Department of Bio & Nano Technology,
Guru Jambheshwar University of Science & Technology, Hisar

Syllabus for
Pre-Ph.D Microbiology

Pre- Ph.D Course Work

Common Courses:

PPD-101 Research Methodology
PPD-102 Review of Literature and Seminar
(The topic of credit seminar will be decided by the Teacher incharge which will be of recent interest and the student will collect the literature and deliver the credit seminar on the above topic which will be evaluated by a minimum of 3 faculty members including Nominee of the Dean from other department).
PPD-103 Departmental Elective Course (Advances in Microbiology)
PPD-104: Research and Publication Ethics (RPE)

PPD-101 Research Methodology

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 presentation, 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 result, preparation of tables, figures ; writing discussion : writing conclusion Writing summary and synopsis ; Reference citing and listing/Bibliography. safety, safe disposal of hazardous materials.
Laboratory safety issues : Related to various labs, Workshop, electrical, health and fire

Unit-III

Statistical analysis and errors: Mean, Mode, Median, Relative and Hypothesis testing for mean, proportion and variance, Chi-square tests, regression analysis, Factor 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's
Online Resources: Introduction to Massive Open Online Courses (M00Cs) 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

References

1. Gurumani, N. (2010), Scientific thesis writingand Paper presentation, MJP publishers.
2. Gerald, C. F. and wneatley, 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, Prentic 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.science marg. org, www.springer.com, www.pnas.org, www.tandf.co.uk, www.opticsinfobase.org for research updates.

absolute errors,
Correlation and

PPD-103 Departmental Elective Course (Advances in Microbiology)

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, Plant microbial interaction, Important plant pathogens.

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.

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, Probiotics.

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. Ist 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 (RPE)

Course structure

- The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit title	Teaching hours
Theory		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
Practice		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Databases and Research Metrics	7
	Total	**30**

Syllabus in detail

THEORY

- **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: SCIENTIFICCONDUCT (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 contributorship
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
4. 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 (1967) *A Short History of Ethics*. London.

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

Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2019), ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Book.pdf

Scheme of Examination for Pre- Ph.D Programme in Microbiology
w.e.f. Jan.-2012

Sr.No.	Course Code No.	Nomenclature	Type	L + T + P	Credits	Max. Marks
1.	PPD- 101	Research Methodology	PC	4 + 0 + 0	4	100
2.	PPD- 102	Review of Literature and Seminar	PC	2 + 0 + 0	2	100
3.	PPD- 103	Departmental Elective Course (Advances in Microbiology)	PE	4 + 0 + 0	4	100
4.	PPD-104	Research and Publication Ethics (RPE)	PC	2+0+0	2	100

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 be offered in the first semester. It will consist of 04 papers.

ii) Each paper of the course work except PPD-102 & PDP-104 will be of 4 credits. PPD-102 & PDP-104 will be of 02 credits. Each paper will of 100 marks.

iii) The scheme for Ph.D. course work is as under:

PPD-101: Research Methodology

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.

PPD-103: Departmental Elective Course It includes an elective course related to the relevant field of research and it will be offered by the respective department/school.

PPD-104: Research and Publication Ethics (RPE) It includes basics of philosophy of Science and ethics, research integrity, publication ethics.