

**DEPARTMENT OF MICROBIOLOGY**  
**FACULTY OF ARTS, SCIENCE AND HUMANITIES**  
**RESEARCH PROGRAM – M.Phil / PhD in microbiology**  
**(2018–2019 Batch and onwards)**

<b>Course code</b>	<b>Name of the course</b>	<b>Instruction hours/ week</b>	<b>Credits</b>	<b>Maximum Marks (100)</b>
18RMB101	Research methodology and pedagogy	4	4	100
18RMB201	Recent trends in microbiology	4	4	100
18RMB301	Industrial and pharmaceutical Microbiology	4	4	100
18RMB302	Immunotechnology and biotechnology			
18RMB303	Virology			
18RMB304	Medical microbiology			
<b>Program Total</b>		<b>12</b>	<b>12</b>	<b>300</b>

**18RMB101 PAPER – I: RESEARCH METHODOLOGY AND PEDAGOGY 4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0****Marks: External: 100 Total: 100****End Semester Exam: 3 Hours****UNIT – I (Spectroscopy and Chromatography)**

Spectroscopy: Principles and instrumentation and applications of UV-Visible light spectroscopy, UV-Visible absorption spectroscopy, Spectrofluorimeter, Atomic spectroscopy, IR spectroscopy, NMR spectroscopy and MALDI-TOF. Chromatographic techniques: Principles of column chromatography. Instrumentation of Low pressure liquid chromatography (LPLC), High performance liquid chromatography (HPLC) Fast protein liquid chromatography (FPLC), Perfusion chromatography, Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, Gas chromatography (GC – MS).

**UNIT – II (Research design)**

Research: Scope and significance – Types of Research – Research Process – Characteristics of good research – Problems in Research – Identifying research problems. Research Designs – Features of good designs. Sampling design: Meaning – Concepts – Steps in sampling – Criteria for good sample design.

**UNIT – III (Sample design and analysis)**

Scaling measurements – Techniques – Types of scale. Correlation – Meaning and definition - Scatter diagram –Karl pearson's correlation coefficient. Rank correlation. Regression: Regression in two variables – Regression coefficient problems – uses of regression. Hypothesis testing – Errors in Hypothesis testing - large sample test (Z – test) single and two tailed test, Small sample test (t – test)-Single mean-Two mean-Paired t-test, F – test, Chi-square test –Single variance-Goodness of fit, SPSS Software, Anova – one way and two way. – CRD, RBD Designs. RSM (Response Surface Methodology). Thesis report writing.

**UNIT – IV (Computer Applications)**

Spreadsheet tool - Introduction to spreadsheet application, features and functions, using formulas and functions, data storing, features for statistical data analysis, generating charts/ graph and other features. Tools used may be Microsoft Excel, Open office or similar tool. Presentation tool - Introduction to presentation tool, features and functions, creating presentation, customizing presentation, showing presentation. Tools used may be Microsoft Power Point, Open Office or similar tool. Web Search - Introduction to internet, use of internet and WWW, using search engine like Google, Yahoo etc, using advanced search techniques. Plagiarism software, Literature search, Endnote, Mendeley and its application.

**UNIT – V (Pedagogical Methods in Higher Learning)**

Historical Perspectives – Objectives and role of Higher Education – Learning and Learning Hierarchy – Information processing – Learning Events and Outcomes – Motivation. Education Evaluation: A Conceptual Framework – Methods of Evaluation – Self Evaluation and Student Evaluation in Higher Education – Question Banking – Diagnostic Testing and Remedial Teaching.

**REFERENCES:**

1. Boyer, R. 2006 Modern Experimental Biochemistry. 3<sup>rd</sup> Edition. Addison Wesley Longman. New Delhi.
2. Wilson, K and J. Walker 2006. Principles and techniques of biochemistry and molecular biology, 6<sup>th</sup> Low Price Edition, Cambridge University Press, India
3. David Friedfelder 2001. Physical Biochemistry. 5<sup>th</sup> Edition Oxford Publishers. New York.
4. Kothari, C. R. 2005. Research Methodology-Methods and Techniques, Wiley International Ltd, UK
5. S. Palanichamy and M. Manoharan 2001. Statistical methods for biologists, Palani Paramount Publications, Palani.
6. R. Rajaram, 2008. Basic Computer Science and Communication Engineering Second Edition. SCITECH Publication India Private Limited, Chennai, India.

