

## **M.D. UNIVERSITY, ROHTAK SCHEME**

### **OF STUDIES & EXAMINATION**

#### **Doctor of Philosophy (Ph.D.) - BIOTECHNOLOGY,**

**Jan,17 to Dec,17**

- i) The duration of the Ph.D. course will be of one semester.
- ii) Review should be submitted within month after the final examination is over and the candidate will give Presentation on the topic of review in the presence of Committee consisting of faculty members and one external examiner.
- iii) The qualifying marks in each paper of the course work shall be 50%.

<b>S. No.</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Marks of</b>	<b>Marks of Examination</b>		<b>Total Marks</b>	<b>Duration of Exam</b>	
<b>1</b>	<b>17BTEPCC1</b>	<b>Research Methodology</b>	<b>20*</b>	<b>80</b>		<b>100</b>	<b>3</b>	
<b>2</b>	<b>17BTEPCC2</b>	<b>Review writing and</b>	<b>----</b>	<b>40 Presentation</b>	<b>60 Review</b>	<b>100</b>	<b>3</b>	
<b>3</b>	<b>17BTEPCC3</b>	<b>Advances in Biotechnology</b>	<b>20*</b>	<b>80</b>		<b>100</b>	<b>3</b>	
			<b>40</b>	<b>260</b>		<b>300</b>		

\*Two assignments of 10 marks each.

## 17BTEPCC1 Research Methodology

**Note for the paper-setter:** Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

Marks of Internal:	20
Examination:	80
Total Marks:	100
Duration of Exam:	3 Hrs

### Unit 1

Centrifugation: Principle, types and application to biological systems. Rotors angle/vertical/zonal/continuous flow centrifuge, differential centrifugation density gradient centrifugation, ultra centrifugation

### Unit 2

Gel electrophoresis. Analysis of Proteins: Electrophoretic separation of proteins (single dimension native and denaturing gels, 2D and digital electrophoretic analysis), detection (staining, blotting and immuno-detection, ELISA, RIA)

Purification of proteins: Dialysis, salting out and precipitation by organic solvents, Ion exchange, gel filtration, affinity chromatography, HPLC, reverse phase, immunoprecipitation.

### Unit 3

Applications of spectroscopic and other techniques to the study of biomolecules: UV-Vis spectroscopy, Circular dichroism, Fluorescence, NMR, Mass, IR and Raman spectroscopy, X-Ray diffraction. Cellular Imaging Techniques: Microscopy: electron, Atomic Force and confocal.

### Unit 4

Automatic analyzer for amino acids, protein sequencer, peptide synthesizer & nucleic acid synthesizer. Cell sorters and their applications. Theory of lyophilization and its applications to biological systems.

### Text/Reference Books:

- 1. Biological Spectroscopy:** Campbell and Durek.
- 2. Physical Biochemistry,** 2<sup>nd</sup> edition by D.Friefelder, W.H.Freeman and company U.S.A.
- 3. Introduction to instrumental analysis :** Robert. D. Braun (1987). McGraw Hill International Edition, Chemistry Series.
- 4. Analytical Chemistry for technicians :** John kenkel (1994), Lewis Publishers.Boca Raton
- 5. Principles and techniques of Practical Biochemistry:** K.Wilson and J.Walker (1994), Cambridge University Press, Cambridge

- .6. **Biophysical Chemistry: Principle and Techniques**, 2nd edition by A. Upadhyay, K. Upadhyay and N. Nath. (1998). Himalya Publication House. Delhi.

## 17BTEPCC3 : Advances In Biotechnology

**Note for the paper-setter:** Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

Marks of Internal:	20
Examination:	80
Total Marks:	100
Duration of Exam:	3 Hrs

### UNIT I

**Plant Genetic Engineering:** production of transgenic plants for fungal, bacterial and viral disease resistance; herbicide resistance, drought and other abiotic stress resistance; quality parameters: nutraceuticals, edible vaccines, Applications of gene pyramiding and RNAi technology.

### UNIT II

**Industrial Biotechnology:** General Bioprocess plant design information, design facilities for cleaning of process equipment used in bioprocess industries, Utilities for biotechnology production plants, Bioprocess validation, Safety considerations, Process economics. Process technology of: clavulanic acid, macrolides, and lipases production.

### UNIT III

**Population Genetics:** Population vs individual; Dynamics of population; Gene and genotypic frequencies; Hardy-Weinberg equilibrium; Homeostasis- genetic and developmental; Co-adapted and integrated gene pool. Approach to equilibrium under random mating-single autosomal locus with two alleles; Single sex-linked locus; Two pairs of autosomal linked and unlinked loci; Linkage as a cause of correlation; Population mean and variance under different situations; Estimation of number of loci governing a metric trait; Average effect, average effect of gene substitution.

### UNIT IV

**Bioinformatics:** Types of biological data, Biological Databases: Nucleic acid and protein sequence and protein structure databases, Bioinfo tools DNA sequence analysis (DSA) Sequence annotations and sequence analysis - Phylogeny of gene (blast, fasta, HMMer) and residue conservation. Primer design and T<sub>m</sub> Calculation, DNA Restriction pattern analysis. Protein sequence and structure insights (PSSI): X-ray, NMR, Comparative modeling, *ab initio*, threading methods. Structure refining techniques Energy minimisation approaches (Steepest descent, Conjugate gradient etc), Basis of Molecular dynamics simulations and its application.

### Reference Books:

1. Plants, Genes and Crop Biotechnology (2003) 2nd Edition by Chrispeels, M.J. & Sadava D.E. American Society of Plant Biologists, Jones and Bartlett Publishers, USA.

2. Biochemistry and Molecular Biology of Plants: Edited by Buchanan B.B., Grissem W, and Jones RL (2000), American Society of Plant Biologists, USA.
3. Crow JF & Kimura M., An Introduction to Population Genetics Theory, Harper & Row. 1970.
4. Falconer DS & Mackay TFC, An Introduction to Quantitative Genetics, Longman, 2004.
5. David W. Mount. Bioinformatics: Sequence and Genome Analysis 2nd Edition, CSHL Press, 2004.
6. A. Baxevanis and F. B. F. Ouellette, Bioinformatics: a practical guide to the analysis of genes and proteins, 2nd Edition, John Wiley, 2001.
7. Jonathan Pevsner, Bioinformatics and Functional Genomics, 1<sup>st</sup> Edition, Wiley-Liss, 2003.
8. **Various research and review journals like Nature Biotechnology, Current Opinion, Trends and Annual Reviews**