ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM
Single Major B.Sc. Biotechnology (w.e.f:2023-24A.B)

SEMESTER-II

COURSE 3: BIOMOLECULES AND ANALYTICAL TECHNIQUES

Theory Credits: 3 3 hrs/week

I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about classification, structure and properties of Carbohydrates, Proteins and Lipids.
2. Learn about structure and function of DNA, RNA, Vitamins and Bioenergetics.
3. Learn about basic principles of Centrifugation, Chromatography and Electrophoresis.
4. Learn about principles of Spectroscopy, Microscopy and Techniques.
5. Learn about basics of Biostatistics.

II. Syllabus

Unit-I-Carbohydrates, Protein and Lipids

1. Classification, structure, properties of carbohydrates, amino acids, peptide bond and peptides.
2. Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins. Denaturation and renaturation of proteins.
3. Classification structure and properties of saturated and unsaturated fatty acids.

Unit-II- Nucleic acid, Vitamins, and Bioenergetics

1. Structure and functions of DNA and RNA.
2. Source, structure, biological role, and deficiency manifestation of vitamin A, B, C, D, E, and K. Free energy, entropy, enthalpy, and redox potential.
3. High energy compounds, Electron-Transport System and Oxidative Phosphorylation.

Unit-III-Centrifugation, Chromatography, and Electrophoresis

1. Basic principles of sedimentation and types of centrifugations.
2. Principle, instrumentation, and application of partition, absorption, paper, TLC, ion exchange, gel permeation, and affinity chromatography.
3. Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE). Introduction to 2D & Isoelectric Focusing.

Unit - IV-Spectroscopy, Microscopy and Laser Techniques

1. Beer-Lambert law, light absorption and transmission. Extinction coefficient, Design and application of photoelectric calorimeter and UV-visible spectrophotometer. Introduction to crystallography and application.
2. Types and design of microscopes - compound, phase contrast, fluorescent electron microscopy (TEM, SEM).
3. Introduction to radioisotopes, measurement of radioactivity (scintillation counter and autoradiography

Unit –V- Biostatistics

1. Mean, median, mode, standard deviation,
2. One-way ANOVA, Two-way Anova
3. t-test, F-test and chi-square.

III . Skills Outcome

On Successful Completion of this Course, Student shall be able to

1. learn about basic instruments and their operation
2. learn about Qualitative and Quantitaive analysis of carbohydrates
3. Learn about estimations nucleic acids and protein by various methods
4. learn about the separation of molecules by chromatography and electrophoresis
5. Learn about problems on mean median mode

SEMESTER-II

COURSE 3: BIOMOLECULES AND ANALYTICAL TECHNIQUES

Practical Credits: 1 2 hrs/week

1. Introduction to basic instruments (Principle standard operation procedure) demonstration and record
2. Calculation of molarity, normality, and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates
5. Quantitative estimation of protein - Lowery method
6. Estimation of DNA by diphenylamine reagent
7. Estimation of RNA by orcinol reagent
8. Assay of protease activity
9. Preparation of starch from potato and its hydrolyze by salivary amylase
10. Preparation of standard buffer and pH determination
11. Separation of amino acids by paper chromatography
12. Separation of lipids of TLC
13. Agarose gel electrophoresis
14. Calculation of mean, median and mode

V. REFERENCES

1. Outlines of Biochemistry, 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Principles of Biochemistry, 4th edition, (1997), Jeffory Zubey; McGraw-Hill College, USA
3. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & Michael Cox; W.H. Freeman and Company, NY
4. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet & Judith Voet; John Wiley and Sons, Inc. USA
5. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H.Freeman and Company, NY
6. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods,1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
8. Textbook of Biochemistry with Clinical Correlations, 7th Edition, (2010), Thomas M. Devlin; John Wiley and Sons, USA
9. Proteins: biotechnology and biochemistry, 1st edition, (2001), Gary Walsch; Wiley, USA
10. Biochemical Calculations, 2nd Ed., (1997), Segel Irvin H; John Wiley and Sons, NY
11. Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K. Upadhyay, and N. Nath
12. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001), Palmer Trevor, Publisher: Horwood Pub. Co., England.
13. Analytical Biochemistry, 3rdedition, (1998), David Holmes, H.Peck, Prentice-Hall, UK
14. Introductory Biostatistics, 1st edition, (2003), Chap T. Le; John Wiley, USA.
15. Methods in Biostatistics, (2002), B. K. Mahajan –Jaypee Brothers.
16. Statistical methods in biology, (1995), Bailey, N. T.; Cambridge university press