**18RMB201 PAPER – II: RECENT TRENDS IN MICROBIOLOGY 4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0****Marks: External: 100 Total: 100****End Semester Exam: 3 Hours****UNIT – I (General Microbiology)**

History of Microbiology, microbial groups and their taxonomic position, in relation to other living organisms. Prokaryotes and eukaryotes. Classification and nomenclature of bacteria. Structure, morphology and reproduction of bacteria, fungi, yeast, algae, protozoa, mycoplasma, rickettsiae. Viruses – structure and life cycle of bacteriophage. Microbial growth-physical conditions required for bacterial growth. Ecosystems – concepts, structure and function of major ecosystems. Types – Terrestrial, aquatic, marine. Nutrient cycles.

**UNIT – II (Microbial physiology and genetics)**

Structure and function of cell organelles. Fundamentals of cell organelles. Enzymes and factors affecting enzymatic reactions. Fundamentals of bioenergetics, glycolysis, Krebs cycle, oxidative phosphorylation, Anaerobic respiration, fermentation. Structure and functions of DNA and RNA. Genetic code, protein synthesis, mutations. Genetic recombination methods in bacteria-transformation transduction and conjugation. Mendelian Genetics, Basics of Molecular Genetics, Genetics Engineering and recombinant DNA technology.

**UNIT – III (Medical Microbiology)**

Diseases caused by microbes in humans. Collection – transportation – handling and examination of pathological specimens – methods of isolation, identification and interpretation of pathogenic organisms – Antibiotic susceptibility testing. Bacterial infections - *Staphylococcus sp.*, *E.coli.*; Protozoan infections - *Entamoeba histolytica*, *Ascaris lumbricoides*, *Wuchereria bancrofti.*; Viral infection – *HIV*, *Hepatitis*; Fungal infection – *Aspergillosis*.

**UNIT – IV (Environmental Microbiology)**

Aquatic environment - microbiology of water - water pollution and water borne pathogens. Bacteriological examination of water, indicator organism. Microbiology of sewage - Chemical and biochemical characteristic of sewage. Methods of sewage treatment - physical screening, chemical, Biological (sludge digestion; activated sludge, aerating filters, oxidation pond)

**UNIT – V (Patenting and IPR)**

Patenting – fundamental requirements – multicellular organisms and its patenting. Patenting the genes, Regulating - recombinant technology, Food and food ingredients. Discrepancies in biotechnology / chemical patenting. IPR – historical perspective – recent developments – IPR in India, IPR and the rights of farmers in developing countries.

**REFERENCES:**

1. Prescott, M., J.P Harley and D.A. Klein 1993. Microbiology. 2<sup>nd</sup> Edition, McGraw-Hill Inc. New York
2. Micheal T. Madigan, J.M. Martinko and J.Parker 2003. Brock Biology of Microorganisms. 10<sup>th</sup> Edition. Prentice Hall. New Jersey
3. Shuler, M.L. and F. Kargi 2005. Bioprocess engineering basic concepts. Pearson Education, New Delhi.
4. Hugo, W.B and A.D. Russell 2007. Pharmaceutical Microbiology, 7<sup>th</sup> Edition, Publisher Blackwell Science Ltd.
5. Ananthanarayanan R and C.K. Jayaram Panicker 2005. Text Book of Microbiology. 7<sup>th</sup> Edition. Orient Longman. New Delhi.
6. Jawetz, E.; J.L., Melnic and E.A. Adelberg 2001. Review of Medical Microbiology. 22<sup>nd</sup> Edition Lange Medical Publishers, New York.
7. Glick,B.K and Pasternak,J.J. 2003. Molecular Biotechnology: Principles and applications of recombinant DNA” 3<sup>rd</sup> Edition. ASM Press, Washington
8. Jagadish Chander. 1996. A Text book of medical Mycology. Interprint, New Delhi
9. Parija, S, C. 1996. Text Book of Medical Parasitology, Orient Longmans, Chennai, India.

