INSTITUTE	**FACULTY OF SCIENCE**
PROGRAM	**MASTER OF SCIENCE (MICROBIOLOGY)**
SEMESTER	**3**
COURSE TITLE	**EXPERIMENTAL LABORATORY-III**
COURSE CODE	**02MB0510**
COURSE CREDITS	**6**

Objective:

1 Equip students with hands-on experience in advanced molecular biology, pharmaceutical microbiology, bioprocess technology, food and dairy microbiology, and environmental biotechnology for practical applications in research and industry.

Course Outcomes: After completion of this course, student will be able to:

1 Perform DNA and protein isolation, electrophoresis, spectrophotometric quantification, and bacterial transformation techniques for molecular biology applications.

2 Conduct microbiological assays, sterility testing, preservative and disinfectant efficacy evaluation, and pharmaceutical formulation techniques for quality control and product development.

3 Perform microbial isolation, preservation, strain improvement, fermentation, and enzyme production techniques for bioprocess optimization and industrial applications.

4 Perform microbial identification, food and dairy quality analysis, fermentation, and antibiotic efficacy testing to ensure product safety.

5 Assess water quality by measuring hardness, solids content, oxygen demand, nutrient levels, and microbial contamination to ensure environmental and wastewater standards.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	12	0	0	0	50	50

Contents : Unit	Topics	Contact Hours
Total Hours		

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Advanced Molecular Biology** 1. Isolation of Plasmid DNA from Bacterial Cells. 2. Restriction Digestion of Plasmid DNA using Specific Restriction Endonucleases. 3. Amplification of Target Gene from Genomic DNA using Polymerase Chain Reaction (PCR) and Standardization of PCR parameters. 4. Cloning of DNA Fragment into Vector by Ligation Reaction. 5. Preparation of Competent E. coli Cells by Calcium Chloride Method. 6. Transformation of Recombinant Plasmid into Competent E. coli Cells. 7. Screening, Selection, and Confirmation of Recombinant Clones. 8. Extraction and Precipitation of Extracellular Proteins from Bacterial Culture. 9. Separation and Analysis of Proteins using SDS-PAGE (Sodium Dodecyl Sulfate-Polyacrylamide Gel Electrophoresis). 10. Quantitative Gene Expression Analysis using Real-Time PCR (qPCR).	30
2	**Pharmaceutical Microbiology** Antibiotic sensitivity assay Microbial examination of Non-sterile products Sterility testing of different locations of production area and packaging area Bio burden estimation of package material or medical devices To check the effect of preservative in different formulations To check the effect of disinfectant To prepare various pharmaceutical formulations: Ointment, Emulsion, Chemical Depilatory To formulate liposomes	30
3	**Bioprocess Technology** Isolation and Preservation (Agar plate, Slant, Glycerol stock) of economically important strain of microorganisms. Study of Upstream Processing (a) Preparation of Inoculum for Scale up. (b) Strain Improvements by random mutagenesis (Physical/Chemical/UV). (c) Study of Growth curve of Microorganisms. Effect of media supplements on growth of microorganisms and production of metabolite. Production of ethanol using submerged fermentation. Production of citric acid using submerged fermentation. Optimisation, isolation and purification of Enzyme using submerged/ solid state fermentation. Immobilisation of enzyme.	30

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	**Food and Dairy Microbiology** Isolation and identification of Xanthomonas spp. from infected sample Production of ethanol from wheat flour / grapes etc. Determination of moisture content in food sample Estimation of ascorbic acid in beverage/juices Determination of microbiological quality (TPC/SPC) of any food sample: pasteurized and sterilized/ flavoured milk/cheese/butter/veg/fruit/bread/meat samples. Quality assurance tests: Antibiotic and growth factor assay (agar gel diffusion technique) / MIC and MBC of Antibacterial compounds To analyse the quality of milk and dairy products by following methods Phosphatase test MBRT test Test for mastitis Milk fat estimation Standard Plate Count (for milk / milk product e.g. milk powder) Direct Microscopic count Somatic cell count Pyrogen Testing Sterility testing of non-biocidal injectables Sauerkraut production	30
5	**Environmental Biotechnology** To Estimate Total Hardness of Water B) To Estimate Calcium Hardenss of Water To Estimate The Total Solids (Ts), Total Dissolved Solids (TDS) And Suspended Solids (SS) In The Given Water Sample. To Estimate Dissolved Oxygen Content of Wastewater (DO) To Estimate Chemical Oxygen Demand of The Given Sample (COD) To Estimate Biological Oxygen Demand (BOD) To Measure the Concentration of Chloride in the Given Sample To Estimate the Amount of Ammonical Nitrogen in the Given Sample To Estimate the Amount of Nitrate Nitrogen To Estimate the Amount of Phosphorus Phosphate in the Given Sample To Find Out The Most Probable Number of Coliforms In The Given Water Sample	30
Total Hours		**150**

Textbook :

1 Molecular Cloning: A Laboratory Manual , Green, M.R., & Sambrook, J. , Cold Spring Harbor Laboratory Press., 2019

2 Molecular Biotechnology: Principles and Applications of Recombinant DNA, Glick, B.R., & Pasternak, J.J., ASM Press, 2010

3 Handbook of Microbiological Quality Control in Pharmaceuticals and Medical Devices, Baird, R.M., Hodges, N.A., & Denyer, S.P. , CRC Press., 2000

References:

1 Microbiology and Technology of Fermented Foods, Microbiology and Technology of Fermented Foods, Hutkins, R.W., Wiley-Blackwell., 2008

Suggested Theory Distribution:

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
5.00	10.00	30.00	30.00	20.00	5.00

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.
3. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1. https://mbvi-au.vlabs.ac.in/

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