Indira Gandhi University, Meerpur, Rewari

Scheme of Examination

Ph.D. Course Work (Environmental Sciences)

w.e. f. 2020-21

Core Courses

Course Code	Title of the Course	Theory Marks	Internal Marks	Practical Marks	Max Marks	Credits
PHD EVS-101	Research Methodology	80	20	-	100	4
PHD EVS-102	Computer Applications	50	-	50	100	4

Course Code	Title of the Course	Max Marks	Credits
PHD EVS-103	Review of Literature and Seminar	50	2

Core Course provided by the University

Course Code	Title of the Course	Theory Marks	Practical and Viva Voce Marks	Max Marks	Credits
PHD EVS-104	Research and Publication Ethics	25	25	50	2

Subject Specific Courses (Anyone)

Course Code	Title of the Course	Theory Marks	Internal Marks	Max Marks	Credits
PHD EVS - 105	Biosensor	80	20	100	4
PHD EVS - 106	Bio-nanotechnology	80	20	100	4

Total Credits: 16

Note: 1. The internal assessment of 20 marks in each paper shall be based on two assignments of 5 marks each and one seminar of 10 marks presented by each candidate and their participation in seminar.

2. Subject specific courses will be offered subject to availability of requisite resources/faculty.

PHD EVS 101: Research Methodology

Time : 3 hours | Max. Marks : 100
Theory Marks : 80 Internal Marks : 20 Credits : 4

Note: The question paper will contain four units and eight questions in all. The candidates are required to attempt four questions in all selecting one from each unit. All questions carry equal marks.

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.

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:
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, Intellectual Property Right and Patent laws.

Unit 3: 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 4: 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.

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.

Books recommended

1. Kothari CR (2009) Research Methodology and techniques, Delhi New age international publisher.
2. Rosengreen K.E. (2000) Communication: An Introduction. New Delhi; Sage Publication
3. Bill Taylor, Research Methodology: A Guide for Researchers in Management and Social Sciences, PHI.
4. R. P. Mishra, Research Methodology, Concept Publishing Company(P) Ltd., New Delhi.
5. G.V. Shenoy and Madan Pant, Statistical Methods in Business and Social Sciences, McMillan Indian Ltd., New Delhi.
6. Suresh C. Sinha and Anil K. Dhiman, Research Methodology, Ess Ess Publications, New Delhi, 2002
7. ITL Education Solutions Ltd., Introduction to Information Technology, Pearson Education.

PHD EVS 102: Computer Applications

Time: 3 hours Max. Marks : 100

Theory Marks: 50
Practical Marks: 50
Credits 4

Note: Note: The question paper will contain four units and eight questions in all. The candidates are required to attempt four questions in all selecting one from each unit. All questions carry equal marks.

Course Objectives:
1. Students will learn computer basics
2. Students will learn MS-Word and MS-excel
3. Students will learn IT tools for data analysis

Unit – I

Computer Basics: Introduction, Characteristics of a Computer, Classification of Computers, Applications of Computer, Internet Basics, Surfing the Internet, Sending Email, web search internet basics, internal protocols, search engines, computer virus.

Unit - 11

Word processing: Introduction and working with MS-Word and EXCEL basic commands; formatting-text and documents; Sorting and tables; Working with graphics; Introduction to mail merge, macros, math type, equation editor. Working with graphics in Excel; Using worksheets as database, data sort, functions; measurements and uncertainty, error analysis; If then analysis. Charts

Unit - III

Data Analysis Techniques:

Quantitative and qualitative methods of data analysis; Hypothesis Testing - Parametric tests (Z-test, t-test, F-test) and Non-parametric Tests (Chi-Square Test, ANNOVA), Tests of significance based on normal distributions; association of attributes

Unit IV

Use of IT software in data analysis and data presentation; SPSS software. Optimization Techniques
Introduction of Linear Programming, Formulation and Solution of LPP, PERT and CPM

Student Learning Outcomes:

- The students become well versed with computer basics
- They will learn different software's
- They will learn different data analysis methods, statistical tools for better representation of data

Books recommended

1. Date, C.J: An Introduction to Database Systems, Addison Wesley, Massachusetts.
2. Virginia Andersen: Microsoft Office Access 2007 : The Complete Reference, Tata McGraw Hill Education.
3. Mansfield, Ron : The Compact Guide to Microsoft office, BPB publication, Delhi.
4. Norton, peter : Working with IBM-PC, BPB Publications Delhi.
5. Quantitative Techniques 1st Edition by S. K. Khandelwal, 2012
6. Quantitative Techniques: Theory and Problems by by P. C. Tulsian and Vishal Pandey, 2002

PHD EVS 103: Review of Literature and Seminar

Max. Marks : 50
Credits : 2

Note: Students shall review 15 to 20 research papers in their concern field. The evaluation shall be done by one internal examiner and one external examiner.

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 article

RESEARCH AND PUBLICATION ETHICS
COURSE CODE: PHD EVS – 104

Maximum Marks: 50 Theory Marks: 25
Time: 2 Hrs. Practical and viva voce Marks: 25
Credit - 02

Note: The question paper shall have total eight questions of five marks each covering Unit 1, 2 and 3. The students shall be asked to attempt total five questions in all.

