

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE



DEPARTMENT OF MICROBIOLOGY

Choice Based credit system

Outcome Based Education Syllabus

ACADEMIC YEAR 2020 - 2021

Programme Name : M.Phil. Microbiology

Programme Code : 56


Head

P.G. Research Department of Microbiology
Dwaraka Doss Goverdhan Doss
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Arumbakkam, Chennai-600 106.



PRINCIPAL
Dwaraka Doss Goverdhan Doss
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PART I

Course Title: Research methodology and its applications

Course Code : I	Credits : 04
L:T:P:S : 4:0:0:0	CIA Marks : 25
Exam Hours : 03	ESE Marks : 75

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the fundamental framework of research process, designs and methodologies.
CO2	Identify appropriate topics for research, various sources of information for literature review and data collection for organized conduct of research.
CO3	Appreciate the elements of scholarly writing and evaluate its quality and prepare a project proposal, formulate research synopsis and dissertation.
CO4	Acquainted with the key terminology, concepts, tools and techniques used in statistical analysis to analyze and interpret outcomes.
CO5	Adequate scientific understanding of the basic concepts in instrumentation used in research for both qualitative and quantitative analysis.
CO6	Develop an understanding of the varied aspects of Bioprocess Technology.
CO7	Briefing the techniques and tools associated with recombinant DNA technology.

Mapping of Course Outcomes to Program Outcomes & Program specific outcomes:

CO/PO/ PSO	PO					PSO					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	2	3	3	1
CO3	3	3	3	3	3	3	3	3	3	3	1
CO4	3	3	2	2	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	2
CO6	3	3	3	3	3	3	3	3	3	3	3
CO7	3	3	3	3	3	3	3	3	3	3	3

Sl. No.	CONTENTS OF MODULE	Hrs	Cos
1	Scientific Writing & ethics: An Insight into Research and research ethics: Definition and basic concepts, objectives, significance and techniques of research, finding research materials – literature survey, compiling records; Definition and kinds of scientific documents – research paper, review paper, book reviews, theses, conference and project reports (for the scientific community and for funding agencies); Components of a research paper– the IMRAD system, title, authors and addresses, abstract, acknowledgements, references, tables and illustrations, plagiarism; Dealing with publishers – submission of manuscript, ordering reprints Oral and poster presentation of research papers in conferences/symposia; Preparation and submission of research project proposals to funding agencies.	9	CO1, CO2, CO3
2	Biostatistics & computer application: Collection and classification of data – diagrammatic & graphical representation - Measurement of central tendency – standard deviation – correlation & regression student ‘t’ test, chi square test- analysis of variance; MS power point –Graphical presentation, chart and histogram- major search engines – web browsing – major websites, books & scientific information, scientific writing.	9	CO3, CO4
3	Research Techniques: Enzyme assay, enzyme activity and specific activity determination; Cell disintegration and extraction techniques, separation of proteins by fractionation (ammonium sulphate, organic solvents), Ion exchange chromatography, molecular sieve chromatography, affinity chromatography, paper chromatography, thin layer chromatography, ultra filtration, Ultracentrifugation; Gel electrophoresis, isoelectric focusing and immunoelectrophoresis, capillary electrophoresis, pulse field electrophoresis; Hyphenated techniques: HPLC, HPTLC, GC-MS, FTIR, Microscopy –Hr – SEM, Hr - TEM, Confocal	9	CO5
4	Bioprocess Techniques: Bioreactors - Solid State fermentation - Submerged fermentation; Strain improvement - Downstream processing of industrial products (Vitamin, Aminoacid, SCP, and Beverages).	9	CO6
5	rDNA Techniques: Restriction mapping - RFLP, Cloning strategies, DNA sequencing – manual and automated methods; Blotting methods - Northern, Southern, Western, Dot blotting and	9	CO7

hybridization; Polymerase Chain Reaction – principles, types and applications; Single locus and multi locus DNA finger printing - PCR based DNA finger printing; RAPD, AFLP, STRR and LTRR analysis.		
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TEXT BOOKS:

1. Gurumani N (2006), Research methodology for biological sciences.1st Edition, MJP Publishers, A unit of Tamilnadu Book House, ISBN:9783527295890 .
2. Des Higgins & Willie Taylor (2000), Bioinformatics: Sequence, structure and databanks. Oxford University Press, ISBN 10: 0199637903 ISBN 13: 9780199637904.
3. Arora PN & Malhon PK, (1996), Biostatistics. Imalaya Publishing House, Mumbai, ISBN Number : 978-93-5142-823-7.
4. John G Webster(2004).Bioinstrumentation .Student edition, John Wiley &sons, Ltd., ISBN 978-0-471-67600-3.
5. Palanivelu P (2001), Analitical biochemistry and separation Techniques A Laboratory manual. 2nd edition, Published by Tulsi Book Centre, Madurai, Tamilnadu, ISBN : 4567142233.
6. Jogdand SN (2004), Gene Biotechnology Published by Himalaya Publishing House, Mumbai, ISBN Number : 978-93-5262-087-6.

