GLOCAL UNIVERSITY
SHAPING GLOBAL MINDS

Ph.D. Course Work Common Syllabus

Paper Name: Research Methodology	Paper Code: PHD-101/RM	Credits: 4 (4-0-0)
Evaluation (Maximum Marks = 100)	Internal = 30	External = 70
Course Objectives 1. To introduce the fundamental concepts, methods, and ethics of scientific research. 2. To develop skills in research design, data collection, analysis, and interpretation. 3. To enable students to formulate research problems and communicate findings effectively.		

Unit	Contents	Lectures
I	Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.	10
II	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.	10
III	Sampling: Concepts of Statistical approach, Sample, Sampling Frame, Sampling Error, Sample Size. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.	15
IV	Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Techniques of Scientific Measurement. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopedias, The art of Scientific Communication.	12

V	Use of tools/techniques for Research: methods to search required information effectively, Reference Management Software like Endnote/Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism. Presentation in Seminars and Conferences, Sponsored Research-basics, Major funding bodies for research, National- DST, UGC, CSIR, ICMR, DBT, SERB, ISRO, and DRDO, International- NSF, NIH, Horizon Europe and UNESCO.		**13**
	Total		**60**

Suggested Readings

1. Kothari, C. R., and Gaurav Garg. Research Methodology: Methods and Techniques. 4th ed., New Age International Publishers, 2019.
2. Creswell, John W., and J. David Creswell. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 5th ed., SAGE Publications, 2018. https://us.sagepub.com/en-us/nam/research-design/book255675
3. Saunders, Mark, Philip Lewis, and Adrian Thornhill. Research Methods for Business Students. 8th ed., Pearson Education, 2019.
4. Bryman, Alan. Social Research Methods. 5th ed., Oxford University Press, 2016. https://global.oup.com/ukhe/product/social-research-methods-9780199689453
5. Flick, Uwe. An Introduction to Qualitative Research. 6th ed., SAGE Publications, 2018.
6. Walliman, Nicholas. Research Methods: The Basics. 2nd ed., Routledge, 2017. https://www.routledge.com/Research-Methods-The-Basics/Walliman/p/book/9781138693981
7. Kumar, Ranjit. Research Methodology: A Step-by-Step Guide for Beginners. 5th ed., SAGE Publications, 2022.
8. Neuman, W. Lawrence. Social Research Methods: Qualitative and Quantitative Approaches. 8th ed., Pearson, 2014.
9. Research Methods in Psychology. https://www.saylor.org/courses/psych301/
10. https://onlinecourses.nptel.ac.in/noc23_ge36/preview
11. https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Ph.D. Course Work Common Syllabus

Paper Name: Research and Publication Ethics	Paper Code: PHD-102/RPE	Credits: 2 (2-0-0)
Evaluation (Maximum Marks = 100)	Active participation, group discussion and quizzes (25%); Practical: 40%; and End Semester written examination: 35 %	

Introduction:

This course is designed to create awareness among doctoral students about research and publication ethics and different types of unethical practices and misconduct in publications. 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.

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
RPE05	Publications Misconduct	4
RPE 06	Databases and Research Metrics	7
	Total	**30**

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 misrepresentations of data.

RPE 03: PUBLICATION ETHICS (7 hrs.)

1. Publication ethics: definition, introduction and importance
2. Best practices/standards setting initiatives and guidelines: CARE, 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 Tools to Identify Predatory Publications
4. Journal Finder/Journal Suggestion Tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

RPE 05: PUBLICATION MISCONDUCT (4 hrs.)