Practical and viva voce examination will be of 25 marks from Unit number 4, 5 and 6 and shall be conducted by two internal examiners appointed by the Vice-Chancellor.

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: Unit 1, 2, 3 are to be covered via Theory mode and Unit 4, 5, 6 are to be covered via practice mode.

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.

Pedagogy:

Class room teaching, Guest Lectures, group discussions and practical sessions. Total teaching hours shall be 30 hours.

Evaluation

Continuous assessment will be done through tutorials, assignments, quizzes and group discussions. Weightage will be given for active participation. Final written examination will be conducted at the end of the 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, i 10 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.
- 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

PHD EVS 105: Biosensor

Time : 3 hours

Max. Marks : 100
Theory Marks : 80
Internal Marks : 20
Credits : 4

Note: The question paper will contain four units and eight questions in all. The candidates are required to attempt four questions in all selecting one from each unit. All questions carry equal marks.

Course Objective:

This course covers the principles, technologies, methods and applications of biosensors and bioinstrumentation. It will provide the student with detail of methods and procedures used in the design, fabrication and application of biosensors. The fundamentals of measurement science are applied to optical, electrochemical, mass, and pressure signal transduction. Upon successful completion of this course, students are expected to be able to explain biosensing and transducing techniques, design and construct biosensors instrumentation.

Course Contents:

Unit 1: Introduction:

Biosensor introduction and types of sensors, target analytes, various recognition, signals, and device types, history of field. Sensitivity selectivity, interference, calibration, dynamic Range, signal to noise,

Unit 2: Types of Biosensors and immobilization techniques:

Bio-catalysis based biosensors, bio-affinity based biosensors & microorganisms-based biosensors, biologically active material and analyte. Types of membranes used in biosensor constructions. Immobilisation : adsorption, encapsulation (hydro-gel, sol-gel glass, etc.), covalent attachement,

Unit 3: Concept and types of Transducer:

Various types of transducers; principles and applications - Calorimetric, optical, potentiometric / amperometric conductor-metric/resistor-metric, Piezoelectric, semiconductor, and impedimetric based transducers.

Unit 4: Application of Biosensors

Application of biosensor in: environmental monitoring., water quality testing, Low cost- biosensor for industrial processes for online monitoring; biosensors for biomedical.

Student Learning Outcomes:

- Student will be able to understand the techniques of biosensor fabrication various industrial, biomedical and related applications of biosensors

Books recommended

1. **Yoon**, Jeong-Yeol, Introduction to biosensors, From Circuits to immunosensors,2013
2. **Electrochemical**, **Bioelectronic**, **Piezoelectric**, **Cellular** and **Molecular Biosensors**. Editors: Prickril, Ben, Rasooly, Avraham (Eds.)., 2017

3. Mohd Imran Ahamed, Abdullah M. Asiri, Tauseef Ahmad Rangreez, **Biosensors**: **Materials and Applications, 2019**

4. Bansi **Malhotra** Anthony Turner.Advances in Biosensor volume 5, 2003

PHD EVS 106: Bio-nanotechnology

Time : 3 hours Max. Marks : 100
Theory Marks : 80 Internal Marks : 20
Credits : 4

Note: The question paper will contain four units and eight questions in all. The candidates are required to attempt four questions in all selecting one from each unit. All questions carry equal marks.

Course Objective:

The overriding aim of this course is to provide basic knowledge in the interface between chemistry, physics and biology on the nanostructure level with a focus on Environmental usage.

Course Contents:

Unit 1: Introduction

Introduction to Nano-biotechnology. Synthesis techniques of various types of nanostructured materials and their application within biotechnology. using biomaterials and biomolecules as bases for inorganic structures i.e: CNT, Graphene conducting polymer

Unit 2: Green Nanotechnology

- Synthesis of nanomaterial using green chemistry from
- plants,
- Microbes

Characterization and application of Nanostructures materials produced by green route for environmental application.

Unit 3: Environmental Bio-molecules and their functionalization

- Introduction to surface science of biomaterials.
- Methods for derivatization/functionalization and characterization of surfaces
- Methods of nanomaterial interaction with surfaces of biomolecules

Unit 4: Application of bio- nanotechnology

- Environmental application of bio-nanotechnology
- Waste -water treatment
- Waste to wealth conversion
- Environmental Quality Monitoring
- Medical: Treatment, drug delivery, Diagnostics

Student Learning Outcomes:

- able to synthesized various types of nanostructured materials.
- able to understand the interaction of biomolecules with surfaces of different chemical and physical species.

- Will gain expertise in selective immobilization of biomolecules on surface.

- Will have a required knowledge of application of bio-nanotechnology in environmental, medical and industrial field

Books recommended

1. David S. Goodsell , Bio-nanotechnology: Lessons from Nature. Willy press, 2004
2. Rakesh Tekade, Biomaterials and Bio-nanotechnology - 1st Edition. Elsevier
3. Pierfrancesco Morganti Bio-nanotechnology to save the environment, MDPI, 2019
4. Ljiljana. Fruk and Antonia Kerbs, Bio-nanotechnology, Concept and applications, Cambridge University Press