

बरकतउल्ला विश्वविद्यालय,भोपाल  
***Barkatullah University, Bhopal***

As per model syllabus of U.G.C. New Delhi, Approved by Board of  
Studies Microbiology



जीव विज्ञान संकाय  
**Faculty of Life Science**  
पाठ्यक्रम एवं निर्धारित पुस्तकें  
**Syllabus & Prescribed Books**

एम.एस.सी. (माइक्रोबायोलॉजी) द्वितीय सेमेस्टर

**M.Sc. (Microbiology) Second Semester**

प्रकाशक  
कुलसचिव  
बरकतउल्ला विश्वविद्यालय,भोपाल

# BARKATULLAH UNIVERSITY, BHOPAL

## M.Sc. (Microbiology)

### Second Semester Examination Scheme

1. Course Code	:		6. Maximum Theory Marks	:	500
2. Course Name	:	M.Sc. Microbiology	7. Minimum Passing Percentage	:	36
3. Total Paper	:	04	8. Laboratory	:	100
4. Compulsory Paper	:	04	9. Laboratory Passing Percentage	:	18
5. Laboratory	:	01			

Title of the Paper	Theory		CCE		Total Marks		Practical		Total Marks	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Molecular Biology & Genetic Engineering	85	31	15	05	100	36	---	---	100	36
Microbial Metabolism	85	31	15	05	100	36	---	---	100	36
Food Microbiology	85	31	15	05	100	36	---	---	100	36
Industrial Microbiology	85	31	15	05	100	36	---	---	100	36
Lab Course I: Based on the paper	---	---	---	---	---	---	50	18	50	18
Lab Course II: Based on the paper	---	---	---	---	---	---	50	18	50	18

## **BARKATULLAH UNIVERSITY, BHOPAL**

<b>Class</b>	-	<b>M.Sc.</b>
<b>Subject</b>	-	<b>Microbiology</b>
<b>Paper Name</b>	-	<b>MB-201 MOLECULAR BIOLOGY AND GENETIC ENGINEERING</b>
<b>Paper</b>	-	<b>5</b>
<b>Semester</b>	-	<b>Second</b>

**MM : 85**

- UNIT-I** Core techniques and essential enzymes used in r-DNA technology. Restriction digestion, ligation and transformation. Cloning vectors – Plasmids, phages and cosmids. Cloning strategies – Cloning and selection of individual genes, gene libraries – cDNA and genomic libraries.
- UNIT-II** Specialized cloning strategies - Expression vectors, promoter probe vectors, vectors for library construction - artificial chromosomes, Rationale for the design of vectors for the over-expression of recombination protein, selection of suitable promoter sequences, ribosome binding sites, transcription terminator, fusion protein tags, purification tags, protease cleavage sites and enzymes, plasmid copy number and inducible expression system.
- UNIT-III** DNA sequencing methods – Dideoxy and chemical method, sequence assembly. Automated sequencing and physical mapping of genomes. Gene amplification - PCR and its applications. Ribozymes and RNAi.
- UNIT-IV** Expression of cloned DNA – Expression in heterologous system. Identification of cloned gene – Study of the transcript of a cloned gene. Hybridization techniques. Modification of cloned DNA – Site directed mutagenesis, Efficient expression of cloned genes.

**UNIT-V** Applications of r-DNA technology- Requirement and production of recombinant molecules in pharmaceutical, health, agricultural and industrial sectors and research laboratories. Transgenic animals, *Agrobacterium* mediated transformation, Bt cotton, Gene Therapy. Safety of recombinant DNA technology, IPR and patenting.

#### **REFERENCE BOOKS**

- Molecular Biotechnology by Pasternack and Glick.
- From Genes to Genomes: Concepts & Applications of DNA Technology by J.W. Dale & M.V. Scharz.
- Gene Cloning & DNA Analysis: An Introduction (4th edition) by T.A. Brown.
- Principles of Gene manipulation: An Introduction to Genetic Engineering, Old RW, Primrose SB, Blackwell science Publication
- An introduction to Genetic engineering by D.S.T. Nicholl, Cambridge University Press.

## **BARKATULLAH UNIVERSITY, BHOPAL**

<b>Class</b>	-	<b>M.Sc.</b>
<b>Subject</b>	-	<b>Microbiology</b>
<b>Paper Name</b>	-	<b>MB-202 MICROBIAL METABOLISM</b>
<b>Paper</b>	-	<b>6</b>
<b>Semester</b>	-	<b>Second</b>

**MM : 85**

- UNIT-I** Basic aspects of Bioenergetics, Free energy, Entropy, enthalpy and activation energy, Energy yielding and energy requiring reactions. Electron carriers, Role of ATP, reducing power and precursor metabolites in metabolism, Biochemical mechanisms of ATP generation.
- UNIT-II** First and Second Law of thermodynamics, concept of free energy. High Energy Phosphocompounds, ATP cycle, Structural basis of free energy change during hydrolysis of ATP. Carbohydrate Metabolism: basic concepts, glycogenesis, gluconeogenesis- Pathway and regulation , Glycolysis, Kreb's cycle pentose phosphate pathway, glyoxalate pathway, glycogenolysis: pathway and regulation. Electron Transport and oxidative phosphorylation: electron carriers, complex I to IV, chemiosmotic theory, substrate level phosphorylation.
- UNIT-III** Lipid metabolism: Biosynthesis of lipids. Degradation of odd carbon and even carbon: saturated and unsaturated fatty acids. Nucleic acid metabolism: biosynthesis and break down of purines, pyrimidines by de novo and salvage pathways, regulation of pathways. Photosynthesis: oxygenic and nonoxygenic photosynthetic prokaryotes.
- UNIT-IV** Amino Acid metabolism: Biosynthetic families of amino acid. Breakdown of amino acid into six (to check) common intermediates. Regulation of amino acid metabolism (Steps for the biosynthesis and break down of amino acids are not required).Nitrogen assimilation: nitrogen fixation, incorporation of nitrogen in amino acids.