REFERENCE BOOKS:

1. Baxevanis, A.D. & Ouellette, B.F.F. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins – Wiley Interscience – New York, ISBN: 978-0-471-47878-2.
2. Cynthia Gibas & Per Jambeck (2001), Developing Bioinformatics Computer Skills: Shroff Publishers & Distributors Pvt. Ltd (O'Reilly), Mumbai, ISBN: 1-56592-664-1.
3. Zar, J.H. (2010). Biostatistical analysis. Prentice Hall, Upper saddle River, New Jersey, USA, ISBN, 0131008463.
4. Keith Wilson& John Walker (2010), Practical Biochemistry Principles & techniques.5th edition, Cambridge university press, ISBN 0-521-42809-2.

Course Title: Advances in Microbiology

Course Code : II	Credits : 04
L:T:P:S : 4:0:0:0	CIA Marks : 25
Exam Hours : 03	ESE Marks : 75

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Explicate the significance of laboratory and hospital acquired infections and carry out the importance of control and preventive measures of Emerging MDR and XDR microbes.
CO2	Explore the role of biological weapons and harmful microbes and discuss about the environmental aspects of emerging microbes.
CO3	Demonstrate bioactive compounds from Extremophiles and Decode the significance of Biosensors, Biofuels and Biofilms.
CO4	Point out quorum sensing in relation to barcoding of microbes, its application in clinical and industrial field.
CO5	Explain the importance of Single cell protein and microbial enzymes and explore the significance of Biofertilizers in response to crop yield.
CO6	Elucidate the quantitative and qualitative assays in antigen antibody reactions. Interpret various immuno assay methods. Illustrate HLA typing and ABO, Rh incompatibility testing and clarify Chemiluminescent detection of proteins.
CO7	Expound the role of Nanoparticles and comment on the significance of Nanomaterial in medical and environmental field.

Mapping of Course Outcomes to Program Outcomes & Program specific outcomes:

CO/PO/ PSO	PO					PSO					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2	3	3	2	3	3
CO2	3	3	3	3	2	3	1	3	2	3	3
CO3	2	3	3	2	2	3	3	3	3	3	3

CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	2	3	3	3	1	2	2	3	2
CO7	2	3	3	3	3	3	3	3	3	3	3

Sl. No.	CONTENTS OF MODULE	Hrs	Cos
1	Microbes and Health: Laboratory and hospital acquired infection; Emergence of MDR and XDR microbes; Harmful microbes and biological weapons; GLP, Automated diagnostic method; Recombinant vaccines; Environmental aspects of emerging diseases.	9	CO1, CO2
2	Current trends: Exploration of bioactive compound from Extremophiles; bio remediation, biosensors, biofuels, Biofilms, remote sensing microbiology, microbial communication - quorum sensing - Bar coding of microbes – application in clinical and industrial fields.	9	CO3, CO4
3	Microbial Products and their bioprocesses: Single cell protein – Chlorella, Spirulina, Yeasts and Mushrooms – SCP from wastes. Economic implications of SCP; Microbial production of enzymes – cellulases, proteases, lipase, Taq polymerase and restriction endonuclease; Production of wine, vinegar and alcohol; Biofertilizers – Cyanobacteria, Azospirillum, VAM and Azolla.	9	CO5
4	Immunotechnology: Diagnostic Immunology- methods for immunoglobulin determination – Quantative and qualitative antigen and antibody reactions; Agglutination and precipitation; Immunoflourescence, Immunoblotting, Immunometric methods, Enzyme immunoassays, flow cytometry- Assessment of human allergic diseases; Molecular methods- HLA typing; Immunohaematology- transfusion and compatibility testing, Transfusion reaction; Chemiluminescent detection of proteins.	9	CO6, CO7
5	Nanobiotechnology: Introduction and history of nanotechnology, Nanomaterials- nano wires, nanoclusters, carbon nanostructures and nanocomposites. Biological synthesis of nano materials - use of bacteria, fungi, actinomycetes and plants for nanoparticle synthesis; Applications of nanobiotechnology in medicine and environment; Challenges to nanotechnology.	9	CO8

