SYLLABI AND SCHEME OF EXAMINATION FOR Ph.D. COURSE WORK

(W.E.F. SESSION January 2026)

Ph.D. Biotechnology

Approved By	DC Meeting	Board of Studies	Academic Council
Approval Status	√	√	
Approval Date	23.06.2022	24.09.2022	09.12.2022
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DEPARTMENT OF BIOTECHNOLOGY

Indira Gandhi University, Meerpur-Rewari, HARYANA
(Established under State legislature Haryana Act 29 of 2013) Recognized u/s 12-B & 2(f) of UGC Act, 1956

15/01/2026

15/01/2026

Ph.D. Course Work (Biotechnology)
Scheme of Examination
(Under Credit System w.e.f. 2025-26)

Total Credits: 12

Programme Objective:

The objective of the course is to familiarize the PhD scholars with research and its various methods. The focus of the course is applied and decisional. It aims at providing the relevant inputs to the research scholars so that they could study systematically various complex problems and provide information and solutions for the same.

Courses (at Department level/ Common at across the University)

Course Code	Title of the Course	Theory Marks	Internal Marks	Practical Marks	Max Marks	Credits
25L8.0-BTY-101	Research Methodology	70	30	-	100	4
25L8.0-BTY-102 (A)	Recent Advances in Biotechnology	70	30	-	100	4
25L8.0-BTY-102 (B)	Advances in Plant Biotechnology	70	30	-	100	4
25L8.0-RPE-103	Research and Publication Ethics*	40	10	-	50	2
25L8.0-BTY-104	Review of Literature & Seminar	-	50	-	50	2

*Common paper across all the departments provided by the University

15/01/2026

15/01/2026

Indira Gandhi University, Meerpur– Rewari
DEPARTMENT OF BIOTECHNOLOGY
(Ph.D. Course Work)
PAPER-1: RESEARCH METHODOLOGY
COURSE CODE: 25L8.0-BTY-101

Time: 3 Hrs.
Contact Hours/ Week: 4 hrs

Credit - 04
Maximum Marks: 100
Theory Marks: 70
Internal Assessment: 30

Course Objective:
The objective of the course is to familiarize the PhD scholars with research and its various methods. The focus of the course is applied and decisional. It aims at providing the relevant inputs to the research scholars so that they could study systematically various complex problems and provide information and solutions for the same.

Note: The question paper will contain total of nine questions in all from four units of syllabus. The candidates are required to attempt five questions in all selecting one from each unit, the 1st question will be compulsory and covered from all units. All questions carry equal marks.

Course Contents:

Unit 1: Introduction:
Definitions and types of research; invention, innovation, and research; Research process and steps in conducting research; Review of literature; Planning research – Preparing the Research Proposal, Elements of Research Proposal, Evaluating Research Proposal; Problem identification and formulation; Research design; Applications of Research.

Unit 2: Scientific communications and Presentation:
Scientific communications: publishing research papers, selection of a journal, writing of research papers, abstract, introduction/formulation of a problem, experimental details, results & discussion, references,
submission of manuscript and handling or reviewer's comments,
Writing of thesis. Pre -writing consideration; Formulation of research projects / proposals; Format of Report; Presentation of Research report.
Paper Types: Research / review articles, bibliography norm & plagiarism. Presentation,
Poster and oral presentation tools: introduction to presentation tools, MS power point features and functions, creating presentation, customizing presentation, presentation reference citing and listing bibliography.

Unit 3: Statistical tools
Measures of Central tendency: Mean, Median, Mode; Introduction of Probability Theories and Concepts; Probability Distributions: Discrete and Continuous Probability Distributions; Measures of Association: Correlation and regression; Advance Multivariate analysis - discriminant analysis, cluster analysis, factor analysis and conjoint analysis.

