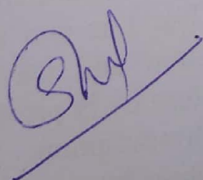
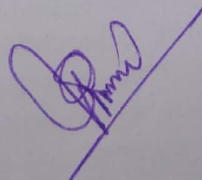
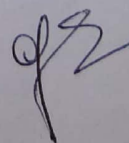
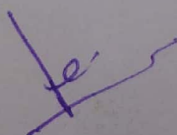


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Department of Botany and Microbiology
St. Aloysius' College (Auto.) Jabalpur
M.Sc. Microbiology- Semester II
Choice Based Credit System

(A) Continuous evaluation, Theory, Practical		Credits	Maximum Marks			
			Continuous Evaluation	End Exam	Semester	Total
Course	Course Title					
I Core courses						
P I	Molecular biology and Recombinant DNA Technology	4	10		40	50
P II	Microbial Genetics	4	10		40	50
P III	Biostatistics & Computer Application	4	10		40	50
	Practical based on P VI & P VII	4				50
	Practical based on P VIII & P IX/ P X	4				50
II Electives courses (Any one to choose)		4	10		40	50
P IV	Biology of the Immune System					
P V	Microbial Metabolism					
III Skill Development course						
	Skill Development	1	Grade Point will be provided by Skill Development Centre			
Total valid credits		25	Marks			
			25			
(B) Seminar and viva voce		2				

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Department of Botany and Microbiology
St. Aloysius' College (Auto.) Jabalpur
M.Sc. Microbiology

SECOND - SEMESTER

Paper I: Molecular Biology and Recombinant DNA Technology

Course outcome: Conceptual knowledge of properties, structure, function and regulation of genes in living organisms at the molecular level, recombinant DNA technology in prokaryotes and eukaryotes, develops skills of molecular techniques and handling instruments required in molecular biology laboratory.

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.

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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.

List of recommended books

1. Molecular cloning: A Laboratory Manual, J. Sambrook; Fritsch and T. Maniatis Cold Spring Harbor Laboratory Press, New York, 2000
2. Introduction to practical molecular biology P.D. Dabre, John Wiley & sons Ltd. New York 1988
3. Molecular Biology LabFax, T.A. Brown (Ed) Bios Scientific Publishers Ltd. Oxford, 1991
4. Molecular Biology of the Gene (4th edition), J.D. Watson N.H. Hopkins, J.W. Roberts J.A. Steitz and A.M. Weiner, The Benjamin/ Cummings Publ Co. Inc. California, 1987.
5. Molecular Cell Biology (2nd Edition) J. Darnell, H. Lodish and D. Baltimore, Scientist American Books, Inc., USA, 1994.
6. Molecular Biology of the Cell (2nd Edition) B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, and J. D. Watson, Garland Publishing, Inc., New York, 1994.
7. Gene VI (6th Edition) Benjamin Lewin, Oxford University press, U.K., 1998.
8. Molecular Biology and biotechnology; a comprehensive desk reference, R.A. Meyers (Ed.) VCH Publishers, Inc, New York, 1995
9. Genomes, T.S. Brown.

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St. Aloysius' College (Auto.) Jabalpur
M.Sc. Microbiology

SECOND SEMESTER
Paper II: Microbial Genetics

Course outcome: Gain better knowledge structure of nucleic acids, gene mutation, repair mechanisms, and nuclear genome organization. Comprehensive and detailed analysis of fine structure of the gene, role of transposable elements, insight into the manipulation of genetic material for a wide variety of purposes and product.

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.

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. Molecular Biology of the Gene 4th Edition by J.D. Watson, N.H. Hopkings, J.W. Roberts, J.A. Steitz and A.M. Weiner. 1987, The Benjamin / Cummings Publications Co. Inc. California.
5. Gene VII by Lewin Oxford University Press. 2000.
6. Bacterial and Bacteriophage Genetics. 4 th Editions by Birge.
7. Microbial Genetics by Frefielder. 4th Edition.

Department of Botany and Microbiology
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M.Sc. Microbiology
SECOND SEMESTER

Paper III: Biostatistics and Computer Application

Course outcome: analyze and interpret the significance of data by manual as well as using statistical software. They become accustomed with use of computers in biological studies and communicate the results of statistical analyses accurately and effectively.

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

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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
10. Statistics for Biologist by Campbell R.C. (1974) Cambridge University Press, UK.
11. INTERNET - CDC publication, India.

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COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Practical

SECOND SEMESTER

Paper I: Molecular Biology and Recombinant DNA Technology

Suggested list of Practical

1. Isolation of genomic DNA.
2. Southern blotting
3. RFLP analysis
4. Isolation of RNA
5. Isolation of poly A+ RNA
6. To study the effect of UV Radiation on yeast cell.
7. To study the dark repair mechanism in the UV radiated yeast cell.
8. To study the photo repair mechanism in the UV radiated yeast cell.
9. To perform replica plating of yeast cell.

Paper II: Microbial Genetics

Suggested list of Practical

1. To perform conjugation.
2. To study the effect of UV radiated on Bacterial cells.
3. To study the dark repair mechanism and photo repair mechanism in the UV radiated bacterial cells.
4. To perform replica plating of bacterial cells.
5. To study effect of mutagens (Nitrous acid) on bacterial cells.
6. Purification of chromosomal / plasmid DNA and study of DNA profile:
7. Confirmation of nucleic acid by spectral study.
8. Quantitative estimation by diphenylamine test.
9. DNA denaturation and determination of T_m and G+C content.

