KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

Eachanari (PO), Coimbatore – 641 021.

Part -I - M. Phil. / Ph.D. – Syllabus

MICROBIOLOGY

Paper – I: Research Methodology and Pedagogy 16RMB101

(Effective from the academic year 2016-2017 onwards)

COURSE OBJECTIVE:

This course is designed to enable students to:

- Identify and discuss the role and importance of research in the social sciences.
- Identify and discuss the issues and concepts salient to the research process.
- Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
- Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.
- To discuss the principle and working mechanisms of instrumentation and its application.
- To prepare a project proposal by using various research designs
- To organize and conduct research (advanced project) in a more appropriate manner

COURSE OUTCOMES:

1. Students will be able to explain key research concepts and issues
2. Students will be able to read, comprehend, and explain research articles in their academic discipline.
3. Understanding the nature of problem to be studied and identifying the related area of knowledge.
4. Reviewing literature to understand how others have approached or dealt with the problem.
5. Collecting data in an organized and controlled manner so as to arrive at valid decisions.
6. Analyzing data appropriate to the problem and making generalizations.

UNIT – I (Spectroscopy and Chromatography)

Spectroscopy: Principles and instrumentation and applications of UV-Visible light 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, Anova – one way and two way. – CRD, RBD Designs. Thesis report writing.

UNIT – IV (Computer Applications)

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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.

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
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4. David Friedfelder 2001. Physical Biochemistry. 5th Edition Oxford Publishers. New York.
5. Kothari, C. R. 2005. Research Methodology-Methods and Techniques, Wiley International Ltd, UK
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MICROBIOLOGY

Paper – II: Subject Paper: Recent trends in Microbiology 16RMB201

(Effective from the academic year 2016-2017 onwards)

COURSE OBJECTIVE:

- The objective of the course is to equip the students to gain bimolecular knowledge and analytical skills at an advanced level.
- Emphasizes to apply knowledge acquired about prokaryotic and eukaryotic cellular processes, interaction of microorganisms among themselves, with physical and chemical agents and higher order organisms in environment and biological systems to various conditions.
- The students will acquire the skills to qualify for a broad range of positions in research, industry, consultancy, education and public administration, or for further education in a doctoral program.
- Students will be able to address broad range of fields including microbial physiology, environmental microbiology, food science, microbiology, microbial genetics, molecular biology and systems biology.
- Knowledge provided will be on the understanding on the fundamental principles of microbiology.
- The main knowledge provided will be of the main microbiological techniques to be applied in the laboratory.

COURSE OUTCOMES:

1. Students will be developing skills to identify and evaluate critically the principles and the mechanisms underlying the different fields of microbiology.
2. Analyse different applications of microbiology in industry and medicine.
3. Students able to acquired knowledge to use bacteria in lab and sterilization techniques.
4. Design an experiment to test a hypothesis or fundamental concept in microbiology and perform basic microbiological lab techniques.
5. Upon completion, students gained the knowledge of most common medically important organism and the infections they cause.
6. Different approaches, techniques and tools used to identify pathogens and control them.

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 conjucation. Mendelian Genetics, Basics of Molecular Genetics, Genetics Engineering and recombinant DNA technology.

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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:

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

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Paper – III: Special Paper I: Industrial and Pharmaceutical Microbiology 16RMB301
(Effective from the academic year 2016-2017 onwards)

COURSE OBJECTIVE:

- Enable Graduates to enter industry with an appropriate level of understanding of the need for both the science.
- Ability to apply the techniques used in industries.
- To produce new drug.
- To equipped with a theoretical and practical understanding of industrial microbiology.
- To enable the inoculum development for various fermentation process.
- Appropriate use of free cell immobilization and enzyme immobilization.

COURSE OUTCOMES:

1. Students are capable of describing a large number of substrates that are used for the industrial fermentation processes.
2. Have developed an understanding of different types of reactors or fermenters which are used for laboratory, pilot and industrial scale fermentations and their processes parameters.
3. Have acquired a detailed knowledge of number of products which are produced by industrial fermentation processes.
4. Know about design of bioreactor, factors affecting growth and production.
5. Understand the rationale in medium formulation and design for microbial fermentation, sterilization of medium and air.
6. Discuss microbial contamination, product spoilage and antimicrobial preservation of cosmetic products.

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, cylindroconical 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.

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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
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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
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8. Hugo, W.B. and A.D. Russell 2007. Pharmaceutical Microbiology, 7th Edition, Blackwell Science Ltd, Oxford

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Paper – III: Special Paper II: Immunotechnology and Biotechnology 16RMB302

(Effective from the academic year 2016-2017 onwards)

COURSE OBJECTIVE:

- To provide students with a foundation in immunological processes and critical thinking.
- To provide students with knowledge on how the immune system works building on their previous knowledge from biochemistry, genetics, cell biology and microbiology
- To be able to clearly state the role of the immune system, compare and contrast the innate versus adaptive immune systems
- To be able to articulate the roles of innate recognition receptors (i.e. Toll-Like Receptors) in immune responses
- To be able to compare and contrast humoral versus cell-mediated immune responses and to distinguish various cell types involved in immune responses and associated functions.
- Students be able to understand the role of cytokines in immunity and immune cell activation and identify and characterize cytokines of particular immune importance.

