

## Ph.D. Course Work 2012

### Sub : Biotechnology

#### Important points to be noted:

- ☐ Duration of Course Work : One Semester (6 Months)
- ☐ Total Marks : 200 (Four papers 50 Marks Each)
- ☐ Passing marks will be: 40 %.
- ☐ Duration of Examination: 2 Hrs. for each paper

**Paper I:** Research Methodology : 50 Marks

**Paper II:** Subject paper -I : 50 Marks

**Paper III :** Subject paper – II : 50 Marks

**Paper IV:** Review of literature : 50 Marks

Subject Course Work: 100 Marks (2 Hrs.)

- ☐ Examination will be held at the end of the Semester.

- ☐ Total Lecture Hour (periods) for Paper II (elective units): 60 (sixty).

#### Scheme of Examination of Pre-Ph.D. (Course Work) Examination

Paper No.	Nomenclature of the Paper	Internal Assessment	Theory (Written Exam)	Max. Marks	Lectures (One hour per lecture)
Paper I	Research Methodology	-	50	50	42
Paper II (Subject)	Subject Paper – I	-	50	50	25
Paper III (Subject)	Subject Paper – II	-	50	50	25
Paper IV	Review of Literature	50	-	50	60

Paper No.	Nomenclature of the Paper	Internal Assessment	Theory (Written Exam)	Max. Marks	Lectures (One hour per lecture)
Paper I	Research Methodology	-	50	50	42

## Paper-I – Research Methodology

### Unit - 1

1. **Introduction to Research Methodology:** Meaning, Objectives, Significance, Types
2. **Research Problem:** Definition, testing and procedures

### Unit-2

1. **Hypothesis:** Definition, testing and procedures
2. **Research Design/Plan:** Meaning, need and features, Basic principle of experimental signs

### Unit-3

1. **Data collection/data analysis:** Tools for data collection
2. **Statistical Applications:** Mean, Median, Mode, Mean Deviation & Standard deviation, Correlation and Regression, Probability distributions ,chi square test, z test, t test, two sample t test, paired-t test

### Unit- 4

1. **Report Writing:** Types of Reports, Research Report Format, Referencing, Bibliography, Appendices
2. **Computer Applications:** Fundamentals of Computers, Operating systems, use of software (MS-Office, SPSS)

### Unit-5

1. **Safety and safety measures:** Introduction, safety of individuals/laboratory/community/environment
2. **Code of Ethics/ethics of research/good laboratory practices:** IPR and record keeping/archives

### References:

1. Methodology of Research in Social Sciences by O. R. Krishnaswamy and M. Rangnatham Himalaya publication House, 2005, ISBN: 8184880936
2. Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers, ISBN:81-224-1522-9
3. Statistical Methods for Research Workers by Fisher R. A., Cosmo Publications, New Delhi ISBN:81-307-0128-6
4. Design and Analysis of Experiments by Montgomery D.C. (2001), John Wiley, ISBN: 0471260088
5. SPSS online manual
6. MINITAB online manual

Paper No.	Nomenclature of the Paper	Internal Assessment	Theory (Written Exam)	Max. Marks	Lectures (One hour per lecture)
Paper II (Subject)	Subject Paper – I	-	50	50	25

## PAPER II

### Unit I- Microscopy

Different types of microscopic techniques (Light microscope, Compound microscope, dark field microscope, Phase contrast microscope, Normaski microscope, Confocal microscopy, Transmission electron microscopy (TEM) and scanning electron microscopy (SEM)), Cells sorting flow cytometry, Inverted microscope, Stereoscopic microscope.

### Unit II- Molecular Biology

Nucleic Acid isolation, Polymerase chain reaction, DNA sequencing techniques (PCR, RT-PCR, Restriction analysis, DNA fragmentation analysis, Hybridization techniques), Gene cloning, Gene expression, Molecular Markers; RAPD, RFLP, AFLP Techniques.

### Unit III- Immunological Techniques

Routes of immunization, Types of adjuvant and their importance, Antigen- Antibodies interaction, Monoclonal and Polyclonal Antibodies, ELISA techniques, principle and applications, Immunoradiometric Assay: Principles and applications, Hybridoma technology.