Unit 4: Safety & Disaster Management and IP Management:

Good Laboratory Practices, Responsibilities of a researcher, handling and storage of biological material, safety equipments, personal protective equipments, safety practices for disposal of broken glasswares, centrifuge safety, treated biomedical wastes and scientific ethics. Emergency response: chemical spills, radiation spills, biohazard spills, fires, medical emergency, accident reporting

Introduction to Intellectual property rights- Aims and objectives, Indian patent act. Types of Intellectual properties- Patents, Trademarks, Copyright and related rights, Industrial design, trade secret. Legal and IPR issues in biotechnology research. Patent infringement and remedies, Licensing and franchising.

Suggested Reading:

1. Grant writing 101; Jason et al, 2013
2. From research to manuscript: a guide to scientific writing; Katz, M. J. (2009).
3. Research Methods for the Biosciences; Holmes, D., Moody, P., Dine, D. and Trueman, L. (2016). Oxford University Press.
4. Experimental Design for Biologists; Glass, D.J. (2014). Cold Spring Harbor Laboratory.
5. Experimental design for the Life Sciences; 4th Edition. Ruxton, G.D. and Colegrave, N. (2016). Oxford University Press.
6. Research Methodology and techniques; Kothari CR (2009)
7. Communication: An Introduction; Rosengreen K.E. (2000); Sage Publication
8. ITL Education Solutions Ltd., Introduction to Information Technology, Pearson Education.
9. Intellectual Property Right and Patent laws.
10. https://www.who.int/tdr/publications/documents/glp-trainer.pdf
11. http://www.w3.org/IPR/http://www.wipo.int/portal/index.html
12. http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
13. http://www.cbd.int/biosafety/background.shtml
14. http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/section3.html

Examination Scheme

Components	Internal Assessments (Total Marks=30)		End Semester
	Exam/Case study/ Presentations/ Fieldwork/ Viva voce	Attendance	
Weightage (%)	20	10	70

Student Learning Outcomes:

✓ The students become well versed with skills of writing research papers and conclusion of the research problems.

✓ Exposure to MS office and other scientific software's enable the scholars in analyzing the data as well as in preparing manuscript and presentation.

Indira Gandhi University, Meerpur – Rewari

Department of Biotechnology

(Ph.D. Course Work)

PAPER-2 (A): RECENT ADVANCES IN BIOTECHNOLOGY

COURSE CODE: 25L8.0-BTY-102 (A)

Time: 3 Hrs.
Contact Hours/ Week: 4 hrs

Credit - 04
Maximum Marks: 100
Theory Marks: 70
Internal Assessment: 30

Course Objective:
This course is designed to enable the student to understand the basic principles and practices of common methods used for research in various arms of Biotechnology. The course deals with contemporary research in biotechnology.

Course Outcomes:
At the end of the course, the student will have in depth knowledge of biotechnological topics where research can be carried out.

Note: The question paper will contain total of nine questions in all from four units of syllabus. The candidates are required to attempt five questions in all selecting one from each unit, the 1st question will be compulsory and covered from all units. All questions carry equal marks.

Course Contents:

Unit 1: Molecular Microbial technology
Sterilization methods; Microbial Growth kinetics; Techniques to establish a pure culture; Molecular basis and approaches for the identification and diagnosis of microorganisms (Bacteria, virus, fungi and parasite); Methods of antimicrobial activity testing,
Virus isolation and propagation, TCID, MTT and MNTD assays. Advances in antibiotic development. Search for Natural/ plants for new antivirals and antibacterial.

Unit 2: Advances in Immunology and Cancer research
Oncoviruses (RNA and DNA viruses), Carcinogens; Molecular Biology of Cancer; Biomarkers for Cancer Diagnosis; Gene editing-CRISPR, Experimental Techniques in Cancer Research, Cell Proliferation assays, CART cells, Gene Cloning, Antibody engineering,
Natural Products as a platform for anti-cancer drug development. Applications of recombinant DNA technology in Medicine and Clinical Research.

