VANITA VISHRAM WOMEN'S UNIVERSITY

SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF MICROBIOLOGY

BACHELORS OF SCIENCE (B.Sc.-Honors)
MICROBIOLOGY PROGRAMME

under Learning Outcomes-based Curriculum Framework (LOCF)

SEMESTER: 2

Core Courses (CC)

Syllabus applicable to the students seeking admission in the B.Sc.- Microbiology (Honors)

under LOCF

w.e.f. the Academic Year 2021-2022

Course Learning Outcomes & Contents of the Courses

MB11050: Basic Biochemistry		
Course Objectives: The course learning objectives is to provide the knowledge of biomolecules Carbohydrates, Lipids, Proteins, Vitamins, nucleic acids with reference to its structure, function, classification, properties, enzymes- nomenclature, classification, and theories of mechanism of action, factors affecting enzyme activity, enzyme inhibition and regulation of enzyme activity. Objectives of lab course is study of preparation of buffers, qualitative tests for carbohydrates, lipids and proteins, study of temperature and pH on enzyme activity, its Km & Vmax.		
Course learning outcomes : By the end of this course the students- **Outcome 1**. Have developed how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the bacterial cells **Outcome 2.** Well conversant about multifarious functions of amino acids and proteins, their composition, structure and classification. **Outcome 3**. To understand the classification, Structure and distribution of lipid, Nucleic acid and Vitamins in microbial cells. **Outcome 4**. Students can make buffers and various qualitative and quantitative estimation of biomolecules.		
THEORY COURSE **(4 Credits)**		
Unit – 1	Carbohydrate: Families of monosaccharides – aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, mutarotation and anomers of glucose. Furanose and pyranose forms of glucose and fructose, Haworth projection formulae for glucose; chair and boat forms of glucose, sugar derivatives, glucosamine. Disaccharides; concept of reducing and non-reducing sugars, occurrence, polysaccharides, storage polysaccharides, starch and glycogen. Structural polysaccharides, cellulose, peptidoglycan and chitin. Properties of monosaccharides, disaccharides and polysaccharides.	**12 Lectures**
Unit – 2	Amino acids, Proteins and Enzymes: **Amino acids**- structure, classification, properties, derivatives of amino acids **Proteins**: Primary, secondary, tertiary and quaternary structures, properties and classification. **Enzyme**s: enzyme as biological catalysts & its chemical nature. Nomenclature and classification of enzymes (including translocase), Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis. Significance of hyperbolic, double reciprocal plots of enzyme activity, Km, and allosteric mechanism. Definitions of terms – enzyme unit, specific activity and turnover number, apoenzyme and cofactors, prosthetic group-TPP, coenzyme -NAD, metal cofactors, factors affecting enzyme activity.	**18 Lectures**
Unit – 3	**Lipids**: Definition and major classes of lipids. Storage Lipids: Fatty acids: structure and functions. Essential fatty acids. Triacylglycerols: structure, functions and properties. Saponification.	**12**

	Structural lipids: Phosphoglycerides: Building blocks, general structure, functions and properties. Structure of phosphatidylethanolamine and phosphatidylcholine, Sphingolipids: building blocks, structure of sphingosine, ceramide. Special mention of sphingomyelins, cerebrosides and gangliosides. Amphipathic lipids. Lipid functions, Introduction to lipid micelles, monolayers, bilayers.	**Lectures**
Unit – 4	**Nucleic acids and vitamins**. **Nucleic Acids**: Structure of nucleosides and nucleotides, nomenclature, binding to form nucleic acids. Base composition. A+T and G+C rich genomes. Structure and functions of DNA and RNA. Concept and types (classification) of vitamins and their role in metabolism.	**18 Lectures**

MB11060 Practical III

(2 Credits)

1. Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts.
2. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars.
3. Qualitative tests for lipids.
4. Qualitative tests for proteins.
5. Study effect of temperature on enzyme activity.
6. Study effect of pH on enzyme activity.
7. Determination of km and Vmax of enzyme.

