIYA UNIVERSITY – WARANGAL - TELANGANA
Under Graduate Courses (Under CBCS 2020-21 onwards)
B. Sc. I YEAR - SEMESTER - I

PAPER-I: INTRODUCTION TO NUTRITION & DIETETICS (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT I: INTRODUCTION TO FOOD GROUPS, CEREALS & MILLETS & PURE CARBOHYDRATES

1.1 Definition- Food, nutrition, nutrients; food groups based on functions, origin and nutritive value; Food guide pyramid, balanced diet
1.2 Cereals and Millets - Composition, nutritive value and nutrient losses during processing; breakfast cereals
1.3 Sugars - Types of sugars and stages of sugar cookery
1.4 Jaggery - Manufacture and stages of jaggery cookery

UNIT II : PULSES & LEGUMES, NUTS & OIL SEEDS AND FATS & OILS

2.1 Pulses & Legumes - Composition, nutritive value, nutrient losses during processing, importance of germination and malting; anti nutritional factors
2.2 Nuts & Oilseeds – Nutritive value, toxins and role in cookery
2.3 Fats & Oils – Composition, nutritive value, properties- physical and chemical, functions of oils and fat in foods
2.4 Rancidity of Oils- Types and prevention

UNIT III: VEGETABLES, FRUITS & FOOD PRESERVATION

3.1 Vegetables - Classification, composition and nutritive value, changes during cooking, loss of nutrients during cooking, storage, factors affecting storage
3.2 Fruits - Classification, composition, nutritive value, storage and ripening
3.3 Enzymatic browning and its prevention
3.4 Food preservation – principles, methods- dehydration, low temperature, high temperature and preservatives.

UNIT IV: ANIMAL FOODS AND FOOD ADULTERATION

4.1 Milk- Composition, nutritive value, fermented and non-fermented milk products
4.2 Egg - Composition, nutritive value and quality ; poultry- Classification, composition and nutritive value
4.3 Meat -Nutritive Value and changes during cooking; fish - classification, composition and nutritive value
4.4 Food Adulteration- intentional and incidental

Books Recommended:

Text Books

- Srilakshmi B- Food Science, 5th Edition, New Age International Publishers, New Delhi – 110002, 2011.

Reference Books

- Shakuntala Manay N - Food Facts and Principles, New Age International Publishers, New Delhi – 110002, 2005.
- Norman Potter N -Food Science, CBS Publishers and Distributors, New Delhi – 110002, 2007.

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Under Graduate Courses (Under CBCS 2020-21 onwards)
B. Sc. I YEAR - SEMESTER - I

PAPER-I: INTRODUCTION TO NUTRITION & DIETETICS (Practical)

I. Standardization, Preparation and Nutritive value calculation of the recipes based on the following food group and combination

1. Cereal, millet and malting of grains
2. Pulse, germination of grains
3. Cereal-pulse combination
4. Stages of sugar cookery, preparation with jiggery

II. Methods of Preservation of

5. Fruits- Squashes and jams
6. Vegetables by Pickling

III. 7. Determination of quality of an egg

IV. Detection of Adulterants

8. Water, urea and starch in milk
9. Hydrogenated fat in ghee and butter
10. Identification of food colours and textile colours

Books Recommended:

- Srilakshmi B- Food Science, 5th Edition, New Age International Publishers, New Delhi – 110002, 2011.
- Longvah T. , Ananthan R. , Bhaskarachary K. and Venkaiah K. Indian Food Composition Table, National Institute of Nutrition, Tarnaka, 2017.

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B. Sc. I YEAR - SEMESTER - II

PAPER-II: NUTRITIONAL BIOCHEMISTRY AND HUMAN PHYSIOLOGY (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT-I: MACRO NUTRIENTS

1.1 Carbohydrates - Composition, classification, sources, functions, deficiency and excess, glycolysis, citric acid cycle, glycogenesis, glycogenolysis and gluconeogenesis
1.2 Lipids - Composition, classification, sources and functions; deficiency and excess of fats; essential fatty acids, beta-oxidation and synthesis of fatty acids.
1.3 Proteins- Composition, classification, sources, functions, deficiency and excess, basic steps in protein synthesis
1.4 Amino acids- Classification - chemical and nutritional; deamination, transamination and urea cycle

UNIT II: MICRONUTRIENTS, WATER, ELECTROLYTES AND ENZYMES

2.1 Vitamins - Classification, sources, functions and deficiency symptoms of fat soluble and water soluble vitamins
2.2 Minerals - Classification, sources, functions and deficiency symptoms of macro and micro minerals
2.3 Water - Functions, distribution, intake and elimination, water balance Electrolytes - Concentrations in intracellular and extra cellular fluids and osmotic pressure; acid base balance
2.4 Enzymes – Definition, classification (IUBMB), properties, mechanism of enzyme action

UNIT III: CELL, CIRCULATORY SYSTEM, NERVOUS SYSTEM AND ENDOCRINE SYSTEM

3.1 Cell- Structure & functions
3.2 Circulatory system- Parts & functions of heart, heart rate, cardiac cycle, cardiac output; blood pressure, Blood- Composition, coagulation and blood groups
3.3 Nervous system – Classification and functions
3.4 Hormones- Endocrine glands their secretion and functions

UNIT-1V: RESPIRATORY, DIGESTIVE AND EXCRETORY SYSTEM

4.1 Respiratory system- Parts and functions, mechanism of respiration; oxygen and Carbon- di-oxide transport
4.2 Digestive system- Parts and functions of GI tract, digestive glands, digestion, absorption and transport
4.3 Excretory system - Urinary system – parts and functions, structure of nephron, formation of urine
4.4 Skin: functions and its role in regulation of body temperature

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Books Recommended

Text Books:

- Chatterjee C.C., Human Physiology, Vol. I & II, Medical Allied Agency, Calcutta (1987).
- AVSS Rama Rao - A Text Book of Bio Chemistry, 9th edition, UBS Publishers distribution Pvt. Ltd, 2002.

Reference Books:

- Swaminathan N - A Handbook of Food and Nutrition, 5th edition volume 1, Bangalore printing and publishing Co.Ltd, 1986.
- Mahtab S. Bamji, N Prahlad Rao, Vinodini Reddy -Text book of Human Nutrition, 2nd edition, Oxford and IBH publishing Co. Pvt. Ltd 2004.
- Swaminathan M, Advanced Textbook on Food and Nutrition, Vol. I, Bappco.

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PAPER-II: NUTRITIONAL BIOCHEMISTRY AND HUMAN PHYSIOLOGY (Practical)

1. Qualitative tests of carbohydrates
2. Qualitative tests of amino acids and proteins
3. Quantitative analysis of calcium by titrimetry
4. Quantitative analysis of vitamin C 2,6 dichloro indophenol dye method
5. Determination of rancidity parameters: acid value, peroxide value
6. Estimation of hemoglobin
7. Estimation of blood glucose
8. Identification of blood group
9. Estimation of urinary glucose
10. Estimation of urinary albumin

Books Recommended

- Raghuramulu, Madhavan nair, Kalyansundram, A manual of laboratory techniques, NIN. Hyderabad (2003).
- Sawhney SK, Randhir Singh, Introductory practical biochemistry, Nasora Publishers, New Delhi (2000).

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B. Sc. IInd YEAR - SEMESTER - III

PAPER-III: NORMAL AND THERAPEUTIC NUTRUTION (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT-I : MEAL PLANNING

1.1 RDA- factors affecting RDA, derivation; Principles of meal planning; Steps involved in planning a meal
1.2 Adulthood – Nutritional Requirements for an Adult Man and Adult Woman
1.3 Pregnancy – Physiological Changes, Increase in Nutritional Requirement Complications of Pregnancy
1.4 Lactation – Role of hormones in milk production, Increase in Nutritional Requirement and Lactogogues

UNIT-II : NUTRITION THROUGH LIFE CYCLE

2.1 Infancy – Nutritional Requirement, Importance of Breastfeeding, Artificial Feeding (Comparison of various milks Vs Human Milk), Weaning and Supplementary Food
2.2 Pre-Schoolers and School Going Child – Nutritional Requirement and School Lunch Programmes
2.3 Adolescence – Nutritional Requirement, Eating Disorders
2.4 Geriatrics – Nutritional Requirement, Physiological changes and Dietary Modification

UNIT-III: INTRODUCTION TO THERAPEUTIC NUTRITION

3.1 Introduction to therapeutic nutrition, dietary supplements and adjuncts to diet therapy, therapeutic modifications of normal diets in terms of Nutrients, Consistency
3.2 Special feeding methods- Enteral feeding and Parenteral feeding
3.3 Fevers-Definition, Causes (Exogenous and Endogenous), Types – Typhoid Causative organism, Symptoms, Principles of the Diet, Dietary Modifications, Foods to Be included and Foods to Be Avoided
3.4 Tuberculosis - Causative Organism, Symptoms, Principles of the Diet, Dietary Modifications, Foods to be Included and Foods to be avoided

UNIT-IV: DIET IN GENETIC DISORDERS AND FOOD ALLERGY

4.1 Inborn Errors of Metabolism; Phenylketonuria – Definition, symptoms, Dietary management
4.2 Galactosemia - Definition, symptoms, Dietary management
4.3 Lactose Intolerance- Definition, symptoms, Dietary management
4.4 Food Allergy–Definition, Classification, Clinical Signs and Symptoms, Food as Allergens.

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Books Recommended:

Text Books:

- Srilakshmi B – Dietetics, 5th edition, New Age International publishers, 2002.

Reference Books

- Antia F.P - Clinical Dietetics and Nutrition, Oxford University Press, New Delhi, 2003.
- Mahtab S. Bamji, N Prahlad Rao, Vinodini Reddy -Text book of Human Nutrition, 2nd edition, Oxford and IBH publishing Co. Pvt. Ltd, 2004.
- Swaminathan, M - Essentials of Food and Nutrition, Vol 2, Bangalore Printing and Publishers Co Ltd, Bangalore, 1985.

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PAPER-III: NORMAL AND THERAPEUTIC NUTRUTION (Practical)

1. Standardization of Weights and Measures
2. Planning, Calculation and Preparation of Diet for
    - Adulthood- Male and Female
3. Planning, Calculation and Preparation of Diet for physiological conditions
    - Pregnancy
    - Lactation
4. Planning, Calculation and Preparation of Diet for Infancy -Weaning Mix
5. Planning, Calculation and Preparation of Diet for Preschoolers
6. Planning, Calculation and Preparation of Diet for School Going Child- Packed Lunch
7. Planning, Calculation and Preparation of Diet for Adolescence- Boy and Girl
8. Planning, Calculation and Preparation of Diet for Geriatrics
9. Planning, Calculation and Preparation of Diet for clear fluid, full fluid and soft diet
10. Planning, Calculation and Preparation of Diet for Fevers- typhoid, Tuberculosis

Books Recommended

- Srilakshmi B – Dietetics, 5th edition, New Age International publishers, 2002.
- Longvah T. , Ananthan R. , Bhaskarachary K. and Venkaiah K. Indian Food Composition Table, National Institute of Nutrition, Tarnaka, 2017.
- Indian Dietetic Association, Clinical Dietetics Manual 2nd Edition

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PAPER-IV: DIET IN DISEASE (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT I: ENERGY METABOLISM

1.1 Energy metabolism- Measurement of energy by direct and indirect calorimetry, determination of energy value of food by bomb calorimeter and benedicts oxy calorimeter
1.2 Energy balance, Factors affecting TEE - BMR, Physical Activity, SDA
1.3 Underweight- Definition, Causes, Principles of the Diet, Dietary Modifications, Foods to Be Included and Foods to be Avoided
1.4 Obesity - Definition, Causes, Assessment (BMI, Body Weight, Brokas Index), Type (Grade I, II, II, Apple and Pear shape) Complications, Principles of the Diet Dietary Modifications , Foods To Be Included And Foods To Be Avoided

UNIT II: DIET IN DIABETES AND CARDIO VASCULAR DISEASES

2.1 Diabetes - Definition, Causes, Types, T2DM- risk factors, Signs, Symptoms, Complications and Dietary Modifications
2.2 T1DM- risk factors, Signs, Symptoms, Complications and Dietary Modifications
2.3 Hypertension- Definition, Causes, Types, risk factors, Signs, Symptoms, Complications and Dietary Modifications
2.4 Atherosclerosis - Definition, Causes, risk factors, Signs, Symptoms, Complications and Dietary Modifications

UNIT III: DIET IN GASTRO – INTESTINAL DISEASES

3.1 Diarrhoea - Definition, causes, types, symptoms, complications and dietary Modifications, foods to be included and foods to be avoided
3.2 Constipation - Definition, causes, types, symptoms, complications and dietary modifications, foods to be included and foods to be avoided
3.3 Peptic Ulcer - Definition, causes, types, symptoms, complications and dietary modifications, foods to be included and foods to be avoided
3.4 Celiac disease, tropical sprue, irritable bowel syndrome, inflammatory bowel disease- Definition, Symptoms

UNIT IV: DIET IN LIVER AND PANCREATIC DISEASES

4.1 Hepatitis - Definition, Causes, Types, Symptoms, Complications and Dietary Modifications, Foods to Be Included and Foods to Be Avoided
4.2 Cirrhosis - Definition, Causes, Symptoms, Complications and Dietary Modifications, Foods to Be Included and Foods to Be Avoided
4.3 Gall stones - Definition, Causes, Symptoms, Complications and Dietary Modifications, Foods to Be Included and Foods to Be Avoided
4.4 Pancreatitis- Definition, Causes, Types, Symptoms, Complications and Dietary Modifications, Foods to Be Included and Foods to Be Avoided

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Books Recommended:

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- Srilakshmi B – Dietetics, 5th edition, New Age International publishers, 2002.