A. Group Discussions (2 hrs.)
1. Subject specific ethical issues, falsification, fabrication, and plagiarism (FFP), authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

B. Software tools (2hrs.)

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

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

A. Databases (4 hrs.)
1. Indexing Databases
2. Citation Databases: Web of Science, Scopus, etc.

B. Research Metrics (3hrs.)

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

Essential Readings

- Suber, P. (2012). *Open Access*. Cambridge, MA, USA: MIT Press.
- Resnik, D.B. (2011). What Is Ethics in Research & Why Is it Important. National Institute of Environmental Health Sciences, I-10.
- National Academy of Sciences, National academy of Engineering and Institute of Medicine (2009). *On Being a Scientist: A Guide of Responsible Conduct in Research*: Third Edition, National Academies Press.
- Madalli, D.P. (2015). *Concepts of Openness and Open Access*. UNESCO Curriculum for Researchers, Module 2. Paris: UNESCO.
- Maclntyre, Alasdair (1967). A Short History of Ethics. London.
- Kanjilal, U. & Das, A.K. (2015). *Introduction to Open Access*. UNESCO Curriculum for Library Schools, Module 1. Paris: UNESCO.
- INSA (2019). Ethics in Science Education, Research and Governance, Edited by K. Muralidhar, A. Ghosh, & A.K. Singhvi. New Delhi: Indian National Science Academy. ISBN: 9788193948217.
- Das, A.K. (2015). *Research Evaluation Metrics*. UNESCO Curriculum for Researchers, Module 4. Paris: UNESCO.

- Das, A.K. & Mishra, S. (2014). Genesis of Altmetrics or Article-level Metrics for Measuring Efficacy of Scholarly Communications: Current Perspectives. *Journal of Scientometric Research*, 3(2): 82-92.
- Chaudhari, N. & Baliga, V. (2015). *Intellectual Property Rights*. UNESCO Curriculum for Researchers, Module 3. Paris: UNESCO.
- Chaddah, P. (2018). Ethics in Competitive Research: Do Not Get Scooped; To Not Plagiarized. ISBN: 9789387480865
- Bird, A. (2006). Philosophy of Science. Routledge.

Supplementary Readings

- ICMR (2017). *National Ethical Guidelines for Biomedical and Health Research Involving Human Participants*. New Delhi: Indian Council of Medical Research.
- Indian Sociological Society (2020). *ISS Code of Ethics*. New Delhi: Indian Sociological Society.
- PSA (2019). *Draft National Policy on Academic Ethics*. New Delhi: Principal Scientific Adviser (PSA) to the Government of India.
- The InterAcademy Partnership (2022). *Report: Combatting Predatory Academic Journals and Conferences*. Trieste: The InterAcademy Partnership.
- UGC (2019). *Consortium for Academic Research and Ethics (CARE)*. New Delhi: University Grants Commission.
- UGC (2020). *Good Academic Research Practices*. New Delhi: University Grants Commission.
- UNESCO (2021). *UNESCO Recommendation on Open Science*. Paris: UNESCO.
- Das, A.K. (2008). *Open Access to Knowledge and Information: Scholarly Literature and Digital Library Initiatives - the South Asian Scenario*. New Delhi: UNESCO, ISBN 9788189218218.
- Das, A.K. (2015). *Scholarly Communications*. UNESCO Curriculum for Researchers, Module 1. Paris: UNESCO.
- Das, A.K. (2019). Research Integrity in the Context of Responsible Research and Innovation Framework. *DESIDOC Journal of Library & Information Technology*, 39(2): 82-86.
- Das, A.K. (2020). UNESCO Recommendation on Open Science: An Upcoming Milestone in Global Science. *Science Diplomacy Review*, 2(3): 39- 43.
- Mishra, S. & Das, A.K. (2015). *Sharing your Work in Open Access*. UNESCO Curriculum for Researchers, Module 5. Paris: UNESCO.

- Nisha, F., Das, A.K. & Tripathi, M. (2020). Stemming the Rising Tide of Predatory Journals and Conferences: A Selective Review of Literature. *Annals of Library and Information Studies*, 67(3): 173-182.
- Smith, I. (2015). *Open Access Infrastructure*. UNESCO Curriculum for Library Schools, Module 2. Paris: UNESCO.
- Bealt, J. (2012). Predatory Publishers Are Corrupting Open Access. *Nature*, 489(7415),179-179.

