

SRI VENKATESWARA UNIVERSITY - TIRUPATI
B.Sc., (HONOURS) IN BIO-CHEMISTRY (MAJOR)
III SEMESTER

(W.E.F. Academic Year 2024 - 25)

COURSE NO-5: ANALYTICAL TECHNIQUES

Credits -3

COURSE OBJETIVES

1. To understand the basic concepts of analytical techniques.
2. To gain knowledge about the latest advances in analytical techniques.
3. To apply these techniques in research.

UNIT-I

Methods of tissue homogenization. Salt and organic solvent extraction and fractionation. Dialysis, Reverse dialysis, ultra filtration, lyophilization.

Chromatography: principle, procedure and application of partition chromatography, adsorption chromatography, ion exchange chromatography, gel chromatography, affinity chromatography, GLC and HPLC.

UNIT-II

Electrophoresis: Principle, procedure and application of free flow, zone electrophoresis (Paper electrophoresis, Gel electrophoresis, PAGE, SDS-PAGE and Disc PAGE). Isoelectric focusing, High voltage electrophoresis, Pulse field electrophoresis, Immunoelectrophoretic.

UNIT-III

Centrifugation: Principle of sedimentation technique. Different types of centrifuge and rotors. Principle, procedure and application of differential centrifugation, density gradient centrifugation, ultra centrifugation, rate zonal centrifugation, isopycnic centrifugation.

UNIT-IV

Colorimetry and spectrophotometry: Laws of light absorption -Beer - Lambert's law. UV and visible absorption spectra, molar extinction coefficient and quantitation. Principle and instrumentation of colorimetry and spectrophotometry. Principle of nephelometry, fluorometry, Atomic absorption and emission spectrophotometer

UNIT-V

Important stable radioisotopes used in biochemical research. P 32, I 125, I 131, Co 60. C 14 etc. Radiation hazards and precautions taken while handling radioisotopes. Principle and application of RIA. Measurement of radioactivity by GM counter and Scintillation counter.

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Course No-5 : ANALYTICAL TECHNIQUES

Credits -1

1. Estimation of ascorbic acid
2. Separation and estimation of total carotenoids and β -carotene
3. Extraction and estimation of vitamin A, vitamin E, niacin and free amino
4. Estimation of phosphorus by Fiske and Subbarow method Characterization of fats – estimation of saponification number, iodine number, acid number and R.M.Number
5. Extraction of Phytoconstituents by Soxhlet and quantification

COURSE OUTCOMES

1. After completing this course, the student will
2. Understand the basic concepts and principles of biochemical techniques namely Spectrophotometry, Fluorimetry, Chromatography and Centrifugation.
3. Analyse biochemical compounds such as Carotenoids, Vitamins, Alkaloids and Flavonoids.
4. Identify the compounds by various biochemical techniques and interpret the results
5. Apply the laboratory skills and concepts in carrying out experiments using sophisticated instruments.

Reference Books

1. Physical Biochemistry- Application to Biochemistry and Molecular Biology: Friefelder D. WH Freeman and Company 1. Principles and Techniques of Biochemistry and Molecular Biology: - Ed. K. Wilson and J. Walker, Cambridge Univerity Press.
2. The Tools of Biochemistry: Cooper T.G., John Wiley and Sons Publication.
3. Biophysical chemistry. Principles and Techniques: Upadhayay A, Upadhayay K and Nath N., Himalaya publishing house.
4. Experimental Biochemistry. Cark Jr J. M. and Switzer R.L, W.H. Freeman and Company.
5. Research Methodology for Biological Sciences: Gurumani.N. M.J.P. Publishers., Chennai, India.
6. Instrumental Methods of Chemical Analysis: Chatwal. G and Anand.S., Himalaya Publishing House, Mumbai, India.
7. A Biologist's Guide to Principles and Techniques of Practical Biochemistry: Williams. B.L. and Wilson. K. (ed.) Edward Arnold Ltd. London
8. Jayaraman, J. (2011). Laboratory Manual in Biochemistry, New Age International (P) Ltd.
9. Sadasivam, S. and Manickam, A. (2005). Biochemical Methods, Second edition, New Age International (P) Ltd.

