

COURSES OF STUDY IN M.Sc. MICROBIOLOGY

SECOND -SEMESTER

Session 2022-23

Paper I: Molecular Biology and Recombinant DNA Technology M.M:40

UNIT – I

Nucleic acids as genetic information carriers: DNA structure, melting of DNA; superhelicity in DNA, linking number and topological properties; DNA replication., general principle, various modes of reading, continuous and discontinuous synthesis, asymmetric & dimeric nature of DNA polymerase III & simultaneous synthesis of DNA leading and lagging strands, polymerase and exonuclease activities, eukaryotic DNA polymerases; Mechanism of action of topoisomerases, ligases.

UNIT – II

Initiation of replication and construction of replication fork in test tube; retroviruses and their unique mode of DNA synthesis; relationship between replication and cell cycle in prokaryotes and eukaryotes; inhibitors of DNA replication (blocking precursor synthesis, nucleotide polymerization altering DNA structure).

UNIT III

Transcription: general principles, basic apparatus types of RNA polymerase; steps: initiation, elongation and termination, inhibitors of RNA synthesis, polycistronic and monocistronic RNA's; control of transcription by interaction by interaction between RNA polymerases and promoter regions, role of alternate sigma factors; regulation of rRNA and tRNA synthesis; maturation and splicing of mRNA, cutting and modification of tRNA: catalytic RNA, group I and group II splicing.

UNIT – IV

Gene expression in prokaryotes: induction and repression operon concept, regulatory and structural genes, operator, promoter, repressor and co-repressor, catabolite repression, cyclic AMP, CRP/CAP protein, regulation of lactose, tryptophan, histidine and arabinose operons, attenuation regulation. Gene expression in eukaryotes, Britton and Davidson's model of regulation involvement of HCP, NHCP and hormones. Regulation by N protein and nut sites in DNA binding proteins, enhancer sequences and control of transcription. Global regulatory responses: heat shock response, stringent response and regulation by small molecules such as ppGpp.

UNIT – V

Basic principle of gene cloning, genomic libraries, vectors, strategies of gene cloning using DNA or cDNA inserts, gene expression in recombinants, screening method for recombinant clones, important molecular techniques like Southern Blotting, PCR, RAPD, RFLP, DNA sequencing, and probe hybridization. Innovative topic added – Genetically Modified Organisms

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COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Paper II: Microbial Genetics
Session 2022-23

M.M:40

UNIT-I

Gene as unit of mutation and recombination, molecular mechanism of mutation, mutagens, types of DNA damage (deamination, oxidative damage, alkylation, pyridine dimmers). spontaneous mutations-origin, suppression of mutation. Innovative topic added – Strain improvement

UNIT-II

Gene transfer and genetic mapping, transformations, transfection, conjugation and transduction, genetic mapping of *E.coli*; Molecular aspects of genetic recombination.

UNIT-III

Complementation analysis, cis-trans test, deletion mapping; Benzer's concept of cistron, overlapping genes. DNA repair- photo repair, excision or dark repair, recombinational repair, SOS repair, methyl- directed mismatch repair, very short patch repair.

UNIT-IV

Plasmids. F-factors description and their uses in genetic analysis; R factors, colicin and col factors; plasmids as vectors for gene cloning; replication of selected plasmids; compatibility. transposons and their uses in genetic analysis, plasmid vectors and bacteriophage vectors.

UNIT-V

Important application of advances in microbial genetics, production of proteins, hormones and design of vaccines: conventional as well as new generation recombinant DNA vaccine, their design and advantages.

List of Recommended Books

1. Microbial Genetics by Maloy ET. Al. 1994. Jones and Bartlett Publishers.
2. Molecular Genetics of Bacteria by J. W. Dale. 1994. John Wiley and Sons.
3. Modern Microbial Genetics. 1991 by Streips and Yasbin. Niley Ltd.
4. Gene VII by Lewin Oxford University Press. 2000.
5. Bacterial and Bacteriophage Genetics. 4 th Editions by Birge.
6. Microbial Genetics by Freifelder. 4th Edition.
7. Organization of Prokaryotic Genome. 1999 by Robert L.Charlebois, ASM Publications.
8. DNA repair and mutagenesis. 1995 by Errol C. Friedberg, Graham C. Walker and Wolfram, Siede, ASM Publications.
9. Molecular Genetics of Bacteria, 1997 by Larry, Snyder and Wendy, Champness, ASM Publications.
10. Methods of General and Molecular Bacteriology, 1993. Edited by Philip. Gerhardt, ASM Publications.
11. Recombinant DNA by Watson, J.D.
12. Essentials of Molecular Biology by Malacimski.
13. Mobile DNA II by Nancy Craig, Martin Gellert Allan Lambowitz.