Reference Books

- Antia F.P - Clinical Dietetics and Nutrition, Oxford University Press, New Delhi, 2003.
- Mahtab S. Bamji, N Prahlad Rao, Vinodini Reddy -Text book of Human Nutrition, 2nd edition, Oxford and IBH publishing Co. Pvt. Ltd, 2004.
- Swaminathan, M - Essentials of Food and Nutrition, Vol 2, Bangalore Printing and Publishers Co Ltd, Bangalore, 1985.

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PAPER-IV: DIET IN DISEASE (Practical)

I. Planning, Calculation and Preparation of Diets for
   1. Underweight
   2. Obesity

II. Planning, Calculation and Preparation of Diets for
   3. Diabetes- T2DM
   4. Hypertension

III. Planning, Calculation and Preparation of Diets for gastro intestinal diseases
   5. Diarrhea
   6. Constipation
   7. Peptic Ulcer

IV Planning, Calculation and Preparation of Diets for Liver diseases
   8. Hepatitis
   9. Cirrhosis
   10. Gall stones

Books Recommended

- Srilakshmi B – Dietetics, 5th edition, New Age International publishers, 2002.
- Longvah T. , Ananthan R. , Bhaskarachary K. and Venkaiah K. Indian Food Composition Table, National Institute of Nutrition, Tarnaka, 2017.
- Indian Dietetic Association, Clinical Dietetics Manual 2nd Edition

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PAPER-V: A-BASIC DIETETICS (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT-I

1.1 Concept in Basic Dietetics, Nutritional Assessment
1.2 Nutritional Care Process
1.3 Modified hospital diets-Consistency and texture modifications, Nutrient modifications, Food and Nutritional labelling.
1.4 Nutrition and Weight Management

UNIT-II

2.1 Diets for gastro - intestinal disorders, constipation, diarrhoea, peptic ulcer.
2.2 Diet for renal diseases - Nephritis, Nephrotic syndrome and renal failure.
2.3 Diet for obesity and cardiovascular disorders. Nutrition support in metabolic disorders.
2.4 Diet for Diabetes mellitus.

UNIT-III

3.1 Diet & nutrition in kidney diseases.
3.2 Nutrition in cancer. Dietary management of cancer patients
3.3 Nutrition in Immune system dysfunction, AIDS & Allergy.
3.4 Nutrition in burns and surgery.

UNIT-IV

4.1 Nutrition - Addictive behaviour in annorexia, nervosa, bulimia & alcoholism.
4.2 Feeding the patients - Psychology of feeding the patient, assessment of patient needs.
4.3 Feeding infants & children - problems in feeding children in hospitals.
4.4 Nutrition & diet clinics - Patients checkup and dietary counseling, educating the patient and followup

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Books Recommended

- Sri Lakshmi B., Dietetics, New Age International P. Ltd. Publishers
- Antia F.P. Clinical Dietetics and Nutrition, Oxford University Press, Delhi.
- Robinson C.H., Lawler M.R., Chenoweth, W.L. and Garwick A. E., Normal and Therapeutic Nutrition, Mac Millan Publishing Co.
- Burtis G, Davis J & Martin S., Applied Nutrition and Diet Therapy, W. B. Saunders Co.
- Swaminathan M., Advanced text book in food and nutrition Vol-II, The Bangalore Printingand Publishing Co.
- Kumud Khanna, Text book of Nutrition and Dietetics, Phoenix Publishing House, NewDelhi.

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B. Sc. IIIrd YEAR - SEMESTER - V

PAPER-V: A-BASIC DIETETICS (Practical)

1. Standardization of common food preparations.
2. Planning and preparation of Normal diet.
3. Planning and preparation of liquid diet.
4. Planning and preparation of soft diet.
5. Planning and preparation of low calorie reducing diet.
6. Planning and preparation of Bland diet for Peptic Ulcer.
7. Planning and preparation of diets for Infectious Hepatitis and Cirrhosis of liver.
8. Planning and preparation of diet for Diabetes mellitus.
9. Planning and preparation of diets for Atherosclerosis and Hypertension.
10. Planning and preparation of diets for Nephritis and Nephrotic syndrome.

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PAPER-V: B-DIET THERAPY (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT-I

1.1 Role of dietarian: The hospital & community. Basic concepts of diet therapy.
1.2 Principles of diet therapy & therapeutic nutrition for changing needs. It should corner all age groups.
1.3 Adaptation of normal diet for changing needs.
1.4 Routine hospital diets - Regular diet, light diet, full liquid and tube feeding.

UNIT-II

1.1 Energy modifications and nutritional care for weight management: Assessment, etiology, complications, prevention and treatment of obesity and underweight.
1.2 Diet in disease of the endocrine pancreas: Classification, symptoms and diagnosis of diabetes mellitus. DM management through Insulin therapy.
1.3 Oral hypoglycaemic agents, glucose monitoring at home, dietary care and nutrition therapy, meal plan (with and without insulin), special diabetic foods and artificial sweeteners.
1.4 Dietary management of Hepatitis, cirrhosis, Jaundice, fatty liver, cholecystits and cholelithiasis, Hepatic coma. Pancreatitis

UNIT-III

3.1 Hypertension: classification, aetiology, symptoms and dietary management.
3.2 Diseases of the cardiovascular system: Definition of infarct, ischemia, angina pectoris, myocardial infarction, heart attack and stroke.
3.3 Atherosclerosis and hyperlipidaemias – classification, symptoms, dietary and lifestyle management.
3.4 Prevention of cardiovascular diseases.

UNIT-IV

4.1 Renal Diseases: Etiology, symptoms and dietary management of acute and chronic Glomerulonephritis.
4.2 Nephrotic syndrome - dietary management.
4.3 Uraemia – dietary Nephrolithiasis - dietary management.
4.4 Use of sodium and potassium exchange list. Nephrolithiasis - dietary management. Use of sodium and potassium exchange list.

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Books Recommended

- Antia F.P. Clinical Dietetics and Nutrition, Oxford University Press, New Delhi.
- Robinson C.H., Lawler M.R., Chenoweth W.L. and Garwick A.E., Normal and Therapeutic Nutrition, Mac Millan Publishing Co.
- Sri Lakshmi B. Dietetics, New Age International (P) Ltd., Publishers.
- Burtis G., Davis J. and Martin S. Applied Nutrition and Diet Therapy, W.B. Saunders Co.
- Kumud Khanna, Text book of Nutrition and Dietetics, Phoenix Publishing House P. Ltd. New Delhi.
- Sue Rodwell Williams, Nutrition and Diet Therapy, Times, Mirror/Mosby, College publishing, St. Louis.

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PAPER-V: B-DIET THERAPY (Practical)

1. Routine Hospital Diets
2. Planning and preparation of diets with modified residue for Diarrhea and Constipation.
3. Planning and preparation of diets for Hepatic Coma and Influenza.
4. Planning and preparation of diets for Hyperlipidemia and Congestive Heart Failure.
5. Planning and preparation of diets for Burns patients.
6. Planning and preparation of diets for Cancer.
7. Preparation of diet chat for Diabetic patients.
8. Preparation of diet chat for patients with cardiovascular ailments
9. Preparation of diet chat for cancer patients
10. Preparation of diet chat for nutritional disorders like –anemia, obesity, underweight

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B. Sc. IIIrd YEAR - SEMESTER - VI

PAPER-VI: A-PUBLIC HEALTH NUTRITION (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT-I

1.1 Introduction to Public Health Nutrition (PHN)-Definition and Scope, Relation between health and nutrition, productivity and development
1.2 Functions and Requirements and effect of difeciency of Macro nutrients-energy, protein, fat and carbohydrate
1.3 Functions and Requirements and effect of deficiency of micro nutrients-Vitamin A, B complex, C, D, E and K.
1.4 Functions and Requirements and effect of deficiency of minerals-Iron, Calcium, Zinc, Sodium, Potassium, Iodine and Fluoride.

UNIT-II

2.1 Introduction to Nutritional Epidemiology
2.2 Key components of epidemiology, Demography
2.3 Epidemiology and Public Health. Important epidemiological studies.
2.4 National and International agencies in community nutrition: FAO, WHO, UNICEF, CARE, ICMR, NIN, CFTRI, ICDS (Integrated Child Development Scheme) and Mid-day Meal Programs.

UNIT-III

3.1 Present Scenario of malnutrition in India
3.2 Causes of malnutrition-Illiteracy, poverty, social factors.
3.3 Implications and strategies of malnutrition
3.4 Assessment of nutritional status and nutritional surveillance-Anthropometry, biochemical examination, clinical examination and Dietary survey.

UNIT-IV

4.1 Research Methods specific to nutrition, Factors important in study design.
4.2 Indirect assessment - Food balance sheets and vital statistics. Nutrition Education-Objectives, Channels of Nutrition education in the community.
4.3 Methods of educating the community, Lecture and method demonstrations, Nutrition exhibitions and visual aids.
4.4 Fortification and enrichment of foods - Objectives of Fortification, Food fortification programmes in India.

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Books Recommended

- Sheila CV. Public Health Nutrition in Developing Countries, Published by Wood head publishing India PVT Ltd, New Delhi.
- Stein, N. Publich Health Nutrition: Principles and Practice in community and global health, Jones and Bartlett Learning USA, 2015
- Text book of Human Nutrition, 4thEdition, Ed. by Mahtab S.Bamji, Kamala Krishnaswamy and G.N.V. Brahmam. Oxford and IBH Publishing Co., P. Ltd. New Delhi.
- Srilakshmi B, Nutrition Science, New Age International Publishers.
- Ritchey S.J. and Taper L.J., Maternal and child nutrition, Harper and Row publishers N.Y.
- Swaminathan M. Advanced Text book on Food and Nutrition, Vol-II, The Bangalore Printing and Publishing Co. Ltd.
- Mc Laren D.S. Nutrition in the Community, John Wiley and Sons.
- Gordis Leon. Epidemiology (Fifth edition) , Elsevier Saunders, 2013.
- Barkar, D.J.P., Practical Epidemiology: Churchill pub, Livingstone, 1991
- Public Health at the Crossroads –Achievements and Prospects. Robert Beaglehole and Ruth Bonita 2nd Edition Cambridge University Press

PAPER-VI: A-PUBLIC HEALTH NUTRITION (Practical)

1. Diet and Nutrition Surveys
2. Identifying at risk and vulnerable groups.
3. Assessment of nutritional status: Anthropometry- Height, Weight, BMI
4. Assessing the dietary intakes of Adolescent girls using a diet survey
5. Community diagnosis and identification of areas of nutrition-health education.
6. Visits to observe the working of Nutrition and Health oriented Programmes-a govt. school to observe the mid day meal program
7. Visit to an ICDS (Integrated Child Development Scheme) Project Center
8. Visit to UNICEF to observe Child Nutrition Programs

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PAPER-VI: B-COMMUNITY NUTRITION (Theory)

Theory:	**4 hrs/week;**	**Credits: 4**	**Marks : 100 (Internal-20, External-80)**
Practical:	**3 hrs/week;**	**Credits : 1**	**Marks : 25**

UNIT-I

1.1 Definition of Balanced diets, RDA, Factors affecting RDA, ICMR recommendations.
1.2 Food pyramid, my food plate.
1.3 Food Exchange List (raw), food composition tables.
1.4 Principles& objectives of meal planning. Nutrient requirement & meal planning for adults, changes in nutrient requirement according to sex, age & activity.

UNIT-II

2.1 Nutrient requirement & RDA for Expectant mother-physiological changes, dietary modification & complications.
2.2 Nutritional requirement for Lactation-general dietary guidelines & role of special foods.
2.3 Nutritional requirement for pregnancy women.
2.4 Nutritional requirement for Infancy-growth & development, breast feeding v/s artificial feeding, factors to be considered while preparing & introducing supplementary foods.

UNIT-III

3.1 Nutritional requirement for preschoolers-problems in feeding, factors affecting nutritional status.
3.2 Nutritional requirement for School going child-importance of breakfast, packed lunch & mid-daymeal programs-ICDS, SNP.
3.3 Nutritional requirement for Adolescence-eating disorder, anemia, anemia prophylaxis program.
3.4 Geriatrics-RDA & nutritional requirement during old age, physiological changes & dietary modification.

UNIT-IV

4.1 Assessment and management of moderate and severe malnutrition among children, Micronutrient malnutrition among preschool children.
4.2 Child health and morbidity, neonatal, infant and child mortality, link between mortality and malnutrition.
4.3 Maternal health and nutritional status, maternal mortality and issues relating to maternal health
4.4 Overview of maternal and child nutrition policies and programmes.

Dr. Estari Manidala
Chairman
Board of Studies in Zoology
Department of Zoology
Kakatiya University
Warangal-506009

Reference Books:

- Sri Lakshmi. B-Dietetics, New Age International Publishers, New Delhi-110002, 2011.
- Sri Lakshmi.B-Nutrition Science, 5thEdition, New Age International Publishers, New Delhi-110002, 2011
- Wadhwa A and Sharma S (2003). Nutrition in the Community-A Textbook. Elite Publishing House Pvt. Ltd. New Delhi.
- Park K (2011). Park's Textbook of Preventive and Social Medicine, 21st Edition. M/sBanarasidas Bhanot Publishers, Jabalpur, India.
- Text book of Human Nutrition, 4thEdition, Ed. by Mahtab S.Bamji, Kamala Krishnaswamy and G.N.V. Brahmam. Oxford and IBH Publishing Co., P. Ltd. New Delhi.