Unit 3: Computational Biology and Molecular Modelling
Various sequence file formats; Biological databases (Overview of available Bioinformatics resources on the web) such as NCBI, EMBL, SWISS-Prot, TIGR; CLUSTAL X/W; Molecular phylogeny-MEGA and PHYLIP etc. software; BLAST; protein structure databases PDB and MMDB;

Technologies and strategies for drug discovery- personalized medicine, ligand based drug designing; 3D-QSAR, docking, New approaches to vaccine design- mRNA/DNA vaccines. Primer designing,

Unit 4: Biosensors and Bio-nanotechnology & Environmental Biotechnology

Introduction to bio-nanotechnology. Synthesis techniques of various types of nanostructured materials e.g., CNT, Graphene etc. Synthesis of nanomaterial using green chemistry from plants, microbes, and their characterization. Quantum dots. Applications of bio-nanotechnology in treatment and drug delivery.

Principle & fabrication of various biosensors, Applications of Biosensors in Diagnostics.

Overview of environmental biotechnology, Microbial strains (engineered and natural) for bioremediation, Various application areas in community health & environment health.

Suggested Reading:

1. Microbiology-An introduction; 10th edn. Tortora, etal. 2010.,
2. Field's Virology; David M.Knipe and Peter Howley; 2013
3. Medical Microbiology: Murray, Rosenthal and Pfaller
4. Lewin's Genes XII; 12th Edition. Krebs, J.E., Goldstein, E.S., & Kilpatrick, S.T. (2017).
5. Cellular and Molecular Immunology; 9th Ed. Abbas A, Lichtman A, Pillai S.; Elsevier.
6. An introduction to the use of anti-cancer drugs; Rafi, Imran.2006; Elsevier Publishing Co.
7. Cancer microenvironment and therapeutic implications: Tumor pathophysiology mechanisms and therapeutic strategies; Baronzio, Gianfranco; Fiorentini, Giammaria; 2009. Pringer.
8. Principles of tissue engineering; Edition 4. Lanza, Robert; Langer, Robert. Elsevier.
9. Animal Cell Culture & Technology; 1st edition. Butler, M. Tailor & Francis Publishers 2004.
10. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins; Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009.
11. Nano Structures and Nano Materials; Geozhog Gao, 2004, ICP.
12. 3D Bioprinting and nanotechnology in tissue engineering and regenerative medicine; Zhang, Lijie Grace; Fisher, John P. Elsevier Academic Press.
13. Journals in the area

Examination scheme

Components	Internal Assessments (Total Marks=30)		End Semester
	Exam/Case study/ Presentations/ Fieldwork/ Viva voce	Attendance	
Weightage (%)	20	10	70

Indira Gandhi University, Meerpur – Rewari

Department of Biotechnology

(Ph.D. Course Work)

PAPER-2 (B): ADVANCES IN PLANT BIOTECHNOLOGY

COURSE CODE: 25L8.0-BTY-102 (B)

Time: 3 Hrs.
Contact Hours/ Week: 4 hrs

Credit - 04
Maximum Marks: 100
Theory Marks: 70
Internal Assessment: 30

Course Objective:

This course is designed to enable the student to understand the basic principles and practices of common methods used for research in various arms of Biotechnology. The course deals with contemporary research in biotechnology.

Course Outcomes:

At the end of the course, the student will have in depth knowledge of biotechnological topics where research can be carried out.

Note: The question paper will contain total of nine questions in all from four units of syllabus. The candidates are required to attempt five questions in all selecting one from each unit, the 1st question will be compulsory and covered from all units. All questions carry equal marks.

Course Contents:

Unit I:

Commercial plant tissue culture lab organization. Micro propagation – plant multiplication, hardening – Low-cost alternatives. Commercialized photoautotrophic micro propagation-automation technologies-Synthetic seed production. Totipotency – morphogenesis: in vivo and in vitro – different pathways of organogenesis and embryogenesis – applications of cellular manipulations – meristem culture – anther and pollen culture – ovule and ovary culture – embryo and endosperm culture – protoplast isolation, culture and fusion – in vitro mutant selection for biotic and abiotic stresses – In vitro germplasm conservation – somaclonal variation.

