Department of Biotechnology,
Guru Jambheshwar University of Science & Technology, Hisar

Scheme & Syllabus of PhD Course work of Biotechnology w.e.f. Winter Session 2024-25

Scheme of Examination for PhD Course work w.e.f. Winter Session 2024-25

Sr. No.	Course Code No.	Nomenclature	Credits	Internal	External	Max. Marks	Exam. Duration
1.	PPD- 101	Research Methodology	4	30	70	100	3 Hrs.
2.	PPD- 102	Review of Literature and Seminar	2	50	-	50	2 Hrs.
3.	PPD- 103	Departmental Elective Course - **Advances in Biotechnology**	4	30	70	100	3 Hrs.
4.	PPD-104	Research and Publication Ethics (RPE)	2	15	35	50	2 Hrs.

The distribution of marks for external examination and the sessional examinations will be as per prevailing scheme for other courses in the university.

i) The duration of the Ph.D. course work will be of one semester. It will consist of 04 papers.
ii) Each paper of the course work except PPD-101&PDP-103 will be of 4 credits. PPD-102 &PDP-104 will be of 02 credits. 4 credits paper will be of 100 marks and 2 credits of 50 marks as per scheme.
iii) The external examinations preferably PPD 101, 102 & 104 will be conducted centrally not Department wise by the COE during Saturday/Sunday/Holiday.

PPD-101: RESEARCH METHODOLOGY

(FOR SCIENCES GROUP)

(For PhD scholars of Department of Biotechnology, Physics, Chemistry, Mathematics, Food Technology, Environmental Science & Engineering, Pharmaceutical Sciences, Physiotherapy)

PPD-101: RESEARCH METHODOLOGY

Course Code: PPD-101 Course Credits: 4.0 Contact Hours: 4 hours/week (4 Lectures) Examination Duration: 3 hours	**Course Assessment Methods:** **Internal Examination (30 marks):** *Two minor tests each of 20 marks will be conducted. The highest marks obtained by a student in any of the two minor examinations will be considered. Class performance will be measured through percentage of lectures attended (04 marks), Assignments, quiz, etc. (06 marks).* **External End semester examination (70 marks):** *The examiner is required to set 9 questions in all. The first question will be compulsory covering the entire syllabus and consisting of 4 short answers type questions of 3.5 marks each. In addition to that, 8 questions have to be set consisting of 2 questions from each unit. A candidate is required to attempt 05 questions in all, selecting one question from each unit and the compulsory question No 1. All questions carry equal marks.*

Unit-I

Introduction to Research Methodology: Meaning, Objectives, Types, and Significance of research, Creativity and Innovation, Hypothesis formulation and development of Research plan. Research Problem: Definition, necessity, and techniques of defining the research problem. Library: Classification system, e-library, Reference management, Web-based literature search engines. Use of modern aids: Making technical presentations, Research and academic integrity. Avoiding Plagiarism: Using software, Copyright issues, Ethics in research, Intellectual Property Rights (IPRs) & Patent Law.

Unit-II

Scientific Communications: Role and importance of communications, Effective oral and written communication, Scientific and Research paper writing, technical report writing. Making Research & Development (R&D) proposals.

Publishing Research paper: Selection of journal, formulation of problem, discussion and references, Submission and handling of reviewers' comments.

Writing of thesis: Format of thesis, Review of literature, Formulation: Writing methods, results, preparation of tables, figures; writing discussion; writing conclusion; writing summary and synopsis; Reference citing and listing/Bibliography.

Laboratory safety issues: Related to various labs, Workshop, electrical, health and fire safety, safe disposal of hazardous materials.

Unit-III

Statistical analysis and errors: Mean, Mode, Median, Relative and absolute errors, Hypothesis testing for mean, proportion and variance, Chi-square tests, Correlation and regression analysis, Factora analysis. Linear and non-linear least squares fitting methods, Interpolation methods including cubic splines, Fourier Series Analysis, Fast Fourier Transform, Convolution and Correlation.

Unit-IV

Computational tools and Programming: Resume of practical approach of learning operating systems (DOS, Windows, UNIX), Graphical packages, Calculations using Spreadsheet programming. Technical research paper writing in LaTeX. Introduction to HTML, XML & programming languages, an overview of Modeling and simulation software.
Online Resources: Introduction to Massive Open Online Courses (MOOCs) and Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM), Indexing and abstracting services, Citation index and impact factor, Research quality parameters and indicators.

Recommended Books/Sources:

1. Gurumani, N. (2010), Scientific thesis writing and Paper presentation, MJP Publishers.
2. Gerald, C.F. and Wheatley, P.O. (2002), Applied numerical analysis, 6th Ed., Addison Wesley.
3. Smith, G.D. (1982), Numerical solution of partial differential equation, Oxford University Press.
4. Schwartz H.R., Rutishauser H., Stiefel E. et al. (1976), Numerical analysis of symmetric matrices, Prentice Hall.
5. C.R. Kothari & Gaurav Garg (2014), Research Methodology, Third Edition, New Age International Publishers.
6. Web resources: www.sciencedirect.com; for journal references, www.aip.org and www.aps.org for references styles.
7. Web Resources: www.nature.com, www.sciencemag.org, www.springer.com, www.pnas.org, www.tandf.co.uk, www.opticsinfobase.org for research updates.

