

## SYLLABUS FOR Ph.D. COURSE WORK BIOTECHNOLOGY

(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      |
| <b>PAPER I</b><br>RESEARCH METHODOLOGY  | <b>4</b> | <b>100</b>        | <b>50</b>     | <b>100</b> |
| <b>PAPER II</b><br>REVIEW OF PUBLISHED RESEARCH<br>IN RELEVANT FIELD<br>(IN THE FORM OF THESIS) | <b>3</b> | <b>100</b>        | <b>50</b>     | <b>100</b> |
| <b>PAPER III</b><br>COMPUTER APPLICATIONS   | <b>3</b> | <b>100</b>        | <b>50</b>     | <b>100</b> |
| <b>PAPER IV</b><br>ADVANCES IN BIOTECHNOLOGY  | <b>3</b> | <b>100</b>        | <b>50</b>     | <b>100</b> |
| <b>PAPER V</b><br>COMPREHENSIVE VIVA VOCE<br>(VIRTUAL CREDITS)                                  | <b>3</b> | <b>100</b>        | <b>50</b>     | <b>100</b> |

**Note : Aggregate passing marks 55 %**

**\*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 ADVANCES IN BIOTECHNOLOGY**

#### **Unit –I**

Fermentation : Aerobic ,Anaerobic Fermentation Process :Selection of feed-stock, pH, Antifoaming Agents, Air ; Type of Fermentations: Solid State Fermentation, Semi continuous Fermentation, Continuous Fermentation, Chemostat Turbidostat.

Type of Fermentors: Stirred Tank Fermentors, Air-lift Fermentors, Fixed Bed Fermentors, Tower Fermentors, Batch Culture Fermentation, Fed-batch Culture Fermentation, Fixed volume fed-batch, Variable Volume Fed-Batch, Product Recovery : Precipitation, Solvent Extraction, Ion Exchange

#### **Unit –II**

Principles of enzymatic analysis- handling enzymes and coenzyme, Biotechnological application of enzymes: Large- scale production of enzymes- Immobilized enzymes - Enzyme utilization in industry- Enzymes and recombinant DNA technology- Applications in medicine. Applications in industry.

#### **Unit –III**

Xenobiotics -microbial remediation; Microbial mining, ore leaching, oil recovery; solid waste treatment- composting, vermicomposting, biofuel, animal feed, mushroom cultivation, oil spill remediation, biomedical waste treatment; Wastewater treatment primary, secondary and tertiary , heavy metal removal, industrial waste treatment.

#### **Unit –IV**

Transgenic plants: Genetic engineering of plants for herbicide resistance, Pest resistance, virus resistance, Disease resistance, Stress tolerance, Cytoplasmic male sterility, Delayed

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fruit ripening. Genetic engineering in floral industries, Genetic engineering of seed storage proteins. Vaccine production in plants, Edible vaccine, Transgenic plants as bioreactors.

**Unit –V**

Transgenic animal, production, and application, Transgenic animals as Models for human disease, Transgenic animals in live- stock improvement, expression of the bovine growth hormone, Transgenics in industry, Ethical issues in animal biotechnology.

**PAPER-V**  
**COMPREHENSIVE VIVA VOCE**

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