

Ph. D – BIOCHEMISTRY
(Effective from the academic year 2023 - 2024 and onwards)

PREAMBLE

- The degree of Doctor of Philosophy (Ph.D) is awarded to a candidate who has submitted a thesis based on original and independent research in any biochemistry field of research.
- This contributes to the advancement of knowledge, which can be useful to the society.

PROGRAMME EDUCATIONAL OUTCOME (PEO)

PEO 1: Awareness about the discipline major issues and will have an in-detail understanding of biochemistry, selected for research importance.

PSO 2: Ethical issue awareness in research and career options to gain expertise in continuing laboratory procedures for experimental animal handling and disposal.

PSO 3: Capable of planning and executing experiments safely and infer experimental data.

PSO 4: Develop skills to present their work via written, oral and visual presentations of an original research proposal.

PSO 5: Persistent production of good research findings for quality publication

PROGRAMME OUTCOME (PO)

PO1: Literature review: Elaborate survey on the particulars of research advancements and its methodologies.

PO2: Subject knowledge: In-depth knowledge in the respective field to find the solutions for the uncovered areas.

PO3: Innovative ideas: Agenda is to adopt a constructive idea to accomplish a unique goal

PO4: Project/Model design: Developing/promoting ideas using tools of biochemistry

PO5: Science and Society: Finding remedies which can solve problems oriented to the society.

PO6: Ethics: Research and career options to gain more expertise in continuing laboratory procedures for experimental animal handling and disposal.

PO7: Product development: At the outset the ultimate aim is to develop a product which can be later commercialized and utilized for the beneficiaries.

PO8: Data interpretation: Analyzing the outcome using statistical tools which can exhibit a complete picture of problem.

PO9: Continuous quest: Investigation on a particular topic to be an expert on it.

PROGRAMME SPECIFIC OBJECTIVE (PSO)

PSO 1: Exhibit in-depth mastery/scholarly of a wide range of knowledge biochemically that concern to the essentials of advanced biochemistry.

PSO 2: Be familiar in appropriate laboratory procedures and regulations in conduct and discarding of experimental animals with proper ethics.

PSO 3: Capable to associate biochemical model through theoretical view with laboratory skills to originate hypotheses, plan and execute experiments and then data collection, comparison and infer results to depict logical finale.

PSO 4: Data acquisition process using available software tools to analyze and further, can present their work through scientific publications and visual presentations.

DEPARTMENT OF BIOCHEMISTRY
FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT
RESEARCH PROGRAM – PhD in Biochemistry
(2023–2024 and onwards)

| Course code | Name of the course | Instruction hours / week | Credits | Maximum Marks (100) |
|----------------------|---|---------------------------------|----------------|----------------------------|
| 23RBC101 | Research Methodology and Pedagogy | 4 | 4 | 100 |
| 23RBC201 | Research and Publication Ethics | 4 | 4 | 100 |
| 23RBC301 | Enzyme and Enzyme Technology | 4 | 4 | 100 |
| 23RBC302 | Cancer Biology and Immunology | | | |
| 23RBC303 | Medicinal Plants and Plant Therapeutics | | | |
| 23RBC304 | Clinical Biochemistry and Toxicology | | | |
| 23RBC305 | Plant Molecular Biotechnology | | | |
| 23RBC306 | Animal Tissue Culture | | | |
| 23RBC307 | Computer Aided Drug Designing | | | |
| Program Total | | 12 | 12 | 300 |

Instruction hours/week: L: 4 T: 0 P: 0**Marks:100****End Semester Exam: 3 Hours**

Course Objectives

The course will help the scholars to

- Learn to collect, analyze and interpret research data and to identify appropriate research topics
- Inculcate technical writing and communication skills
- Gain a practical understanding of the various statistical tools used for scientific research
- Learn the usage of appropriate tools for the types of research
- Learn pedagogical methods for small and large groups
- Gain basic understanding of the usage of computer for data preparation and presentation

Course Outcomes

On completion of the course, students will be able to

1. Gain practical knowledge of handling the instruments
2. Understand some basic concepts of research and its methodologies
3. Design their research and present their data
4. Interpret the data in an effective way
5. Write and prepare research papers and research proposals
6. Handle classes effectively since they know the pedagogical techniques

UNIT I: Research Problem

Definition - Identification - Review of Literature – Phases of Research - Lacunae identification-Research process - Research design –Experimental and non experimental designs- Exploratory Diagnostic.

Sample selection Acceptance and rejection criteria- Serum, plasma, whole blood, urine CSF. Ethical consideration. Study conduct in human sample, animal sample. Experimental design. Sample collection- Order of draw.

