EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्

School of Basic And Applied Sciences

Class	**M.Sc. (Microbiology)**
Semester/Year	**I Semester**
Subject & Subject Code	**Microbiology - MMBIO20S102**
Paper	**Biochemistry – 102**
Max. Marks	**30 (ETE) + 20 (IA) = 50**

Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

This course deals with characteristics, properties and biological significance of the biomolecules of life. In depth knowledge of the energetic and regulation of different metabolic processes in microorganisms. From this course the students will know the structure-function relationship of these molecules found in microbial cell and their importance with regard to maintenance and perpetuation of the living systems.

Course Outcome:

At the end of the course, learners will be able to:

1. Developed a very good understanding of various biomolecules which are required for development and functioning of a cell.
2. Developed knowledge about how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the cells
3. Well conversant about multifarious function of proteins; are able to calculate enzyme activity and other quantitative and qualitative parameters of enzyme kinetics; also knowledge about lipids and nucleic acids.
4. Student are able to make buffers, study enzyme kinetics and calculate Vmax, Km, Kcat values.

Student Learning Outcomes (SLO):

Students will:

1.Be able to describe a standard carbohydrate and the different bonding patterns that lead to different attributes or uses.
2.Be able to describe the four classes of lipids and how each is used in a biological system.
3.Be able to explain how protein denaturation is performed, describe the structure-function relationship of a protein, and how this relates to the ability to catalyze reactions as an enzyme.
4.Describe the "Central Dogma of Biology."
5.Describe how are nucleic acids replicated.
6.Elaborate on the relationship between the primary sequence of DNA and the primary sequence of proteins, and explain what a gene or genome are.

Unit	Syllabus	Periods
UNIT - I	**Carbohydrates :** Classification, structure, properties and functions. Homo and Hetero- polysaccharides. : Storage polysaccharides Starch and cellulose. **Amino Acids :** Classification, synthesis, structure and properties. **Proteins:** classification, synthesis, structure and properties. Structural and functional proteins. **Lipids :** Classification, structure and properties of fatty acids, triacylglycerols, phospholipids, wax, sterols, terpenes and prostaglandins. Biological functions of lipids and lipoproteins.	12
UNIT - II	**Nucleic Acids:** Structure and synthesis of purines and pyrimidines. Nucleosides, Nucleotides. **DNA and RNA :** Structure, properties, synthesis and processing. Central Dogma, Concept of genes and their regulation. Operon concept, Role of CAP and cAMP.	12
UNIT - III	**Enzymes :** Classification, Mechanism of enzyme action. Constitutive and inducible enzymes. **Enzyme Kinetics:** Michalis- Menten Kinetics and Lineweaver –Burke plot. Regulation of enzyme synthesis, Repression. Factors affecting enzyme activity. Enzyme Inhibition. Reversible and Irreversible. Allosterism. Basic concepts of Vitamins. Hormones and Coenzymes.	12
UNIT - IV	**Metabolic pathways and their regulation :** Glycolysis, Gluconeogenesis, Citric Acid cycle. Anaerobic respiration. Oxidative phosphorylation, Respiratory chain complexes. Glycogen metabolism. **Fatty acid oxidation:** α and β pathways. Protein turnover and amino acid catabolism. Biosynthesis of amino acids, nucleotides and membrane lipids.	12
UNIT - V	**Transport of Molecules :** Active and passive diffusion. Membrane proteins. Cell Junctions, Signal transduction. **Bioenergetics :** Transduction and storage of energy. ATP generation. Metabolic coupling. Nitrogen Metabolism. Transamination and deamination reactions.	12

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. Fundamentals of biochemistry Wiley
4. M.M. Cox, D. L. Nelson. Lehninger's principles of biochemistry. W H Freeman
5. Stryer. Biochemistry W H Freeman
6. Biochemistry, D Freifilder, W.H. freeman and company
7. Laboratory techniques in biochemistry and molecular biology, Work and Work
8. A Biologists guide to principles and techniques of practical biochemistry, K.W. KH Goulding, ELBS edition, 1986

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School of Basic and Applied Sciences

Class	**M.Sc. (Microbiology)**
Semester/Year	**I Semester**
Subject & Subject Code	**Microbiology - MMBIO20S103**
Paper	**Principles of Bioinstrumentation, Bioinformatics and Biostatistics – 103**
Max. Marks	**30 (ETE) + 20 (IA) = 50**

Credit			Total Credits
L	T	P	3
3	0	0	

Course Objectives:

Discuss the applications of biophysics and principle involved in bio instruments .Describe the methodology involved in biotechniques .Describe the applications of bioinstruments. The course is aimed at introducing the students to the field of Bioinformatics and enable them understand the concepts of statistics in biology. To impart practical exposure upon Bioinformatics tools and data bases.