B.Sc. NUTRITION & DIETETICS
KAKATIYA UNIVERSITY – WARANGAL - TELANGANA
Under Graduate Courses (Under CBCS 2020-21 onwards)
B. Sc. IIIrd YEAR - SEMESTER - VI

PAPER-VI: B-COMMUNITY NUTRITION (Practical)

1. Planning of diets
   - Adult-according to sex & activity.
   - Pregnant & lactating women.
   - School going child.
   - Adolescents.
   - Old age group
2. Visit to a Govt. Hospital to observe a new born infant -Premature and full term baby.
3. Preparing charts, models and posters for imparting Nutrition education
4. Preparation of diet chat for pregnant mother.
5. Preparation of diet chat for lactating mother.
6. Preparation of diet chart for old age.
7. Nutrition education to mothers of infants (0-6 months) on importance of breastfeeding.
8. Assessing Nutritional status of mothers using diet survey and anthropometry.
9. Conducting demonstration of a nutritious weaning food for mothers of infants (6 - 12 months of age)
10. Formulation & preparation of weaning mix.

*****

SEMESTER-I
CORE COURSE DCS -1
THEORY-I
CELL BIOLOGY AND GENETICS

1. **Unit : Cell structure and Functions**
   - 1.1. Cell as basic unit of living organisms-bacterial, fungal, plant and animal cells
   - 1.2. Ultrastructure of prokaryotic cell (cell membrane and plasmids, Nucleoid)
   - 1.3. Ultrastructure of eukaryotic cell (cell wall, cell membrane, nucleus, mitochondria, chloroplast, endoplasmic reticulum, Golgi apparatus, vacuoles)
   - 1.4. Fluid mosaic model, Sandwich model, Cell membrane permeability
   - 1.5. Structure of chromosome-morphology, components of chromosomes (histones and non-histones), specialized chromosomes (Polytene, Lampbrush)
   - 1.6. Chromosomal aberrations- structural and numerical

2. **Unit : Cell Division and Cell cycle**
   - 2.1. Bacterial cell division
   - 2.2. Eukaryotic cell cycle –phases
   - 2.3. Mitosis - Stages (spindle assembly)-significance
   - 2.4. Meiosis- Stages (synaptonemal complex)-significance
   - 2.5. Senescence and necrosis
   - 2.6. Apoptosis

3. **Unit : Principles and mechanism of inheritance**
   - 3.1. Mendel's experiments- factors contributing to success of Mendel's experiments
   - 3.2. Law of segregation- Monohybrid Ratio; Law of independent assortment- Dihybrid Ratio,Trihybrid Ratio
   - 3.3. Deviation from Mendel's laws- partial or incomplete dominance (eg: Flower Color in Mirabilis jalapa), Co-dominance (eg: MN Blood groups), Non allelic interactions-types of epistasis, modification of dihybrid ratios
   - 3.4. Penetrance and Expressivity (eg: Polydactyly, Waardenburg syndrome), pleiotropism, phenocopy- microcephaly, cleft lip
   - 3.5. Multiple alleleism (eg: Coat color in Rabbits, eye color in Drosophila and ABO Blood groups)
   - 3.6. X-Y chromosomes - Sex determination in Drosophila, Man, X-linked inheritance– Hemophilia and Color blindness; X-inactivation.

4. **Unit : Linkage, Recombination and Extension to Mendel's Laws**
   - 4.1. Linkage and recombination- Cytological proof of crossing over, phases of linkage, recombination frequency, gene mapping and map distance
   - 4.2. Non-Mendelian Inheritance – Maternal effect (Shell coilng in snail), variegation in leaves of Mirabilis jalapa
   - 4.3. Cytoplasmic male sterility in Maize.
   - 4.4. Mitochondrial inheritance in human and poky in Neurospora crassa
   - 4.5. Chloroplast inheritance in Chlamydomonas
   - 4.6. Hardy-Weinberg Equilibrium.

Dr. P. Shyamala Chandra

Dr. A. V. Rao

R. Shyamala Chandra

Chair Person
Board of Studies in Biotechnology
Kakatiya University
Warangal - 506 009 (A.P.) INDIA

CORE-I: PRACTICALS

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (grasshopper testis)
4. Preparation of Polytene chromosome from Drosophila salivary gland
5. Monohybrid and dihybrid ratio in Drosophila
6. Monohybrid and dihybrid ratio in Maize
7. Problems on co-dominance, epistasis, two point and three point test cross, gene mapping.
8. Statistical applications of Hardy-Weinberg Equilibrium

Spotters:

1. Prokaryotic Cell(Bacteria),
2. Mitochondria,
3. Chlorolplast,
4. Polytene Chromosomes,
5. Test Cross,
6. Blood Grouping,
7. Hemophilia Pedigree,
8. Crossing Over
9. Synaptonemal Complex,
10. Nucleosome Model.

REFERENCE BOOKS

1. Cell & Molecular Biology. E.D.D De Robertis & E.M.F De Robertis, Waverly publication
2. An introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication
3. Principles of Genetics by E.J.Gardner and D.P. Snusted. John Wiley & Sons, New York
4. The science of Genetics, by A.G. Atherly J.R. Girton, J.F. Mcdonald, Saundern College publication
5. Principles of Genetics by R.H. Tamarin McGrawhill
6. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill
7. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. American Scientific Books. W.H. Freeman, New York
8. The cell: A molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press
9. Cell and Molecular Biology, Concepts and Experiments – Gerald Karp, John Wiley & Sons, Inc.
10. Cell Biology And Genetics by P.K. GUPTA

Dr. A. V. Rao

Chair Person
Board of Studies in Biotechnology
Kakatiya University
Warangal - 506 009 (A.P.) INDIA

PRACTICALS

BS306: BIOCHEMISTRY AND MICROBIOLOGY

1. Preparation of normal molar, molal solutions.
2. Preparation of buffers (acidic, basic ,neutral)
3. Qualitative tests of sugars, amino acids and lipids
4. Estimation of total sugars by anthrone method
5. Separation of amino acids by paper chromatography
6. Estimation of proteins by biuret method
7. Sterilization methods
8. Preparation of microbiological media (bacterial, algal & fungal)
9. Isolation of bacteria by streak, spread and pour plate methods
10. Isolation of bacteria from soil
11. Simple staining and differential staining (gram's staining)
12. Bacterial growth curve
13. Technique of micrometry(ocular and stage)

Spotters:

1. Osazone
2. Globular protein
3. Lock and key model
4. Completive inhibition
5. RUBISCO
6. ATP synthase
7. Autoclave
8. Laminar air flow
9. Tyndalization
10. Bacterial growth curve
11. Hot air oven
12. Serial dilution technique

REFERENCE BOOKS

1. Lehninger Principles of Biochemistry By: David L. Nelson and Cox
2. Biochemistry By: Rex Montgomery
3. Harper's Biochemistry By: Robert K. Murray
4. Enzymes By: Trevor Palmer
5. Enzyme structure and mechanism By: AlanFersht
6. Principles of Biochemistry By: Donald J. Voet, Judith G.Voet, Charlotte W.Pratt
7. Analytical Biochemistry By: Cooper
8. Principles and techniques of Biochemistry and Molecular Biology Edited By: Keith Wilson and John Walker
9. Experimental Biochemistry: A Student Companion by: Sashidhar Beedu et al.
10. Practical Biochemistry By: Plummer
11. Biology of Microorganisms by: Brock, T.D. and Madigan, M.T.
12. Microbiology by: Prescott, L.M., Harley, J.P. Klein,D.A.
13. Microbiology by: Pelczar, M.J, Chan, E.C.S., Ereig,N.R.
14. Microbiological applications by: Benson

Dr. A. V. Rao

Chair Person
Board of Studies in Biotechnology
Kakatiya University

PRACTICAL PAPER –V

1. Preparation of medium for tissue culture (MS or B5)
2. Sterilization methods of explants (seed leaf, inter node and root), medium
3. Establishment of callus cultures from carrot
4. Cell suspension culture
5. Protoplast isolation and culture
6. Synthetic seed production

SPOTTERS

1. Callus
2. Somatic embryos
3. Rhizogenesis
4. Multiple shoots
5. Somatic hybrids
6. Synthetic seeds
7. Green house
8. Gene gun
9. GUS gene
10. Ti –Plasmid

REFERENCE BOOKS

1. Plant tissue culture and its biotechnological application by W. Aarz, Reinhard, M.H Zenk
2. Plant tissue culture by Akio Fujiwara
3. Frontiers of plant tissue culture by Trevor, Thorpe
4. In vitro Haploids production in Higher plants S. Mohan Jain, SK Sopory, R.E Veilleux
5. Plant tissue by culture : Theory and practice by S.S Bhojwani and A. Razdan
6. Plant cell, tissue and organ culture applied and fundamental aspects by YPS Bajaj and A. Reinhard

PRACTICAL PAPER –V

1. Karyotyping of normal and abnormal human chromosome sets
2. Human pedigree analysis
3. Estimation of C-reactive protein
4. Dot ELISA
5. Genotyping of candidate genes for diseases by RFLP
6. Encapsulation of mammalian cells

SPOTTERS

1. Pedigree
2. Monoclonal antibodies
3. ELISA
4. Oncogenes
5. Cri du Chat syndrome
6. Trisomy
7. Diabets Mellitus
8. SCID
9. Stem cells
10. HBV

REFERENCE BOOKS

1. Medical biotechnology-Pratibha Nallari, V. Venugopal Rao- Oxford Press
2. Introduction to Human Molecular Genetics- J.J Pasternak, John Wiley Pubishers
3. Human Molecular genetics Tom strache and AP read , Bios Scxientific publishers
4. Recombinant DNA technology AEH Emery
5. Principles and Practice of Medical genetics, I, II, III volumes by AEH Edts, Emery
6. Molecular biotechnology, Glick and Pasternak

PRACTICAL PAPER –VI

1. Estimation of BOD in water samples
2. Estimation of COD in water samples
3. Estimation of total dissolved solid in water samples
4. Isolation of microorganisms from soil/ industrial effluents
5. Production of biogas using cow/cattle dung
6. Bioremediation

SPOTTERS

1. Aerosals
2. Biomagnification
3. Tidal energy
4. Habitat destruction
5. Biodegradable plastic - Poly hydroxyl butyrate
6. Elinino affect
7. Coral reefs
8. Xenobiotic compounds
9. Global warming
10. Bioethanol

REFERENCE BOOKS

1. Text Book of Biotechnology- By H.K. Das (Wiley Publications)
2. Biotechnoolgy- By B.T. Nijaguna
3. Biogas Technology-by K Trehan
4. Industrial Microbiology by L.E. Casida
5. Food Microbiology by M.R. Adms and M.O Moss
6. Introduction to biotechnology by P.K. Guptha
7. Essentials of Biotechnology for Satya N. Das
8. Bioprocess Engineering by Shuler (Pearson Education)
9. Essentials of Biotechnology by Irfan Ali Khan and Atiyakhanum (Ukaaz Publication)

PRACTICAL PAPER –VI

1. Preparation of media
2. Isolation of cells from Chick Embryo
3. Establishment and maintenance of primary cell cultures
4. Subculture of monolayer cells
5. Subculture of suspension cells
6. Determination of viable cells by trypan blue test

SPOTTERS

1. Trypsinization
2. Monolayer
3. Transgenic mice
4. Lipofection
5. Cells lines
6. Marker genes
7. Bioreactor
8. HAT
9. Dolly
10. Microinjection

REFERENCE BOOKS

1. Strategies in transgenic animal sicences by Glemn MM and James M. Robl ASM
2. Press 2000
3. Practical biotechnology methods and protoclols by S. Janarthana and S. Vincent
4. Animal cells as bioreactors by Terence Gartoright, Cambridge university
5. Essentials of biotechnology for students by Sayan N Das
6. Principles and practice of Animal tissue culture by Sudha Gangal university
7. Biotechnology by U. Satyanarayana

KAKATIYA UNIVERSITY, WARANGAL - 506 009
B.Sc. PROGRAMME
Under CBCS System
Scheme wef A.Y: 2019-20

FIRST YEAR

SEMESTER - I

Code	Course category	Title of the Paper	No. of Credits	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS101	AECC-1	Environmental Science	2	2	10	40	-	50
BS102	FL-1A	English	4	4	20	80	-	100
BS103	SL-1A	Second Language	4	4	20	80	-	100
BS104	DSC-1A	Optional - I	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS105	DSC-2A	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS106	DSC-3A	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	25	-	110	440	75	625

SEMESTER – II

Code	Course category	Title of the Paper	No. of Credits	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS201	AECC-2	Basic Computer Skills (Taught by: Computer Science)	2	2	10	40	-	50
BS202	FL-2B	English	4	4	20	80	-	100
BS203	SL-2B	Second Language	4	4	20	80	-	100
BS204	DSC-1B	Optional - I	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS205	DSC-2B	Optional – II	4	4	20	80	25	125
		Optional – II Lab	1	3				
BS206	DSC-3B	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL :	25	-	110	440	75	625

KAKATIYA UNIVERSITY, WARANGAL - 506 009
B.Sc. PROGRAMME
Under CBCS System
Scheme wef A.Y: 2020-21