UNIT II: Sampling methods

Sampling - Population –Census - Sample – Types – Probability – Non Probability sampling – Sampling size – Sampling process – Hypothesis and its formulation. Sampling distribution – Students t test. Experimental design – CRD, RBD. Analysis of experimental results – ANOVA and its interpretation. Duncan's Multiple Range Test. Interpretation.

Clinical research study measurement- Site selection, sample size, test evaluation.

UNIT III: Data Processing

Data Collection Tools -Case studies - Preparing for Interview – Questionnaire -Schedule - observation- Scaling techniques – Scale Construction – Rating scales. Hypothesis testing – Parametric and non parametric tests - Coding – Editing – Tabulation –Analysis – Correlation & regression.

UNIT IV: Scientific writing and presentation

Definition of scientific documents - Research paper, review paper, books, thesis and project reports. Technical Writing: Scientific and technical subjects; formal and informal writings; formal writings/reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes; common errors to be avoided. Microsoft Windows: Macintosh versions, Microsoft Word- Characteristics - Document statistics - Typical usage, Microsoft Excel - Basic operation – Charts - Using other Microsoft applications - Using external data, Microsoft Power Point –power point viewer – versions – uses, Microsoft Access –Uses – Features.

UNIT- V: Pedagogical methods in higher education

Objectives and role of higher education- Important characteristics of an effective lecture- Quality teaching and learning- lecture preparation- characteristics of instructional design- Methods of teaching and learning: Large group- Technique – lecture, seminar, symposium, team teaching, project, small group technique- simulation, role playing demonstration, Brain storming, Case discussion, and assignment, methods of evaluation- self evaluation, student evaluation, diagnostic testing and remedial teaching- question banking- electronic media in education:- ‘e’ learning researches- web based learning. Risk management. Classification of medical devices. Risk- definition, identification, FMEA analysis.

SUGGESTED READING

1. Nind, Melanie & Lewthwaite, Sarah (2018) Methods that teach: developing pedagogic research methods, developing pedagogy, International Journal of Research & Method in Education. DOI: <https://doi.org/10.1080/1743727X.2018.1427057>.
2. Voss, T., Kunter, M., & Baumert, J. (2011). Assessing teacher candidates’ general pedagogical/ psychological knowledge: Test construction and validation. Journal of Educational Psychology, 103(4), 952-969.
3. Dr. Shanti Bhushan Mishra, Dr. Shashi Alok (2017). Hand book of research methodology, Educreation publishing, New Delhi.
4. C R Kothari, Gaurav Garg. (2020). Research Methodology Methods and Techniques, new age international (p) limited, publishers, India.
5. Research Methodology - Course – NPTEL 2023, <https://onlinecourses.nptel.ac.in>

Instruction hours/week: L: 4 T: 0 P: 0**Marks:100****End Semester Exam: 3 Hours****Course Objectives**

The main objectives of the course are

- To impart the knowledge on philosophy and ethics
- To apply the state of art knowledge for scientific conduct
- To become familiarize with publication ethics
- To understand the methods of publication misconduct
- To grasp knowledge on database and research metrics
- The students will learn overall open access publishing.

Course Outcomes

On completion of the course, students are able

1. To understand principles of philosophy and ethics
2. To explain research Intellectual honesty
3. To get insight into plagiarism
4. To develop the e-content
5. To access the Learning Management System
6. To understand publication misconduct

Unit I Philosophy and Ethics

Introduction to Philosophy: definition, nature, scope, concept, branches Ethics: definition, moral philosophy, nature of moral judgment and reactions.

Unit II Scientific Conduct:

Ethics with respect to science and research - Intellectual honesty and research integrity, copyright Scientific misconduct: falsification, fabrication and Plagiarism (FFP) Redundant Publication: duplication and overlapping publication, salami slicing. Selective reporting and misrepresentation of data.

Unit III Publication Ethics

Publication Ethics: definition, introduction and importance, Best practice/standard setting initiative and guidelines: COPE, WAME, etc. Conflict and interest - Publication misconduct: definition, concept, problems that leads to unethical behaviour and vice versa, type. Violation of

publication ethics, authorship and contributorship Identification of publication misconduct, complaint and appeals Predatory publisher and journals.

UNIT IV Publication Misconduct

Group Discussions: Subject Specific Ethical Issues FFP, authorship, Conflict interest, Complaints and appeals: examples and fraud, from India and abroad. Software tools: Use of plagiarism software like Turnitin, Urkund and other open-source software tools.

UNIT V: Database and research metrics

Database: Indexing database, Citation database: 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, i-10 index, altmetrics.

UNIT VI: Development of e-content & IPR

Integrated Library Management System (ILMS): e-journals, e-books, e-shodhsindushodhganga- Database – e content development – Learning Management System (LMS) – e-PG - Pathshala- CEC (UG) SWAYAM- MOOCs- NPTEL-NMEICT.

IPR: Patent – Copyrights- Trademarks- Geographical Indications.