Unit II:

Overview of transgenic plants – current status of transgenic plants. Agrobacterium mediated gene transfer. Direct gene transfer method. Recent advances– cisgenesis and intragenesis, RNAi technology, targeted genome modification – CRISPR-Cas9 and advancements in CRISPR technology. Regulated and tissue-specific expression of transgenes for crop improvement.

Bio-safety studies – Environmental issues associated with transgenic crops; Food and feed safety issues; risk assessment – problem formulation; risk assessment for environment and food safety. Field studies with transgenic crops; National and international regulatory framework

Unit III:

Cell suspension cultures. Hairy root cultures – secondary metabolite production. Methods to enhance secondary metabolite production – precursor feeding, elicitation, immobilization, mutagenesis – Scale

up through bioreactors. Production of useful compounds via biotransformation. Secondary metabolites of industrial and pharmaceutical importance – examples. Plant Stem Cell applications – cosmetic and therapeutics.

Production of secondary metabolites from plant cell cultures, Technology of plant cell culture for production of chemicals. Molecular farming of plants for pharmaceutical applications advances in chloroplast transformation – production of therapeutic proteins in chloroplasts. Expression of recombinant proteins using viral vectors.

Unit IV:

Various sequence file formats; biological databases (Overview of available Bioinformatics resources on the web such as NCBI-Gene Bank, EMBL, SWISS-Prot, CLUSTAL X/W; Molecular phylogeny-MEGA and PHYLIP etc. software; BLAST.

Primer design and Tm Calculation, DNA Restriction pattern analysis, Codon bias and its effect on the protein expression; Basis of Molecular dynamics simulations and its application,

Suggested Readings:

1. Plant Biotechnology- The genetic manipulation of plants by Authors, Slater et al., 2008, Oxford University Press, 376 pages.
2. Genetically Engineered Food: Methods and Detection, Edited by Heller KJ, Wiley-Blackwell, 2006, 287 pages
3. Handbook of Plant Biotechnology, 2 volume set, Edited by Christou P and Klee H. Wiley publisher, 2004, 1488 pages.
4. P.K. Gupta: Elements of Biotechnology, Rastogi and Co. Meerut, 1996
5. Plant Biotechnology: Principles and Applications. Edited by Abdin MZ et al., Springer, 2017; 392 pages.
6. Bhojwani SS and Razdan MK: Plant Tissue Culture: Theory and Practice- Elsevier.
7. B.D. Singh: Biotechnology, Kalyani Publ.
8. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing
9. Recent Advances in Plant Biotechnology and Its Applications: Prof. Dr. Karl-Hermann Neumann Commemorative Volume. Edited by Ket N al., I. K. International Pvt.Ltd, 2008, 694 pages.
10. H.D. Kumar: Modern Concepts of Biotechnology, Vikas Publ. Pvt. Ltd.
11. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
12. H.S.Chawla, Plant Biotechnology, S.Chand Publications
13. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins; Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009.

Examination scheme

Components	Internal Assessments (Total Marks=30)		End Semester
	Exam/Case study/ Presentations/ Fieldwork/ Viva voce	Attendance	
Weightage (%)	20	10	70

Indira Gandhi University, Meerpur– Rewari

DEPARTMENT OF BIOTECHNOLOGY

(Ph.D. Course Work)

PAPER-3: RESEARCH AND PUBLICATION ETHICS

COURSE CODE: 25L8.0-RPE-103

Time: 3 Hrs.
Contact Hours/ Week: 2 hrs

Credit-02
Maximum Marks:50
Theory Marks:40
Internal Assessment:10

Course Objective:

1. To understand the philosophy of science and ethics, research integrity and publication ethics.
2. To identify research misconduct and predatory publications.
3. To understand indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc.)
4. To understand the usage of various plagiarism tools.

Course Outcomes:

At the end of the course, the student will have awareness about the publication ethics and publication misconducts.

Note: The examiner will set Eight questions in all covering the whole syllabus. Each question consists of 08 marks. The students shall be asked to attempt total five questions in all.