COURSE OUTCOMES:

1. Conceptualized the protective role of the immune system of the host and developed an understanding of the basic components.
2. The mechanisms underlying the immune system and its response to pathogenic microorganisms.
3. Students able to conduct experiments for growing common bacteria in different microbiological media, antibiotic sensitivity determination and antigen antibody reaction (precipitation test in the agarose).
4. Understand the significance the Major Histocompatibility Complex in terms of immune response and transplantation.
5. Emphasize to describe lymphocyte development and the expression of their receptors.
6. Have a knowledge to provide an overview of the interaction between the immune system and pathogens.

UNIT – I

Cells and Organs of immune system, T / B cell – maturation, activation – receptor, Cytokines – structure and fuctions, 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

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MICROBIOLOGY

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. 5th Edition. W.H. Freeman and Company, New York.
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Paper III Special Paper III: Virology 16RMB303

(Effect from the academic year 2016-2017 onwards)

COURSE OBJECTIVE:

- To describe the structure and replication strategies of the individual viruses discusses including the processes of entry into cells, control of gene transcription.
- To define the process of virus latency and describe in molecular terms control of the process and activation of viral genomes during reactivation.
- To describe the growth behavior differences between normal cells and cells transformed by oncogenic DNA and RNA viruses.
- Perform laboratory investigations for the diagnosis of infectious diseases caused by viruses.
- Identify various viral diseases of human, different diagnostic techniques and also with various methods involved in infection control
- Describe the processes involved in the anti-tumor effects of "anti-tumor" viruses.

COURSE OUTCOMES:

1. Students able to explain the rationale behind the Baltimore classification system of viruses and present example viruses for each Baltimore group
2. Students able to explain viral replication strategies and compare and contrast replication mechanisms used by viruses relevant for human disease
3. This course has been intended to provide the learner insights into helpful areas of virology which plays an essential role in application-oriented biology.
4. Provides computational skill on used for laboratory diagnosis of viral infections.
5. Able to describe viral strategies to evade host immune and cellular factors.
6. Coherently analyse and report outcomes of virological research in oral and written output

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.

UNIT - IV

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

UNIT -V

Part -I - M. Phil. / Ph.D. – Syllabus

MICROBIOLOGY

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

(Effective from the academic year 2016-2017 onwards)

REFERENCES

1. Review of Medical Microbiology: Jawetz & Melnick -21st Edn. (2000) Lange Medical Publications.
2. Medical Virology – Morag C, and Timby M.C. X Edition (1994) Churchill Livingstone, London.
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7. Diagnostic Procedures for viral and Ricketsial diseases – Lennetter EH. (1984). American Public Health Association. N.Y.
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Part -I - M. Phil. / Ph.D. – Syllabus

MICROBIOLOGY

Paper – III: Special Paper IV: Medical Microbiology 16RMB304

(Effective from the academic year 2016-2017 onwards)

COURSE OBJECTIVES

- Medical Bacteriology introduces basic principles and then applies clinical relevance of many etiological agents responsible for global infectious diseases.
- The infectious disease cycle of the pathogens enables to solve the epidemics.
- The territory covered by infections and the immune response
- We focus on pathogenic mechanisms in order to foster a student's ability to solve problems in their future clinical career and able to establish the medical laboratory.
- This course provides learning opportunities in the basic principles of medical microbiology and infectious disease
- It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.

COURSE OUTCOMES

1. Demonstrate an understanding at an advanced level of microbial virulence mechanisms and host response toinfection.
2. Application of molecular techniques to medical microbiology; biochemical and genetic mechanisms of antimicrobial agent activity, microbial susceptibility and resistance to antimicrobialagents.
3. Demonstrate an understanding of skin and respiratory tract infections (microbial causes, pathogenesis, transmission of infection, diagnosis, prevention and treatment) by being able to identify a unknown organisms in clinical samples, and describe the pathogenesis of important pathogens.
4. It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.
5. To understand the importance of pathogenic bacteria in human disease with respect to infections of. the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue
6. Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.

UNIT – I

Laboratory precaution and gidelines – 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, pathogenecity, laboratory diagnosis and Treatment. *Staphylococcus* sp., *Streptococcus* sp., *Bacillus* sp., *Corynebacterium* sp., *Clostridium* sp. and *Mycobacterium* sp.

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UNIT – III

Gram negative organisms: Morphology, cultural characteristics, antigenic property, pathogenecity, 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.

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*.

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