**18RMB301 PAPER – III: INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY 4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0****Marks: External: 100 Total: 100****End Semester Exam: 3 Hours****UNIT – I**

History and chronological development of industrial microbiology. Industrially important strains – Isolation and preservation. Inoculum development for various fermentation processes. Strain development – mutation, recombinant DNA technology and protoplast fusion

**UNIT – II**

Fermentation – submerged and solid state fermentation. Types of fermentors (Tower, cyllindroconical and airlift) – batch fermentation – continuous fermentation. Fermentor design – body construction – mass transfer – oxygen transfer – effect of viscosity – scale-up process.

**UNIT – III**

Production of beverages: beer and wine, Vitamin: B12 and riboflavin, Antibiotics: penicillin and streptomycin, Production of enzymes: amylase and proteases. Free cell immobilization and enzyme immobilization techniques. Production of Single cell protein – bakers yeast, spirulina, red algae. Downstream process – intracellular and extracellular product separation. Liquid extraction, precipitation and floatation.

**UNIT – IV**

Clinical uses of antimicrobial drugs, Microbial spoilage and preservation of pharmaceutical products, Sterilization of pharmaceutical products, Applications of microorganism in the pharmaceutical sciences

**UNIT – V**

Role of precursors and steering agents in production of antibiotics, vitamins and enzymes. Antiseptics-disinfectants - preparation, standardization. Quality control of Pharmaceutical products – Injectables, IV fluids and pyrogen testing.

**References**

1. Patel, A.H. 2003. Industrial microbiology, Macmillan India Ltd. New Delhi
2. Prescott and Dunn's 1983. Industrial microbiology, CBS Publishers, New Delhi
3. Stanbury, P.T. and A. Whitaker 2005. Principles of Fermentation Technology, Pergamon Press, NY
4. Atlas R.N and R. Bartha 2007. Microbial Ecology-Fundamental and Applications. 4<sup>th</sup> Edition. Redwood City CA. Benjamin/Cumming Science Publishing Co., New Delhi
5. Michael J Waites 2007. Industrial microbiology, Blackwell publishing.UK
6. Mansi, E.M.T. and C.F.A. Bryce 2000. Fermentation Microbiology and Biotechnology, Taylor and Francis, New York.
7. Shuler, M.L. and F. Kargi 2005. Bioprocess engineering basic concepts. Pearson Education, New Delhi.
8. Hugo, W.B. and A.D. Russell 2007. Pharmaceutical Microbiology, 7<sup>th</sup> Edition, Blackwell Science Ltd, Oxford.

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**18RMB302 PAPER – III: IMMUNOTECHNOLOGY AND BIOTECHNOLOGY 4H – 4C****Instruction Hours / week: L: 4 T: 0 P: 0****Marks: External: 100 Total: 100  
End Semester Exam: 3 Hours****UNIT – I**

Cells and Organs of immune system, T / B cell – maturation, activation – receptor, Cytokines – structure and functions, Antigen – Structure and chemical make-up, Immunoglobulin – structure - Organization and expression of Immunoglobulin genes, Purification of antigens and immunoglobulins., MHC – structure and functions, HLA tissue typing,

**UNIT – II**

Antigens - Antibody reactions, *In vitro* methods – Agglutination – Passive and reverse passive agglutination, Precipitation – reactions in gels – Immuno diffusion – Counter immuno electrophoresis, Complement fixation test, Immunofluorescence, ELISA, RIA, Immuno electron microscopy, Forensic serology.

**UNIT – III**

Introduction to genetic engineering, Restriction enzymes – types and nomenclature - classification – and uses, Cloning Vectors – types of vectors, Prokaryotic hosts: *E. coli*, Eukaryotic hosts: Yeast cell. Gene cloning - construction of cDNA and genomic libraries - selection and screening method of recombinants - Screening of recombinants for Site directed Mutagenesis by SSCP, heteroduplex analysis.

