

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) प्रथम सेमेस्टर

M.Sc. (Microbiology) First Semester

प्रकाशक
कुलसचिव
बरकतउल्ला विश्वविद्यालय,भोपाल

BARKATULLAH UNIVERSITY, BHOPAL

M.Sc. (Microbiology)

First 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 1		Total Marks	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
General Microbiology	85	31	15	05	100	36	---	---	100	36
Microbial Biochemistry	85	31	15	05	100	36	---	---	100	36
Microbial genetics	85	31	15	05	100	36	---	---	100	36
Biostatistics, Instrumentation Bioinformatics	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

Class	-	M.Sc.
Subject	-	Microbiology
Paper Name	-	MB-101 GENERAL MICROBIOLOGY
Paper	-	1
Semester	-	First

MM : 85

Unit- I History and Development of Microbiology-Contribution of Scientists, spontaneous generation and germ theory, Haeckel's three kingdom, Whittaker's five kingdom and three domain concept of Carl Woese, Eight kingdom system of classification of Cavalier Smith; Classification and salient features of bacteria according to the Bergey's Manual of Determinative bacteriology. Physical and Chemical methods of sterilization.

Unit-II Morphology and ultrastructure of bacteria - size, shape and arrangement , structure and chemical composition and function of cell walls of Gram positive and Gram negative bacteria; Structure, composition and function of cell membrane; capsule; flagella, pilli, gas vesicles, cytoplasmic matrix, reserve food materials; chromosomes, carboxysomes, magnetosomes and phycobilisomes; nucleoid. Reproduction and Recombination in bacteria. Nature and properties of spores: Bacterial exo and endospore , Germination of spores.

Unit-III Techniques in Microbiology – Isolation, pure and enrichment culture, staining procedure, Biochemical tests, physical & Chemical Sterilization, Preservation of bacterial cultures. Cultivation of bacteria-aerobic, anaerobic; nutritional types of bacteria, culture media used, growth curve, generation time, growth kinetics, synchronous growth; batch and continuous culture; measurement of growth; factors affecting growth; Microbes in Extreme Environment –Special features of the thermophilic, methanogenic and halophilic archaea; Photosynthetic bacteria, Cyanobacteria; microbes in other extreme conditions – deep ocean, and space.

Unit -IV General characteristics of viruses, Nomenclature ,classification, morphology and ultrastructure of capsid and its arrangement, types of envelopes and its composition, viral genome, its type and structure. Viroids, virusoids, cyanophages and mycoviruses. Prions and its diseases. Bacteriophages: structural organization, multiplication cycle, eclipse phase, phage production, burst size, lytic and lysogenic cycle, application in bacterial genetics and uses. Plant and Animal viruses: classification and nomenclature, disease symptoms, histology, physiology and cytology of plants. Diagnostic techniques and transmission of plant viruses.

Unit-V Current status of fungi; their classification with reference to Ainsworth; General characters, somatic structure, asexual and sexual reproduction of microbiologically important genera of Myxomycota, Mastigomycotina. Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina; Heterothallism; sex hormones in fungi; physiological specialization and phylogeny of fungi. Parasexual life cycle; Symbiotic associations of fungi with algae; Economic importance of fungi. General characters of algae; classification of algae; Somatic structure, asexual and sexual reproduction of microbiologically important genera of Chlorophyceae, Phaeophyceae, Bacillariophyceae and Rhodophyceae. Algal nutrition, ecology and biotechnology. General characters of protozoans; Structure and reproduction in protozoans: *Entamoeba*, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma* and *Plasmodium*. *Paragonimus*, *Fasciola hepatica*, *Schistosoma*.

REFERENCE BOOKS:

- Microbiology: An Introduction: Tortora, Funke & Case. 7th edition, 2001
- Microbiology VI Edition: M.J.Pelczar, E.C.S. Chan, N.R.Krieg.Publisher: Tata McGraw.
- Principles of Microbiology: R.M.Atlas.Publisher:W. C. Brown.
- General Microbiology: R.Y.Stainier, J. L. Ingraham, M.L. Wheelis and P.R. Painter. Publisher: Macmillan.
- Essentials of Immunology: Ivan. M. Roitt, Clackwell Scientific Publications, London.

BARKATULLAH UNIVERSITY, BHOPAL

Class	-	M.Sc.
Subject	-	Microbiology
Paper Name	-	MB-102 MICROBIAL BIOCHEMISTRY
Paper	-	2
Semester	-	First

MM : 85

UNIT-I Monosaccharides and their relationship, structure of sugars, stereoisomerism and optical isomers of sugars. Reactions of aldehyde and ketone groups, Ring structures and tautomeric forms, Mutarotation, Reaction of sugars to -OH groups. Important derivatives of monosaccharides, disaccharides and trisaccharides. Structure, identification and importance of mono and oligosaccharides. Structure, occurrence and biological importance of structural polysaccharides *e.g.* Blood group lipopolysaccharides.

UNIT-II Definition and classification of lipids. Building blocks of lipids, fatty acids, glycerol, sphingosine. Fatty acids distribution in nature, classification, physico-chemical properties, separation, characterization and chemical properties. Saponification and iodine number. Properties and function of phospholipids. Lipoproteins - classification, composition and their importance. Role of lipids in cellular architecture and functions.

UNIT- III Amino Acids- structure, classification and properties. Handerson and Hasselbach equation for ionization of amino acids. Chemical reactions of amino acids, Lab synthesis of poly peptide. Primary, secondary, tertiary and quaternary structure of Haemoglobin and Myoglobin. Ramchandran plot. Determination of amino acid sequence in proteins / polypeptides.

