UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATIONS

Doctor of Philosophy (Ph.D.) – Biotechnology

Scheme of Examination w.e.f. 2020-21

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 Code	Course Title	Credits	Examination Marks		Total Marks	Duration of Exam
				Theory	Internal**		
1.	20BTPH11C1	Research Methodology	4	80	20	100	3
2.	20MPCC1	Research and Publication ethics	2	40	10	50	3
3.	20BTPH11C3	Review of Literature and Seminar (in Relevant Research Area)	4	80	20	100	3
4.	20BTPH11C4	Advances in Biotechnology	4	80	20	100	3
	Total		**14**	**280**	**70**	**350**	

****** Each theory paper/course shall have an internal assessment of 20 marks. It shall comprise of two written assignments and two presentations of 05 marks each. The concerned teacher/Head of the Department shall maintain the record on the basis of which internal assessment has been awarded for at least three months after the declaration of result.

20BTPH11C1 **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/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.

Program Name	Ph.D. [Biotechnology] UIET	Program Code	
Course Name	Review of Literature and Seminar (in Relevant Research Area)	Course Code	20BTPH11C3
Credits	4	No. of hours/Week	4
Duration of End term examination	3 hours	Max. marks	100 (T : 80 and IA : 20)
Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units (one question of four marks from each unit). The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks)			

1. The research student is required to prepare a concept paper/working, paper/review paper by reviewing at least 50 research papers / references books / unpublished doctoral dissertations / other reports etc.

2. To qualify the paper the research student is required either to present the prepared paper in an International Conference/ Seminar/ Workshop or publish the same in a research journal. Acceptance for publication or presentation will be considered as published/ presented.

3. A duly constituted committee of three teachers of the department by the Director/Head shall evaluate the completion of the paper.

Name of the Program	Ph.D. Course work	**Program Code**	PH
Name of the Course	Research and Publication ethics	**Course Code**	20BTPH11C2
Hours/Week	2	**Credits**	2
Max. Marks.	40	**Time**	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 8 = 40 marks)

Course Objectives:

1. To study the philosophy of ethics
2. To study the scientific conduct of research
3. To study the publication ethics
4. To know about various journal citation databases
5. To know the importance of quality publications

Course Outcomes:

By completion of course the student is able to

1. Ethics in conduct of scientific research
2. Know the scientific misconducts
3. How to avoid plagiarism and what are the penalties of plagiarism
4. Know the quality of research publications
5. Write research and review articles.

Unit - I

PHILOSOPHY AND ETHICS

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions

SCIENTIFIC CONDUCT

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

Unit - II

PUBLICATION ETHICS

1. Publication ethics: definition, introduction and importance
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

Unit - III

DATABASES AND RESEARCH METRICS

(A) Databases

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

(B) Research Metrics

1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score
2. Metrics: h-index, g index, i10 index, altmetrics

Unit - IV

Practice

OPEN ACCESS PUBLISHING

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

PUBLICATION MISCONDUCT

(A) Group Discussions

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

(B) Software tools (2 hrs.) :Use of plagiarism software like Tumitin, Urkund and other open source software tools

References:

1. Bird, A. (2006). Philosophy of Science, Routledge
2. P. Chaddah (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarised.
3. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019).
4. Beall, J (2012), Predatory publishers are corrupting open access. Nature, 489(7415), 179.
5. National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009). On being a Scientist: A guide to Responsible Conduct in Research, Third Edition, national Academic press.

20BTPH11C4 **: 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: 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**