

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE



DEPARTMENT OF MICROBIOLOGY

Choice Based credit system

ACADEMIC YEAR 2018 - 2019

Programme Name : M.Phil. Microbiology

Programme Code : 56

Head

P.G. Research Department of Microbiology
Dwaraka Doss Goverdhan Doss
Vaishnav College (Shift II)
Arumbakkam, Chennai-600 106.

PRINCIPAL

Dwaraka Doss Goverdhan Doss
Vaishnav College
Arumbakkam, Chennai - 600106.

Paper-I

RESEARCH METHODOLOGY AND ITS APPLICATIONS

Unit I Scientific Writing: An Insight into Research: 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; 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.

Unit II 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.

Unit III 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.

Unit IV: Bioprocess Techniques: Bioreactors - Solid State fermentation - Submerged fermentation; Strain improvement - Downstream processing of industrial products (Vitamin, Aminoacid, SCP, and Beverages).

Unit V: rDNA Techniques: Restriction mapping - RFLP, Cloning strategies, DNA sequencing – manual and automated methods; Blotting methods - Northern, Southern, Western, Dot blotting and 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.

References:

1. Arora PN & Malhon PK, (1996) Biostatistics. Imalaya Publishing House, Mumbai.
2. Sokal & Rohif, (1973) Introduction to Biostatistics Toppan Co. Japan.
3. Stanton A & Clantz, Primer of Biostatistics — The McGraw Hill Inc., New York.
4. Baxevanis, A.D. & Ouellette, B.F.F. (2001). Bioinformatics: A practical guide to the analysis of genes and proteins – Wiley Interscience – New York
5. Cynthia Gibas & Per Jambeck (2001) Developing Bioinformatics Computer Skills: Shroff Publishers & Distributors Pvt. Ltd (O'Reilly), Mumbai
6. Des Higgins & Willie Taylor (2000) Bioinformatics: Sequence, structure and databanks. Oxford University Press
7. Zar, J.H. (1996). Biostatistical analysis. Prentice Hall, Upper saddle River, New Jersey, USA
8. John G Webster(2004).Bioinstrumentation .Student edition, John Wiley &sons, Ltd.
9. Keith Wilson& John Walker (2003) Practical Biochemistry Principles & techniques.5th edition, Cambridge university press.
10. Grumani N (2006) Research methodology for biological sciences.1st Edition, MJP Publishers, A unit of Tamilnadu Book House.
11. Jogdand SN (2004) Gene Biotechnology Published by Himalaya Publishing House,Mumbai.
12. Palanivelu P (2001)Analitical biochemistry and separation Techniques A Laboratory manual. 2nd edition, Published by Tulsi Book Centre, Madurai, Tamilnadu.
13. Karp, G. 1999. Cell and Molecular Biology – Concepts and experiments. 2nd edn. 14. Kleinsmith, L. J. & Kish, V.M. 1995. Principles of Cell and Molecular Biology. 2nd edn., McLaughlin, S., Trost, K., Mac Elree, E. (eds.), Harper Collins Publishers, New York.

Course Outcome

At the end of the course, the student will be able to

- To execute research by applying the principles of research methodology.
- To apply various analytical techniques for research.
- Explore and recognize the statistical modeling and computer application concepts for research.

Paper - II

ADVANCES IN MICROBIOLOGY

UNIT I 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.

UNIT II 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.

Unit III: 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*

Unit IV: Immunotechnology: Diagnostic Immunology- methods for immunoglobulin determination – Quantative and qualitative antigen and antibody reactions; Agglutination and precipitation; Immunofluorescence, 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.

Unit V: 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.

References

1. Jawetz, E., J.L. Melnick and E.A Adelberg, (1998). Review of Medical Microbiology (19th Edition). Lange Medical Publications, ELBS, London.
2. Chakraborty, P., (2003). A text book of Microbiology (2nd Edition). Published by New central book agency (P) Ltd., Kolkata.
3. Glick, B.R., (2003). Molecular Biotechnology. Principles and Applications of Recombinant DNA. (3rd Edition). ASM Press, Washington DC.
4. Jognand, S.N., (2004). Gene Biotechnology. Himalaya Publishing house, Mumbai.
5. Webster, J.G., (2004). Bioinstrumentation. Student edition, John Wiley and Sons Pvt Ltd., University of Wiscosins.
6. Palanivelu, P., (2001). Analytical biochemistry and separation techniques – A Laboratory Manual (2nd Edition). Tulsi book centre (Publication), Madurai, Tamilnadu.
7. Purohit, S.S., (2003). Phamaceutical microbiology.
8. Young, M.M. (Ed.), (2004). Comprehensive Biotechnology. The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Elsevier India Private Ltd, India.
9. Prave, P., U. Faust, W. Sittig and D.A. Sakatsch (Ed.), (2004). Fundamentals of Biotechnology. Panima Publishing Corporation, India.
10. Mansi, E.M.T.E.L. and C.F.A. Bryle, (2002). Fermentation Microbiology and Biotechnology. Taylor & Francis Ltd, UK.]