### Unit IV- Animal Biotechnology

Gene therapy, Stem cell in therapeutics, Oncogenes, Tumor Suppressor Genes and Cancer Biology, AIDS and other Immuno-deficiency diseases, observation of cultured cell.

### Unit V-Developmental Processes

Gametogenesis collection and maintenance of eggs and embryos, Induced breeding; Embryonic development of frog, chick and mice. In vitro fertilization, Study of cleavage, fate map techniques (Use of vital dyes in embryonic development), embryonic induction competence, Techniques of whole mounts preparation of chick embryos/embryo culture, Study of Morphogenesis and Growth. Demonstration of Cell death during development., Study of differentiation, Trans-differentiation, Homeotic transformation, Homeo box, Multipotency, Totipotency, Regeneration, Plasticity and reprogramming of differentiated cells, Role of hormones in development, Hormonal regulation of reproduction; Implantation preparation for surrogate mother, Tissue transplantation techniques.

Paper No.	Nomenclature of the Paper	Internal Assessment	Theory (Written Exam)	Max. Marks	Lectures (One hour per lecture)
Paper III (Subject)	Subject Paper – II	-	50	50	25

## **PAPER III**

### **Unit I-Spectrometry**

pH measurement, buffers, Estimation of macromolecules (Protein, Carbohydrate and Nucleic Acid), Enzymes kinetics, Colorimetry- Ultraviolet-visible spectrophotometry; Principle, instrumentation and application, Fluorescence spectrophotometry, Mass spectrophotometry, NMR.

### **Unit II- Bio-separation Techniques**

Chromatography techniques, Principles and different types (Affinity chromatography, Ion-exchange chromatography, Gel-exclusion chromatography, Gas chromatography, HPLC, TLC, Paper chromatography), Isolation of natural products (extraction, purifications and separation). Electrophoretic techniques, Iso-electrofocusing, 2D-gel, 2DIE.

### **Unit III- Bioinformatics**

Major Bioinformatics resources (NCBI, EBI, Ex-PASy); Sequence and structural database; Sequence analysis, (Bio-molecular sequence file formats, Scoring matrices, Sequence alignment, phylogeny); Genomics and Proteomics (Large scale genome sequencing strategy; Comparative genomics; Understanding DNA microarrays and protein arrays) Characterization and production of recombinant therapeutic proteins.

### **Unit IV- Microbial Technology**

Microbial production, purification and bio-process applications of industrial enzymes; Production and purification of recombinant proteins on a large scale, Enzymes for industry/ medicine, Immobilized enzyme technology, Designer enzymes-biosensors, Bioremediation of contaminated soil and waste land. Waste Management Strategies, Kinetics of microbial growth, Biopesticides in integrating pest management, Bio-energy, Bio-diesel: Tree borne and algal oils and Trans-esterification. Hydrogen and Electricity from microbes, Biosafety in relation to recombinant organisms and transgenic research application, Social and ethical issues.

### **Unit V- Plant Biotechnology**

Special features and organization of plant cell; Totipotency; Regeneration of plants; Plant products of industrial importance; Biochemistry of major metabolic pathway and products; Autotrophic and Heterotrophic growth, Plants growth regulators and elicitors; Cell suspension culture development: methodology, kinetics of growth and production formation, nutrients optimization; Production of secondary metabolites by plant suspension culture, Hairy root culture and their cultivation, techniques in raising transgenic, Molecular forming, edible vaccines, therapeutics from transgenic plants, biodegradable plastics.

### **References**

1. Wilson and Walker's Principles in Biochemistry
2. Kuby's Immunology
3. Russel and Sambrook's Molecular Cloning
4. Basic Biotechnology --- Colin Ratlidge and Bjorn Kristiansen, Cambridge University press 2006.
5. Biotechnology and Bio-Pharmaceuticals-Rodney J.Y.Ho and Milo Gibaldi, Wiley Liss 2003
6. Culture of animal cells--- Ian Freshney, Wiley Liss 2006
7. Microbial Biotechnology--- Alexander N Glazer & Hiroshi Nikaido, Cambridge University Press, 2006

Paper No.	Nomenclature of the Paper	Internal Assessment	Theory (Written Exam)	Max. Marks	Lectures (One hour per lecture)
Paper IV	Review of Literature	50	-	50	60

#### PAPER – IV

Review of literature.