**UNIT – IV**

Isolation of DNA and RNA – Handling and quantification of nucleic acids, radiolabelling and non radiolabelling of nucleic acids, Gel electrophoresis - Blotting techniques, Hybridization and heteroduplex analysis, Molecular diagnostics of genetic disease using PCR / OLA, DNA diagnostic system in forensic sciences.

**UNIT – V**

Genetic engineering of plants and animals: Gene transfer techniques into plant and animal cell. Plants as tool for recombinant protein production; Development and use of transgenic animals; transgenic mice – methodology and applications. Ethical issues of gene cloning.

**REFERENCES**

1. Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne 2000. Kuby Immunology. 5<sup>th</sup> Edition. W.H. Freeman and Company, New York.
2. Frank C. Hay and Olwyn M.R. Westwood 2002. Practical Immunology. 4<sup>th</sup> Edition, Blackwell Science Ltd. Oxford.
3. Roitt, I.M. Brostoff, J.J. and D.K. Male 2000. Immunology. 6<sup>th</sup> Edition. C.V. Mosby Publishers. St. Louis.
4. Winnacker, E.L. 2003. From genes to clones. Introduction to Gene Technology. 1<sup>st</sup> Edition VCH. Weinheim.

5. Brown, T.A. 2006. Gene Cloning and DNA analysis; An Introduction. 5<sup>th</sup> Edition. Blackwell Publishing, UK
6. Glick, B.K and J.J. Pasternak 2003. Molecular Biotechnology. Principles and applications of recombinant DNA. 3<sup>rd</sup> Edition. ASM Press, Washington
7. Old, R.M and S.B. Primrose 2003. Principles of Gene manipulation. 6<sup>th</sup> Edition. Blackwell Scientific Publication. London.
8. Watson, J.D., M. Gilman, J. Wikowski 2001. Recombinant DNA. 2nd Edition. Scientific American Books. W.H. Freeman & Co. NY.



18RMB303

PAPER – III: VIROLOGY

4H – 4C

**Instruction Hours / week: L: 4 T: 0 P: 0****Marks: External: 100 Total: 100****End Semester Exam: 3 Hours****UNIT -I**

History of Virology, Brief outline of virology: discovery of virus, General properties of viruses, Classification of viruses, Preservation of viruses, & Cultivation of viruses.

**UNIT -II**

Viruses & Human diseases: DNA viruses: Pox virus, Herpes virus, adenovirus. Papova virus, Hepadna virus, Pathogenesis & Laboratory diagnosis.

**UNIT -III**

Viruses & Human diseases: RNA viruses: Orthomyxo viruses, Paramyxo viruses, Influenzae and other arthropod born viruses, Retroviridae. Emerging Viral infection – SARS-CoV, Bird flu and Nipha Virus.

**UNIT - IV**

Virus – Host interaction, immunity to viral diseases. Antiviral agents and Viral Vaccines. Immunization Schedules.

**UNIT -V**

Epidemiology and Laboratory diagnosis of viruses: Electron microscopy, molecular and sero diagnosis of viral infections, PCR; Sequencing & genotyping.

**REFERENCES**

1. Medical Virology – Morag C, and Timby M.C. X Edition (1994) Churchill Livingstone, London.
2. Introduction to Modern Virology – Dimmock N.J. Primrose SB. IV Edition (1994). Blackwell Scientific Publications, Oxford.
3. Virology – Contrat H.F. Kimball PC and Levy JA. IIIrd Edition. (1994). Prentice Hall, Englewood cliff, New Jersy.
4. Principles of Bacteriology, Virology and Immunology – Topley & Wilson's (1995). Edward Arnold, London.
5. Virology -3<sup>rd</sup> Edition 1996, Fiels DN (Edn.) Lippincott – Raven.
6. Principles of Virology -2<sup>nd</sup> Edition 2004, SJ Flint Edn. ASM Press.
7. Clinical Virology -2<sup>nd</sup> Edition 2002, Doughlas D Richman (Edn.) ASM Press.
8. Essentials of Diagnostic Virology – 2000, Gregory A Storch, Churchill Livingstone.
9. Principles of Molecular Virology, 1997. 2<sup>nd</sup> ed. A.Cann. Academic Press.
10. David Greenwood, Richard C.B, Slack, John Forest Peuthere (1992). "Medical Microbiology". 14<sup>th</sup> Edn. ELBS with Churchill Livingstone.