PPD-102: Review of Literature and Seminar:

It includes discussions on research ethics, presenting a seminar on review of published research or on own published review/survey paper or training or field work done in the relevant area of research etc.

The scholars shall review 20 to 30 research papers and shall submit the report as well as present seminar before a three members committee duly constituted by the Dean, Research and Development and headed by the Chairperson/Director or Senior teacher of the Department/School for evaluation of paper PPD-102: Review of Literature and Seminar at Departmental level.

PPD-103 Departmental Elective Course (Advances in Biotechnology)

Course Code: PPD-103 Course Credits: 4.0 Contact Hours: 4 hours/week (4 Lectures) Examination Duration: 3 hours	**Course Assessment Methods:** **Internal Examination (30 marks):** *Two minor tests each of 20 marks will be conducted. The highest marks obtained by a student in any of the two minor examinations will be considered. Class performance will be measured through percentage of lectures attended (04 marks), Assignments, quiz, etc. (06 marks).* **External End semester examination (70 marks):***The examiner is required to set 9 questions in all. The first question will be compulsory covering the entire syllabus and consisting of 4 short answers type questions of 3.5 marks each. In addition to that, 8 questions have to be set consisting of 2 questions from each unit. A candidate is required to attempt 05 questions in all, selecting one question from each unit and the compulsory question No 1. All questions carry equal marks.*

UNIT-I

Introduction and background: History, Scope and relevance of Biotechnology, Recent advancements in biotechnology.

Plant Biotechnology: History of Plant tissue culture and its role and applications in crop improvement; Various Gene transfer methods in plants; genetically modified plants for crop improvement towards designer crops; Present status of commercial cultivation of GMP's worldwide and in India. Current Scenario and Future Prospects of Research in Agricultural Biotechnology. Plant secondary metabolite production, Present status and future prospects.

Bio-business and Bio-safety, Biotechnology for developing countries and relevance of IPR in Biotechnology

Applications of Molecular Markers in Biotechnology: Hybridization techniques, Gene expression studies (Real-Time-PCR, Micro arrays & Gene chips), Molecular Markers (RFLP, AFLP, SCARs, SNPs, EST-SSR), Applications of molecular markers for crop improvements; PCR and its variants, Nucleic acid-based techniques in diagnostics.

UNIT-II

Genomics : Organization of genomes: main features of bacterial and eukaryotic genome organization, Strategies for genome sequencing, Next Generation Sequencing, 454 pyrosequencing, Illumina Sequencing, Sequence assembly, Model plant genome project and its applications (*Arabidopsis*, Poplar, Tomato, Rice, Chickpea)**,** Functions analysis of genes, candidate gene identification in crop plants, deciphering the function of gene in plant secondary metabolism, gene inactivation (knock-out, anti-sense and RNA (interference) and gene over expression.

Proteomics: Introduction to proteomics, Analysis of proteome-2D PAGE, Mass Spectrometry based methods for protein identification: De novo sequencing using Mass spectrometric data, use of MALDI TOF and related methods for protein mass determination, structural proteomics: protein structure determination, prediction and threading, software and data analysis/ management, etc.

Metabolomics: Techniques in metabolomics (HPLC, GC-MS, LC-MS), Application of metabolomics in elucidating metabolic pathways, Metabolic pathways resources: KEGG,

Biocartaetc, Nutrigenomics and metabolic health, Metabolic engineering of plant secondary metabolism.

UNIT-III

Advances in Microbial Molecular Biology: Molecular evolution, Metagenomics, molecular biology of *nif* genes.

Advances in Industrial biotechnology: Recent advances in production of antibiotics, pharmaceutical products, Biofuels, Biosensors, Biopesticides, Biofertilizers, Biodegradable plastics, SCP. Products of non-microbial origin produced by genetically engineered microorganisms.

Protein Engineering: Concept, Methods, Limitations and Applications with examples, Immobilized enzymes–methods and applications.

Bioinformatics: Importance & Scope of Bioinformatics, world wide web as a tool, Bioinformatics institutes and databases, Bioinformatics training & limitations

Environmental Biotechnology: Energy management, Bioremediation, Restoration of degraded lands and Conservation of biodiversity.

Drug discovery & development: Pharmacological microbial, recombinant, biochemical and molecular level screening system and their construction strategies, alternative strategies in lead identification, lead optimization, preclinical, clinical trials, patenting & clearance for application.

UNIT-IV.

Animal Biotechnology& immunology: Various Transfection techniques in animals; Present status of transgenic animals; Hybridoma technology Recombinant DNA and protein-based vaccines, Plant based vaccine, reverse vaccinology, peptide vaccine, conjugate vaccine, Antibody genes and antibody engineering, generation of immunoglobin gene library, Tumor immunology-tumor antigen, response to tumor and evasion of the immune system, cancer immunotherapy, stem cell therapy.