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Paper III: Biostatistics and Computer Application
Session 2022-23

M.M:40

UNIT-I

Importance and scope of statistics in biochemical experimentation; Elements of Probability-Mathematical and Statistical definitions; Addition and Multiplication theorems; Probability Distribution Functions – Binomial, Poisson and Normal; Area under normal distribution curve.

UNIT-II

Measures of central tendency: Arithmetic, geometric & harmonic means; Measures of dispersion: range, quartile deviation, variance, standard deviation, coefficient of variation, confidence limits of population mean. Tests of significance hypotheses and errors; student t statistics- population mean equals a specified value; equality of 2 independent means (equal & unequal variance), equality of 2 means (paired samples).

UNIT-III

Analysis of variance: one-way analysis (sample sizes equal and unequal), completely randomized design; two-way analysis (one observation per cell), randomized block design; multiple comparisons: least significant difference, Duncan's new multiple range test.

UNIT-IV

Linear regression: regression diagram and equation, regression coefficient, standard error, significant tests, prediction of dependent variable from the independent variable; linear correlation- scatter diagram, correlation coefficient, standard error, significance tests; relationship between regression and correlation coefficients; Non parametric tests: Chi-square statistics, test of goodness of fit, test of independence of attributes; standard line interpolation.

UNIT-V

Introduction to Computers: Basic architecture, generations of computer hardware and software; operating systems-WINDOWS and UNIX; system and application software; introduction to internet-LAN, MAN, WAN, Concept of bioinformatics; application of bioinformatics in microbiology.

List of Recommended Books

1. Statistics in biology, Vol. 1 by Bliss, C.I.K. (1967) Mc Graw Hill, New York.
2. Practical Statistics for experimental biologist by Wardlaw, A.C. (1985).
3. Programming in C by E. Ballaguruswamy
4. How Computers work - 2000. By Ron White. Tech. Media
5. How the Internet Work 2000 by Preston Gralla Tech. Media.
6. Statistical Methods in Biology - 2000 by Bailey, N.T. J. English Univ. Press.
7. Biostatistics - 7th Edition by Daniel
8. Fundamental of Biostatistics by Khan
9. Biostatistical Methods by Lachin

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**COURSES OF STUDY IN M.Sc. MICROBIOLOGY
SECOND - SEMESTER**

Elective Paper

**Paper VI: Microbial Metabolism
Session 2022-23**

M.M:40

UNIT-I
Microbial growth: mathematical expression of growth, growth measurement, efficient growth curve, synchronous growth and continuous culture, effect of environmental factors on microbial growth, nutrients diffusion, active transport, group translocation, solutes, temperature, oxygen relations.

UNIT-II
Chaeolithotrophy: Sulphur, iron, hydrogen, carbon monoxide, nitrogen oxidations. Methanogenesis, luminescence. Brief account of photosynthetic and accessory pigments chlorophyll, bacteriochlorophyll, carotenoids, oxygenic, anoxygenic photosynthesis. Electron transport- photoautotrophic generation of ATP, fixation of CO₂- Calvin cycle, reverse TCA, carbohydrate anabolism.

UNIT-III
Respiratory metabolism: Embden Mayer Hoff pathway, Entner Doudroff pathway, glyoxalate pathway, Krebs cycle, oxidative and substrate level phosphorylation, Pasteur effect, fermentation of carbohydrates-homo and heterolactic fermentations. Synthesis of polysaccharides- gluconeogenesis and other pathways.

UNIT-IV
Assimilation of nitrogen: Dinitrogen - nitrate nitrogen-ammonia- denitrification, synthesis of major amino-acids, polyamines; peptidoglycan-biopolymers as cell components.

UNIT-V
Microbial development, sporulation and morphogenesis, hyphae vs. yeast forms and their significance. Multicellular organization of selected microbes. Dormancy. Endospore-structure, properties and germination.

List of Recommended Books

1. Doelle H.W. 1969. Bacterial Metabolism. Academic Press.
2. Gottschalk G. 1979. Bacterial Metabolism. Springer Verlag. Mont AG. 1979. Microbial Physiology. John Wiley & Sons.
3. Sokatch JR. 1969. Bacterial Physiology and Metabolism. Academic Press.
4. Mont A G., Foster J W., Spector M P. Microbial Physiology, 4th Ed: Wiley India Pvt Ltd 2009

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