Ph.D. Course Work Common Syllabus

Paper Name: Computer Application	Paper Code: PHD-103/CA	Credits: 4 (4-0-0)
Evaluation (Maximum Marks = 100)	Internal = 30	External = 70
Course Objectives 1. To introduce the fundamental concepts, architecture, and classifications of computers along with operating systems like Windows and Linux. 2. To develop proficiency in using Microsoft Office tools (Word, Excel, PowerPoint) for document preparation, data analysis, and presentations. 3. To familiarize students with internet usage, email communication, and basic networking concepts for effective digital connectivity and communication.		

Unit	Contents	Lectures
I	Definition and Characteristics of systems-Hardware & Software, Windows and Linux (Latest Version) Microsoft Tools- Definition and Characteristics of Computers: Classification of Computers; Application of Computers; Hardware; Software; Functional Units of a Computer System; Computer Architecture; Bit, Nibble and Byte. Windows: Introduction to Windows Operating System; Windows Features; Starting Windows; Parts of Windows Screen; Shortcuts in Winodows; Windows Applets; Windows : My Computer; Working with files and Folders; what is MS-DOS? Booting Process; The DOS Directory Structure; Referencing Group of files; Command Syntax; Types of Commands; Microsoft Word (Latest Version): Introduction to Microsoft Tools; Starting Word; Mail Merge.	15
II	Microsoft Excel; (Latest Version) Excel Features; Entering data into a Cell; Entering Numbers; Spreadsheets Operations; Freezing Window Panes; Excel Offers Several Methods for Selecting Cells; Erasing the Content of A Cell; Formatting Cells from the Home Tab; The Format Painter; Formulas and Functions; Using Logical Functions; Date and Time Functions; Math and Trigonometric Functions; Statistical Functions; Copying Formulas; Charts; Creating a New Embedded Chart; Type of Charts; Formatting Chart Elements from the Format tab.	15
III	Microsoft PowerPoint (Latest Version) What is Presentation? Introduction to PowerPoint; Starting PowerPoint; PowerPoint Views; Save a Presentation; Exiting PowerPoint; Working with Slides.	10
IV	Introduction to Internet and E-Mail Hardware requirement; to connect to the Internet; Types of Connections; Internet Service Providers; Internet Addressing; Resource Addressing; The World Wide Web; E-Mail.	10
V	Networking Concepts What is a Networks?; Uses of Computer Networks; Network Topologies; Network Hardware and Software.	10

Total	60

Suggested Readings

1. Rajaraman, V. Fundamentals of Computers. 6th ed., PHI Learning, 2018.
2. Sinha, P. K., and Priti Sinha. Computer Fundamentals. BPB Publications, 2010.
3. Balagurusamy, E. Programming in ANSI C. 8th ed., McGraw Hill Education, 2019.
4. Forouzan, Behrouz A. Data Communications and Networking. 5th ed., McGraw Hill Education, 2017.
5. Tanenbaum, Andrew S., and Herbert Bos. Modern Operating Systems. 4th ed., Pearson, 2014.
6. Stallings, William. Computer Organization and Architecture: Designing for Performance. 10th ed., Pearson, 2016.
7. Riley, David, and Kenny Hunt. Computational Thinking for the Modern Problem Solver. CRC Press, 2014.
8. Rouse, Margaret Z. Information Technology for Management. Wiley, 2020.
9. Evans, Alan, Kendall Martin, and Mary Anne Poatsy. Technology in Action: Introductory. 15th ed., Pearson, 2019.
10. NPTEL. Computer Science and Engineering, https://nptel.ac.in/course.html
11. GeeksforGeeks. Computer Science Portal for Geeks, https://www.geeksforgeeks.org/
12. Coursera. Computer Science Courses, https://www.coursera.org/browse/computer-science
13. TutorialsPoint. Computer Programming and IT Tutorials, https://www.tutorialspoint.com/index.htm
14. https://nptel.ac.in/courses/106106092

Glocal School of Life and Allied Health Sciences
Ph.D. Course Work Botany- Elective

Paper Name: Techniques in Molecular Modeling	Paper Code: PHD-104/BO (I)	Credits: 4 (4-0-0)
Evaluation (Maximum Marks = 100)	Internal = 30	External = 70
Course Objectives 1. To provide understanding of concepts in computational methods used in molecular modeling. 2. Applying quantum and classical modeling techniques for solving chemical problems. 3. Apply and analyses the molecular data using software/ tools relevant to their research areas.		