Course Outcome:

At the end of the course, learners will be able to:

1. Recall and differentiate absorption and emission spectra. Identify the application of each region of EM spectrum for spectroscopy.
2. Recall and explain the techniques and underlying theory of UV- Visible, IR, NMR
3. Get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.
4. Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics.
5. Explain about the methods to characterise and manage the different types of Biological data.
6. Classify different types of Biological Databases.
7. Introduction to the basics of sequence alignment and analysis.
8. Overview about biological macromolecular structures and structure prediction methods.

Student Learning Outcomes (SLO):

At the end of course the students shall

1. Explain the electro-analytical techniques and spectroscopic techniques.
2. Describe the application and methodology involved in different types of chromatographic techniques.
3. Explain the principle involved in electrophoresis.
4. Know the theory behind fundamental bioinformatics analysis methods.
5. Be familiar with widely used bioinformatics databases.
6. Know basic concepts of probability and statistics.
7. Be able to describe statistical methods and probability distributions relevant for molecular biology data.

Unit	Syllabus	Periods
UNIT - I	Principle of Spectrophotometry. NMR mass spectroscopy their applications. Principle, working and applications of DNA sequencer, Freeze Drying, Thermal cyclers (Real Time PCR), Microplate reader, Fluorimeter, Filtration systems. Principle and application of centrifuge and methods of isolation of cellular fractions of cell.	12

Unit	Syllabus	Periods
UNIT - II	Chromatographic techniques : types and uses of paper chromatography, thin layer chromatography, column chromatography, HPLC. Electrophoresis, their application in identification and purification of micro molecules such as protein and enzyme.	12
UNIT - III	History and Development of Bioinformatics; Biological information resources and data mining, data characteristics and presentation. Molecular databases (Sequence and structural); database searching (keyword and sequence homology searching using BLAST and FASTA) . Software for identification of microorganisms: PIVWIN, Biologue.	12
UNIT - IV	Computational Methods : Gene identification methods; data mining (Genome databases) and phylogenetic analysis; Predictive methods using nucleic acids and protein sequences. Gene identification; Programmes for sequence comparison and analysis. Bioinformatics software; Molecular structure drawing tool (Chemdraw) Application of Clustal W; OLIGO; Molecular modeling/ Docking (CA Che); Introduction to SQL (Sequence Query Language)	12
UNIT - V	Biostatics: Mean median and mode. Standard error, standard deviation. Dispersion. Basic idea of probability, Sampling methods, chi-square test and analysis of variance, Exponential and logarithmic functions.	12

REFERENCE BOOKS –

1. Mount D., Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, New York. (2004).
2. Baxevanis, A.D. and Francis Ouellellette, B.F., Bioinformatics- A Practical Guide to the
Analysis of Genes and Proteins. Wiley India Pvt Ltd. (2009). 3. Teresa K. Attwood, David J. Parry-Smith, Introduction to Bioinformatics. Pearson
Education. (1999).
4. Jean-michel Claverie Cedric Notredame. Bioinformatics for Dummies. Publisher: Dummies (2007).
5. Arthur M. Lesk.Introduction to bioinformatics. Oxford University Press.(2004)
6. Dan E. Krane and Michael L. Raymer Fundamental Concepts of Bioinformatics (2002)
7. KRANE. Fundamental Concepts of Bioinformatics, (2003)
8. Teresa Attwood. Introduction to Bioinformatics. (2007)

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School of Basic and Applied Sciences

Class				**M.Sc. (Microbiology)**
Semester/Year				**I Semester**
Subject & Subject Code				**Microbiology - MMBIO20S104**
Paper				**Mycology and Phycology – 104**
Max. Marks				**30 (ETE) + 20 (IA) = 50**
Credit			**Total Credits**	
L	**T**	**P**	**3**	
3	0	0		

Course Objectives: This course deals with detailed classification and identification of fungi and algae. Fungal and algal ecology in terrestrial, aquatic and extreme habitats . Applications of fungal enzymes and various primary and secondary metabolites.Applications of algae.

Course Outcome:

At the end of the course, learners will be able to:

1. Describe useful and harmful activities of fungi and algae.
2. Identify commonly available fungi and algae and their characteristics.
3. Discuss how fungi and algae are used as biofertilizers in agriculture and as biopesticides.
4. Grow mushroom in the laboratory

Student Learning Outcomes (SLO):

Students will:

1. Apply the knowledge in fungal taxonomy, bioremediation and bioprospecting of secondary metabolites and industrially important fungal enzymes.
2. Demonstrate skills in laboratory, field and glasshouse work related to mycology and phycology.
3. Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies.
4. Learn importance of biofertilizer learn importance of microbiological production, single cell protein and algal biotechnology.

