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

# Scheme & Syllabus of PhD Course work of Microbiology 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 Microbiology** | 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**

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|---|---|
| Course Code: PPD-101<br>Course Credits: 4.0<br>Contact Hours: 4 hours/week (4 Lectures)<br>Examination Duration: 3 hours | **Course Assessment Methods:**<br>**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).*<br>**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 Microbiology)**

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|---|---|
| Course Code: PPD-103<br>Course Credits: 4.0<br>Contact Hours: 4 hours/week (4 Lectures)<br>Examination Duration: 3 hours | **Course Assessment Methods:**<br>**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).*<br>**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

**Soil & Plant Microbiology**: Microbial successions and transformation of organic matter; Role of microorganisms in soil fertility, Bioremediation of polluted soils; pesticide degradation. Biological control of fungal pathogens and insects, Biofuels, Biosensors, Biopesticides, Biofertilizers, Biotransformation, Plant microbial interaction, Important plant pathogens.

## UNIT-II

**Microbial Physiology**: Differentiation in bacteria, slime molds, yeasts. Molecular biology of bioluminescence, bacterial virulence. Heat shock response, Meta-genomics.

**Microbial Regulation**: Regulation of initiation, termination and anti-termination of transcription. Global regulation and differentiation by sigma factor. Regulatory control in bacteria: inducible and biosynthetic pathways. Antisense RNA regulation of gene expression, Regulation of cell cycle, Lytic and lysogenic cascade.; Global nitrogen control and regulation of nitrogen fixation, SOS regulatory control.

## UNIT-III

**Advances in Food Microbiology:** Advances in Food preservation, fermented foods and Beverages, HACCP, Hurdle Technology. Nucleic acid-based techniques in food diagnostics

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

## UNIT-IV

**Fermentation**: Recent developments on production of primary and secondary metabolites; Microbial production of health care products, Treatment of biological wastes, microbial inoculants and enzymes for waste treatment; Yeast technology – classification, genetics, strain improvement for brewing, baking and distilleries and topics of current interest in fermentations.

**Suggested Reading**:


1. Selected articles from Journals.
2. Ahluwalia AS. 2003. Phycology: Principles, Processes and Applications. Daya Publ.
3. Barsanti L &Gualtieri P. 2006. Algae: Anatomy, Biochemistry and Biotechnology. Taylor & Francis, CRC Press.
4. Herrero A & Flores E. 2008. The Cyanobacteria Molecular Biology, Genomics and Evolution. Calster Academic Press.
5. Mahendra Rai. 2006. Handbook of Microbial Biofertilizer. 1st Ed. Springer.
6. Sylvia DM, Fuhrmann JJ, Hartlly PT & Zuberer D. 2005. Principles and Applications of Soil
Microbiology. 2nd Ed. Pearson Prentice Hall Edu.
7. Nancy T & Trempy J. 2004. Fundamental Bacterial Genetics. Blackwell.
8. Paul EA. 2007. Soil Microbiology, Ecology and Biochemistry. 3rd Ed. Academic Press.
9. Lewin B. 2000. Gene. Vols. VI-IX. Oxford University Press

**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)**

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|---|---|
| Course Code: PPD-104<br>Course Credits: 2.0<br>Examination Duration: 2 hours | **Course Assessment Methods:**<br>**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).*<br>**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.