UNIT-IV Enzymes as biocatalysts- Enzyme classification. Mechanism of enzyme action- specificity, active site, activity unit and isozymes. Factors affecting enzyme efficiency, enzyme activators, coenzymes and cofactors. Enzyme kinetics - Michaelis - Menton equation for simple enzymes, determination of kinetic parameters, multi-step reactions and rate limiting steps. Enzyme inhibition- reversible, irreversible, competitive and noncompetitive. Allosterism- kinetic analysis of allosteric enzymes, Principles of allosteric regulation.

UNIT-V Vitamins - Discovery, role and chemistry of fat soluble vitamins A, D, E and K. Water soluble vitamins – Pantothenic acid, niacin, pyridoxine, biotin, riboflavin, cyanocobalamin, folic acid and ascorbic acid.

REFERENCE BOOKS:

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

BARKATULLAH UNIVERSITY, BHOPAL

Class	-	M.Sc.
Subject	-	Microbiology
Paper Name	-	MB-103 MICROBIAL GENETICS
Paper	-	3
Semester	-	First

MM : 85

UNIT-I Fine structure of prokaryotic and eukaryotic genome. DNA as genetic material, DNA structure and types. DNA replication- general principles, various modes of replication, Proof-reading, Continuous and discontinuous synthesis, Synthesis of leading and lagging strands. Superhelicity in DNA. Mechanism of action of topoisomerases. Inhibitors of DNA replication.

UNIT-II Gene as a unit of mutation, molecular nature of mutation. Mutagens, spontaneous mutation, DNA damage (Deamination, oxidative damage, alkylation, pyrimidine dimers) Repair pathways- methyl directed mismatch, repair, very short patch repair, nucleotide excision repair, base excision repair, recombination repair and SOS repair.

UNIT-III Gene Expression, Transcription- General Principles, basic apparatus and types of RNA polymerases. Initiation, elongation and termination steps Inhibitors of RNA synthesis. Polycistronic and monocistronic RNAs. Control of transcription by interaction between RNA polymerases and promoter regions. Use of alternate sigma factors, controlled termination, attenuation and anti-termination RNA. Maturation and processing of RNA: Methylation, cutting and trimming of rRNA; capping, polyadenylation and splicing of mRNA; cutting and modification of tRNA. Structural features of RNA (rRNA, tRNA and mRNA)

UNIT-IV Basic features of the genetic code, Wobble hypothesis, Protein synthesis: steps, details of initiation, elongation and termination, role of various factors in these steps, inhibitors of protein synthesis. Regulation of gene expression: Operon concept, positive and negative

regulation of lac operon; catabolite repression, inducers and co-repressors, arabinose and tryptophan operon.

UNIT-V Gene transfer mechanisms- Transformation, conjugation, transduction, transfection: mechanisms and their Applications.

REFERENCE BOOKS:

- Cell and Molecular Biology by Karp. John Wiley & Sons
- Genomes, T. A. Brown, John Wiley and Sons PTE Ltd
- Gene VII by B. Lewin
- Essentials of molecular Biology, Malacinski and Freifelder Jones and Bartlett Publishers

BARKATULLAH UNIVERSITY, BHOPAL

Class	-	M.Sc.
Subject	-	Microbiology
Paper Name	-	MB-104 BIostatistics, Instrumentation AND Computer Proficiency
Paper	-	4
Semester	-	First

MM : 85

- UNIT-I** Principles & applications of microscopy: light microscopy: bright field, dark field, phase contrast, fluorescent microscopy. Electron microscopy: transmission & Scanning, Chromatography: basic principle, types: partition, absorption, paper, thin layer, gas, ion exchange, gel filtration, Affinity chromatography, HPLC.
- UNIT-II** Electrophoresis: basic principles, types: moving boundary & zonal electrophoresis; paper & gel techniques, (Polyacrylamide and agarose gel electrophoresis) its application & isoelectric focusing. Centrifugation: basic principles, types: differential, zonal, density gradient & Ultracentrifugation - basic instrument design & application.
- UNIT-III** Electromagnetic spectrum, spectrophotometer: its principle & analysis. Nuclear magnetic resonance: principle, instrumentation and application. Atomic absorption, electron paramagnetic resonance. Immunological technique: immunoelectrophoresis, immunodiffusion, immunofluorescence: radioimmunoassay, enzyme linked immunosorbent assay. Autoradiography: principles, methods of processing and application.
- UNIT-IV** Significance of statistical methods in biological investigation. Sampling techniques, statistical evaluation of results, calculation of mean, mode & median range, variance, standard deviation & quartile deviation for grouped and non grouped data concepts of coefficient of variation. skewness & kurtosis, simple correlation and compound probability

elementary idea of random variables, student's test, chi square & P distributions (shape range & finding percentage pts from tables). Regression; correlation; multiple linear, regression analysis of variance.

UNIT-V Basic idea of computers: Introduction to MS Office software concerning MS Word processing. Excel spreadsheets and Power point presentation software. Networking fundamentals, client, server, LAN, WAN, FTP, Telenet, INTERNET, NICNET, WWW, html and e- mail.

REFERENCE BOOKS

- Wilson & Walker, Practical Biochemistry
- Vasantha Pattabhi and N. Gautham, Biophysics
- Helmut Gunzler and Alex Williams, Handbook of analytical techniques
- Alan Cooper, Biophysical chemistry
- Skoog & West, Fundamentals of Analytical Biochemistry