Unit	Syllabus	Periods
UNIT - I	History and development of mycology. Structure and cell differentiation in fungi. General Characteristics of Slime moulds, Zoosporic fungi (Chytridiomycota. Hyphochytridiomycota, Oomycota) Zygomycetes and Trichomycetes. Life cycle of Stemonites, Synchytrium, Phytophthora, Rhizopus.	12
UNIT - II	General characteristics of Ascomycetes and Endomycetes. General Characteristics of yeast and filamentous ascomycetes (Loculoascomycetes, Pyrenomycetes,Discomycetes and Plectomycetes) General Characteristics of Uredinales ustilaginales and Agaricales. Life cycle of Saccharomyces, Penicillum, Aspergillus, Neurospora, Puccinia, Ustilago, Agaricus , Pleurotus .	12

Shama Nidhi

Unit	Syllabus	Periods
UNIT - III	Heterothallism in fungi, Lichens: (ascolichens, basidiolichens, deuterolichens) General characteristics and classification of Deuteromycetes. Morphological features of Alternaria, Curvularia, Helminthosporium, Fusarium, Humicola and Microsporum.	12
UNIT - IV	Classification of algae, algal nutrition, morphological variation and features of reproduction. Characteristic features of different groups of algae (green algae, diatoms, Euglenoids, brown and red algae). Algal ecology and algal biotechnology.	12
UNIT - V	Importance of blue green algae as biofertilizers. Algae as food and fodder, Algal blooms and their remediation. Algae as source of single cell protein- Chlorella, Spirulina, Algal toxicity.	12

REFERENCE BOOKS –

1. Alexopoulus, C.J., Mims,C.W. and Blackwel, M, Introductory Mycology. John Wiley, New York.
2. Mehrotra, R.S. and K.R.Aneja An Introduction to Mycology. New Age InternationalB Press, New Delhi.
3. Webster, J. Introduction to fungi. Cambridge University Press. Cambridge, U.K. (1985).
4. Bessey E.A. Morphology and Taxonomy of fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
5. Jhon Webster and R W S Weber. Introduction to Fungi. Cambridge University Press 2007.
6. A. V. S. S. Sambamurty. A Textbook of Algae. I.K. International Publishing House Pvt.

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Class				**M.Sc. (Microbiology)**
Semester/Year				**I Semester**
Subject & Subject Code				**Practical Microbiology - MMBIO20S105**
Paper				**Paper- I and II, Practical- I Sitting**
Max. Marks				**30 (ETE) + 20 (IA) = 50**
L	**T**	**P**	**2**	
0	0	2		

PRACTICALS

1 Microbiology Laboratory rules : Basic rules of a microbiology Laboratory.

2 Basic Requirements of a microbiology laboratory: common glassware, Cleaning of glassware.

3 Tools in microbiology laboratory, Disposal of Laboratory wastes and culture.

4 Sterilization Techniques of glass wares.

5 Preparation of culture media : Solid / liquid.

6 Isolation techniques: Streak plate method, pour plate method, spread plate method and serial dilution agar plate method.

7 Isolation of microorganisms (Bacteria, Fungi, Actinomycetes) from soils and their enumeration using serial dilution method.

8 Isolation of bacteria from water/waste water and their enumeration.

9 Staining Technique of fungi and simple and differential staining of bacteria including Gram's staining, spore staining, flagella staining and capsule staining.

10 Microscopy and Micrometry of fungal propagules and camera Lucida drawing of morphological features of fungi.

11 Method of culture preservation and maintenance.

12 Perform Slide Culture Technique.

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Class				**M.Sc. (Microbiology)**
Semester/Year				**I Semester**
Subject & Subject Code				**Practical Microbiology - MMBIO20S106**
Paper				**Paper- III and IV, Practical- II Sitting**
Max. Marks				**30 (ETE) + 20 (IA) = 50**
L	**T**	**P**	**2**	
0	0	2		

PRACTICALS

1 Isolation of aquatic fungi using bait technique.

2 Purification of cultures using hyphal tip method/serial dilution method.

3 Microscopic examination of fungi, cyanobacteria and eubacteria.

4 Chromatographic techniques for identification of sugar, proteins, amino acids, fatty acids.

5 Knowledge of software used in classification of microorganisms.

6 Analysis of data by statistical methods : chi-square test, variance, t-test.

7 Isolation and identification of algae from soil.

8 Quantitative estimation of sugar by (DNS) dinitrosalicylic acid reagent method.

9 Quantitative estimation of protein by Lowry's method.

10 Purification of protein through electrophoresis.

11 Experiments on calculation of mean/median/mode of the experimental data.

12 Experiments on cultivation of edible mushrooms.

13 Identification of actinomycetes using probabilistic identification of bacteria (PIB) Win software.

Sharma Nidhi