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III SEMESTER

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COURSE NO-06: BASIC MICROBIOLOGY

Credits -3

COURSE OBJECTIVES

1. The objective of the course is learning and understanding the fundamentals of Microbiology like important characteristics and biology of bacteria, fungi, mycoplasma, viruses etc. and to learn basic knowledge about control methods of microorganisms and industrial application of microbes for water and sewage treatment.
2. Designed to learn nutritional requirements in microorganisms and virus classification, morphology and Methods of culturing of viruses, Isolation, purification and characterization.
3. The objectives of the course are to learn and understand the genetic material, chromosome and gene and understand the gene arrangement in prokaryotes.
4. To know the various microbial diseases and their prevention and treatment.

UNIT-I

Morphology and classification of bacteria – phenotype, numerical and phylogenetic tree - rRNA, DNA and Proteins, Microbial diversity, Major characteristics used in taxonomy – morphological, physiological and metabolic, ecological, genetic analysis and molecular characterizations- (protein, nucleic acid composition), Isolation and cultivation of bacteria, bacterial growth curves. Culture media and methods, staining techniques, differences between Gram-positive and Gram-negative bacteria. Methods of sterilization and Pasteurization.

UNIT-II

Molds – characteristics, classification and reproduction. Yeasts – morphology, characteristics, and reproduction. General characteristics of Actinomycetes, Rickettsiae, Spirochaetes and mycoplasma. Economical and industrial uses of algae.

UNIT-III

Microbial interactions – mutualism, proto cooperation, commensalism, predation, parasitism, amensalism, competition, symbiosis in complex system. Role of microorganisms in domestic and industrial sewage.

Microbiology of fermented foods, food spoilage and its control (Preservation). Food borne diseases – Botulism, Salmonellosis, E. coli diarrhoea, Shigellosis, Staphylococcal food poisoning

UNIT-IV

Microbial diseases-Pathogenesis of bacterial diseases – maintenance, transport, invasion and multiplication and regulation. Airborne diseases–Diphtheria, Meningitis, Pneumonia, Tuberculosis and Streptococcal diseases. Arthropod borne – Lyme, Plague. Direct contact – Anthrax, Gonorrhoea, Conjunctivitis, Gastritis, Syphilis, Tetanus, Leprosy, Staphylococcal diseases. Sepsis, Mycoses, Malaria, Amoebiasis, Candidiasis

UNIT-V

Viruses- classification, structure, and replication. Methods of assay and cultivation chicken embryo, animal inoculation and tissue culture, quantification and propagation. Maintenance of animal and plant viruses. Tumour viruses. Viral diseases – Dengue, Hepatitis, HIV, Polio, Rabies, SARS. Inactivation of viruses – photodynamic inactivation. Antiviral agents- chemical and biological agents.

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COURSE NO-06: BASIC MICROBIOLOGY

Credits -1

PRACTICAL OBJECTIVES

- 1) To understand various methods involved in sterilization and preparation of media.
- 2) To study the methods of isolation of microbes from various sources.
- 3) To impart knowledge about Biochemical tests.

PRACTICAL SYLLABUS

1. Sterilization Techniques-Autoclaving, hot-air oven sterilization, Sieve filtration, membrane filtration.
2. Preparation of culture media – Nutrient Broth, Nutrient Agar, Blood agar MacConkey's agar, Potato dextrose agar.
3. Isolation of bacteria – Streak plate and pour plate methods
4. Identification of bacteria by staining techniques – simple, differential, Gram staining and acid-fast staining.
5. Identification of bacteria – Morphological, cultural and biochemical characteristics
6. Motility of Bacteria – “Hanging drop” technique
7. Bacteriological examination of water and milk
8. Bacterial growth curve

COURSE OUTCOMES:

After completing this course, the student will:

1. Understand the concept of basic microbiology – sterilization techniques.
2. Know about the isolation of microorganisms from various sources.
3. Discuss the staining techniques to study the morphology of microorganisms.
4. Describe the antibiotic activity 5. Infer the importance of various biochemical test.