Reference Books

1. Tortora, G.J., Funke, B.R and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
2. Stanbury, Biochemistry
3. Voet and Voet.Fundamentals of Biochemistry. Johns wiley & sons, Asia.
4. M.M. Cox, D. L. Nelson.Lehninger's principles of biochemistry. W H Freeman
5. Stryer. Biochemistry W H Freeman
6. U. Satyanarayana, U. Chakrapani. Biochemistry. Upala Author-Publisher Interlinks. ISBN: 9788187134800
7. S.C.Rastogi. Biochemistry. S. Chand publication.
8. Sanjay Parekh. Biomolecules of Microorganisms. Nirav Prakashan, Ahmedabad
9. Jain J. L. and Jain N. Fundamentals of Biochemistry. S. Chand publication. ISBN: 9788121924535

10. Murray, R. K., Granner, D. K., Mayes, P. A., & Rodwell, V. W. Harper's Biochemistry. Appleton and Lange.

11. Keith Wilson, John Walker. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. ISBN: 9780521516358

MB11070: Microbial techniques & Instruments		
Course Objectives: Course Objectives are microbial techniques like, isolation, cultivation, preservation and methods of microbial control. Different types of microscopy and other techniques like, chromatography, electrophoresis, and spectrophotometry. Objectives of lab course are, understanding microscopy techniques, chromatography, electrophoresis, and spectrophotometry.		
Course learning outcomes: Major learning outcome of this course is that students develop a very good understanding of several microbiological techniques and instruments which are commonly used in a microbiology laboratory. The students have learnt- **Outcome 1**. Principles that underlie sterilization of culture media, glassware and plasticware to be used for microbiological work. **Outcome 2.** Principles and Handling of several analytical instruments like microscope, electrophoresis and chromatography which the students have to use during the study and also later as microbiologists for performing various laboratory manipulations.		
THEORY COURSE **(4 Credits)**		
Unit – 1:	Microbial techniques: Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures. Components of the culture medium and their significance. Cultivation of fungi, actinomycetes, yeasts, algae. Cultivation of anaerobes.	**15 Lectures**
Unit – 2:	Sterilization, Disinfection, Antiseptic, Disinfectant, Sanitizer, Fungicide, Virucide, Bacteriostatic and Bactericidal agent. Sterilization by Physical Agent, Heat: a. Moist Heat (Boiling, Tyndallization, Pasteurization, Steam under pressure (Autoclave)), b. Dry heat (Incineration, Hot air Oven). Radiations: Ionizing and Non-ionizing radiations. Principle and application of Laminar airflow.	**15 Lectures**
Unit – 3:	Microscopy**:** Principle, mechanism and application of photo optical instruments (different types of Microscopes), Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence microscopy, Confocal microscopy, Scanning and Transmission Electron Microscopy. Micrometry.	**15 Lectures**

Unit – 4:	Chromatography: Classification, Principle and techniques with applications (Paper, Thin layer, ion exchange, molecular exclusion and affinity chromatography). Electrophoretic technique (agarose and polyacrylamide gel), principle, its components, working and applications, factors affecting electrophoretic separation. Principle, mechanism and application of instruments used in Spectrophotometric techniques (UV and visible). Principles of Centrifugation and Ultracentrifugation techniques and its applications.	**15 Lectures**

MB11080 Practical IV
(2 Credits)

1. Study of ray diagrams of dark field microscopy, phase contrast microscopy and Electron microscopy.
2. Study of fluorescent micrographs to visualize bacterial cells.
3. Separation of amino acid mixtures by paper chromatography.
4. Separation of biomolecular mixtures by thin layer chromatography.
5. Determination of absorption max for an unknown sample and calculation of extinction coefficient.
6. Separation of components of a given mixture using a laboratory scale centrifuge.
7. Understanding density gradient centrifugation with the help of pictures.
8. Estimation of protein by spectrophotometric method.

Reference Books

1. Wilson & Walker, Principles and Techniques in Practical Biochemistry. 5th Edition Cambridge University Press (2000).
2. K L Ghatak, Techniques and Methods in Biology, PHI Publication (2011).
3. Pranav Kumar. Fundamentals and Techniques of Biophysics and Molecular Biology. 2016.
4. D.T Plummer. An Introduction to Practical Biochemistry. McGraw Hill Publication. 1987.