SECOND YEAR

SEMESTER - III

Code	Course category	Title of the Paper	No. of Credits	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS 301	SEC-1	Fundamentals of Nano Technology (Taught by : Physics)	2	2	10	40	-	50
BS 302	SEC-2	Bio Statistics (Taught by : Statistics)	2	2	10	40	-	50
BS 303	FL-3 A	English	3	3	15	60	-	75
BS 304	SL-3 B	Second Language	3	3	15	60	-	75
BS 305	DSC-1C	Optional - I	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS 306	DSC-2C	Optional – II	4	4	20	80	25	125
		Optional– II Lab	1	3				
BS 307	DSC-3C	Optional – III	4	4	20	80	25	125
		Optional – III Lab	1	3				
		TOTAL:	25	-	110	440	75	625

SEMESTER - IV

Code	Course category	Title of the Paper	No. of Credits	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS401	SEC-3	Fundamentals of Python (Taught by: Computer Science)	2	2	10	40	-	50
BS402	SEC-4	Remedial Methods of Pollution – Drinking Water & Soil Fertility (Taught by: Chemistry)	2	2	10	40	-	50
BS403	FL-4 A	English	3	3	15	60	-	75
BS404	SL-4 B	Second Language	3	3	15	60	-	75
BS405	DSC-1D	Optional - I	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS406	DSC-2D	Optional – II	4	4	20	80	25	125
		Optional – II Lab	1	3				
BS407	DSC-3D	Optional – III	4	4	20	80	25	125
		Optional– III Lab	1	3				
		TOTAL :	25	-	110	440	75	625

KAKATIYA UNIVERSITY, WARANGAL - 506 009
B.Sc. PROGRAMME
Under CBCS System
Scheme wef A.Y: 2021-2022

THIRD YEAR

SEMESTER - V

Code	Course Type	Title of the Paper	No. of Credits	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS 501	FL-5 A	English	3	3	15	60	-	75
BS 502	SL-5 B	Second Language	3	3	15	60	-	75
BS 503	G.E.	Water Resources Management (Taught by: Any Science Dept.)	4	4	20	80	-	100
BS 504	DSE-1E	Optional – I	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS 505	DSE-2E	Optional – II	4	4	20	80	25	125
		Optional – II Lab	1	3				
BS506	DSE-3E	Optional – III	4	4	20	80	25	125
		Optional – III Lab	1	3				
		TOTAL:	25	-	110	440	75	625

SEMESTER - VI

Code	Course Type	Title of the Paper	No. of *Credits*	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS 601	FL-6A	English	3	3	15	60	-	75
BS 602	SL-6 B	Second Language	3	3	15	60	-	75
BS 603	P.W / Optional	Optional: Public Health & Hygiene (Taught by: Zoology / Botany / Biotechnology / Micro Biology)	4	4	20	80	-	100
BS 604	DSE-1F	Optional - I	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS 605	DSE-2F	Optional – II	4	4	20	80	25	125
		Optional – II Lab	1	3				
BS 606	DSE-3F	Optional – III	4	4	20	80	25	125
		Optional – III Lab	1	3				
		TOTAL:	25	-	110	440	75	625

5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn.
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.
9. Textbook of Inorganic Chemistry by R Gopalan.

Unit- II

1. Organic Chemistry by Morrison and Boyd.
2. Organic Chemistry by Graham Solomons.
3. Organic Chemistry by Bruice Yuranis Powla.
4. Organic Chemistry by L. G. Wade Jr.
5. Organic Chemistry by M. Jones, Jr
6. Organic Chemistry by John McMurry.
7. Organic Chemistry by Soni.
8. General Organic chemistry by Sachin Kumar Ghosh.
9. Organic Chemistry by C N pillai

Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry byLewis Glasstone.

Unit IV

1. Qualitative analysis by Welcher and Hahn.
2. Vogel's Qualitative Inorganic Analysis by Svehla.
3. Text Book of Organic Chemistry by Morrison And Boyd.
4. Text Book of Organic Chemistry by Graham Solomons.
5. Text Book of Organic Chemistry by Bruice Yuranis Powla.
6. Text Book of Organic Chemistry by Soni.
7.Text Book of Physical Chemistry by Soni And Dharmahara..
8. Text Book of Physical Chemistry by Puri And Sharma.
9. Text Book of Physical Chemistry by K. L. Kapoor.

Laboratory Course

45h (3 h / week)

Paper I - Qualitative Analysis - Semi micro analysis of mixtures

Analysis of two anions (one simple, one interfering) and two cations in the given mixture.

Anions: $CO_3^{2-}, SO_3^{2-}, S^{2-}, Cl^-, Br^-, I^-, CH_3COO^-, NO_3^-, PO_4^{3-}, BO_3^{3-}, SO_4^{2-}$. .

Cations: Hg_2^{2+}, Ag^+, Pb^{2+}

$Hg^{2+}, Pb^{2+}, Bi^{3+}, Cd^{2+}, Cu^{2+}, As^{3+/5+}, Sb^{3+/5+}, Sn^{2+/4+}$

$Al^{3+}, Cr^{3+}, Fe^{3+}$

$Zn^{2+}, Ni^{2+}, Co^{2+}, Mn^{2+}$

$Ba^{2+}, Sr^{2+}, Ca^{2+}$

Mg^{2+}, NH_4^+

26/06/19 26/06/19 26/6/19 26/6/19 26/6

References

General reference: B.Sc I Year Chemistry : Semester II, Telugu Academy publication, Hyd

Unit I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.
4. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press1989.
5. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.
6. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th Edn.
7. Textbook of inorganic chemistry by R Gopalan.

Unit II

1. Organic Chemistry by Morrison and Boyd.
2. Organic Chemistry by Graham Solomons.
3. Organic Chemistry by Bruice Yuranis Powla.
4. Organic Chemistry by L. G. Wade Jr.
5. Organic Chemistry by M. Jones, Jr
6. Organic Chemistry by John McMurry.
7. Organic Chemistry by Soni.
8. General Organic chemistry by Sachin Kumar Ghosh.
9. Organic Chemistry by C N pillai

Unit III

1. Physical chemistry by P W Atkins
2. Principles of physical chemistry by Prutton and Marron.
3. Text Book of Physical Chemistry by Soni and Dharmahara.
4. Text Book of Physical Chemistry by Puri and Sharma
5. Text Book of Physical Chemistry by K. L. Kapoor
6. Physical Chemistry through problems by S.K. Dogra.
7. Elements of Physical Chemistry by Lewis and Glasstone.
8. Material science by Kakani & Kakani

Unit IV

1. Vogel's Text Book of Quantitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999.
2. Quantitative Analysis by Day and Underwood Prentice Hall (India) VI Edn..
3. Nano: The Essentials by T. Pradeep, McGraw-Hill Education.
4. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et.al.
5. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press
6. Practical chemistry by V K Ahluwalia, Sunitha Dhingra and AdarshGulati.

Laboratory Course

45hrs (3 h / week)

Paper II- Quantitative Analysis

Acid - Base titrations

1. Estimation of Carbonate in Washing Soda.
2. Estimation of Bicarbonate in Baking Soda.
3. Estimation of Carbonate and Bicarbonate in the Mixture.

B.Sc., III YEAR CHEMISTRY

SEMESTER-V

LABORATORY COURSE

Paper –V: *Experiments in Physical Chemistry-I*

(01 Credit) **45 Hrs (03 Hrs/week)**

1. **Distribution law**
   a) Determination of molecular status and partition coefficient of benzoic acid in Toluene and water.
   b) Determination of distribution coefficient of acetic acid between n-butanol and water.
2. **Electrochemistry**
   a) Determination of cell constant of conductivity cell.
   b) Verification of Ostwald's dilution law- Determination of dissociation constant (K_a) of acetic acid by conductivity measurements.
3. **Colorimetry**
   a) Verification of Beer's - Lamberts law for $KMnO_4$
   b) Determination of the concentration of the given $KMnO_4$ solution.
4. **Adsorption**
   a) Adsorption of acetic acid on animal charcoal- Verification of Freundlich adsorption isotherm.
5. **Physical constants**
   a) Surface tension and b) Viscosity of liquids. (Demonstration Experiment)

Reference books:

1. Senior Practical Physical Chemistry, B. D Khosla, V. C. Garg , Adarsh Gulati Published by R. Chand & Co.
2. Practical Physical Chemistry, B.Vishwanathan and P.S. Raghavan. Viva Books.
3. Practicals in Physical Chemistry by P.S. Sindhu ISBN-10: 1-4039-2916-5/1403929165 ISBN-13: 978-1-4039-2916-7/9781403929167.

B.Sc., III YEAR CHEMISTRY

SEMESTER-VI

LABORATORY COURSE

Paper –V: *Experiments in Physical Chemistry-II*

(01 Credit) **45 Hrs (03 Hrs/week)**

1. **Kinetics**
   a) Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.
   b) Determination rate of decomposition of hydrogen peroxide catalyzed by $FeCl_3$.
2. **Electrochemistry**

A. Potentiometry:

a) Determination of redox potential of Fe^{2+}/Fe^{3+} by potentiometric titration of ferrous ammonium sulphate vs potassium dichromate.

b) Precipitation titration of KCl vs $AgNO_3$ –Determination of given concentration of silver nitrate.

B. pH metry:

a) pH metric titration of strong acid (HCl) vs strong base- Determination of the concentration of given acid.

b) pH metric titration of strong acid (acetic acid) with strong base (NaOH)- Determination of acid dissociation constant (K_a) of weak acid.

3. **Conductometry:**
   a) Determination of overall order: Saponification of ethyl acetate with NaOH by conductance measurement

Reference books:

1. Senior practical physical chemistry, B.D.Khosla, V.C.Garg, Adarsh Guati.
2. Advanced Practical Physical chemistry, J.B.Yadav.
3. Practical Physical chemistry, B.Vishvanathan and P.S.Raghavan.
4. Practical Physical chemistry, P.S. Sindhu.

Programming in C **Semester -I**

Theory	4 Hours/Week	4 credit
Practical	3 Hours/Week	1 credit

Unit – I

Computer Fundamentals: Introduction of Computers, Classification of Computers, Anatomy of a Computer, Memory Hierarchy, Introduction to OS, Operational Overview of a CPU.
Program Fundamentals: Generation and Classification of Programming Languages, Compiling, Interpreting, Loading, Linking of a Program, Developing Program, Software Development.
Algorithms: Definitions, Different Ways of Stating Algorithms (Step-form, Pseudo-code, Flowchart), Strategy for Designing Algorithms, Structured Programming Concept.
Basics of C: Overview of C, Developing Programs in C, Parts of Simple C Program, Structure of a C Program, Comments, Program Statements, C Tokens, Keywords, Identifiers, Data Types, Variables, Constants, Operators and Expressions, Expression Evaluation–precedence and associativity, Type Conversions.

Unit – II

Input-Output: Non-formatted and Formatted Input and Output Functions, Escape Sequences.
Control Statements: Selection Statements – if, if-else, nested if, nested if-else, comma operator, conditional operator, switch; Iterative Statements–while, for, do-while; Special Control Statement–goto, break, continue, return, exit.
Arrays and Strings: One-dimensional Arrays, Character Arrays, Functions from ctype.h, string.h, Multidimensional Arrays.

Unit – III

Functions: Concept of Function, Using Functions, Call-by-Value Vs Call-by-reference, Passing Arrays to Functions, Score of Variables, Storage Classes, Inline Functions, and Recursion.
Pointers: Introduction, Address of Operator (&), Pointer, Uses of Pointers, Arrays and Pointers, Pointers and Strings, Pointers to Pointers, Array of Pointers, Pointer to Array, Dynamic Memory Allocation.

Unit – IV

User-defined Data Types: Declaring a Structure (Union) and its members, Initialization Structure (Union), Accessing members of a Structure (Union), Array of Structures (Union), Structures verses Unions, Enumeration Types.
Files: Introduction, Using Files in C, Working with Text Files, Working with Binary Files, Files of Records, Random Access to Files of Records, Other File Management Functions.

Text — Pradip Dey, Manas Ghosh, Computer Fundamentals and Programming in C (2e)

References
BOOKS

Ivor Horton, Beginning C
Ashok Kamthane, Programming in C
Herbert Schildt, The Complete Reference C
Paul Deitel, Harvey Deitel, C How To Program
Byron S. Gottfried, Theory and Problems of Programming with C
Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language
B. A. Forouzan, R. F. Gilberg, A Structured Programming Approach Using C

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Board of Studies
Department of Computer Science

With Effect from the Academic Year 2019-2020

C Lab Semester -I

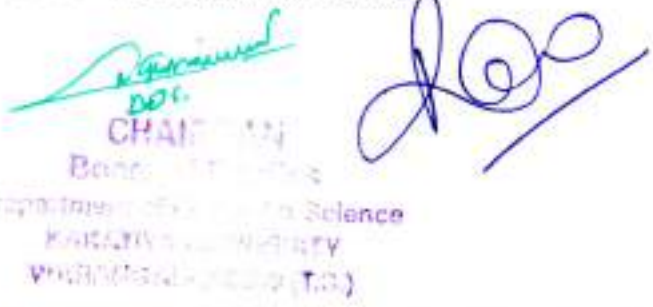
Practical 3 Hours/Week 1 credit

1. Write a program to find the largest two (three) numbers using if and conditional operator.
2. Write a program to print the reverse of a given number.
3. Write a program to print the prime number from 2 to n where n is given by user.
4. Write a program to find the roots of a quadratic equation using switch statement.
5. Write a program to print a triangle of stars as follows (take number of lines from user):

```
*
***
*****
*******
*********
```

6. Write a program to find largest and smallest elements in a given list of numbers.
7. Write a program to find the product of two matrices.
8. Write a program to find the GCD of two numbers using iteration and recursion.
9. Write a program to illustrate use of storage classes.
10. Write a program to demonstrate the call by value and the call by reference concepts.
11. Write a program that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program to illustrate use of data type enum.
13. Write a program to demonstrate use of string functions string.h header file.
14. Write a program that opens a file and counts the number of characters in a file.
15. Write a program to create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
16. Write a program that opens an existing text file and copies it to a new text file with all lowercase letters changed to capital letters and all other characters unchanged.