11. Crueger, W. and Crueger, A., (2000). Biotechnology: A Textbook of Industrial Microbiology. Panima Publishing Corporation, India.

12. Stanbury, P.F., A. Whitaker and S.J. Hall, (1997). Principles of Fermentation Technology. Aditya Books Pvt Ltd, India.

Course Outcome

At the end of the course, the student will be able to

- Understand the concepts and significance of industrially important products from microbes.
- Describe the different biofuels, their advantages and applications.
- Exemplify the effect of biomolecules and nanoparticles to imply on innovative applications.

Paper – III

GUIDE PAPER

Paper – III (A)

Industrial and Pharmaceutical Microbiology

Unit I: 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.

Unit II: 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.

Unit III: Downstream process – Intracellular and extracellular product separation. Liquid extraction, precipitation and floatation. Purification by different methods. Concentration by precipitation, ultra-filtration, reverse osmosis. Drying and crystallization.

Unit III: 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.

Unit IV: 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.

Unit V: 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.

References

- 1 . Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications.
2. Analytical Microbiology –Edt by Frederick Kavanagh Volume I & II. Academic Press New York.
3. Quinolone antimicrobial agents – Edt. by David C. Hooper, John S.Wolfson .ASM Washington DC.
4. Quality control in the Pharmaceutical Industry - Edt. by Murray S.Cooper Vol.2. Academic Press New York.
5. Biotechnology – Edt. by H.J.Rehm & G.Reed, Vol 4. VCH Publications, Federal Republic of Germany.
6. Pharmaceutical Biotechnology by S.P.Vyas & V.K.Dixit. CBS Publishers & Distributors, New Delhi.

7. Good Manufacturing Practices for Pharmaceuticals Second Edition, by Sydney H. Willig, Murray M. Tuckerman, William S. Hitchings IV. MerceL Dekker N. York.
8. Advances in Applied Biotechnology Series Vol 10, Biopharmaceuticals in transition. Industrial Biotechnology Association by Paine Webber. Gulf Publishing Company Houston.
9. Drug Carriers in biology & Medicine Edt. by Gregory Gregoriadis. Academic Press New York.

Course Outcome

At the end of the course, the student will able to

- Identify the ethics of significant unit processes used in downstream processing for a range of commercially significant products.
- Formulate antibiotics, therapeutic enzymes and immunological products and apply Standard procedures in pharmaceutical industry
- Build knowledge with the basics of Pharmaceutical safety regulations, control agencies of quality control and gain knowledge about sterilization control.

Paper – III (B)

Bioremediation

Unit I: 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.

Unit II: Bioremediation of various ecosystem - Contaminated aquifers Bioremediation of contaminated soils – Bioremediation of air pollutants - criteria for bioremediation-biological mechanism of transformation strategies for bioremediation

Unit III: 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.**

Unit IV: Xenobiotics- cometabolism and detoxification reactions. Biochemistry of xenobiotic metabolism. Testing for biodegradability- A brief account of biodegradable plastics and super bug.

Unit V: 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.

Reference:

1. Atlas and Bartha. 1992. Microbial Ecology. Fundamental and applications. Benjamin/Cumming. Red wood city
2. J.J. Glick and Pastner J.J. 1994. Molecular biotechnology ASM press Washington DC
- Josdand, S.N. 1995. Environmental Biotechnology. Himalaya Publishing House, Bombay.
3. Soli J Arceivala. 1998. Waste water treatment for pollution control. 2nd edition. TataMcGraw Hill publishing company Ltd
4. Pandey A, Lasroche C, Soccol C. R and Dussop C. G. Advances in Fermentation technology (2008). Asiatech publishers Inc.
5. Mathuriya A. S. Industrial Biotechnology (2009) Ane Books Pvt. Ltd.
Alexander Glazer., Microbial Biotechnology.

Course Outcome

At the end of the course, the student will be able to

- To understand the importance and concepts of bioremediation process.
- Provide appropriate scientific knowledge on real-world applications of bioremediation.