Unit	Contents	Lectures
I	Overview of modeling techniques: Quantum vs Classical viewpoint, Potential energy surfaces (PES), Born-Oppenheimer approximation, Coordinate systems (Cartesian, internal), Force fields and parameterization basics.	10
II	**Quantum Mechanical Methods** Ab initio methods: Hartree-Fock, post-HF methods (MP2, CI, CCSD), Semi-empirical methods (AM1, PM3, MNDO), Density Functional Theory (DFT) basics.	10
III	**Molecular mechanics:** principles and energy components, Common force fields (AMBER, CHARMM, OPLS, GROMOS).	15
IV	**Models** Molecular Dynamics (MD) and Monte Carlo (MC) Simulations Basics of MD: equations of motion, integrators, thermostats, Free energy calculations.	10
V	**Applications and Software** Modeling of small molecules, proteins, and materials, Docking, QSAR, and drug design applications, Introduction to Software tools: Gaussian, ORCA, GAMESS, VASP, GROMACS, NAMD, AutoDock Vina. Energy minimization, property prediction.	15
	Total	60

Suggested Readings

1. Hans-Dieter Höltje, Wolfgang Sippl, Didier Rognan, Gerd Folkers. Molecular Modeling: Basic Principles and Applications, 3rd Edition, 2008.
2. https://nptel.ac.in/courses/104101095
3. https://www.nature.com/articles/s41598-023-40160-2
4. https://link.springer.com/article/10.1007/s00706-023-03076-1

Glocal School of Life and Allied Health Sciences
Ph.D. Course Work Botany- Elective

Paper Name: Advances in Botany	Paper Code: PHD-104/BO(II)	Credits: 4 (4-0-0)
Evaluation (Maximum Marks = 100)	Internal = 30	External = 70
Course Objectives 1. Understanding the concepts in advances in ecology and biodiversity. 2. Applying techniques for secondary metabolites isolation. 3. Apply and analyse the systematics and genomics of botanical species.		

Unit	Contents	Lectures
I	Ecology & Biodiversity Concept of Ecology, Ecological factors, concept of Biome and Biosphere, Ecosystem, types of Ecosystems, Plant succession , Plant indicators, Forest types, Environment (Protection) Act, Endangered species(plants), Endemism, IUCN categories, Red Data Book, Biodiversity and its conservation, Hotspots of Biodiversity, Conventions on Biodiversity, Indian Biodiversity Act (2002), Global warming and Climate change, Environmental Impact Assessment(EIA) and Introduction to Ethnobotany.	**15**
II	Secondary metabolites Secondary metabolites-Terpenoids, Phenolics, Alkaloids. Major secondary metabolite synthesis pathways in plants, Acetate Pathway (Fatty acid and polypeptides), Mevalonate and deoxyxylulose phosphate pathway (for production of Terpenoids and steroids), Shikimate pathway(Phenols, Amino acids etc) and role of Secondary metabolites.	**15**
III	Plant Systematics Plant Classifications: Artificial, Natural, Phonetic, Phylogenetic and APG IV Computational phylogenetics:Theoretical framework of phylogenetic, Distance Vs. Discrete methods, Minimum Evolution, UPGMA, Neighbor Joining, Maximum Likelihood, Maximum Parsimony, Bayesian Inference, reconstruction of phylogeny from morphological data, Gene Tree Vs. Species tree, and lineage sorting.	**15**
IV	Genomics & Proteomics Genome structure & Organization, Eukaryotic genome, Organelle genome, Genomics of Microbes and Microbiomes, Genome sequencing technologies. Proteome-Structural and functional features, Qualitative proteome technology (Gel based and Gel free), Quantitative proteome technology, Functional proteome technology, Application of Proteomics in Agricultural biotechnology.	**15**
	Total	**60**

Suggested Readings

1. Krishnamurthy K.V.2004 An advanced text book of Biodiversity.Oxford & IBH ,New Delhi.

2. Odum E.P Gary W.Barrelt. 2004 Fundamentals of Ecology-15th edition. Thomson Asia Pvt.Ltd.

3. L Taiz and E.Zeiger 2002 Plant physiology (second edition) Simauer Associates Inc Publishers Sunderlands, Massachussetts.