**UNIT-V** Assimilation of nitrogen: Dinitrogen fixation-free living and symbiotic diazotrophic organisms. Biochemistry of nitrogen fixation: Nitrogen complex nitrogenase types and function, alternative nitrogenase, regulation of nitrogenase by oxygen and combined nitrogen sources. Genetics of nitrogen fixation: *nif* genes and their regulation. Nitrification denitrification and pathways of nitrate and ammonia assimilations.

**REFERENCE BOOKS:**

- Biochemistry by Lubert Stryer. W. H. Freeman & Company, NY
- Biochemistry by Lehninger. McMillan publishers
- Biochemistry by West and Todds
- Harper's review of Biochemistry by Martin. D. W, Mayes. P. A and Rodwell. V. M

## **BARKATULLAH UNIVERSITY, BHOPAL**

<b>Class</b>	-	<b>M.Sc.</b>
<b>Subject</b>	-	<b>Microbiology</b>
<b>Paper Name</b>	-	<b>MB-203 FOOD MICROBIOLOGY</b>
<b>Paper</b>	-	<b>7</b>
<b>Semester</b>	-	<b>Second</b>

**MM : 85**

- UNIT – I** History of Microorganisms in Food, Taxonomy, Sources, Types, Incidence, and Behavior of Microorganisms in Food, Intrinsic and Extrinsic Parameters of Foods that affect Microbial Growth, Incidence and Types of Microorganisms in Foods.
- UNIT – II** Microbial Spoilage of Foods, Spoilage of Fruits and Vegetables, Spoilage of Fresh and processed meats, poultry and seafood, Spoilage of miscellaneous foods, Milk Microbiology.
- UNIT – III** Culture, Microscopic and Sampling Methods, Physical, Chemical and Immunologic Methods, Bioassay and Related Methods.
- UNIT – IV** Food Preservation and Some properties of Psychrotrophs, Thermophiles, Radiation resistant and lactic Acid Bacteria, Food preservation with chemicals, Radiation Preservation of foods and nature of microbial radiation resistance, Low-temperature food preservation and characteristics of Psychrotropic Microorganisms, High-Temperature food preservation and characteristics of thermophilic microorganisms, Preservation of foods by Drying, Fermented foods and related products of fermentation.
- UNIT – V** Microbial indicators of food safety and quality, principles of quality control and microbiological criteria, Indicators of food microbial quality and safety, Microbiological safety of foods, Food borne Diseases : Staphylococcal Gastroenteritis, Food poisoning caused by gram-positive spore forming bacteria, Food borne listeriosis, Food borne Gastroenteritis caused by *Salmonella*, *Shigella* and *Escherichia* and by *Vibrio*, *Yersinia*, and *Campylobacter* Species, Food borne Animal parasites, Other proved and suspected foodborne agents : Mycotoxins, Viruses, *Aeromonas*, *Plesiomonas*, Scombroiod and Paralytic shellfish poisonings.

## **REFERENCE BOOKS**

- James M Jay, Modern Food Microbiology, CBS Publishers, 1987
- Frazier, Food Microbiology
- G. Reed, Prescott and Dunn's Microbiology, CBS Publishers, 1987
- Desrosier, Technology of food preservation, CBS Publishers



## **BARKATULLAH UNIVERSITY, BHOPAL**

<b>Class</b>	-	<b>M.Sc.</b>
<b>Subject</b>	-	<b>Microbiology</b>
<b>Paper Name</b>	-	<b>MB-204 INDUSTRIAL MICROBIOLOGY</b>
<b>Paper</b>	-	<b>8</b>
<b>Semester</b>	-	<b>Second</b>

**MM : 85**

- UNIT-I** Industrially important strain of bacteria, fungi and actinomycetes; Novel microbes for industry. Isolation and screening of the industrially important strain from diverse ecosystem. Methods of strain improvement, mutagenesis, strain breeding by protoplast fusion, sexual and Para sexual recombination. Fermentation technology: principal of fermentation. Fermenter and bioreactor monitoring and control of parameters designing operation and application .
- UNIT-II** Downstream processing: filtration of fermentation broths recovery of biological products by distillation, superficial and extraction. Detection, analysis and quality control of fermentation products and raw materials. Industrial production of alcohols: vinegar, wine, and alcohol. Industrial production of solvents, glycerol, acetone, and butanol
- UNIT-III** Industrial production of citric acid and glutamic acid. Microbial production of enzyme of industrial important: amylase and protease. Methods of whole cell immobilization, enzyme immobilization and application. Industrial production of antibiotics, penicillin , and streptomycin
- UNIT-IV** Hygiene and safety in fermentation industries. Microbial products of vitamin B2 and B 12. Microbial production of interferon, Insulin, flavors and fragrances. Bioelectronics: Biochips and biosensors.
- UNIT-V** Microbial production of vaccines. Microbial production of polymers: Dextran and xanthan. Microbial transformation: steroid and biotransformation. Intellectual property rights (IPR) and protection (IPP)

## **REFERENCE BOOKS**

- Industrial Microbiology, Prescott and Dunn,
- Biochemical Engineering and Biotechnology Handbook, Atkinson, B and Marituna, F., The Nature Press,  
and Macmillan Publ. Ltd.
- Biochemical Engineering Fundamentals, Bailey & Olis. MGH.