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SYLLABUS FOR M.SC. (PART.II) MICROBIOLOGY  
(IN FORCE FROM JUNE - 1999)

There shall be 3 theory papers, each of 100 marks and 3 hours duration. There shall be 3 practicals each of 7 hours duration. The practical examination will be of 150 marks of out of which 15 marks will be from each practical will be assigned on the basis of term work and oral examination.

The last date for submission of term work will be 1st March.

THEORY :

- Paper-IV : Advance in Microbial Technology  
Paper-V : Economic Microbiology  
Paper-VI : Environmental Microbiology

Every theory paper is divided into five units. Each unit will have equal weightage while setting the Question-paper. Questions of its sub-questions including the options will be set from the same unit.

Unit-I

ELEMENTS OF MICROBIAL TECHNOLOGY :

- Substrate modification
- Strain development and preservation
- mixed culture and mixed substrate concept
- Bioreactor design and Scale-up
- Product modification

Unit-II

SELECTIVE TECHNIQUES AND ITS APPLICATION:

- Immobilization techniques - enzymes, cells, enzyme+cells
- Tissue culture
- Monoclonal Antibodies
- Biosensors : development and application
- Bioassay techniques

unit III

UPSTREAM AND DOWNSTREAM PROCESSING :

- Solid and liquid handling
- Sterilization
- Aeration and agitation
- Development of inoculum for bacterial, yeast and mycelial processes
- Recovery and purification of products.

unit-IV

MICROBIAL BIOMASS PRODUCTION :

- Biofertilizers : nitrogen, phosphorus, sulphure and iron
- Mycorrhizae
- Bioinsecticide
- ✓ Biopesticides
- SCO, SCP
- Edible mushrooms

unit V

QUALITY ASSURANCE AND FERMENTATION ECONOMY:

- Influence of growth condition on inocula
- Influence of Post growth condition on inocula
- Screening for novel products
- Sterility testing, LAL test and bioassays
- Product safety analysis

PAPER - V : ECONOMIC MICROBIOLOGY

Unit I

HEALTH CARE PRODUCTS:

- Antibiotics : peptide antibiotics, penicillin, streptomycin
- Anticancer agents
- Steroids
- Vaccines
- Products from rDNA
- Gene therapy

Unit II

FOOD AND BEVERAGES PRODUCTS :

- Modern brewing technology : wine, beer, whiskey
- Traditional fermented foods
- Dairy products : starter culture and cheese technology
- Amino acids : lysine, glutamic acid
- Vitamins : B<sub>2</sub>, B<sub>12</sub>

Unit III

INDUSTRIAL CHEMICALS AND BIOCHEMICALS:

- Organic acids : citric acid, acetic acid and gibberalic acid.
- Ethanol, acetone-butanol
- Amylase, protease, lipase

Unit IV

BIOFUELS AND BIOPOLYSACCHARIDES:

- Biogas, gasohol, Biophotosynthesis of H<sub>2</sub>O
- Dextran, xanthan
- Microbial surfactants

Unit V

BIOGEO TECHNOLOGY

- Bioleaching
- Biobeneficiation
- MEOR
- Desulfurization of fuels.

PAPER -VI ENVIRONMENTAL MICROBIOLOGY

Unit-I

CONCEPT AND DYNAMICS OF ECOSYSTEM:

- Component
- Food chain and energy flow
- Types and complexity of ecosystems
- Community structure and organization
- Productivity and biogeochemical cycles
- Environmental pollution
- Environmental impact assessment
- Conservation strategies
- Microbial production of pollutants

Unit-II

PRINCIPLES AND METHOD OF WASTE MANAGEMENT:

- Characterization of waste
- Principles of biological waste treatments
- Waste treatment processes : activated sludge, fixed-film system, rotating biological contactor (RBC), fluidized-bed and packed-bed reactors, oxidation ditches, aerated lagoons, anaerobic digestion.

Unit-III

BIOREMEDIATION:

- Principles
- Bioremediation techniques: in-situ, solid phase treatment, slurry reactors, biofilters, fixed film and immobilized cells
- Biosorption and bioaccumulation
- Bioconversions
- Co-metabolism
- Bioremediation kinetics

Unit-IV

BIODEGRADATION:

- Principles
- Mechanisms: activation and enhancement, growth linked, detoxification, aerobic and anaerobic
- Hydrocarbons, lignin, dyes, pesticides, recalcitrant compounds
- Biopulping and biobleaching
- Microbial degradation of water based metal working fluids

Unit-V

BIODETERIORATION:

- Principles
- Microbial mechanism
- Testing methodology
- Prevention and control measures
- Biodeterioration of :wood, petroleum, foods and feed, paints, leather, stone, pharmaceuticals, metal, rubber, plastic, paper

Paper-IV

1. Oxygen Transfer Rate (OTR)
2. Study of rheological changes of broth due to fungal growth
3. Recovery & Purification of fermentation products-enzymes, antibiotics, organic acids, alcohol.
4. Influence of medium composition
5. strain improvement study
6. Biooxidation Iron
7. Bioleaching study
8. Deverlopment of SCP
9. Development of biofertilizer
10. Immobilization of cells and enzymes.

PAPER-V

1. Production of antibiotics
2. Production of amylase
3. Production of Lipase
4. Production of Alcohol
5. Production of Vinegar
6. Study on Indian fermented food
7. Production of Organic Acids
8. Microbial production of polysaccahrude
9. Microbial production of Biosurfactants
10. Microbial production of Biogas.

PAPER-VI

1. Study of microbial ecology
2. Biotreatment of domestic water
3. Biodegradation of hydrocarbon
4. Biotransformation of metals
5. Bioremediation of metals.
6. Biodeterioration of stone/leather
7. Biodeterioration of paper.
8. Characterization of waste - physical
9. Characterization of waste - chemical
10. Analysis of drinking water.

Besides these practicals, other practicals of relevance shall be introduced as per the need.

REFERENCES :M. SC. PART II

Microbial Mineral recovery	Ehrlich & Brierley
Genetic Engineering	S. Mitra
Recombinant DNA Methodology II	Ray We
Enzymes and Immobilized Cells in Biotechnology	A.L. Laskin
Environmental Microbiology - - A Laboratory Manual	Pepper et.al
Biodegradation and Bioremediation	M Alexander
Source or experiments for the teaching of Microbiology	Primrose & Wardlaw
Microbial Transformation and Degradation of toxic Organic Chemicals	Young & Cernigilla
Biotechnology of Filamentous Fungi	Finkelstein & Ball
Assessing Ecological Risks of Biotechnology	Lev. R. Ginzburg
Microbiological Quality Assurance	Brown & Gilbert
Comprehensive Biotechnology Vo. II	Cooney & Humphrey
Biotechnology Volumes	H.J.Rehm & G. Reed
Waste Water Treatment	Arceivala
Molecular Industrial Mycology	Leong & Berka
Topics in enzyme & Fermentation biotechnology	Volumes by Wisemen
Bioprocess Engineering	P.K. Ghosh
Principles of Fermentation Technology	Stanbury, Whittaker & Hall
Superbugs	Horikoshi & Grant
N <sub>2</sub> fixation	Muller & Newton
Biodeterioration	Volumes
Handbook of water and waste water treatment technology	Paul
Recent advances in biological N <sub>2</sub> fixation	Subbarao
New approaches in microbial ecology	Tiwari & Saxena
Genetic control of environmental Pollutants	Gilbert & Alexander
Microbial cell-cell interactions	Martin
Bacteria in their natural environment	Fletcher

For each topic the current references will be given as and when needed.