TEXT BOOKS:

1. Jawetz, E., J.L. Melnick and E.A Adelberg, (2013), Medical Microbiology, 6th Edition, McGraw-Hill Company, ISBN: 978-0-07-179031-4.
2. John L. Havlin, Samuel L. Tisdale, Werner L. Nelson and James D. Beaton (2016), Soil Fertility and Fertilizers, Eighth Edition, Pearson Education India, New Delhi, India.
3. E Paul E, (2014), Soil Microbiology, Ecology and Biochemistry, Fourth Edition, Academic Press, Burlington, MA, USA, ISBN: 9780124159556.
4. Murty, B.S., Shankar,P., Baldev Raj, Rath, B.B. Murday, J.,(2013), Textbook of Nanoscience and Nanotechnology, Springer-Verlag Berlin Heidelberg, ISBN: 9783642280306 3642280307.

REFERENCE BOOKS:

1. Ananthanarayan and Jayaram Paniker (2013), “Text book of Medical Microbiology”,9th Edition, Orient Longman publications, ISBN: 978-9386235251
2. Murray, Rosenthal and Michael A. Pfaller,(2012),Medical Microbiology,7th Edition, Elsevier Sciences, ISBN, 0323091245, 9780323091244.
3. Poole, JR, (2014), Introduction to Nanotechnology, Wiley India PvtLtd.India, ISBN: 9788126510993.

Course Title: Industrial and Pharmaceutical Microbiology

Course Code: IIIA	Credits : 04
L:T:P:S : 4:0:0:0	CIA Marks : 25
Exam Hours: 03	ESE Marks : 75

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain insight on industrially important microbes, recent developments in fermentation processes and various optimization strategies at fermenter level.
CO2	Design, types of fermenters and various critical components of bioreactors, Comprehend the techniques and the underlying principles in downstream processing
CO3	Get introduced to various strategies of product recovery from fermentation at industrial level.
CO4	Elucidate various industrially relevant microbial products and their production process

CO5	Manifest Good Manufacture Practice (GMP), Good Laboratory practice (GLP) providing guidelines and better control for In – Process and Final Product Control
CO6	Acquire well-grounded knowledge and fully prepared for employment within the pharmaceutical and biomedical science industries

Mapping of Course Outcomes to Program Outcomes & Program specific outcomes:

CO/PO/ PSO	PO					PSO					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	2	2	3	3	3	3
CO2	3	3	2	3	3	3	3	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	2	3	3	3	3	2	1	2	2	3
CO6	3	2	3	3	3	2	2	2	2	2	3

Sl. No.	CONTENTS OF MODULE	Hrs	Cos
1	History and chronological development of industrial microbiology - Industrially important strains – Isolation and preservation. Inoculum development for various fermentation process. Strain development – mutation, recombinant DNA technology and plasmid fusion.	9	CO1, CO2, CO3
2	Fermentation – Submerged and solid state fermentation. Components of CSTR – types of fermentors (Tower, cylindroconical and airlift) – batch fermentation – continuous fermentation. Fermentor design – body construction – mass transfer – oxygen transfer – effect of viscosity – scale-up process.	9	CO3, CO4
3	Production of pharmaceutical Products - Production of antibacterial, antifungal and antiparasitic agents. Production of semi-synthetic antibiotics and anti cancerous agents. Production of Pharmaceutical Products like Streptokinase, Streptodornase, and Clinical Dextrin. Biosensors in pharmaceuticals.	9	CO5

4	Production of immunological products and their Quality control - Vaccines, New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials. immuno sera and immunoglobulins.	9	CO6
5	Quality assurance and Validation - Good Manufacture Practice (GMP), Good Laboratory practice (GLP) in Pharmaceutical Industry; Regulatory aspects of Quality control; Quality control in Pharmaceutical: In – Process and Final Product Control; Sterilization control: Physical, Chemical and Biological Indicators.	9	CO7

TEXT BOOKS:

1. W.B.Hugo & A.D.Russell, (2004), Pharmaceutical Microbiology Sixth edition. Blackwell scientific Publications, ISBN 0-632-06467-6.
2. Murray S.Cooper, (2003), Quality control in the Pharmaceutical Industry Vol.2. Academic Press New York, ISBN: 9788176710671.
3. H.J.Rehm & G.Reed, (2001), Biotechnology, Vol 4. VCH Publications, Federal Republic of Germany, ISBN:81-307-0128-6.
4. S.P.Vyas & V.K.Dixit. (2010), Pharmaceutical Biotechnology, CBS Publishers & Distributors, New Delhi, ISBN 13: 9788123906140.
5. Sydney H.Willig, Murray M.Tuckerman, William S.Hitchings IV, (1996), Good Manufacturing Practices for Pharmaceuticals Second Edition,. MerceL Dekker N.York, ISBN 10: 0824797701.

