

**St. Aloysius' College, (Autonomous),
Jabalpur, M.P., India.
Department of Botany and Microbiology
Session 2023-2024**

Theory Paper

Part A Introduction			
Subject: Industrial Microbiology			
Program : Degree		Class: B.Sc.	Year: III
		Session: 2023-24	
1	Course Code	S3INMB1D	
2	Course Title	Molecular Biology and Genetics of Microbes Group A Paper I Theory	
3	Course Type (Core Course/ Discipline Specific Elective/ Elective/ Generic Elective /Vocational)	Discipline specific elective DSE	
4	Prerequisite (if any)	To study this course, a student must have had subject Industrial microbiology in Diploma.	
5	Course Learning outcomes (CLO)	On successful completion of this course, the students will Be able to understand 1. Genetics and molecular basis of microorganism. 2. Nucleic acid metabolism and DNA 3. Protein synthesis Gene Regulation 4. Mutation and recombination in Bacteria 5. Recombination DNA technology 6. Gene Interaction and Fingerprinting	
6	Credit Value	4	
7	Total Marks	Max, Marks: 30 + 70	Min. Passing Marks: 35

Part B-Content of the Course		
Total No. of Lectures-Tutorials- Practical (in hours per week): L-T-P:		
Unit	Topics	No. of Lectures 1 Hr each
1	Nitrogen, Nucleic acid Metabolism and DNA <ul style="list-style-type: none"> Nitrogen Metabolism, Nucleic Acid as genetic material DNA-Physical and Chemical Structure and different forms of DNA Types and Mechanism-Replication of DNA (Conservative, semi-conservative and dispersive mode of replication) DNA Replication in Prokaryotes and Eukaryotes DNA Topology, melting curve of DNA, & T_m Value Determination RNA-Structure and types of RNA 	12

2	Protein Synthesis and Gene Regulation <ul style="list-style-type: none"> • Ribosomes Structure and its role in protein synthesis • Protein Synthesis and operon concept lac and trip • Gene Structure and Function • Gene Regulation in Prokaryotes and Eukaryotes • Gene Expression Britten Davidson Model of Gene Expression 	12
3	Mutation and Gene Recombination in Bacteria <ul style="list-style-type: none"> • Mutation- Molecular Basis of Mutation, types of mutation. Mode of action of physical and chemical & biological mutagens. Reverse in mutation • Gene Recombination in bacteria, transformation, transduction, and conjugation. • Auxotrophs, Prototrophs and Ames test F Factor, Hfr-Strain • Genetic Mapping microbes and binary vectors. 	12
4	Recombinant DNA Technology <ul style="list-style-type: none"> • Isolation of DNA. Enzyme used in recombinant DNA • Technology • Plasmids and Binary vectors • Use of vectors PBR322, PUC, 8 phage vector m 13 λ(lambda). • Use of Bacteria & Virus engineering • Cosmid, phagemid Ti plasmid, SV40, gene cloning in Prokaryotes. 	12
5	Gene Interaction and Fingerprinting <ul style="list-style-type: none"> • Extrachromosomal Genetic Material • Genetic Interaction in microbes and analysis in microbial pathogen • Overlapping of gene and silent gene • DNA Profiling -DNA Fingerprinting • Transposons, Blotting, Southern and western • DNA Damage & Repair • rDNA Products- Insulin, Interference and immunotoxin 	12

Keywords /Tags: DNA Replication, Protein Synthesis, Mutation, Recombinant DNA Technology, Finger Printing

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Introduction to Molecular Biology and Genetic Engineering -Oliver Brandenberg, Alessandra Sensi, Kakoli Ghosh, Andrea Sonmino
2. Molecular Biology by David P Clarke, Michelle R Mcgehen
3. Molecular Cell Biology Two Vol Set by Mousumi Debnath
4. Cell and Molecular Biology- N Arumugam
5. Molecular Cell Biology by Darnel I James E
6. M.P. Hindi Grant academy Publications

2.Suggestivedigital platforms/weblinkswww.eshiksha.mg.gov.in

Suggested equivalent online courses: https://onlinecourses.swayam2.ac.in/cec22_bt05/12review

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 30 Marks University Exam (UE): 70 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	30	
External Assessment: University Exam Section Time: 03.00 Hours	Section (A): Very Short Questions (Each) Section (B): Short Questions Section (C): Long Questions	Total 70	
Any remarks/ suggestions:		30+ 70 = 100	

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Theory Paper

Part A Introduction		
Program: Degree	Class: B.Sc.	Year: III
		Session:2023-24
Subject: Industrial Microbiology		
1	Course Code	S3INMB2D
2	Course Title	Environmental Microbiology and Bioremediation Group A Paper II Theory
3	Course Type (Core Course/ Discipline Specific Elective/ Elective/ Generic	Discipline Specific Elective/DSE