18RMB304

PAPER – III: MEDICAL MICROBIOLOGY

4H – 4C

**Instruction Hours / week: L: 4 T: 0 P: 0****Marks: External: 100 Total: 100****End Semester Exam: 3 Hours****UNIT – I**

Laboratory precaution and guidelines – collection – transportation – handling and examination of pathological specimens – methods of isolation, identification and interpretation of pathogenic organisms – Antibiotic susceptibility testing. Infections – types – methods – Infectious disease cycle. Quality control in microbiology lab and automation in medical microbiology.

**UNIT – II**

Gram positive organisms: Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis and Treatment. *Staphylococcus* sp., *Streptococcus* sp., *Bacillus* sp., *Corynebacterium* sp., *Clostridium* sp. and *Mycobacterium* sp.

**UNIT – III**

Gram negative organisms: Morphology, cultural characteristics, antigenic property, pathogenicity, laboratory diagnosis and Treatment. *E.coli*, *Klebsiella* sp., *Proteus* sp., *Pseudomonas* sp., *Vibrio* sp., *Salmonella* sp., *Shigella* sp., *Treponema* sp., *Neisseria* sp. and *Haemophilus* sp. MDR, XDR and PDR.

**UNIT – IV**

Superficial mycosis - *Pityriasis versicolor*, *Tinea nigra*, *pedra*. Cutaneous mycosis Dermatophytes. Systemic mycosis - Coccidiomycosis - Blastomycosis – Histoplasmosis. Opportunistic mycosis, Candidosis, Aspergillosis, Zygomycosis. Subcutaneous mycosis – Sporotrichosis, Chromoblastomycosis and Mycetoma.

**UNIT – V**

Protozoan infections - *Entamoeba histolytica*, *Plasmodium vivax*, *Plasmodium falciparum*, *Giardia intestinalis*, *Trichomonas vaginalis*, *Taenia solium*. Trematodes - *Fasciola hepatica*, *Schistosoma haematobium*, Nematodes - *Trichuris trichiura*, *Ascaris lumbricoides*, and *Wuchereria Bancrofti*.

**REFERENCES**

1. Ananthanarayanan, R. and C.K.J. Panicker, 2005. Text Book of Microbiology 7<sup>th</sup> Edition. Orient Longman, New Delhi.
2. Brook, G.F., J. S. Butel, A. Stephen and Morse, 2003. Medical Microbiology, 22<sup>nd</sup> Edition. Mc Graw Hill.
3. Chakraborty, P., 2003. A Text book of Microbiology. 2<sup>nd</sup> Edition. New Central Book Agency (P) Ltd., Calcutta.
4. Chander, J., 2002. A Text book of Medical Mycology. Interprint Mehta Publishers, New Delhi.

5. Chatterjee, K.D., 1980. Parasitology in relation to medicine. 12<sup>th</sup> Edition, Chatterjee Medical Publishers, Calcutta.
6. Churin, J., 2000. Parasitology. New York Publishers, London.
7. Dismukes, W.E., P.G. Pappas and D. Sobel, 2003. Clinical Mycology. Oxford University Press, UK.
8. Jawetz, E., J.L. Melnic and E.A. Adelberg, 2001. Review of Medical Microbiology. 22<sup>nd</sup> Edition. Lange Medical Publishers. New York.
9. Mehrotra, R.S. and K.R. Aneja, 2007. Introduction to Mycology. New Age International Ltd. New Delhi.
10. Panjarathinam, R., 2007. Text book of Medical Parasitology, 2<sup>nd</sup> Edition. Orient Longman Publishers. New Delhi.
11. Parija, S.C., 2000. A Text book of Medical Parasitology .All India Publishers and Distributors, New Delhi.