Note Write the Pseudo Code and draw Flow Chart for the above programs.
Recommended to use Open Source Software: GCC on Linux; DevC++ (or) CodeBlocks on Windows 10.



With Effect from the Academic Year 2019–2020

C++ Lab

Semester -II

Practical | 3 Hours/Week | 1 credit

1 Write a program to.

a. Print the sum of digits of a given number.

b. Check whether the given number is Armstrong or not

c. Print the prime number from 2 to n where n is natural number given.

2 Write a program to find largest and smallest elements in a given list of numbers and sort the given list.

3 Write a program to read the student name, roll no, marks and display the same using class and object.

4 Write a program to implement the dynamic memory allocation and de-allocation using new and delete operators using class and object.

Write a program to find area of a rectangle, circle, and square using constructors.

5

6 Write a program to implement copy constructor.

7 Write a program using friend functions and friend class.

8 Write a program to implement constructors

§ Default Constructor, Parameterized Constructor, Copy Constructor
§ Define the constructor inside/outside of the class
§ Implement all three constructors within a single class as well as use multiple classes(individual classes)

Write a program to implement the following concepts using class and object

§ Function overloading
§ Operator overloading (unary/binary(+ and -))

Write a program to demonstrate single inheritance, multilevel inheritance and multiple inheritances.

Write a program to implement the overloaded constructors in inheritance.

Write a program to implement the polymorphism and the following concepts using class and object.

§ Virtual functions
§ Pure virtual functions

Write a program to implement the virtual concepts for following concepts

§ Constructor (not applied)
§ Destructor (applied)

Write a program to demonstrate static polymorphism using method overloading.

Write a program to demonstrate dynamic polymorphism using method overriding and dynamic method dispatch.

Write a program to implement the template (generic) concepts

§ Without template class and object
§ With template class and object

Write the Pseudo Code and draw Flow Chart for the above programs.

Recommended to use Open Source Software: GCC on Linux; DevC++ (or) CodeBlocks on Windows.

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2020–2021 onwards)

B.Sc. Computer Science II Year

SEMESTER – III

DATA STRUCTURES USING C++ LAB

Practical 3 Hours/Week 1 Credit Marks: 25

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary.
- External Vice-Voce is compulsory.

1. Write C++ programs to implement the following using an array
   a) Stack ADT b) Queue ADT
2. Write a C++ program to implement Circular queue using array.
3. Write C++ programs to implement the following using a single linked list.
   a) Stack ADT b) Queue ADT
4. Write a C++ program to implement Circular queue using Single linked list.
5. Write a C++ program to implement the double ended queue ADT using double linked list.
6. Write a C++ program to solve tower of Hanoi problem recursively
7. Write C++ program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from binary search tree.
   c) Search for a key in a binary search tree.
8. Write C++ programs for the implementation tree traversal technique BFS.
9. Write a C++ program that uses recursive functions to traverse a binary search tree.
   a) Pre-order b) In-order c) Post-order
10. Write a C++ program to find height of a tree.

11 Write a C++ program to find MIN and MAX element of a BST.

12 Write a C++ program to find Inorder Successor of a given node.

13. Write C++ programs to perform the following operations on B-Trees and AVL Trees.
    a) Insertion b) Deletion

14 Write C++ programs for sorting a given list of elements in ascending order using the following sorting methods.
   a) Quick sort b) Merge sort

15. Write a C++ program to find optimal ordering of matrix multiplication.
16. Write a C++ program that uses dynamic programming algorithm to solve the optimal binary search tree problem
17. Write a C++ program to implement Hash Table
18. Write C++ programs to perform the following on Heap
    a) Build Heap b) Insertion c) Deletion
19. Write C++ programs to perform following operations on Skip List
    a) Insertion b) Deletion
20. Write a C++ Program to Create a Graph using Adjacency Matrix Representation.
21. Write a C++ program to implement graph traversal techniques
    a) BFS b) DFS
22. Write a C++ program to Heap sort using tree structure.

KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2020 – 2021onwords)

B.Sc. Computer Science II Year

SEMESTER – IV

DATA BASE MANAGEMENT SYSTEMS - LAB

Practical 3 Hours/Week 1 Credit Marks: 25

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary.
- External Vice-Voce is compulsory.

1. Create a database having two tables with the specified fields, to computerize a library system of a University College.
   LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price),
   IssuedBooks (Accession number, Borrower)

   a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
   b) Delete the record of book titled “Database System Concepts”.
   c) Change the Department of the book titled “Discrete Maths” to “CS”.
   d) List all books that belong to “CS” department.
   e) List all books that belong to “CS” department and are written by author “Navathe”.
   f) List all computer (Department=”CS”) that have been issued.
   g) List all books which have a price less than 500 or purchased between “01/01/1999” and “01/01/2004”.

2. Create a database having three tables to store the details of students of Computer Department in your college.
   Personal information about Student (College roll number, Name of student, Date of birth, Address, Marks(rounded off to whole number) in percentage at 10 + 2, Phone number)
   Paper Details (Paper code, Name of the Paper)
   Student’s Academic and Attendance details (College roll number, Paper Code, Attendance, Marks in home examination).

   a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
   b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper2.
   c) List all students who live in “Warangal” and have marks greater than 60 in paper1.
   d) Find the total attendance and total marks obtained by each student.
   e) List the name of student who has got the highest marks in paper2.

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – V
Programming in Java Lab

Practical 3 Hours/Week 1 Credit Marks: 25

Note:

- Programs of all the Concepts from Text Book including exercises must be practice and execute.
- In the external lab examination student has to execute two programs with compilation and deployment steps are necessary.
- External Vice-Voce is compulsory.

1. Write a program to find the largest of n natural numbers.
2. Write a program to find whether a given number is prime or not.
3. Write a menu driven program for following:
   a. Display a Fibonacci series
   b. Compute Factorial of a number
4. Write a program to check whether a given number is odd or even.
5. Write a program to check whether a given string is palindrome or not.
6. Write a program to print the sum and product of digits of an Integer and reverse the Integer.
7. Write a program to create an array of 10 integers. Accept values from the user in that Array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.
8. Write a program that will prompt the user for a list of 5 prices. Compute the average of the prices and find out all the prices that are higher than the calculated average.
9. Write a program in java to input N numbers in an array and print out the Armstrong numbers from the set.
10. Write java program for the following matrix operations:
    a. Addition of two matrices
    b. Transpose of a matrix
11. Write a java program that computes the area of a circle, rectangle and a Cylinder using function overloading.
12. Write a Java program for the implementation of multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
13. Write a java program to create a frame window in an Applet. Display your name, address and qualification in the frame window.
14. Write a java program to draw a line between two coordinates in a window.
15. Write a java program to display the following graphics in an applet window.
    a. Rectangles b. Circles
    c. Ellipses d. Arcs e. Polygons
16. Write a program that reads two integer numbers for the variables a and b. If any other character except number (0-9) is entered then the error is caught by NumberFormatException object. After that ex.getMessage () prints the information about the error occurring causes.
17. Write a program for the following string operations:
    a. Compare two strings b. concatenate two strings c. Compute length of a string
18. Create a class called Fraction that can be used to represent the ratio of two integers. Include appropriate constructors and methods. If the denominator becomes zero, throw and handle an exception.

KAKATIYA UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Computer Science)
SEMESTER – VI

Web Technologies Lab

Practical 3 Hours/Week 1 Credit Marks: 25

1. Write a HTML program using basic text formatting tags, <p>,
, <pre>.
2. Write a HTML program by using text formatting tags.
3. Write a HTML program using presentational element tags <b>, <i>, <strike>, <sup>, <sub>, <big>, <small>, <hr>
4. Write a HTML program using phrase element tags <blockquote>, <cite>, <abbr>, <acronym>, <kbd>, <address>
5. Write a HTML program using different list types.
6. Create a HTML page that displays ingredients and instructions to prepare a recipe.
7. Write a HTML program using grouping elements and .
8. Write a HTML Menu page for Example cafe site.
9. Write a HTML program using images, audios, videos.
10. Write a HTML program to create your time table.
11. Write a HTML program to create a form using text inputs, password inputs, multiple line text input, buttons, check boxes, radio buttons, select boxes, file select boxes.
12. Write a HTML program to create frames and links between frames.
13. Write a HTML program to create different types of style sheets.
14. Write a HTML program to create CSS on links, lists, tables and generated content.
15. Write a HTML program to create your college web site using multi column layouts.
16. Write a HTML program to create your college web site using for mobile device.
17. Write a HTML program to create login form and verify username and password.
18. Write a JavaScript program to calculate area of rectangle using function.
19. Write a JavaScript program to wish good morning, good afternoon, good evening depending on the current time.
20. Write a JavaScript program using switch case?
21. Write a JavaScript program to print multiplication table of given number using loop.
22. Write a JavaScript programs using any 5 events.
23. Write a JavaScript program using JavaScript built in objects.
24. Write a JavaScript program to create registration Form with Validations.
25. Write a XML Program to represent Student Data using DTD.
26. Write a XML Program to represent Data using XML Schema Definition.

References:

1. Michael J. Pelczar, Jr. E.C.S.Chan, Noel R. Krieg Microbiology Tata McGraw- Hill Publisher.
2. Prescott, M.J., Harly, J.P. and Klein Microbiology 5th Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker,j. Broch Biology of Microorganism, 9th Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.

I-Semester Practical Paper-I

Introductory Microbiology **2HPW-Credits-1**

5th Credit: Practicals

1. Compound microscope and its handling.
2. Sterilization techniques: Autoclave, Hot air oven and filtration
3. Calibration of microscope by ocular , stage micrometer and measurement of bacterial and fungal spores.
4. Simple and differential staining (Gram staining), Spore staining, capsule staining and flagellar staining.
5. Microscopic observation of bacteria (Gram positive bacilli and cocci, Gram negative bacilli), cyanobacteria (Nostoc, Spirulina), fungi (Saccharomyces, Rhizopus, Aspergillus, Penicillium)
6. Bacterial motility: hanging drop method
7. Preparation of culture media: Solid/Liquid.
8. Isolation of bacteria by serial dilution and pure cultures methods (streak, spread and pour plate techniques)
9. Preservation of microbial cultures- Slant, Stab, mineral oil overlay and glycerol stocks
10. Bacterial biochemical identification-IMViC test, carbohydrate fermentation test

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., Sai Gopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.

6. N.J. Dimmock, A.J Easton, and K.N. Leppard. Introduction to Modern Virology. Blackwell Publishing.

II-Semester Practical Paper – II

Microbial Physiology and Biochemistry 2 HPW- CREDITS-1

5th Credit: Practicals

1. Setting up of Winogradsky's column
2. Cultivation of photosynthetic bacteria
3. Determination of viable count of bacteria
4. Turbidometric measurement of bacterial growth curve
5. Factors affecting bacterial growth – pH, temperature, salts
6. Qualitative tests for carbohydrates and amino acids
7. Determination of pH
8. Preparation of Buffers
9. Colorimetry - Principles, laws, determination of absorption maxima
10. Paper chromatography-separation of sugars/amino acids

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., Sai Gopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.
5. Mahy, B.W.J. and Kangro, H.O. Virology – Methods Manual Academic Press, USA.
6. Burleson et al Virology – A Laboratory Manual. Academic Press, USA.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
Under Graduate Courses (Under CBCS 2020 – 2021 onwards)
B.Sc. MICROBIOLOGY II Year
SEMESTER – III

MEDICAL MICROBIOLOGY & BASICS OF IMMUNOLOGY PRACTICAL
(PAPER – III: Discipline Specific Course)

Practical: 3 Hours/Week Credits: 1 Marks: 25

1. Enumeration of RBC and WBC
2. Estimation of blood haemoglobin.
3. Determination of blood groups and Rh typing.
4. Isolation and identification of medically important bacteria by cultural, microscopic and biochemical tests.
5. Antibiotic sensitivity testing – disc diffusion method.
6. Parasites – Malarial parasite, *Entamoeba* (study of permanent slides).
7. Tests for disinfectant (Phenol coefficient).
8. Typing of human blood groups-slide agglutination
9. Estimation of hemoglobin content of human blood
10. Preparation of blood smear and different blood cell count
11. RBC count
12. WBC count
13. Differential staining of WBC by Leishman's stain
14. Widal-slide agglutination test
15. RPR card test for syphilis
16. Tridot test
17. Tube flocculation test

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
Under Graduate Courses (Under CBCS 2020 – 2021 onwards)
B.Sc. MICROBIOLOGY II Year
SEMESTER – IV

MOLECULAR BIOLGY AND MICROBIAL GENETICS PRACTICAL
(PAPER – IV: Discipline Specific Course)

Practical: 3 Hours/Week Credits: 1 Marks: 25

1. Estimation DNA by diphenylamine (DPA) method.
2. Estimation of RNA by orcinol method
3. Study of cell division in onion root tip (mitotic divisions)
4. Isolation of DNA from bacteria.
5. Isolation of mutants of bacteria by UV exposure.
6. Problems related to Mendilian laws mono and dihybrid cross (problems)
7. Problems related to gene interactions
8. Problems related to DNA and RNA characteristics, Transcription and Translation.