	Elective/ Vocational/.....)	
4	Prerequisite (if any)	To study this course, a student must have had this subject Industrial Microbiology in Diploma.
5	Course Learning outcomes (CLO)	On successful completion of this course, the students will be able to: 1. Environmental Habitat of microbes 2. Physiological Adaptation of microbes 3. Water & Air Microbiology 4. Biogeochemical cycling (in relation to microbes) 5. Microbial bioremediation
6	Credit Value	4
7	Total Marks	Max. Marks: 30 + 70 Marks: 35
		Min. Passing

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical in hours per week): L-
T-P:

Unit	Topics	No. of Lecture s 1 Hour Each
1	<p>Habitat Environment of Microbes</p> <p>Terrestrial environment of microbes- Soil profile and soil microflora, physical and chemical characteristics of soil. Soil fertility and management of agricultural soil. Rhizosphere and</p> <ul style="list-style-type: none"> • phyllosphere. <p>Aquatic Environment -Water Borders and</p> <ul style="list-style-type: none"> • microflora of freshwater and marine habitats. <p>Atmospheric Environment-Different layers of atmosphere, and aero microflora and dispersal of</p> <ul style="list-style-type: none"> • microbes. <p>Extreme Habitats: Different unusual habitats and extremophiles - Microbes thriving at high and low temperature, pH, high hydrostatic and osmotic pressures. Salinity and low nutrient levels.</p> <p>Toxic Photosynthetic microbes-microbial succession in decomposition of plant organic matter.</p>	12

2	Physiological Adaptation of Microbes <ul style="list-style-type: none"> • Concept of environment in relation to microbes. Physiological adaptation in microbes. Nature of microbial population in different habitats. • Microbial Interaction -Mutualism, synergism, commensalism, competition, amensalism, neutralism. • Symbiotic and Asymbiotic interactions of microbes with plants and animals and their role in ecosystem stability. • Micro Organism- as Indicators • Biotransformation and Biodegradation- Biofilms of living surfaces, biodegradation of plastics. 	12
3	Water & Air Microbiology <ul style="list-style-type: none"> • Sources of Water distribution of microorganism in water system, water born disease. • Treatment and safety of drinking waterpotable water. Methods to detect potability of a water ssamples. MPN Analysis. Standard qualitative procedure, presumptive test. • Sampling of Airborne microorganisms. Analysis of bioaerosol samples &fate & transform of microorganism in airborne Bacteria & endotox in. • Air borne viruses. • Standard qualitative procedure presumptive test/MPN analysis. 	12
4	Biogeochemical Cycling <ul style="list-style-type: none"> • Carbon Cycle-Microbial degradation of cellulose, hemicellulose, lignin and chitin. • Nitrogen Cycle-Nitrogen fixation, ammonification, nitrifications, denitrification and nitrate reduction. • Phosphorus Cycle- Phosphate immobilization and solubilization • Sulphur Cycle- Microbes involved in Sulphur cycle • Microorganism in composting 	12
5	Microbial Bioremediations <ul style="list-style-type: none"> • A waste management: Source and types of solid waste of methods of solid waste disposal. (a)Liquid waste management- (b) Nature composition and strength of sewage. BOD&COD Primary, secondary tertiary treatment. • Management of municipal waste • Management of Agricultural waste • Biopesticides-Production of Agricultural bacterial, viral and fungus bio pesticides, microbial warfare on plants. • Micro Arrays- Design and use for agriculture & environmental application. • PCR- Agricultural & environment application for soil microbes • Environmental policies and laws 	12

	<ul style="list-style-type: none"> Remediation of organic and metal pollutants. 	
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Keywords/Tags: Environmental Habitats, Microbial Interaction, Waterborne and Airborne Microorganisms, Biogeochemical Cycle, Bioremediation

Part C- Learning Resources

Text Books Reference Books, Other resources

Suggested Books:

1. Environmental microbiology-A.H. Verma & M.G. Evans (Google Book)
2. Environmental Microbiology for engineers Volodmyr Vanov
3. A text book of environmental microbiology Pradipta K Mohapatra.
4. Manual of Environmental microbiology Christian J Tearst, Ronald L Crawford, Jay L Garland, David A Lipson.
5. Environmental Microbiology S.K Dwivedi
6. Environmental Microbiology Fundamentals and Applications Jean Claude Bertrand-Pierre Caumette, Philippe Lebaron, Robert Matheran.
7. Environmental Microbiology P.D. Sharma
8. Environmental Microbiology K. Vijaya Ramesh.
9. M.P. Hindi Granth academy Publications

Suggested digital platforms web links www.eshiksha.mp.gov.in

Suggested equivalent online courses:

<https://onlinecourses.nptel.ac.in/noc20eel7/preview><https://onlinecourses.nptel.ac.in/noc21bt22/preview>

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:100

Continuous Comprehensive Evaluation (CCE): 30 Marks University Exam(UE):70 Marks

Internal Assessment: Continuous <u>Comprehensive Evaluation (CCE)</u>	Class Test Assignment/Presentation	30
External Assessment: University Exam Section Time: 03.00 Hours	Section (A): Very Short Questions Section (B): Short	

	Questions Each) Section (C): Long Questions Each) 30+70=100	Total 70	
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