

SYLLABUS FOR Ph.D. COURSE WORK MICROBIOLOGY

(Under Revised Ordinance 16 notified vide letter no/Acad./2018/1944 dated 24/05/2018)
(Academic Session 2018 – 2019 & Onwards)

SCHEME OF EXAMINATION

Number & Title of the Paper	Credit	End Semester Exam		
		Maximum Marks	Minimum Marks	Total
PAPER I RESEARCH METHODOLOGY	4	100	50	100
PAPER II REVIEW OF PUBLISHED RESEARCH IN RELEVANT FIELD (IN THE FORM OF THESIS)	3	100	50	100
PAPER III COMPUTER APPLICATIONS	3	100	50	100
PAPER IV APPLIED MICROBIOLOGY	3	100	50	100
PAPER V COMPREHENSIVE VIVA VOCE (VIRTUAL CREDITS)	3	100	50	100

*SCHEME OF EXAMINATION AS APPROVED BY EXECUTIVE COMMITTEE OF THE UNIVERSITY

PAPER – I RESEARCH METHODOLOGY

Unit – I

Sampling technique, sterilization technique, various methods for isolation of pure culture, methods for measurement of microbial growth, manipulation of environment, nutritional and genetic parameters, maintenance and preservation of microbes (pure culture). Introduction to cell & tissue culture. Design & lab setup of tissue culture laboratory, Tissue culture media (Composition preparation), Types of culture.

Unit - II

Chromatographic techniques – Gel filtration, ion exchange chromatography, hydrophobic interaction and reverse phase chromatography, affinity chromatography, gas chromatography, high performance liquid chromatography, fast protein liquid chromatography; Application in separation of proteins.

Unit - III

Molecular Biology and spectroscopic techniques – Comet Assay; Real time PCR; RAPD, RFLP, ARDRA and Fluorescence *in situ* hybridization techniques. Atomic absorption spectroscopy, infrared spectroscopy, nuclear magnetic resonance spectroscopy, mass spectrometry including ESI MS and MALDI-TOF MS and Applications.

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Unit - IV

Electrophoretic and centrifugation techniques - SDS and Native PAGE, Agarose gel electrophoresis, isoelectric focusing and two-dimensional electrophoresis, proteome analysis; Differential and density gradient centrifugation, analytical ultracentrifugation, separation of DNA/RNA using ultracentrifugation technique, determination of molecular weight and Sedimentation coefficient.

Unit - V

Quantitative methods; Principles and Designs of Experiments; Tools Parametric and Non~parametric statistics. Confidence interval, Errors. Levels of significance, Regression and Correlation coefficient. Analysis of variance - one way and two way classifications; Multiple Comparisons – Least Significant Difference Test, Duncan’s New Multiple Range Test; Factorial Analysis; Analysis of Covariance.

**PAPER-II
REVIEW OF PUBLISHED RESEARCH IN RELEVANT FIELD
(IN THE FORM OF THESIS)**

**PAPER - III
COMPUTER APPLICATION**

Unit - I

Features and applications related to presentation of text in suitable format and saving the MS WORD data for future applications. Practical knowledge of MS Word to type the script, insert tables, figures and graphs to prepare thesis and research papers in presentable format.

Unit – II

Construction of spreadsheets from the experimental data. MS EXCEL design and application of formula for calculations and their applications to the experimental data. Use of statistical tools, preparation of graphs, histograms and charts.

Unit – III

Preparation of powerpoint presentations based on the topic of research. Insertion of MS power point figures, graphs, charts in presentation. Preparation of scientific posters for presentations. Use of various presentation techniques.

Unit – IV

Method of preparing data sheets and entering the data according to its characteristics. Use of SPSS & various statistical tools on SPSS. Internet Overview of networking, Internet and its

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applications. Applications exploring various websites and search engines for collecting quality literature and secondary data related to research work.

Unit – V

Data processing, Data mining; Bioinformatics – concept and applications; Biological databases – Primary and Secondary; Sequence Databases (EMBL, GenBank, DDBJ, SWISS-PROT, PIR, TrEMBL); Protein Family/Domain Databases (PROSITE, Pfam, PRINTS & SMART); Structure Database (PDB); Tools like BLAST, FASTA and EMBOS.

PAPER-IV APPLIED MICROBIOLOGY

Unit –I

Sources and characters of industrial microbes, Screening of useful strains: Strain improvement through random mutation (random & rational selection), Role of genetic recombination & genetic engineering in strain improvement.

Unit –II

Fermentation :Principle, Types of Fermentation Metabolisms: Aerobic ,Anaerobic Fermentation Process :Selection of substrate in culture medium, pH, Antifoaming Agents, Air, Steam, Fermentation vessels, Shakers flasks, Type of Fermentations: Solid State Fermentation, Semi continuous Fermentation, Continuous Fermentation, Type of Fermentors: Stirred Tank Fermenters, Air-lift Fermenters, Fixed Bed Fermenters, Tower Fermenters, Batch Culture Fermentation, Fed-batch Culture Fermentation, Fixed volume fed-batch, Variable Volume Fed-Batch,Continuous Culture Fermentation: Chemostat Turbidostat , Sterilization , Product Recovery :Precipitation, Solvent Extraction, Ion Exchange

Unit –III

Production, harvest, recovery, uses and mode of action- enzymes, antibiotics, vitamins (812,82) organic acids (acetic acid, lactic acid, citric acid), alcohol (ethanol), organic solvents (acetone- butanol), amino acids, beverages (beer, wine, brandy), microbial supplements (Lactic acid bacteria) as medicine, biopolymer, biofertilizers, biocides, Steroid biotransformation.

Improvement in production - improved strains by protoplast fusion, recombination, Alteration in metabolic pathway; immobilization of cells.

Fermented foods, fermented milk, butter & cheese

Unit –IV

Bioremediation: biodegradability of Petroleum hydrocarbons, Halocarbons, Chlorophenols, Nitroaromatics; Applicability of bioremediation: Intrinsic bioremediation, Biostimulation,

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Bioaugmentation. Applications of bioremediation to various contaminants & sites: Hydrocarboncontaminated soils & aquifers, Halocarbon-contaminated soils & aquifers, Marine oil spills & Metal-contaminated soils; Carbon sequestration
Microorganisms as biofertilizers (*Rhizobium*, *Azospirillum*, *Azotobacter*, *Acetobacter*, Cyanobacteria, Mycorrhiza, Actinorrhiza and Phosphate solubilising microorganisms) and biopesticides (*Trichoderma*, *Beauveria*, *Metarhizium*, *Nomuraea* and *Bacillus thuringiensis*); Commercial production of biofertilizers and biopesticides; Their applications and limitations for Indian agriculture. Principles and mechanism of biological control. Bioherbicide and weed control, their role in agriculture.

Unit –V

Biofuels: From organic residue (ethanol), biogas production, fuel from algae. Production of bioethanol from molasses, starchy and cellulosic materials. Intellectual Property Rights (IPR), Patents, Trademarks, Copyrights. Introduction to Patenting of Microbiological materials and GMO, implication of patenting, current issues, patenting of genes and DNA sequences.

DNA/ Protein micro-arrays- DNA/ Protein Markers- DNA finger printing- Gene knockout - RNAi and Gene silencing- Metagenomics, application of metagenomic libraries, Metabolic engineering.

PAPER-V COMPREHENSIVE VIVA VOCE

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