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COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Practical
SECOND SEMESTER
Paper III: Biostatistics and Computer Application

Suggested list of Practical

1. Representation of Statistical data by a) Histograms b) Pie diagrams
2. Determination of Statistical averages/ central tendencies. a) Arithmetic mean b) Median c) Mode
3. Determination of measures of Dispersion a) Mean deviation b) Standard deviation and coefficient of variation c) Quartile deviation
4. Tests of Significance-Application of following a) Chi- Square test b) t- test c) Standard error
5. Computer operations-getting acquainted with different parts of Computers. [DOS] and basics of operating a computer.
6. Creating files, folders and directories.
7. Applications of computers in biology using MS-Office.
A] MS-Word B] Excel C] Power Point
8. Creating an e-mail account, sending and receiving mails.
9. An introduction to INTERNET, search engines, websites, browsing and Downloading.

Paper IV: Biology of the Immune System (Elective Paper)

Suggested list of practical

1. To perform test for antibiotics sensitivity by disc method.
2. To determine the minimum inhibitory concentration of given antibiotics.
3. Preparation of blood smear.
4. To isolate serum from blood plasma.
5. To perform agglutination reaction to identification of blood group.

Paper V: Microbial Metabolism (Elective Paper)

Suggested list of Practical

1. Determination of Bacterial growth by turbidity measurements (spectrophotometric method).
2. Study of effect of temperature on growth of bacteria.
3. Study of effect of pH on growth of Bacteria.
4. Isolation of rhizobia from root nodules.
5. Slide culture technique for studying morphology and molds.

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COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Practical
SECOND SEMESTER
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St. Aloysius' College (Auto.) Jabalpur
M.Sc. Microbiology
SECOND - SEMESTER

Elective Paper

Paper IV: Biology of the Immune System

Course outcome: provide students with the basic knowledge about the functioning of the immune system, immune response against infectious agents, the causes and pathogenesis of major alterations in the immune response and immunotherapy.

UNIT-I

Introduction: phylogeny of immune system, innate and acquired immunity, clonal nature of immune response; organization and structure of lymphoid organs, nature and biology of antigens and super antigens.

UNIT-II

Antibody structure and function; antigen-antibody interactions, major histocompatibility complex, BCR & TCR, generation of diversity, complement system.

UNIT-III

Cells of the immune system; hematopoiesis and differentiation, lymphocyte trafficking. B lymphocytes, T-lymphocytes, macrophages, dendritic cells, natural killer and lymphokine activated killer cells, eosinophils, neutrophils and mast cells. Regulation of immune response: antigen processing and presentation, generation of humoral and cell mediated immune responses, activation of B-and T-lymphocytes, cytokines and their role in immune regulation; T-cell regulation, MHC restriction, immunological tolerance.

UNIT-IV

Cell-mediated cytotoxicity; mechanism of T cell and NK cell mediated lysis; antibody dependent cell mediated cytotoxicity, macrophage mediated cytotoxicity; hypersensitivity autoimmunity, transplantation.

UNIT- V

Immunity to infectious agents (intracellular parasites, helminthes & viruses); tumor immunology; AIDS and other immunodeficiencies, hybridoma technology and monoclonal antibodies.

Recommended Books:

1. Kuby immunology, 4th Edition, R.A. Goldsby, Thomas J. Kindt, Barbara, A. Osbarne. (Freeman)
2. Immunology-A short Course, 4th Edition- Eli Benjamin, Richard Coico, Geoffrey Sunshine (Wiley-Liss).
3. Fundamentals of immunology, William Paul.
4. Immunology, Roitt and others.

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SECOND - SEMESTER

Elective Paper

Paper V: Microbial Metabolism

Course outcome: basic knowledge of metabolic pathways (catabolism as well as anabolism), their diversity and specific regulation and interrelation in different cells. They also learn about synthesis of certain microbial products of economic importance. They gain practical knowledge and hands on tools and techniques for analyzing effect of different factors on microbial growth. The knowledge can be utilized for the growth/control of required microbes.

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

Chemosynthesis: 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.

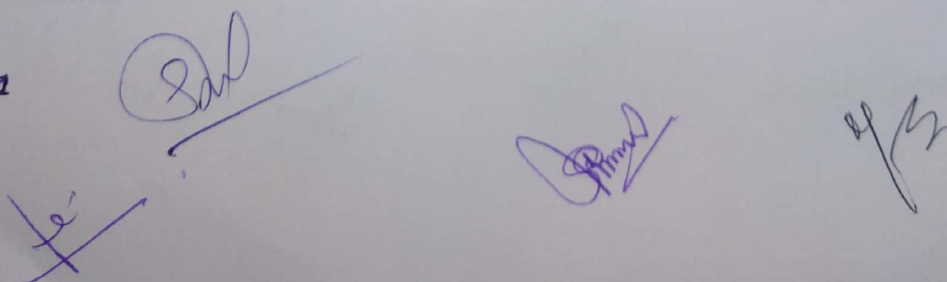
UNIT-IV

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.

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List of Recommended Books

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

