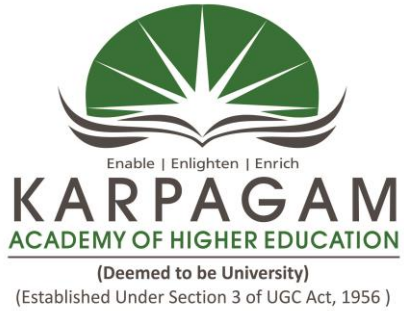
KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

Established Under Section 3 of UGC Act, 1956)

Eachanari (Post), Coimbatore – 641 021.



M.Phil. / Ph.D. MICROBIOLOGY

SYLLABUS

(Effective from the Academic year 2021 – 2022 and onwards)

DEPARTMENT OF MICROBIOLOGY

2021 – 2022

DEPARTMENT OF MICROBIOLOGY
FACULTY OF ARTS, SCIENCE AND HUMANITIES
RESEARCH PROGRAM – PhD in Microbiology
(2021–2022 Batch and onwards)

Course code	Name of the course	Instruction hours/ week	Credits	Maximum Marks (100)
21RMB101	Research Methodology and Pedagogy	4	4	100
21RMB201	Research and publication ethics	4	4	100
21RMB301	Industrial and Pharmaceutical Microbiology	4	4	100
21RMB302	Immunotechnology and Biotechnology			
21RMB303	Virology			
21RMB304	Medical Microbiology			
Program Total		**12**	**12**	**300**

21RMB101 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, ES bound X ray spectroscopy, Red and blue shift, R and B bands various transition compounds, Vibrational spectroscopy, different vibrations, 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), High performance Thin Layer Liquid Chromatography (HPTLC), 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)

Concepts of data base management brief idea of data types, data structures, searching, sorting, designing a data base, genomic, proteomic databases. Computer analysis of genetic sequences: general concepts of sequence analysis identification of functional sequences, homology, brief idea of BLAST, ENTREZ and PUBMED. 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. 3rd Edition. Addision Wesley Longman. New Delhi.
2. Wilson, K and J. Walker 2006. Principles and techniques of biochemistry and molecular biology, 6th Low Price Edition, Cambridge University Press, India
3. David Friedfelder 2001. Physical Biochemistry. 5th 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.

21RMB201 PAPER – II: RESEARCH AND PUBLICATION ETHICS 4H – 4C

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

UNIT I:Philosophy and Ethics

Introduction to Philosophy : Definition, nature and scope, concept, branches – Ethics: Definition, moral philosophy, nature of moral judgments and reaction.

UNIT II:Scientific Conduct

Ethics with respect to science and research – Intellectual honesty and research integrity – scientific misconduct: Falsification – Fabrication – Fabrication and Plagiarism (FFP) – Redundant publications: duplicate and overlapping publication-salami slicing- selective reporting and misrepresentation of date.

Unit III :publication Ethics

Publication Ethics: Definition , introduction and importance- Best practices/ standards setting initiatives and guidelines : COPE, WAME, etc. – Conflicts of interest – publication misconduct: definition , concept , problems that lead to unethical behavior and vice versa, type- violation of publication ethics , authorship and contributing and appeals- predatory publishers and journals.

Unit IV :Publication misconduct

Group discussions : Subject specific ethical issues, FFP, authorship – conflicts of interest-complaints and appeals : examples and fraud from India and abroad.

Unit V : Development of e-content &**IPR**

Database : indexing database- citation database : web of science , scopus, etc.
Research Metrics : impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score – Metrics: h-index, g index, g index, I 10 index, altmetrics.

Unit VI : Development of e- content & IPR

Integrated Library Management System (ILMS) : e-journals – e-books – e-shodhsindu – shodhganga – database – e-content development – Learning Management system (LMS) – e-PG – Pathshala – CEC (UG) SWAYAM – MOOCs – NPTEL – NMEICT. IPR : Patent – Copyrights- trademark – Geographical Indication.

PRACTICE:

Open access publishing

Open access publications and initiatives-SHERPA/RoMEO online resource to check polisher copyright & self -archiving policies-software tool to identify predatory publications developed by SPPU-Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

21RMB301 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 fermentation: batch, fedbatch and continuous fermentation and solid state fermentation. Types of fermentors (Tower, cylindroconical and airlift) – batch fermentation – continuous fermentation. Fermentor design – body construction – mass transfer – oxygen transfer – effect of viscosity, Aeration, Agitation, pH – 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, floatation and filtration: Micro filtration and Ultra filtration.

UNIT – IV

Chemotherapeutic agents; Antimicrobial agents, sulfa drugs, antibiotics- penicillin and cephalosporin; classification of antibiotics; antibiotics from prokaryotes; mode and action of antibiotics, origin of drug resistance, mechanism action of drug resistance. 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. 4th 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, 7th Edition, Blackwell Science Ltd, Oxford.

21RMB302 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, RT PCR, Inverse PCR, Nested PCR, Multiplex PCR, Expression cassette PCR, Real time PCR. Applications – gene cloning, DNA sequencing, genome mapping 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. 5th Edition. W.H. Freeman and Company, New York.
2. Frank C. Hay and Olwyn M.R. Westwood 2002. Practical Immunology. 4th Edition, Blackwell Science Ltd. Oxford.
3. Roitt, I.M. Brostaff, J.J. and D.K. Male 2000. Immunology. 6th Edition. C.V. Mosby Publishers. St. Louis.

4. Winnacker, E.L. 2003. From genes to clones. Introduction to Gene Technology.1st Edition VCH. Weinhein.
5. Brown, T.A. 2006. Gene Cloning and DNA analysis; An Introduction. 5th Edition. Blackwell Publishing, UK
6. Glick, B.K and J.J. Pasternak 2003. Molecular Biotechnology. Principles and applications of recombinant DNA. 3rd Edition. ASM Press, Washington
7. Old, R.M and S.B. Primrose 2003. Principles of Gene manipulation. 6th 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.

21RMB303 **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

Virology methods: Cultivation and purification of viruses, *In vitro* and in ovo system for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation. Epidemiology and Laboratory diagnosis of viruses: Electron microscopy, molecular and serodiagnosis 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 -3rd Edition 1996, Fiels DN (Edn.) Lippincott – Raven.
6. Principles of Virology -2nd Edition 2004, SJ Flint Edn. ASM Press.
7. Clinical Virology -2nd 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. 2nd ed. A.Cann. Academic Press.
10. David Greenwood, Richard C.B, Slack, John Forest Peuthere (1992). "Medical Microbiology". 14th Edn. ELBS with Churchill Livingstone.

21RMB304 **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 (Blood, Urine, Stool and sputum) – 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., *Pseudomona*s 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, piedra.* 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 7th Edition. Orient Longman, New Delhi.
2. Brook,G.F., J. S. Butel, A. Stephen and Morse, 2003. Medical Microbiology, 22nd Edition. Mc Graw Hill.
3. Chakraborty, P., 2003. A Text book of Microbiology. 2nd 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. 12th Edition, Chatterjee Medical Publishers, Calcutta.
6. Chunin, 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. 22nd 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, 2nd Edition. Orient Longman Publishers. New Delhi.
11. Parija, S.C., 2000. A Text book of Medical Parasitology .All India Publishers and Distributors, New Delhi.