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%.

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

*Two assignments of 10 marks each.

Program Specific Outcomes- Ph.D. (Biotechnology)

At the end of the programme, the student shall be able to

PSO1: acquire the necessary theoretical tools as well practical tools to undertake the research in various fields of Biotechnology Engineering.

PSO2: Get expertise in understanding, formulating and solving new and cutting edge problems in various fields of Biotechnology Engineering.

PSO3 : Address the problems of society and industrial interests in various applicable themes.

PSO4 :Produce and disseminate the new knowledge in high quality, peer reviewed research journals and Ph.D. thesis.

PSO5: conduct scholarly or professional activities in an ethical manner.

17BTEPCC1 Research Methodology

Course Outcomes:
By the end of the course the students will be able to:
CO1. Learn the concept of research, research process, types of research, research models and basics formats of report writing.
CO2. Learn the use of statistical analytic techniques for data analysis and testing of hypothesis.
CO3. Identify the differences between measurement and scaling and how sample is selected and determined using various approaches.
CO4. To understand sources of data collection and how data is collected from different sources.
CO5. To understand the concept of interpretation and role of computer in mathematical and

SYLLABUS
17CSEPCC1: RESEARCH METHODOLOGY (Quantitative Techniques and Computer Applications in Research)
Max. Marks: 80 Time: 3 Hrs.
Note: Total
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/continous 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,** 2nd 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**. **BiophysicalChemistry: Principle and Techniques**,2nd eddition by A.Upadhyay, K.Upadhyay and N.Nath.(1998).Himalya Publication House.Delhi.

17BTEPCC3 : Advances In Biotechnology

Course Outcomes

    CO1 Students will be able to understand the production of transgenic plants with different qualities

    CO2 Students will be able to understand the concept of plant design, cleaning in bioprocess industries and safety considerations in biotech industries

    CO3 Students will be able to understand the dynamics of population, Hardy-Weinberg equilibrium, linkages and other aspects of population genetics

    CO4 Students will be able to understand the Biological Databases, Sequence annotations and sequence analysis, primer degign, Protein sequence and structure insights etc

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: neutraceuticals, 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. Pro cess t echnolo gy of: clavula nic a cid, macrolides, and lip ases pr oduction.

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 Tm 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.,Gruissem 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, 1st Edition, Wiley-Liss, 2003.
8. **Various research and review journals like Nature Biotechnology, Current Opinion, Trends and Annual Reviews**