

DEPARTMENT OF BIOTECHNOLOGY
CHAITANYA (DEEMED TO BE UNIVERSITY)

Pre Ph .D. Biotechnology

Syllabus contents and Scheme of Examination

For the candidates admitted from the academic Year 2024-2025

Pre Ph.D. SYLLABUS

(w. e. f. the academic Year 2024-2025)

As per the University Grants Commission (Minimum Standards and Procedures for Award of Ph.D. Degree) Regulations, 2022 provisions laid down under the Sub-Clause of 1 read with main Clause 9 of the Regulations The Credit requirement for the Ph.D. coursework is a minimum of 12 credits, including a “Research and Publication Ethics” course as notified by UGC vide D.O. No. F.1- 1/2018(Journal/CARE) in 2019 and a research methodology course. Based on the above Department proposed Pre. Ph.D. Examination Pattern is as follows from the academic year 2024-25 onwards

Paper	Paper Title	Marks		Credits
		External Exam	Internal Exam	
I	Research and Publication Ethics	50	00	2
II	Research Methodology	70	30 ^a	4
III	Subject Concerned	70	30 ^b	4
IV	Literature Survey Report (LSR)	00	50 ^c	2
	Total Marks	190	110	12

^a Participation Certificate: The research scholar has to present his/her research work (Oral/Poster) in a conference/seminar/workshop and submit certificate of participation to Controller of Examinations (CoE) for valuation. Please make sure to participate conference/seminar/workshop during April-July/August 2024.

^b Research Proposal: The research scholar has to submit a 5-7 pages “Research Proposal” on his/her research topic under the following headings (1) Title of the Ph.D., thesis, (2) Introduction, Review of Literature, Objectives, (3) Materials & Methods, (4) Time-Line of Research work (1st year..., 2nd Year....3rd year.....etc.), (5) Budget Estimate (in Rs.) (Recurring and Non-recurring) and (6) References; He/she has to submit the same to HoD for evaluation.

^c Research Survey Report -The research scholar has to collect published works on his/her research topic, critically analyse them, find gaps in the research work done and formulate 2-3 objective/s for his/her Ph.D., and submit the same to HoD for evaluation.

PAPER-I

RESEARCH AND PUBLICATION ETHICS

• RPE 01: PHILOSOPHY AND ETHICS (3 hrs.)

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

• RPE 02: SCIENTIFIC CONDUCT (5hrs.)

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

• RPE 03: PUBLICATION ETHICS (7 hrs.)

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 contributionship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

PRACTICE

• RPE 04: OPEN ACCESS PUBLISHING (4 hrs.)

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
Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

• RPE 05: PUBLICATION MISCONDUCT (4hrs.)

A. Group Discussions (2 hrs.)

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 Turnitin, Urkund and other open source software tools

• RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)

A. Databases (4 hrs.)

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

B. Research Metrics (3 hrs.)

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

References

Bird, A. (2006). Philosophy of Science.

Routledge. MacIntyre, Alasdair (1997) A Short History of Ethics. London.

P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:U78-

U3874808G5

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 Academies Press.

Resnik, D. B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, I-10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>

Bcall, J. (2012). Predatory publishers are corrupting open access. Nature, 48U(7415), 17U-17U. <https://doi.org/10.1038/48U17Ua>

Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2010).

ISBN:U78-81-U3U482-1-7. http://www.insaindia.rcs.in/pdf/Ethics_Book.pdf

FACULTY OF SCIENCE
Biotechnology
Pre Ph.D. EXAMINATION
Blue print of Question Papers
Paper: I/II

Time: 3 Hrs

Max. Marks: 100

Answer any **FIVE** questions

5x20=100

1. From Unit I
2. From Unit I
3. From Unit II
4. From Unit II
5. From Unit III
6. From Unit III
7. From Unit IV
8. From Unit IV
9. From Unit I/II
10. From Unit III/IV

Paper – II: Research Methodology

UNIT-I: Research Problem and Design

1. Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, types of Research, Research Approaches, Significance of Research, Research Methods v/s Methodology, Research and Scientific Methods, Research Process, Criteria of Good Research.
2. Defining the Research Problem: Concept and need, Identification of Research problem, defining and delimiting Research problem.
3. Research Questions and Hypothesis: Variables and their linkages, characteristics of good Hypothesis. Research question and formulation of hypotheses-directional and non-directional hypotheses, Basis for hypotheses.
4. Research design: Meaning, Need, Features of Good Design, Concepts, Types. Basic principles of Experimental Design, various methods of Research. Survey, Philosophical, Historical, Experimental, Causal Comparative, Genetic, Case Studies.