REFERENCE BOOKS

1. Vasanthakumari.R, (2009) Practical Microbiology, BI Publishers Pvt Ltd, India
2. Dubey.R.C and Maheshwari D.K., (2002), Practical Microbiology, S.Chand& comp Ltd, NewDelhi.
3. Microbiology by Pelczar, Chan and Krieg 5th edn. 1995 Mc Grew- Hill.
4. General Microbiology: Boyd, R.F., Times Mirror/ Mosby College, 1984.
5. A Textbook of Microbiology, R.C.Dubey and D.K.Maheswari, S.Chand Co (2001).
6. Pharmaceutical Microbiology, By Hugo and Russell, Blackwell Scientific (1987).
7. An Introduction to Viruses by S.B.Biswas, Vikas Publishing house.
8. Microbiology 4th edition, Prescott, Harley, Klein (Mc grew Hill)
9. Fundamentals of Microbiology – M. Frebisher.

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COURSE NO-7-GENERAL PHYSIOLOGY

COURSE OBJECTIVES

1. To impart knowledge about blood composition and function and blood clotting mechanism.
2. To study about the muscular and nervous system.
3. To appreciate about the components of Urinary system and mechanism of Urine formation
4. To understand the structure and function and different components of Digestive system.
5. To introduce the organization of endocrine system and classification of hormones

UNIT-I

Blood- composition & function. Types of blood cells, morphology & function - RBC, WBC, platelets erythropoiesis. Blood groups- A B O & Rhesus system; Coomb's test, Bombay blood group, function of plasma proteins. Composition & functions of lymph & lymphoid system, Blood clotting mechanism, anticoagulants

UNIT-II

Muscular system- types of muscle & functions. Brief outline of nervous system, structure of brain and spinal cord. Synapses- chemical and electrical synapse, nerve impulse, action potential and neurotransmitters.

UNIT-III

Urinary system – components of the urinary system, Kidney structure and organization. Structure, function and classification of nephrons. Mechanism of urine formation- functions of glomerular filtration rate and selective reabsorption and tubular secretion.

UNIT-IV

Digestive system- structure and function of different components of digestive system, Mechanism of secretion of HCL, Role of hormones and enzymes in digestive process. Digestion of carbohydrates, lipids, and proteins

UNIT-V

General organization of endocrine system- classification of hormones. Biological functions - Thyroid, Para Thyroid, Insulin, Glucagon, hormones of the adrenal glands and gonadal hormones.

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COURSE NO- 07 GENERAL PHYSIOLOGY

Credits -1

PRACTICAL SYLLABUS

1. Microscopy
2. RBC count & WBC count
3. Differential leucocyte count by Leishman's staining
4. Estimation of Hemoglobin by Sahli's acid haematin method
5. Determination of Packed cell volume (PCV)
6. Determination of Erythrocyte sedimentation rate (ESR)
7. Determination of Coagulation time & Bleeding time
8. Determination of blood group

COURSE OUTCOME

1. Recognize and analyse blood cells and blood groups Blood clotting mechanism
2. Outline the muscular and nervous system, Mechanism of muscle contraction and structure of brain and spinal cord
3. Utilise the knowledge about the structure kidney and nephron, to understand the mechanism of Urine formation and learn the concept of Dialysis,
4. Acquire knowledge about the components of Digestive system, Hcl formation and Digestion process
5. Compile the classification of Hormones and its biological role

REFERENCE BOOKS

1. Textbook of Medical Physiology – Guyton & Hall, 11th edition ,2006
2. Davidson's Principles and Practice of Medicine (XX Edition)- John.A.A.Hunter
3. Human Anatomy & Physiology – Elaine N.Marieb ,3rd edition ,1995
4. Essentials of Medical Physiology –Sembulingam ,1999 5. Medical Physiology – Ganong
5. Text book of Medical Biochemistry Physiology – MN.Chatterjee and , Rana Shinde,7th edition.
6. Animal physiology – Mariakuttikan and Arumugam