KAKATIYA UNIVERSITY
B. Sc (CBCS) Microbiology – III Year
Semester-V – B (Discipline Specific Elective)
INDUSTRIAL AND FOOD MICROBIOLOGY

Practical syllabus

1. Microbial fermentation for the production and estimation of amylase.
2. Microbial fermentation for the production and estimation of citric acid.
3. Microbial fermentation for the production and estimation of ethanol.
4. Determination of the microbiological quality of milk sample by MBRT.
5. Isolation of fungi from spoilt bread/fruits/vegetables.
6. Preparation of yogurt.

References:

7. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2ndEdition. Panima Publishing Company, New Delhi.
8. Patel AH. (1996). Industrial Microbiology .1st Edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India.
9. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An introduction.9th Edition. Pearson Education.
10. Willey JM, Sherwood LM AND Woolverton CJ (2013), Prescott, Harley and Klein's Microbiology.9thEdition. McGraw Hill Higher education.
11. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
12. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
13. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
14. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
15. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
16. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.

KAKATIYA UNIVERSITY
B. Sc (CBCS) Microbiology – III Year
Semester-VI – A (Discipline Specific Elective)
CELL BIOLOGY

Practical syllabus

1. Study a representative plant and animal cell by microscopy.
2. Cytochemical staining of DNA – Feulgen.
3. Study of polyploidy in Onion root tip by colchicine treatment.
4. Identification and study of cancer cells by photomicrographs.
5. Study of cell division in onion root tip (mitotic divisions)
6. Study of different stages of Mitosis.
7. Study of different stages of Meiosis by permanent slides.

References:

1. Hardin J, Bertoni G and Kleinsmith LJ. (2010). Becker's World of the Cell. 8th edition. Pearson.
2. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
3. De Robertis, EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.
4. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

KAKATIYA UNIVERSITY
B. Sc (CBCS) Microbiology – III Year
SEMESTER – VI - C
ENVIRONMENTAL MICROBIOLOGY

Practical's

1. Determination of Biochemical Oxygen Demand (BOD) of sewage water
2. Determination of Chemical Oxygen Demand (COD) of industrial waste water
3.Bacteriological examination of water using multiple tube fermentation test: presumptive test, confirmed test and completed coli form test
4. Analysis of Air Microflora

ViswambharaEducationalSociety

VAAGDEVI DEGREE & P.G.COLLEGE

Kishanapura, Hanamkonda, T.S

(Approvedby A.I.C.T.E.,NewDelhi, Affiliatedto Kakatiya University & TSCHE)

DEPARTMENT OF ZOOLOGY

1	B.SC ZOOLOGY	ANIMAL DIVERSITY – INVERTEBRATES	5
2	B.SC ZOOLOGY	ANIMAL DIVERSITY – VERTEBRATES	7
3	B.SC ZOOLOGY	ANIMAL DIVERSITY -VERTEBRATES	8
4	B.SC ZOOLOGY	ANIMAL PHYSILOGY AND BEHAVIOUR	11
5	B.SC ZOOLOGY	ANIMAL PHYSOLOGY AND ANIMAL BEHAVIOUR	13
6	B.SC ZOOLOGY	CELL BIOLOGY, GENETICS & DEVELOPMENTAL	14
7	B.SC ZOOLOGY	IMMUNOLOGY AND ANIMAL BIOTECNOLGY	17
8	B.SC ZOOLOGY	ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION	20
9	M.SC ZOOLOGY	105-PRACTICAL-1	**COMPLETESYLLABUS**
10	M.SC ZOOLOGY	106-PRACTICAL-2	
11	M.SC ZOOLOGY	205-PRACTICAL-1	
12	M.SC ZOOLOGY	206-PRACTICAL-2	
13	M.SC ZOOLOGY	305--PRACTICAL-1	
14	M.SC ZOOLOGY	306-PRACTICAL-2	
15	M.SC ZOOLOGY	405-PRACTICAL-1	
16	M.SC ZOOLOGY	406-PRACTICAL-2	

Dr A. Sheshachalam
PRINCIPAL
Principal
Vaagdevi Degree & P.G. College
Kishanapura, Hanamkonda

KAKATIYA UNIVERSITY, WARANGAL - 506 009
B.Sc. PROGRAMME - Under CBCS System
Scheme wef A.Y: 2019-20

Subject: ZOOLOGY

FIRST YEAR

SEMESTER – I

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS101	AECC-1	Environmental Science	2	2	10	40	-	50
BS102	FL-1A	English	4	4	20	80	-	100
BS103	SL-1A	Second Language	4	4	20	80	-	100
BS104	DSC-1A	**Animal Diversity - Invertebrates**	4	4	20	80	25	125
		Lab -I	1	3				
BS105	DSC-2A	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS106	DSC-3A	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

SEMESTER – II

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS201	AECC-2	Basic Computer Skills (Taught by: Computer Science)	2	2	10	40	-	50
BS202	FL-2B	English	4	4	20	80	-	100
BS203	SL-2B	Second Language	4	4	20	80	-	100
BS204	DSC-1B	**Animal Diversity - Vertebrates**	4	4	20	80	25	125
		Lab	1	3				
BS205	DSC-2B	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS206	DSC-3B	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

KAKATIYA UNIVERSITY, WARANGAL - 506 009
B.Sc. PROGRAMME - Under CBCS System
Scheme wef A.Y: 2019-20

Subject: ZOOLOGY

SECOND YEAR

SEMESTER – III

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS301	SEC-1	Fundamentals of Nano Technology (Taught by : Physics)	2	2	10	40	-	50
BS302	SEC-2	Bio Statistics (Taught by : Statistics)	2	2	10	40	-	50
BS303	FL-3 A	English	3	3	15	60	-	75
BS304	SL-3 B	Second Language	3	3	15	60	-	75
BS305	DSC-1C	**Animal Physiology & Animal Behaviour**	4	4	20	80	25	125
		Lab	1	3				
BS306	DSC-2C	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS307	DSC-3C	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

SEMESTER – IV

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS401	SEC-3	Fundamentals of Python (Taught by: Computer Science)	2	2	10	40	-	50
BS402	SEC-4	Remedial Methods of Pollution – Drinking Water & Soil Fertility (Taught by: Chemistry)	2	2	10	40	-	50
BS403	FL-4 A	English	3	3	15	60	-	75
BS404	SL-4 B	Second Language	3	3	15	60	-	75
BS405	DSC-1D	**Cell Biology, Genetics & Developmental Biology**	4	4	20	80	25	125
		Lab	1	3				
BS406	DSC-2D	Optional– II	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS407	DSC-3D	Optional – III	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

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B.Sc. PROGRAMME - Under CBCS System
Scheme wef A.Y: 2019-20

Subject: ZOOLOGY

THIRD YEAR

SEMESTER – V

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS501	FL-5 A	English	3	3	15	60	-	75
BS502	SL-5 B	Second Language	3	3	15	60	-	75
BS503	G.E.	Water Resources Management (Taught by: Any Science Dept.)	4	4	20	80	-	100
BS504	DSE-1E	Optional - I : Physiological Chemistry & Endocrinology	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS505	DSE-2E	Optional– II : Laboratory Animals Maintenance & Applications	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS506	DSE-3E	**Optional – III : Immunology and Animal Biotechnology**	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

SEMESTER – VI

Code	Course category	Title of the Paper	Credits No. of	Hrs PW	Max. Marks			Total Marks
					Internal Exam	End Exam	Lab	
BS601	FL-6 A	English	3	3	15	60	-	75
BS602	SL-6 B	Second Language	3	3	15	60	-	75
BS603	P.W / Optional	Optional: Public Health & Hygiene (Taught by: Zoology / Botany / Biotechnology / Micro Biology)	4	4	20	80	-	100
BS604	DSC-1F	Optional - I : Fisheries	4	4	20	80	25	125
		Optional – I Lab	1	3				
BS605	DSC-2F	Optional– II : Limnology	4	4	20	80	25	125
		Optional – II LAB	1	3				
BS606	DSC-3F	**Optional – III : Ecology, Zoogeograpy & Evolution**	4	4	20	80	25	125
		Optional – III LAB	1	3				
		TOTAL:	**25**	**-**	**110**	**440**	**75**	**625**

F.L : First Language;
S.L : Second Language;
A.E.C.C: Ability Enhancement Compulsory Course;
S.E.C : Skill Enhancement Course;
D.S.C : Discipline Specific Course;
D.S.E : Discipline Specific Effective;
G.E : Generic Elective;
P.W : Project Work;

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

(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
4.1.3Dentition 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 (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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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY II Year

SEMESTER – III

ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR

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

UNIT – I

1.1 Digestion

1.1.1 **Enzymes:** Definition, Classification, Inhibition, Regulation
1.1.2 Digestion of Carbohydrates, Proteins, Lipids and Cellulose
1.1.3Absorption 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
1.2.2Urine 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

2.1.1Definition 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

3.1.1Types 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., JohnE. 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 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. **ReenaMathur,** "Animal Behaviour"
13. **Alocock,** "Animal Behaviour- an Evolutionary Approach

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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY II Year

SEMESTER – III

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). 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'sIllustrated Biochemistry*. XXVIII Edition.Lange Medical Books/Mc Graw3Hill.

KAKATIYA UNIVERSITY

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B.Sc. ZOOLOGY II Year

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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B.Sc. ZOOLOGY II Year

SEMESTER – IV

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 UGCguide 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 - WGL-506009 (T.S)

KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

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 DNAAnalysis*. 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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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY III Year

SEMESTER – V

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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KAKATIYA UNIVERSITY

Under Graduate Courses (Under CBCS 2019 - 2022)

B.Sc. ZOOLOGY III Year

SEMESTER – VI

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, Soiland 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 Publising 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 3rd 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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Under Graduate Courses (Under CBCS 2019 - 2022)
B.Sc. ZOOLOGY III Year
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, JeffreyBell.
2. Ecology Lab manual – Darrell S Vodopich.

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Final Examination: Question Papers Pattern

B.A./B.Sc. (ZOOLOGY)

Theory Question Paper Pattern

WEF Academic Year: 2020-2021

Time: 3 hours] [Max. Marks: 80

Section - A

Answer ALL questions. All questions carry equal marks. (4Qx12m=48)

Q1. (a)		
	[OR]	From Unit-I
Q1. (b)		
Q2. (a)		
	[OR]	From Unit-II
Q2. (b)		
Q3. (a)		
	[OR]	From Unit-III
Q3. (b)		
Q4. (a)		
	[OR]	From Unit-IV
Q4. (b)		

Section – B

Answer any EIGHT questions. All questions carry equal marks. (8Qx4m=32)

Q5	From Unit-I
Q6	
Q7	
Q8	From Unit-II
Q9	
Q10	
Q11	From Unit-III
Q12	
Q13	
Q14	From Unit-IV
Q15	
Q16	

B.A./B.Sc. (ZOOLOGY)

Practical Question Paper Pattern

WEF Academic Year: 2020-2021

Time: 2 hours] [Max. Marks: 25

1 Major Experiment (10 M)

2 Minor Experiment (5 M)

3 Record (5 M)

4 Viva (5 M)

***

Internal Examinations:

1. Two Internal exams are to be conducted and best of two internal marks is considered.
2. First internal exam is to be conducted after completion of Unit-I & II.
3. Second internal exam is to be conducted after completion of Unit-III & IV.
4. Internal Examination duration: 1 hr 30 min
5. Internal Theory QP consists of 20 marks.
6. 10 Short questions are to be given (5Q from each of 2 Completed units); 10Q are to be answered (10Q X 2m = 20m).

Final Exam for Other Papers

1. Each SEC QP consists of 50 marks.
   (10Q are given. 5Q from each unit, 5Q are to be answered, 5Q X 10 m = 50m)
   (Duration:2hrs)
2. GE QP consists of 100 marks. QP model is same as Core paper.
3. Project consists of 100 marks with 4 Credits. 80 Marks will be allotted for Project Evaluation and 20 marks for viva-voce.