UNIT-II: Literature Searching and Report Writing

1. Tools for Data Collection: Collections of Primary Data, Collection of Data through questionnaire and Schedules, other Observation Interview Methods, Collection of Secondary Data, Selection of appropriate method for data collection, Case Study, Focus Group Discussion.
2. Techniques of developing research tools, viz. Questionnaire and rating scales etc. Reliability and validity of Research tools.
3. Writing Research Report: Format and style, Review of related literature its implications at various stages of research. (Formulation of research problem, hypothesis, interpretation and discussion of results).
4. Major findings, Conclusions and suggestions. Citation of references and Pribliography.

UNIT-III: Statistical Analysis & Bioinformatics

1. Data collection : Sources of Data: Primary Data, Secondary Data; Sampling Merits and Demerits of Experiments, Procedure and Control Observations, Sampling Errors - Type-I, Error - Type-II Error. Statistical analysis and fitting of data.
2. Probability Theories - Conditional Probability, Poisson Distribution, Binomial Distribution and Properties of Normal Distributions, Estimates of Means and Proportions; Chi-Square Test, Association of Attributes, t-Test . Standard deviation - Coefficient of variations. Correlation and Regression Analysis. Introduction to statistical packages, plotting of graphs.
3. Development of bioinformatics, Operating systems in bioinformatics. Databases: Gene banks, Sequence and structure databases; types of databases, web interfaces; Search tools: Data mining, BLAST and FASTA. Sequence analysis of biological data. Major bioinformatics resources (NCBI, EBI, ExPASy).Phylogenetic analysis:
4. Concept of phylogenetic trees, phylogenetic trees and multiple alignment methods, suitable software-EMBOSS. Approaches methods and function of gene prediction.

UNIT-IV: Analytical Techniques

1. Spectroscopy: Principles of spectroscopy: Laws governing light absorption (Beer-Lambert's Law). Instrumentation and biological applications of UV and visible spectrophotometer. Flamephotometry, atomic-absorption spectrophotometry, Basic principles of IR and NMR spectroscopy. Radioisotope techniques; types of isotopes. Nature and type of radioactivity, Decay units, detection and measurement of radioactivity (GM and Scintillation). Biological uses of radioisotopes.
2. Separation techniques: Principles, methods and biological applications various chromatography techniques. Basic principles and applications of different electrophoresis methods. Principles and applications of various centrifugation techniques.
3. Microscopy: principles and working of light and phase-contrast, fluorescent, scanning and transmission electron-microscopy.
4. Flowcytometry and their applications.

Reference Books:

- a)** Best and Kahn, Research Methodology, PHI Limited.
- b)** Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher.
- c)** Kerlinger, Foundation of Research.
- d)** Fundamentals of modern statistical methods by Rand R. Wilcox.
- e)** Power Analysis for Experimental research A Practical Guide for the Biological, Medical and social Sciences by R. Barker Bausell, Yi-Fang Li Cambridge University Press.
- f)** Design of Experience: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/Cole.
- g)** Principles of Biochemistry – A.L. Lehninger (CBS Publishers).
- h)** Biochemistry – Lubert Stryer (5th Edition).
- i)** Principles of Biochemistry-General aspects- Smith et al. (8th edition).
- j)** Harper's Biochemistry – Murray et al. (Lange).
- k)** Text Book of Biochemistry – West et al., 1966 (Mac Millan).
- l)** Biochemistry (2nd Edition)- David Voet & J.G. Voet.

Paper – III: Applied Biotechnology

Unit –I: Plant and Agricultural Biotechnology

1. Introduction to Plant tissue culture, Role of plant growth regulators *in vitro* morphogenesis. Micropropagation and applications viral free plants production, Somatic hybridization and its applications in crop improvement.
2. Somaclonal variation, Embryo culture, synthetic seed production, Androgenic haploid plants, plants act as bioreactors.
3. Disease resistance in plants – Mechanism of resistance, biochemical basis of resistance, systemic and localized acquired resistance, PR proteins, gene-to-gene resistance (horizontal and vertical). Biotechnological approaches in IPM. Methods of gene transfer in plants, Bt genes and the resistance in insects. Achievements and recent developments in genetic engineering in agriculture.
4. Biofertilizers – Structure, characteristic features,(Examples), Biofertilizer for sustainable agriculture. Biopesticides - Structure and characteristics, Features: *Trichoderma*, *Beauveria*, *Metarrhizium*, *Nomuraea*, *Bacillus thuringiensis* and NPVs . Applications, advantages and limitations of biopesticides.