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COURSE NO-8: GENETICS

Credits -3

Course Objectives

1. The objectives of the course are to learn and understand the fundamentals of genetics like DNA as genetic material, chromosome and gene and understand the gene arrangement in prokaryotes and eukaryotes.
2. To learn and understand the concept of bacterial genetics and detailed information about Mutation.
3. To learn and understand the bacterial, transformation, transduction, and conjugation and Transposable genetic elements and their antibiotic resistance
4. To learn and understand the bacteriophage lifecycle and various plasmids and CRISPR- Gene editing

UNIT-I

Genetic material – Direct and Indirect evidences of DNA as genetic material, experimental proof. Evidences of RNA as genetic material – eg. Virus. Chromosome - Chromosome and genes, chromosomal replication, genetic mapping of chromosomes, structure of chromatin - nucleosomes and higher orders of organization, chromosome banding, transposition in human chromosome and chromosomal abnormalities.

UNIT-II

Gene – arrangements in prokaryotes and eukaryotes. Gene structure in eukaryotic organisms, introns, exons, pseudogenes, and gene clusters, spacers, repetitive sequences. Single and multiple copy genes in eukaryotes, eg – Histones, Alu, copia, satellite. Mapping of human genes – techniques used, assignment of important genes. Gene regulatory mechanisms and cell memory. Mechanism of recombination, extra nuclear inheritance. Non-coding explosion, cell fate determination and reprogramming. Genetic technique for Archea. New gene evolution, Tiniest genome of proteobacteria and bacterioidates.

UNIT-III

Bacterial genetics – Bacterial chromosomes, plasmids – fertility, resistance, colicinogenic and other, PBR322 and other synthetic plasmids - isolation and uses. Transposable genetic elements, transformation, transduction, and conjugation in bacteria. Linkage map of bacterial chromosome. Recombination in bacteria.

UNIT-IV

Structure of Bacteriophages and their use in the study of molecular genetics – lytic cycle-replication of T-phages, Lysogeny and its regulation. Transduction – specialized, generalized and abortive. Transfection and cosmids. Fine structure analysis of T- phages, Benzers work and concept of cistrons. Bacterial defence (CRISPR- Gene turning on).

UNIT-V

Mutation – Types of mutations, mutagens, mechanism of mutation, Mutagenesis, induction and isolation of mutants. Haploid genetic tools. Radiation effects on human heredity. Phylogenetic inheritance. Heritability and its measurements and mapping, gene duplication and self-incompatibility.

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Course No-8: GENETICS

Credits -1

PRACTICAL SYLLABUS

1. Isolation of phages from sewage and quantification by plaque assay.
2. PCR amplification of insert
3. Restriction digestion of the vector and the insert
4. Ligation of restricted DNA fragments
5. Preparation of competent E.coli cells, transformation and expression of cloned gene
6. PCR and restriction diagnosis-based identification of positive clones

COURSE OUTCOMES

After the completion of this course, the student will be able to

1. The students will learn about the DNA, RNA as genetic material.
2. Learn about bacterial transformation, transduction and inputs to genetic engineering
3. Gain knowledge on mutations and isolation of mutants and types of mutagens.

RECOMMENDED BOOKS:

1. Molecular Genetics by D Friefelder
2. Cell molecular biology, Albert Bruce
3. Gene VII by Lewin
4. Molecular cloning by Maniatis and Co Vol I, II, III
5. Genetics by Gardner
6. Molecular Biology of the gene by Watson.
7. Genetics by G Zubay
8. Molecular Biology of the Cell by Albert Bruce.
9. Cell molecular Biology by Baltimore.
10. Molecular Biology by D Friefelder.
11. Genes VII Benjamin Lewin (2000). Oxford Univ. Press. London.
12. Cell and Molecular Biology 2ndEdit. (2002) By P. K. Gupta, Rastogi Publ.