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SYLLABUS FOR
M.Sc. COURSE IN ZOOLOGY
(With effect from the academic year 2021-22 Under CBCS system)

DEPARTMENT OF ZOOLOGY
KAKATIYA UNIVERSITY
HANMAKONDA 506 009
TELANGANA STATE

KAKATIYA UNIVERSITY, DEPARTMENT OF ZOOLOGY
(With effect from the academic year 2021-22 Under CBCS system)

S.No	Paper Code	Title of the Paper	Instruction Hrs/Week	No. of Credits	Marks		Total Marks
					External	Internal	
SEMESTER-I							
1	101	Biosystematics, Structure & Function Of Invertebrates	4	4	80	20	100
2	102	Tools and Techniques in Biology	4	4	80	20	100
3	103	Animal Physiology and Ethology	4	4	80	20	100
4	104	Genetics and Evolution	4	4	80	20	100
5	105	Practical-I	4	4	100	--	100
6	106	Practical-II	4	4	100	--	100
7	107	Seminar	--	1	--	25	25
		Total		25	520	105	625
SEMESTER-II							
1	201	Structure and Function of Vertebrates	4	4	80	20	100
2	202	Environmental Biology	4	4	80	20	100
3	203	Biochemistry	4	4	80	20	100
4	204	Biostatistics and Computer Applications	4	4	80	20	100
5	205	Practical-I	4	4	100	--	100
6	206	Practical-II	4	4	100	--	100
7	207	Seminar	--	1	--	25	25
		Total		25	520	105	625

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S.No	Paper Code	Title of the Paper	Instruction Hrs/Week	No. of Credits	Marks		Total Marks
					External	Internal	
SEMESTER-III							
1	301	Molecular Biology	4	4	80	20	100
2	302	Immunology	4	4	80	20	100
3	303	Subject Elective – I Parasitology (OR) Subject Elective – II Clinical Science	4	4	80	20	100
4	304	Subject Elective – III Endocrinology & Reproductive Physiolgy (OR) Subject Elective – IV Bioinformatics	4	4	80	20	100
5	305	Practical – I	4	4	100	--	100
6	306	Practical – II	4	4	100	--	100
7	307	Seminar	--	1	--	25	25
		Total		25	520	105	625
SEMESTER-IV							
1	401	Cell Biology	4	4	80	20	100
2	402	Developmental Biology	4	4	80	20	100
3	403	Subject Elective – I Fisheries And Aquaculture (OR) Subject Elective – II Neurophysiology	4	4	80	20	100
4	404	Subject Elective – III Animal Biotechnology (OR) Subject Elective – IV Entomology	4	4	80	20	100
5	305	Practical – I	4	4	100	--	100
6	406	Practical – II	4	4	100	--	100
7	407	Seminar	--	1	--	25	25
		Total		25	520	105	625
GRAND TOTAL (Sem I+II+III+IV)				**100**	**2080**	**420**	**2500**

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PRACTICALS :

1. Observations of nervous system development from lower to higher invertebrates and write the indentified modifications in the record. Dissection of the following
   a) Nervous system of Leech
   b) Nervous system of Cockroach & Reproductive system
   c) Nervous system of *Aplsia*
   d) Nervous system of *Unio mytilus*
   e) Nervous system of Cabs
   f) Nervous system of Sepia
2. Modifications of Mouth parts in insects. Separate the mouth parts from the insects, mount and observe the modifications and write the adaptations – Chewing, Piercing and Sucking etc..
3. Collect 10 invertebrates and prepare permanent slides and submit in the examinations (Parasites – 5 and Non-parasites – 5).
4. Museum specimens (from each phylum not less than 10 specimens).
5. Slides and preserved animals (from each phylum not less than 5 slides).
6. Karyotype studies for Numerical Taxonomy.
7. Hemoglobin Variation in different phyla for Evolutionary Studies.
8. Species variation – Drosophila Variants.
9. Collection of Termites to observe variants.
10. Collection of Fresh Water Molluscs.
11. Collection of Endo- parasites for species variations Trypansomes from Rats

REFERENCE BOOKS

1. Invertebrate Zoology ------- EL Jordan; P.S. Verma
2. A Text Book of Zoology Vol.I ------ P.S. Dhami; Jk.Dhami.
3. A Text Book of Invertbrate zoology ----- R.L.Kotpal.
4. Biology of Animals --- Cleveland P. Hickman JR Larryds. Roberts.

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PRACTICALS :

1. Separation of call organelles by Differential centrifugation.
2. Separation of protein by electrophori (Native & SDS page).
3. Separation of amino acids by paper and thin layer Chromatography Demonstration of column Chromatography.
4. Validation of Beer-lamberts law of a coloured compound ($CuSO_4$).
5. Measurement of pH meter Preparation of buffer.
6. Light microscope and its parts Observation of unstained and stained cells.
7. Demonstration of a fixation, dehydration, sectored and stand of any animal tissue.
8. Demonstration of Carbohydrates, Proteins Lipids and nuclear acids in tissue sections.
9. Preparation of chick fibroblast culture and viability testing.

REFERENCE BOOKS :

1. Principles and Techniques in biochemistry and molecular biology - Wilson & Walkes
2. Culture of animal cells - Freshuay
3. Sharma V.K. (1991), Techniques in microscopy and cell Viology, Tata-Mc Craw Hil.
4. Robert Braun Introduction to instrumental analysis - Mc.Crew.Hil
5. Bisen & Mathw. Tools and Techniques in Life Sciences,- CBS Publishers & distributors.
6. Principles of Animal Cell Culture - Basant Kumar & Rinesh Kumar, Int.Bork 2008,XXII edn.

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PRACTICALS:

1. Action of pepsin in digestion of proteins.
2. Estimation of salivary amylase activity.
3. Estimation of lipase activity.
4. Oxygen consumption d estimation in an aquatic or terrestrial animal.
5. Demonstration of fermentation.
6. Action of insulin on blood sugar level.
7. Experiments on urine analysis in human urine sample:

a) Test for urea, blood cells, bile salts, albumin, ketone bodies and sugar in human urine sample.

8. Determination of cell fragility by osmotic hemolysis experiment.
9. Identification of relation between temperature and heart beat in freshwater mussel.
10. Water and ionic regulation of freshwater animal in different osmotic media.
11. The Study of changes in the earthworm's responsiveness to the stimulus of touch.
12. Observation of an earthworm's responses in the cases of repeated stimulation and dual stimulation.
13. Observation of the response of invertebrates to different lighting conditions.

REFERENCE BOOKS :

1. Animal Physiology ----- Samson & Writy
2. Animal Physiology ----- Nelsion & Nelsion
3. Animal Physiology ----- Medical Physiology-Guiton
4. Text book of Animal Physiology ----- Nagbhushenen
5. Text book of Animal Physiology ----- Guize
6. Text book of Animal Physiology ----- A.K. Berry.

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PRACTICALS:

1. Problems based on multiple alleles – Blood groups
2. Problems based on Mendel's Laws – monohybrid and dihybrid ratios
3. Problems based on gene frequency – Hardy Weinberg Law
4. Karyotype studies
5. Haemoglobin variations
6. Insulin variations
7. Collection of termites to observe variants

REFERENCE BOOKS:

1. Genetics by Monroe W Strickberger
2. Evolution by Monroe W Strickberger
3. Genetics by Peter J Russell
4. Evolution by Dobzhansky, Ayala, Stebbins, Valentine
5. Genetics by P.K.Gupta
6. Human molecular Genetics by Tom Strachan and Andrew Rea

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PRACTICALS :

1. Cranial Nerves of Labeo (5th and 7th and 9th and 10th weberian oscicles)
2. Dissection demonstration of Brain and Heart of Fish, Calotes, Chick and Rat
3. Demonstration of flight muscles and Air Sacs in Birds.
4. Demonstration Vascular and urinogenetal system of Rat.
5. Collect 10 vertebrates and submit in the examinations
6. Museum specimens (from each Class not less than 15 specimens).
7. Slides related to vertebrate parts.
8. Mounting of Amphioxus, Doliolum and Scales of fishes.
9. Sketelation System (Vertebra , limbs, Girdles)

REFERENCE BOOKS :

1 Vertebrate Zoology ------- EL Jordan; P.S. Verma

2 A Text Book of Zoology Vol.II ------ P.S. Dhami; Jk.Dhami.

3 A Text Book of Vertbrate zoology ----- R.L.Kotpal.

4` Biology of Animals --- Cleveland P. Hickman JR Larryds. Roberts.

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PRACTICALS:

1. Collection and identification of animal Biodiversity of selected ecosystem.
2. Physico-chemical analysis of soil pH, soil moisture soil , temperature, humidity estimation soil, soil organic matter.
3. Air Monitoring – Particulate Matter.
4. Water Monitoring - five important parameters from drinking water. 1) Dissolved Oxygen 2) Biological Oxygen demand (B O D) 3) Chemical Oxygen demand 4) Chlorides 5) salinity.
5. Bio remediation of waste water using soil micro organisms.
6. Bioconversion of municipal waste by vermi-composting.
7. Collection, preservation and estimation of Zooplankton.
8. Mapping of national parks and wild life sanctuaries in India with a note of important wild life fauna.
9. Estimation of LC50 or LD50 of an organo phosphorous pesticide.
10. Determination of pesticide residues in soil or water.

REFERENCE BOOKS:

1. Fundamental of Ecology. E.p.odum, G W Barrett.

2. Environmental Science . Willam .P.Cunninsham Barbora woodworth saigo.

3. The use of Earthworms in waste disposal by . Edward, C.A.

4. Introduction to Environmental Engineering & Science Gilbert M. Masters.

5. Essential of Ecology by colin R. Townsend Michael Begon John.L.Harper.

6. Environmental Biology -- A.G.Agarwal.

7. Environmental Science by G.Tyler Miller.

8. Toxicology -- Y.K.Lahir.

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PRACTICALS:

1. Estimation of muscle and liver glycogen
2. Estimation of protein by Biuret and Lowry methods
3. Estimation of amino acid by Ninhydrin method
4. Estimation of serum total cholesterol
5. Estimation of vitamin – C by 2,6- dichlorophenol indophenols method
6. Estimation of Ammonia (nesslerisation method) and uric acid
7. The effect of Ph and temperature (α-amylase) activity
8. The effect of concentration of enzyme (trypsin) activity

REFERENCE BOOKS:

1. Principles of biochemistry, by Lehninger
2. Biochemistry , by Donald Voet and Judith Voet.
3. Biochemistry , by Harper.
4. Biochemistry . Jeremy M.Berg, JohnL.Tymovzko, Lubert Stryer

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PRACTICALS:

(a) Statistics

1. Problems on Mean and Median.
2. Problems on Standard Deviation.
3. Problems related to X2 test, Student T Test . And Probuality
4. Problems on Correlation.

(b) Computers

1. Literature collection using INTERNET, search engines, websites, browsing and downloading for scientific investigation.
2. Creating an e-mail account, sending and receiving mails.
3. Application of excel sheet for data processing.
4. Preparation of power point presentation with software.
5. Representation of statistical data by Histograms and Pie diagrams.

(c) Bioinformatics

1. Study of Internet resources in Bioinformatics. E.g. NCBI and EMBL.
2. Searches on MEDLINE and PubMed bibliographic databases.
3. Multiple Sequence Alignment.
4. Construction of Phylogenetic Trees for DNA and Proteins.
5. Sequence Retrieval from Databases.
6. Building of Molecules.
7. BLAST, FASTA programs for sequence database search.

REFERENCE BOOKS:

1. Statistical methods, Snedecor, G.W. and W.G. Cochran, Iowa State Univ. Press Biometry by W. H. Freeman and Francisco
2. Fundamentals of Biometry by L.N. Balaram (1980)
3. Biostatistics by N. Gurumani
4. Biostatistics-Arora and Malhan
5. Biostatistics- Jasraj and Gurudeep Raj
6. Biostatistics- P. Ramkrishan
7. Methods in Biostatistics-Mahajan
8. Mount W. 2004. Bioinformatics and sequence genome analysis 2nd Editon CBS Pub. New Delhi.
9. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer Science+BusinessMedia, 2007.
10. Baxevanis, A. D. Ouellate, B. F. F. 2009. Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
11. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings.

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SECOND YEAR – ZOOLOGY

SEMESTER – III
AND
SEMESTER - IV

PRACTICALS :

1. Isolation of DNA from goat spleen
2. Estimation of DNA (diphenyl method)
3. Estimation of RNA (Orcinol method)
4. UV absorption spectra of native and denatured DNA
5. Agarose gel Electrophoresis of DNA
6. DNA amplification by PCR
7. Gel Documentation

REFERENCE BOOKS:

1. Molecular Cell Biology by Lodish et al
2. Molecular Cell Biology by Alberts et al
3. Principles of Biochemistry by Lehninger
4. The Cell by Geoffrey Cooper
5. Genetics , A molecular approach by Peter J Russell
6. Biochemistry by Voet and Voet
7. Principles of Genetics by Tamarin
8. GENES VIII by Lewin
9. Biochemistry by U.Satyanarayana and U Chakrapani
10. Benjamin Lewin. GENES IX 2008. Ninth edition

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PRACTICALS:

1. Agglutination Reaction:
   a) Tube Agglutination Reaction
   b) Slide Agglutination Reaction
   c) Indirect Agglutination Inhibition Reaction
2. Precipitation Reaction
   a) Double Diffusion Reaction
   b) Single Diffusion Reaction
3. Erythrocyte Rosette-forming Cell Test.
4. Separation of Lymphocytes
5. Enzyme-Linked Immunosorbent Assay
6. Measurement of Phagocytosis by Phagocytes
7. Demonstration of Immunoectrophoresis
8. Neutralization and complement fixation
9. Collection of macrophages and their characterization
10. Identification of histological slides of lymphoid tissue - Spleen, thymus, lymphnode and bone marrow

REFERENCE BOOKS:

1. Abul K. Abbas – Call And Molecular Immunulogy
2. Kuby. Immunology, W.H Freeman,USA
3. W.Pual,Fundamentals of immunology.
4. I.M. Roitt , Essential immunology, ELBS Edition.

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PRACTICALS:

1. Study of prepared slides and museum specimens of selected parasites of representative groups of protozoans, helminths and arthropods
2. Smear preparation for protozoa
3. Study of life cycle, role as vector & control measures of:
    a) Ticks (*Argas, Boophilus*)
    b) Mosquito - anyone from- *Anopheles/ Aedes/ Culex*
    c) Any two flies: *Tabanus/ Phlebotomus/ Sarcophaga*. *Cyclops*
4. Ectoparasites & Endoparasites of wild rat, cattle, dog, chick & human including stages in excreta.
5. Culturing insect parasitic nematode, and chasing the lifecycle of the nematode on the insect host.
6. Preparation of whole mounts for helminthes
7. Collection of Parasites from digestive tract of Cockroach/gut / parasites of hen and their identification and preservation.
8. Spotters based on theory.