SUGGESTED READING

1. Partha Pratim Ray (2023). A Guide to Research and Publication Ethics A Text Book As per UGC Guidelines for UG, PG, MPhil and PhD. ND Publishers, India.
2. Dr.S.B.Kishor, Dr.Ajay S.Kushwaha, Dr. J.Gitanjali (2021). Research & Publication ethics. Das Ganu Prakashan Publishers, Nagpur, India
3. Santosh Kumkar Yadav (2020). Research and Publications Ethics, Ane Books PVT, Ltd, India.
4. NSW Department of Primary Industries and Animal Research Review Panel. Available online: <https://www.animalethics.org.au/three-rs>
5. Webinar on Research and Publication Ethics – 2021
<https://www.youtube.com/watch?v=kIgs6XSMdms>
6. Publication Ethics - Course – NPTEL 2021,
<https://www.youtube.com/watch?v=CXVNIEpC83E>

PRACTICE

Open access publishing

1. Open access publication and initiatives - SHERPA/RoMEOonline resource to check publisher copyright and self-archiving policies Software tool to identify predatory publication developed by SPPU - Journal finder/journal suggestion tools viz. JANE, Elsevier Journal finder, Springer, Journal Suggester, etc.

Instruction hours/week: L: 4 T: 0 P: 0**Marks:100****End Semester Exam: 3 Hours**

Course Objectives

The course will help the scholars to

- Understand the structure and organization of protein structure
- Learn and understand the catalytic mechanisms of enzymes.
- Develop expertise in the purification of enzymes and their analysis in various solvent systems.
- Learn the kinetics of enzyme catalyzed reactions.
- Learn the importance of enzyme immobilization and its wide applications in medicine and industries.
- Study the techniques for clinical analysis and also biochips and biocomputers.

Course Outcomes

On completion of the course, students will be able to

1. Understand the structure of proteins and mechanism of action of enzymes.
2. Understand the catalytic mechanisms of enzymes.
3. Apply the knowledge of enzyme immobilization to produce more products out of it.
4. Understanding of enzyme purification by downstream processes and the efficiency testing of enzymes in various solvent systems.
5. Apply the knowledge of enzymes gained in medicine and industry
6. Handle the sophisticated instruments and clinical analysis of enzymes.

UNIT I: Protein and enzymes

Protein structure, functions, compositions and conformation of proteins. Enzyme catalysis-Acid base catalysis, covalent catalysis, an example, serine proteases. Enzyme kinetics – Michaelis menton equation, Line weaver Burk plot, Hills equation, Hans plot.

UNIT II: Isolation and purification of enzymes

Sources of enzymes for industry, extraction of enzymes for scientific and industrial purposes. Downstream processing of enzymes, uses of soluble enzymes. Study of enzymes in aqueous biphasic systems. Factors affecting the enzyme activity -Substrate concentration, Purification of enzymes. Enzyme concentration, pH, temperature etc.,

7. Clinical and Medical Biochemistry – NPTEL – 2023
https://onlinecourses.swayam2.ac.in/cec20_ag01/preview
8. Clinical Biochemistry – Basic Concepts and Notes:
https://www.youtube.com/watch?v=c2GVY1WWH_4

UNIT III: Types of Techniques

Primary cell culture techniques - mechanical disaggregation, enzymatic disaggregation, separation of viable and non-viable cells. Mass culture of cells - manipulation of cell line selection - types of cell lines - maintenance of cell lines - immobilization of cells and its application - synchronization of cell cultures and cell division - production of secondary metabolites - biotransformation - Induction of cell line mutants and mutations - cryopreservation – germplasm conservation and establishment of gene banks.

UNIT IV: Animal cell culture scale up

Animal cell culture scale up: Scale up in suspension - stirrer culture, continuous flow culture, air-lift fermentor culture; Scale up in monolayer - Roller bottle culture, multi surface culture, multi array disks, spirals and tubes - monitoring of cell growth. Organ culture - whole embryo culture - specialized culture techniques - measurement of cell death.

UNIT V: Tissue engineering

Tissue engineering: Design and engineering of tissues - tissue modeling. Embryonic stem cell engineering - ES cell culture to produce differential cells - Human embryonic stem cell research. Transgenic animals-transgenic animals in xenotransplantation.

SUGGESTED READING

1. Aschner, M., & Costa, L. (Eds.). (2019). Cell Culture Techniques. Neuromethods.
2. Darling, D.C., and Morgan, S.J., (2018). Animal Cells Culture and Media, BIOS Scientific Publishers Limited.
3. Satyanarayana, U., (2006). Biotechnology, Books and Allied (P) Ltd. India.
4. Bhojwani S S (2013). Plant tissues culture – an introductory text
5. Swayam Course – Cell Culture Technologies -<https://nptel.ac.in/courses/102104059>.