4. W.G.Hopkins 1985 Introduction to plant Physiology John Wiley and Sons, Inc. New York.

5. Coombs, Hall, Long and Scurlik. 1985 Techniques in bioproductivity and Photosynthesis,Pergmon Press, Oxford

6. Hall, Sccurlik, Bolhar, Norden Kamf,Leagood and Long 1993 Photosynthesis and productin in a changing Environment. A Field and Laboratory Mannual, Chapman and Hall Publication.

7. Glick, B.r. and Pasternak, J.J 1994 Molecular Biotechnology:Principles and Application of r-RNA Press, Washington.

8. Singh Gurucharan 2010 Plant systematic : An Integrated fapproach. Science Pblisher, USA

9. Judd,W.SCampbell, C.S., Kollogg, E.A., Stevens, P.F and DonoghueM.J.2008 Plant systematic: Phylogenetic approach.Sinauer Associates, Inc.

10. Krishnamoorthy,K.V 2003 Text Book of Biodiversity, Science Publishers Inc, United States of America.

11. Wison E.O and Frances M.Peter 1988 Biodiversity, National Academy Press, Washington

12. Kelvin J Gaston and John I Spicer 2005 Biodiversity an Introduction. Blackwell publishing company, Australia.

Glocal School of Life and Allied Health Sciences
Ph.D. Course Work Botany- Elective

Paper Name: Advances in Plant Biochemistry	Paper Code: PHD-104/BO(III)	Credits: 4 (4-0-0)
Evaluation (Maximum Marks = 100)	Internal = 30	External = 70
Course Objectives 1. Understanding the concepts in advances in ecology and biodiversity. 2. Applying techniques for secondary metabolites isolation. 3. Apply and analyse the systematics and genomics of botanical species.		

Unit	Contents	Lectures
I	**Enzymology**: Enzymes and in-born errors in metabolism; preparation and application of immobilized enzymes; enzymes and recombinant DNA technology.	10
II	**Hormones & Signal Transduction**: Hormonal regulation of plant growth and development, signal transduction, Role of PGRs in agriculture and horticulture, Auxin signal transduction pathway; Gibberellin signaling.	10
III	**Plant Stress Responses:** Biotic and Abiotic stress; Physiological and biochemical responses of plants to environmental stress; Plant responses to salinity and chilling stress; Abiotic stress and secondary metabolite production. Development of transgenic plants for abiotic stress tolerance; Stress proteins in plants; biochemistry of plant defense reactions; plant responses to herbivory, control of plant pathogens by genetic engineering.	20
IV	**Instrumentation in Plant Biochemistry**: Construction and principles of light, electron and scanning probe microscopy. Centrifugation: differential, density. Principles of spectrophotometry and spectroscopy; biomolecules separation, detection and estimation methods methods; HPLC.	20
	Total	60

Suggested Readings

1. Taiz L, Zeiger E. Plant Physiology (Second Edition) Simauer Associates Inc Publishers Sunderlands, Massachusetts (2002).
2. Heldt HW. Plant Biochemistry and Molecular Biology. Oxford University Press (1997).
3. Hopkins WG. Introduction to Plant Physiology. John Wiley and Sons, Inc. New York (1985).
4. Methods in Enzymology Colowick and Caplan Academic Press, New York.
5. Coombs, Hall, Long and Scurlik. Techniques in Bioproductivity and Photosynthesis. Pergamon Press, Oxford (1985).

6. Hall, Sccurlik, Bolhar, NordenKamf, Leagood and Long Photosynthesis and production in a Changing Environment. A Field and Laboratory Manual. Chapman and Hall Publication (1993).

7. Buchanan BB, Gruissem W, Jones RL. Biochemistry and Molecular Biology of Plants (2nd Ed.). Wiley Blackwell. (2015).