OVERVIEW

This course has total 6 units focusing on basics of Philosophy of science and ethics, research integrity, publication ethics. Hands on sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc.) and plagiarism tools will be introduced in this course.

SYLLABUS IN DETAIL

Theory

RPE 01: PHILOSOPHY AND ETHICS (3hrs.)

1. Introduction to Philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgment 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 (FPP)
4. Redundant publications: duplicate and over lapping publications, salami slicing
5. Selective reporting and misrepresentation of data

RPE 03: PUBLICATIUON ETHICS (7hrs.)

1. Publication ethics: definition, introduction and importance
2. Best practices / standard 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 and publication ethics, authorship and contributor ship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals Practice

RPE 04: OPEN ACCESS PUBLISHING (4hrs.)

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

RPE 05: PUBLICATION MISCONDUCT (4hrs.)

A. Group Discussions (2hrs.)

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 (1hrs.)

1. Use of plagiarism software like Turnitin, Urkund and other open source software tools

RPE 06: DATABASE AND RESEARCH METRICS (7hrs.)

A. Database (4hrs.)

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

B. Research Metrics (3hrs.)

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

Suggested Reading

- Nicolas H. Steneck. Introduction to the Responsible Conduct of Research. Office of Research Integrity, 2007. Available at: http://ori.hhs.gov/sites/default/files/rcrintro.pdf
- The student's Guide to Research Ethics By Paul Oliver Open University Press, 2003.
- Responsible Conduct of Research By Adil E. Shamoo; David B. Resnik Oxford University Press, 2003.
- Ethics in Science Education, Research and Governance Edited by Kambadur Muralidhar, Amit Ghosh, Ashok Kumar Singhvi. Indian National Science Academy, 2019. ISBN: 978-81-939482-1-7. http:www.insaindia.res.in/pdf/Ethics_Book.pdf
- Anderson B.H., Dursaton, and Poole M.: Thesis and assignment writing, Wiley Eastern 1997.
- Bijorn Gustavii: How to write and illustrate scientific papers? Cambridge University Press.
- Bordens K.S. and Abbott, B.b.: Research Design and Methods, Mc Graw Hill, 2008.

- Graziano, A., M., and Raulin, M.,L: Research Methods – A process of Inquiry, Sixth Edition, Pearson, 2007.
- Bird, A. (2006). Philosophy of Science. Routledge.
- P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 978-9387480865.
- 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, 1-10. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
- Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a

Examination scheme

Components	Internal Assessments	End Semester (T)
Weightage (%)	10	40

Indira Gandhi University, Meerpur– Rewari

DEPARTMENT OF BIOTECHNOLOGY

(Ph.D. Course Work)

PAPER-4: REVIEW OF LITERATURE AND SEMINAR

COURSE CODE: 25L8.0-BTY-104

Time of Presentation: 1 Hr **(each presentation)**
Contact Hours/ Week: 2 hrs/ week

Credit-02
Maximum Marks: 50
Internal Assessment: 50

Course Objective:

The course will help the students to learn about the basic introduction and literature related to the area of research.

Students are required to prepare a power point presentation on the allotted topic and have to make a presentation in front of Departmental advisory committee. Students are expected to provide latest facts and updated information by consulting latest editions of textbooks, reference books, monographs and peer-reviewed national & international research journals.

Databases: Pubmed/Medline, Web of Science, Scopus, Science Direct, Springer Link, Ingenta Connect etc.

Some Suggested Journal Publishing Groups and Suggestive Relevant Journals

Nature (npg), Cell, Science, Science Direct, Springers, Taylor and Francis, Wiley, Frontiers, BMC, Hindwai, MDPI, IJMR etc.

Examination Scheme

Components	No. Presentations	Evaluation	Marks (For each presentation)
Research Presentations/ Seminars	5	By Internal Assessment	5 (Presentation) + 5 (Q/A) =10 (Total Marks)

Student Learning Outcomes:

- ✓ Student will be able to understand the searching documents relevant to his/her work.
- ✓ This will help the students to write review articles.