

## SYLLABUS FOR Ph.D. COURSE WORK ENVIRONMENTAL SCIENCE

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

**\*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 ENVIRONMENTAL SCIENCE**

#### **Unit –I**

**Population Ecology:** Characteristics, Growth, Self-regulation, fluctuations, r and K strategists; Interactions: Intra- and Inter-specific competitions, Negative relations, Positive relations, Morphological integrations between Mutualists; Community Ecology: characteristics, classification, indices, Super-organismic and Gradient Concepts, Development and Evolution, Climax vs. Relative Stability.

#### **Unit –II**

**Ecosystems:** Components and Processes, Major biomes of the World; Energy Flow: Types, Models, Ecological Pyramids, Ecological Efficiencies; Nutrient Cycling: Exchanges and internal cycling, Recycling pathways, Global Cycles of Carbon, Nitrogen, Phosphorus and Sulfur; Relationship between energy flow and recycling pathways.

#### **Unit –III**

**Pollution:** Concept, Types, Management strategies; Air, Water, Soil and Urban Pollution: Causes, Control, case studies; Waste Management: Disposal, Minimization, Conversion and Treatment; Ozone Holes, Photochemical Smogs, Global Warming.

#### **Unit –IV**

**Resources:** Types, conventional and non-conventional, classification; Conservation: Sustainable Development, in-situ and ex-situ conservation, preservation plots, national parks, sanctuaries, gardens, hot spots; Conservation and Management of resources from forests, ranges, wetlands, freshwater and marine ecosystems;

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**Ecology:** concept, techniques, applications, ecological modeling, Restoration Ecology & Systems Ecology; Remote Sensing: Concepts and applications, platforms, sensors, visual and digital interpretation of remotely sensed data, thematic mapping, Indian Remote Sensing Programme; International Treaties and Programmes for Management of Global Environment and Ecosystem Services.

**PAPER-V  
COMPREHENSIVE VIVA VOCE**

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