Recommended Books:

1. Towner K. J. and Cockayne A (2000), Molecular methods for microbial identification and typing, Chapman & Hall London.
2. Paul A. Rochelle, Environmental Molecular Microbiology: (2002) Protocals and Applications, Horizon Scientific press England.
3. Lewin B. (2004) Gene VIII, Pearson Prentice Hall, New Delhi.
4. Rehm H. J. Reed G. B. Punler A and Standler, Biotechnology, Vol. 1-8 VCH. Publication.
5. Isacc S. Kohane, Aluin T. Kho and Atul J. Butte. (2004) Microarrays for an integrative genomics, Ane Books, India.
6. Edward A. Birge. (Fourth Edition) Bacterial and Bacteria phage genetics. Springer, New York
7. Uldis N. Streips & Ronald E. Yasbin (Second Edition) Modern Microbial genetics. Wiley – Liss New York
8. Glick B. R. & Jack J. Pasternak. (Second Edition) Molecular Biotechnology. Principles and Application of Recombinant DNA.
9. Review of current- topics in microbiology, Microbial Biotechnology and molecular biology. Critical reading and evaluation of current literature.
10. Peterson, A. H. (1996). Genome Mapping in Plants. Academic Press, USA.
11. Old and Primrose (1995) Principles of Gene Manipulation, Blackwell's Publishers
12. Shrivastava P. S., Narula A. and Shrivastava S. S. (2004), Plant Biotechnology and Molecular Markers, Anamaya Publisher, New Delhi.
13. Kirsi-Marja Oksman-Caldentey, Wolfgang Barz (2002) Plant Biotechnology and Transgenic Plants, Marcel Dekker. http://www.cplbookshop.com/contents/C787.htm
14. Adrian Slater, Nigel W Scott, and Mark R Fowler (2004), Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
15. In: Vasil IK. (ed) (2003) Plant Biotechnology 2002 and Beyond: Proceedings 10th IAPTC&B Congress: Florida, USA. 23-28 June 2002. Kluwer Academic Publishers.

PPD-104: RESEARCH AND PUBLICATION ETHICS

(COMMON FOR ALL GROUP'S)

(For Ph.D. Scholars of Department of Science, Humanities, Engineering)

PPD-104: RESEARCH AND PUBLICATION ETHICS (RPE)

Course Code: PPD-104 Course Credits: 2.0 Examination Duration: 2 hours	**Course Assessment Methods:** **Internal Examination (15 marks):** *Two minor tests each of 10 marks will be conducted. The highest marks obtained by a student in any of the two minor examinations will be considered. Class performance will be measured through percentage of lectures attended (02 marks), Assignments, quiz, etc. (03 marks).* **External End semester examination (35 marks):** *The examiner is required to set 5 questions in all. The first question will be compulsory covering the entire syllabus and consisting of 5 short answers type questions of 3 marks each. In addition to that, 4 questions have to be set consisting of 2 questions from each unit. A candidate is required to attempt 03 questions in all, selecting one question from each unit and the compulsory question No 1. Except Q.No.1, all questions will carry equal marks.*

Unit-I

PHILOSOPHY AND ETHICS: -Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgements and reactions.
SCIENTIFIC CONDUCT: - Ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP). Redundant publications: duplicate and overlapping publications, salami slicing. Selective reporting and misrepresentation of data.

PUBLICATON ETHICS: - Publication ethics: definition, introduction and importance. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types. Violation of publication ethics, authorship and contributor ship. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals.

Unit-II

OPEN ACCESS PUBLISHING: Open access publications and initiatives. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies. Software tool to identify predatory publications developed by SPPU. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

PUBLICATION MISCONDUCT: (A) Group Discussion: Subject specific ethical issues, FFP, authorship. Conflicts of interest. Complaints and appeals: examples and fraud from India and abroad. (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools.

DATABASES AND RESEARCH METRICS: Databases: Indexing databases. Citation databases: Web of Science, Scopus, etc. Research Metrics: Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score. Metrics: H-index, g-index, i10 index, altimetric.

References:

1. Bird, A. (2006), Philosophy Routledge. Macintyre, Alasdair (1967) Short History of Ethics. London.
2. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized. Self-published. ISBN-13: 978-9387480865; ISBN-10: 9387480860
3. National Academy of Sciences, National Academy of Engineering & Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible Conduct in Research (3rd ed.). National Academies Press. ISBN-13: 978-0-309-11970-2
4. Resnik, D. B. (2011). What is Ethics in Research & Why Is It Important? (pp. 1–10). National Institute of Environmental Health Sciences. Retrieved from
5. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179. https://doi.org/10.1038/489179a
6. Indian National Science Academy (INSA). (2019). Ethics in Science Education, Research and Governance (Eds: Kambadur Muralidhar, Amit Ghosh & Ashok K. Singhvi). Indian National Science Academy. ISBN-13: 978-81-939482-1-7.