REFERENCE BOOKS:

1. Tim Sandle, Madhu Raju Saghee (2017). *Cleanroom Management in Pharmaceuticals and Healthcare*, Euromed Communications; 2nd Edition edition. ISBN-13: 978-0957349193.
2. Tim Sandle (2015). *Pharmaceutical Microbiology: Essentials for Quality Assurance and Quality Control*. Woodhead Publishing; 1 edition. ISBN-13: 978-0081000229
3. Stephen P. Denyer, Norman A. Hodges, Sean P. Gorman , Brendan F. Gilmore (2011). *Hugo and Russell's Pharmaceutical Microbiology*. Wiley-Blackwell. 8th edition. ISBN-13: 978-1444330632

Course Title: Bioremediation

Course Code: IIB	Credits : 04
L:T:P:S : 4:0:0:0	CIA Marks : 25
Exam Hours: 03	ESE Marks : 75

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the nature and importance of bioremediation and apply the concepts of bioremediation to the real time problems.
CO2	Acquainted with the process of bioremediation - mechanisms, types, monitoring strategies and success rate.
CO3	Impart sufficient scientific understanding of the current environmental tribulations and global concern.
CO4	Apply various techniques for bioassessment and biotreatability studies.
CO5	Understand the impacts of contaminant characteristics to bioremediation process.
CO6	Use microbes to abate or clean up contamination in real world applications.

Mapping of Course Outcomes to Program Outcomes & Program specific outcomes:

CO/PO/ PSO	PO					PSO					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	3	3	2	3	3	3	3	3	3
CO2	2	3	2	3	2	3	3	3	3	3	3
CO3	2	3	2	3	2	3	2	3	3	3	3
CO4	3	3	3	3	2	3	3	2	3	3	3
CO5	2	3	2	3	2	3	3	2	2	3	3
CO6	1	3	3	3	3	3	2	3	2	3	3

Sl. No.	CONTENTS OF MODULE	Hrs	Cos
1	Bioremediation- Definition - process and organisms involved;. Approaches to Bioremediation - Environmental modification. Microbial seeding. Bioengineering approaches to the bioremediation of pollutants - Intrinsic and engineered – Microbial aspects and metabolic aspects; Factors affecting the process; Efficacy testing-side effects testing.	9	CO1, CO2, CO3
2	Bioremediation of various ecosystem- contaminated aquifers Bioremediation of contaminated soils – Bioremediation of air pollutants - criteria for bioremediation-biological mechanism of transformation strategies for bioremediation.	9	CO3, CO4
3	Bioremediation of pollutants - Petroleum biodegradation - Biodegradation enhancement – stimulation of oil spills degradation.; reductive and aerobic dechlorination bioremediation of dyes, bioremediation of Pesticides bioremediation in paper and pulp industries; bioremediation of industrial effluents.	9	CO5
4	Xenobiotics- cometabolism and detoxification reactions. Biochemistry of xenobiotic metabolism. testing for biodegradability- A brief account of biodegradable plastics and super bug.	9	CO6
5	Biomagnification. Bioaccumulation- removal of heavy metals from effluents - Bioaugmentation; Ex-situ and in-situ processes - Major pollutants and polluted sites - Pollutants and associated risk Constraints and priorities of bioremediation.	9	CO7

TEXT BOOKS:

1. Larry L. Barton and Diana E. Northop, (2011), *Microbial Ecology*, Wiley-Blackwell publications.
2. Atlas Ronald, M., Bartha, and Richard,(1987),*Microbial Ecology*, 2nd Edition. Benjamin/Cummings Publishing Company: California, ISBN 981-405-344-9.
3. Forster, C.F. and John Wase, .D.A., (2010), *Environmental Biotechnology*. Ellis Horwood: England.

REFERENCE BOOKS:

1. Mitchel, R., (1992). *Environmental Microbiology*, Wiley – John Wiley and Sons. Inc. Publications: New York.
2. Gabriel Bitton,(2011),*Wastewater Microbiology*, Wiley-Blackwell publications.
3. Charles Gerday, Nicolas Glandsdorff, (2011), *Physiology and Biochemistry of extremophiles*, Wiley-Blackwell publications.