REFERENCE BOOKS:

1. Comparative protozoology, Ecology, Physiology, Life history, Anderson, O.R. , Springer verlag, Berlin.
2. General Parasitology, Cheng T. C., Academic Press.
3. Modem Parasitology, Cox F.E.G.,Eds.Parasitology in focus, facts & trends, Melhorn h., Eds., Spriger Verlag, Beriin.
4. Medical Parasitology, Piakarsky G. L., Springer Verlag, Berlin.
5. Modern Parasitology, Cellular immunological & immunological aspects, Wyler D. J., Eds., W. H. Freeman, NY
6. Helminths, Arthropods and Protozoa of domesticated animals. ELBS and Bailliere Tindall. London. Soulsby, E. J. L. (1982).
7. A Text book of Parasitology, Bombay popular prakashan – by S.S. Kelkar and Rohini S. Kelkar.
8. Parasitology – by Chandler and Chands
9. Parasitology, Medical Pulisher Calcutta, 1987. K.D. Chaterjee.
10. Parasitology – By Ramnik sood, C.B.S. Publisher, New Delhi – 1993.

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PRACTICALS:

1. Histological slides pertaining to endocrine glands.
2. Alloxan diabetes induction and insulinization study by blood glucose and liver glycogen estimation.
3. Effect of thyroids and anti-thyroidal agents on O_2 Consumption in the rat./ crab
4. Effect of oxytocin on uterine contractility.
5. Estrogen bioassay using immature female rats / mice.
6. Study of male and female reproductive systems in some reproductive animals.
7. Histology of ovary and testes.
8. Study of estrus cycle (Rat).
9. Diagnosis of pregnancy by the presence of HCG in urine (Acheim Zondek test)
10. Sperm morphology, motility, count and effect of some antifertility agents.
11. Models pertaining to ART(Assisted reproductive techniques), Transgenic techniques. STDs contraception, teratogenesis.
12. Visit to Veterinary Institutes to learn breeding techniques.

REFERENCE BOOKS :

1. E.J.W. Barington , General and comparative Endocrinology.
2. P.J.Bentley , Comparative Vertebrate Endocrinology.
3. R.H. Williams, Text book of Endocrinology.
4. A.Gorbman *et.al*., Comparative Endocrinology.
5. Austen,C.R. and Short R.V. Reproduction
6. R.G.Edwards, Human Reproduction
7. E. Knobil and J.D Neill,The physiology of Reproduction volume I & II
8. E.S.E .Hafeez, Reproduction and breeding techniques for laboratory animals
9. Vander and Sherman, Human Physiology.
10. Kamini A.Rao, The infertility manual
11. A.V.Nalbondov, Reproduction Physiology.
12. K.Murray and K. Granner, Harper Biochemistry
13. J.Farris and John Griffith, The rat in laboratory investigation.
14. R.Mathur and S.Shukla ,Reproductive Biology.
15. B.P.Setchell, The mammalian testis.
16. S.F.Gilbert, Developmental Biology.
17. Vinod K. Sharma., Sexually Transmitted Diseases and ADIS
18. Gayathri Prakash, Reproductive Biology.

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PRACTICALS

1. Introduction of National Center for Biotechnology Information (NCBI).
2. Introduction of biological search engine- Entrez.
3. Analysis of 3D structure of protein using RasMol through command line.
4. Pair-wise sequence alignment by using ClustalW.
5. Multiple sequence alignment by using ClustalW
6. Similarity search using the Blast and interpretation of the results.
7. Downloading and analysis of the pdb file of the biomolecules.
8. Molecular Docking of protein and ligand by Autodock.
9. Protein Structure Prediction (Homology Modeling) using SPDBV.
10. Molecular dynamics (MD) simulation using Gromacs.

Reference Books:

1. Mount W. 2004. Bioinformatics and sequence genome analysis 2nd Editon CBS Pub.
2. New Delhi.
3. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer
4. Science+BusinessMedia, 2007.
5. Baxevanis, A. D. Ouellate, B. F. F. 2009. Bioinformatics: A Practical Guide to the
6. analysis of genes and proteins. John-Wiley and Sons Publications, New York.
7. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and
8. Bioinformatics, 2nd Edition. Benjamin Cummings.
9. Des Higgins and Willie Taylor 2000. Bioinformatics: Sequence, structure and
10. databanks. Oxford University Press.
11. Rashidi H. H. and Buehler 2002. Bioinformatics Basics: Applications in Biological
12. Science and Medicine, CRC Press, London.
13. Gibas Cynthia and Jambeck P. 2001. Developing Bioinformatics Computer Skills:
14. Shroff Publishersand Distributors Pvt. Ltd. (O'Reilly), Mumbai

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PRACTICALS:

1. Observation of a Eukaryotic cell under higher microscope.
2. Preparation of mitotic chromosomes from roots tips.
3. Preparation of mitotic Chromosomes from testis of grasshopper.
4. Membrane fragility as a measure of osmotic tolerenance
5. Lysosome isolation in isotonic sucroses.
6. Isolation & determination of number of micrchondrice
7. Extraction of nuclear Chromate
8. Extraction of membrane lipids and observation of lipid bilayer formation

REFERENCE BOOKS:

1. Molecular all biology : Lodish, etal.
2. Molecular all biology : Bruce Alberts, etsl.
3. Cell Biology : DeRoberts.
4. Cell and molecular biology, :Gerad karp
5. Molecular cell biology : David Baltimoe.
6. Cell Biology :Sc Rostogi.

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PRACTICALS:

1. Observation of living Chick embryo.
2. Dissection and Morphology observation of the 4-14 somite chick embryo (24-34 hours).
3. Dissection and Morphology observation of the 24-38 somite chick embryo (48-85 hours).
4. Culture of Early chick embryo *in vitro*.
5. Mounting of 72 and 96 hours chick embryo.
6. Chorio-Allantoic Membrane Grafting.
7. Various patterns of Cleavage and development in freshwater Snail.
8. Larval Developmental stages of Drosophila.
9. Chromosome squash preparation from Drosophila larval salivary glands.
10. Patterns of regeneration in the Planarian/Regeneration in the Tail of Frog Tadpoles.

REFERENCE BOOKS:

1. Gilbert, S.F. Developmental Biology. 10th Edition, Sinauer Associated Inc., Massachusetts
2. Balinsky, B.I. Introduction to Embryology. Saunders, Philedelphia
3. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
4. Hamburger V and Hamilton HL. Handbook of chick developmental stages. Saunders Publications. 1965.
5. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
6. Embryology-An Introduction to Developmental Biology—Stanley Shostak
7. Muthukaruppan and Pitchappan. Animal development – a laboratory guide.CoSIP-ULP Publicatiions, India. First Edition, 1979.

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PRACTICALS:

1. Visit to local Fresh water bodies to study their Ecology.
2. Collection, Identification and Screening of fish for Ecto and Endo parasites
3. Morphometric and Meristic data of Fishes (At least 3 types).
4. Estimation of Productivity of local Fresh water bodies.
5. Collection and preservation of Water and Soil from water bodies.
6. Collection, Preservation and Identification of plankton.
7. Estimation of PH, Temperature, Chlorides, Dissolved Oxygen from water samples.
8. Estimation of Organic matter of bottom soil.
9. Visit to local fish seed production centre.
10. Visit to local fish farms.

REFERENCE BOOKS:

1. Business Management in Fisheries and Aquaculture, Fishing News, Chaston, I (Books) Ltd., 1984.
2. Aquaculture Management, Meade, J.W. Van Nostrand, New York, 1989.
3. Aquaculture principles and practices, Pillay, T.V. R. Fishes News (Books) Ltd., London, 1990.
4. Water Quality Management for Pond Fish culture, Boyd, C.E. Elsevier Scientific publishing company, 1982.
5. Principles of Fresh Water Aquaculture, Stickney, R.R. John, Wiley & Sons, New York, 1979
6. Aquaculture – The Farming and Husbandry of fresh water and marine organisms, Bardach, et al., John Wiley & Sons, New York, 1979.
7. A manual of Freshwater Aquaculture, Santhanan, R. et al., Oxford & IBH Publishing Co. Pvt. Ltd., 1987.
8. Advances in Aquaculture, Pillay, T.V.R. & M.A., DIII. Fish News (Books) Ltd., England, 1979.
9. Limnology, Welch, P.S, Mc. Grew Hill, New York, 1952.
10. Text book of Limnology, Cole, C.A., The C.V. Mosby Co., 1983.
11. Fundamentals of Limnology, Ruttner, F, Translated by D.G. Frey and F.E. Fry, University of Toronto Press, 1968.
12. The Fresh Water Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka, Hand Book , Jayaram , K.C., (1981), Z oological survey of India, Calcutta.
13. Fishes, An Introduction of Ichthyology, Moyle Peterb, Prentice Hall, (1979).
14. Principles of Systematic Zoology, Mayer and Ashok..
15. Fish and Fisheries of India, Jhingran, V.G. Hindustan Publishing Co., Calcutta, (1975).
16. Fish and Fisheries, Yadav, B.N. Daya Publishing House,
17. The Biology of Animal Parasites, Chang. T.C. Saunders, Philadelphia, (1964).
18. Text book of Fish Diseases. Conroy. D.A. and R.C. Heanean, (1968).
19. Fish Diseases Vol. I & II, Schauperclaus,
20. Methods for assessment of Fish Production in Fresh Water, Ricker, W.K. (1984), Blackwell Publications.

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PRACTICALS

1 Tail flick test for measurement of pain.
2 Spinal reflexes in decerebrated animal.
3 Preparation of neuromuscular system for electrophysiological recording.
4 Biochemical differentiation of fast and slow muscles – SDH, LDH activities, glycogen and lactatate content in altered neurobiological conditions.
5 Effect of ankle sprain on muscle metabolism.
6 Determination of contractile properties of muscle in pathological condition.
7 Determination of conduction velocity in nerve.
8 Induction of stress and estimation of on glycogen, lactate, AChE and Na-K ATPase activities.
9 Experimental studies on atrophy, hypertrophy of muscles and nerve degeneration as well as regeneration.
10 Moto rod test for motor coordination.

Suggested Books

1 Physiology and biophysics – Ruch and Patten
2 A text book of muscle physiology – D. A. Jones and J. M. Round
3 Neurobiology – Gorden M Sheperd
4 Principles of neural science – E. Kandel and others
5 Essentials of neural science and behaviour – E. Kandel and others
6 Behavioral neuroscience – Cottman
7 From Neuron to Brain – Nichollas, J. G. others
8 Neuroscience – A. Longstaff
9 Elements of molecular Neurobiology – C U M Smith
10 Physiology of excitable cells – D. J. Aidley
11 Text book of medical physiology – Guyton

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PRACTICALS:

1. Laboratory demonstration on safe handling of microorganisms.
2. Isolation of plasmid DNA from E-Coli .
3. Isolation of yeast DNA and Transformation of E-Coli.
4. Qualitative assay of B.Galactosidese in yeast Colonies/cell extracts.
5. Propagation & maintenance of tissue culture.
6. Isolation of Bone marrow and culture of mesenc hymel stem cells from isoleted murine/sleep/rat bone marrow.
7. Try pan blue exclusion method for cell viability estimation.
8. Mycoplasma detection method using PCR.
9. Production of penicillin and testing of antimicrobial activity.
10. Production of monoclonal of tissue culture.

REFERENCE BOOKS:

1. Culture of Animal cells – manual of basic Technique by R. Iam Freshney published by
2. Molecular Biotechnology by john Wiley & Sons Primrose Published by parima publishing corporation.
3. Principles and practice of Animal tissue culture by Sudha Gangal Published by University Pren
4. Laboratory procedures in Biotechnology--- Alam Doyle ,J.Bryan Griffiths.wiley publisher
5. Animal Biotechnology- A Laboratory course, --- Jeddrey M.Beeker. Elsevien IInd edition,2007.
6. Tools & Techniques in Biotechnology – Mousami Debnath, pointer publishers,2002
7. Principles & techniques of Biotechnology & Muecular Biology-- 6th edition, keith Wilson& John Walker
8. Gene cloning & manipulation, Christopher howe, Combridge Publications.
9. A manual of Laboratory Practices. Good

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PRACTICALS

1. Insect Collection and Preservation methods.
2. Collection of medically important Insects and identification up to genus level.
3. Maintenance and study the stages life cycle of Cockroach / house fly / mosquito.
4. Preparation of permanent mounts of mosquito respiratory siphon and trumpet.
5. Preparation of permanent mounts of Insect leg and antennae.
6. Preparation of permanent mounts of wings of Cockroach / house fly / mosquito.
7. Dissection, mounting and preparation of permanent slides of Insect mouth parts.
8. Dissection of salivary glands of Cockroach / house fly / mosquito.
9. Dissection of Digestive system, nervous system and reproductive system of Cockroach / House fly / mosquito.
10. Dissecting and mounting of male and female genitalia of Cockroach / house fly / mosquito.
11. Collection of venomous Arthropods and identification.
12. Maintenance of Insect / venomous arthropod collection box. (**Submission of Insect / venomous arthropod collection box is must during the practical examination)

REFERENCES:

1. Biology of Disease Vectors, 2nd Ed., William C. Marquardt, 2004, Elsevier Academic Press.
2. Medical and Veterinary Entomology, 2nd Ed., Gary Mullen & Lance Durden.
3. Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods, Revised Edition. by Bruce Eldridge & John Edman.
4. Medical Toxicology by Richard C. Dart. Pub: Lippincott Williams & Wilkin.
5. Manual of Medical Entomology by Deane P. Furman & Paul Catts.
6. Infectious Diseases of Arthropods by Goddard.
7. Medical Entomology for Students 5th edition by Mike Service.
8. General and Applied Entomology by David and Ananthakrishnan.
9. Destructive and Useful Insects by R. L. Metcalf.
10. Ecology of Insects by Martin R. Speight Pub: Wiley-Blackwell.
11. Insect ecology by Timothy D. Schowalter 3rd Edition. Pub: Elsevier, 2011.

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