VI. CO-Curricular Activities

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts preparation on vitamins

ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM
Single Major B.Sc. Biotechnology (w.e.f:2023-24A.B)

SEMESTER-II

COURSE 4: MICROBIOLOGY, CELL BIOLOGY

Theory | Credits: 3 | 3 hrs/week

I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about Scope and Techniques of Microbiology.
2. Learn about concept of Microbial species and strains,
3. Learn about cell structure and function.
4. Learn about cell signaling and control mechanisms.
5. Learn about genome organization of prokaryotic and eukaryotic organisms

II. Syllabus

Unit-I- Scope and Techniques of Microbiology

1. History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming.
2. Ultrastructure of bacteria and growth curve. Pure culture techniques.
3. Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram and acid-fast staining.

Unit-II-Microbial Taxonomy and Metabolism

1. Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment. General characteristics, transmission and cultivation of viruses.
2. Structure and properties of plant (tobacco mosaic virus, TMV), animal (Newcastle disease virus, NDV), human (Human immunodeficiency virus, HIV) and bacterial viruses (T4 phage). Emerging and reemerging viruses (dengue) and zoonotic viruses (rabies, SARS-CoV-2).
3. Microbial production of penicillin. Bacterial toxins, tuberculosis, typhoid. Introduction to fungi, algae and mycoplasm.

Unit-III- Cell Structure and Functions

1. Structure, properties and functions of cellular organelles (E.R, Golgibodies, Mitochondria, Ribosomes lysosomes , nucleus) of eukaryotic cells.
2. Cell cycle and its regulation
3. cell division (mitosis and meiosis).

Unit-IV- CELL SIGNALLING

1. Chemical composition and dynamic nature of the membrane,
2. Cell Surface Receptors
3. cell signaling and communication(GPCR .- cAMP,cGMP,IP3-DAG)

Unit – V - Central Dogma of Molecular Biology

1. Genome organization of prokaryotic and eukaryotic organisms
2. Enzymes involved in Replication, Transcription, and Translation
3. DNA repair Mechanism

III. Skills Outcome

On Successful Completion of this Course, Student shall be able to

1. Learn about preparation of media for culturing of various microorganisms
2. Learn about isolation of microrganisms from different sources
3. Learn about staining techniques and biochemical identification of bacteria
4. Learn about different stages of cell division

SEMESTER-II

COURSE 4: MICROBIOLOGY, CELL BIOLOGY

Practical | Credits: 1 | 2 hrs/week

1. Cleaning and preparation of glassware
2. Preparation of nutrient agar medium for bacteria
3. Preparation of PDA medium for fungi
4. Sterilization techniques (autoclave, hot air oven, filter)
5. Isolation of bacteria from soil
6. Simple staining technique
7. Differential staining technique
8. Microbial counting by Haemocytometer
9. Identification of different bacteria
10. Motility test by hanging drop
11. Biochemical identification of bacteria
12. Preparation of pure culture by slab, slant, streak culture
13. Study of stages of cell division

14 Extraction and isolation of DNA from bacteria

V. REFERENCES

1. Microbiology–6th Edition, (2006), Pelczar M.J., Chan E.C.S., Krieg N.R.; The McGrawHill Companies Inc. NY
2. Prescott's Microbiology, 8th edition, (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton; McGrawHill Science Engineering, USA
3. Textbook of Microbiology, Anantnarayan and Paniker (2017)
4. Brock biology of microorganisms, 2003, Brock, T. D., Madigan, M. T., Martinko, J. M., & Parker, J.; Upper Saddle River (NJ): Prentice-Hall, 2003.
5. Genes XI, 11th edition, (2012), Benjamin Lewin; Publisher - Jones and Barlett Inc. USA
6. Molecular Biology of the Gene, 6th Edition, (2008), James D. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R.; Cold Spring Harbour Lab. Press, Pearson Pub.
7. Molecular Biology, 5th Edition, (2011), Weaver R.; McGraw Hill Science. USA
8. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi; Oxford University Press.
9. Molecular Biology: Genes to Proteins, 4th edition (2011), Burton E Tropp Jones& Bartlett Learning, USA.
10. Cell and Molecular Biology: Concepts and Experiments, 6th Edition, Karp, G. 2010.; John Wiley & Sons. Inc.

VI. CO-Curricular Activities

a) **Suggested Co-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on Replication, cell cycle, cell signaling