Unit – II: Molecular Biology & r-DNA technology

1. Mechanism of transcription, promoters, enhancers and other regulatory sequences, inhibition of transcription. Protein synthesis (translation)- basic features of genetic code, wobble concept; prokaryotic and eukaryotic ribosomes and details of translation initiation, elongation and termination.
2. Molecular analysis of genes –concept of gene (classical and neoclassical) – gene fine structure with reference to r II locus in phages. Regulation of gene expression – Operon concept, positive and negative regulation, inducers and corepressors, *lac* operon, *trp* operon, *ara* operon and *gal* operon in yeasts.
3. Enzymes used in genetic engineering, restriction endonucleases, exonucleases, DNA-modifying enzymes. ligases –linkers , adaptors, Terminal Transferases. Cloning vectors: plasmids, cosmids, phagemids, shuttle vectors, viral vectors.

4. PCR technology: Mechanism of PCR, Designing of primers and Essential Requirements of PCR. Types of PCR, PCR applications. Gene transfer methods. (Direct and Indirect). DNA Sequencing methods.

Unit - III: Animal Biotechnology and Immunology

1. Introduction to animal Biotechnology; Cell cultures; Primary and Secondary cell cultures,
2. Hybridoma Technology, Manipulation of reproduction in animals (IVF, AI, ICSI), Production and applications of transgenic animals, Stem cells types and applications.
3. Cells of Immune system, types of immunity, Cellular and Humoral immune response, complement system, MHC Class I and Class II, Hypersensitivity.
4. Antigen, Antibodies, structure, Classification of immunoglobulins and functions, Antigen and antibody interactions.

Unit - IV: Industrial & Environmental Biotechnology

1. Isolation and Preservation of microorganisms, Screening and Strain improvement techniques, Immobilization of Enzymes, Scope utility and methodology of Biotransformation of steroids and nonsteroids, Interferons, Single cell protein, Edible mushrooms and their cultivation, Microbes in food and dairy industry.
2. Microbiology of wastewater treatment: Aerobic process – Activated sludge, oxidation ditches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds. Anaerobic treatment-Septic tanks, Imhoff tank, Upflow anaerobic sludge blanket (UASB), Anaerobic filters, Anaerobic attachment film expanded bed AAFEB).
3. Bioremediation of polluted soils/sites-Degradation of xenobiotics, pesticides, Hydrocarbons and plastics.
4. Air sampling techniques and Air sanitation.

Reference Books:

1. Molecular Cell Biology – 4th Ed. – Lodish, Berk. Et al (W.H. Freeman and Co.)
2. Biochemistry by D. Voet and J. Voet
3. Molecular Biology-A comprehensive introduction to prokaryotes and eukaryotes –
4. D.Friefelder. (Jones an Barlett, USA)
5. Genes VII (2000) – Benjamin Lewin (Oxford University Press)
6. Text Book of Molecular Biology by K.S. Sastry, G. Padmanabhan and C. Subramnyam –
7. McMillan India Ltd.
8. Voet D., Voet J.G, Biochemistry 4 th Edition., John Wiley and Sons, 2011.
9. Nelson, D. C. andCox, M.M., Lehninger Principles of Biochemistry, 5thEdition,W. H.
10. Freeman, 2010. Syllabus: PhD Biochemistry 5
11. Berg J.M., Tymoczko J.L. and Stryer L., Biochemistry. 7th edition, W.H. Freeman and Co. New York, 2011.
12. Molecular biology by Robert F. Weaver McGraw-Hill 4 edition (2007)
13. Advanced molecular biology by R. M. Twyman, (1998) □ Genes VII by B. Lewin
14. Oxford University Press, Cell Press, London (2000)
15. Malhan . . N, P .K. Himalaya Publishing House. Bio statistics, Arora .P, Mani and
16. Vijayaraj Bioinformatics for the beginners.
17. Rastogi. Bioinformatics Basic skills and applications.