DEPARTMENT OF BIOCHEMISTRY

PROGRAM ARCHITECTURE, DURATION, SCHEME OF EXAMINATION, WORKLOAD/WEEK AND CREDITS FOR Ph.D. COURSEWORK IN BIOCHEMISTRY

Duration: One semester (Six months)

Total credits requirement: 14

Program Structure: Ph.D. coursework in Biochemistry

Paper Code	Nomenclature of paper	Theory marks (end semester examination)	Internal Assessment Marks	Max Marks	Hours /week	Credits
20BCHPH11C1	Research Methodology	80	20*	100	4	4
20MPCC1 (*Compulsory for all Ph.D. courseworks*)	Research and Publication Ethics	40	10$	50	2	2
20BCHPH11C2	Bioinformatics & Biostatistics	80	20*	100	4	4
20BCHPH11C3	Advanced Techniques in Biochemistry	80	20*	100	4	4
Total Marks/credits		280	70	350	14	14

Note: The compulsory paper on 'Research and Publication Ethics' shall be offered by *Ch. Ranbir Singh Institute of Social and Economic Change* for all UTD/s/Centres/Institutes, as per Resolution No. 27 of the 271st meeting of EC held on 29.7.2020.

****Internal Assessment details***: Two assignments of 5 marks each and two presentations of 5 marks each

$***Internal Assessment details***: One assignment and one presentation of 5 marks each

Pass percentage will be 50% in each paper and 55% in aggregate

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Program specific outcomes The students after completing Ph.D. coursework in Biochemistry will be able to-

PSO1: Be able to apply principles of research and techniques in efficiently carrying out Ph.D. work

PSO2: Be able to critically analyze data and use the same to analyze hypothesis in context of relevant literature

PSO3: Be able to explore various resources for documentation and validation of their findings in research work

PSO4: Be able to prepare and give presentations on research progress using own data as well as integrating information from relevant literature

PSO5: Be able to develop themselves as future independent and ethical researchers by choosing specific areas of Biochemistry

Ph.D. Course Work syllabus

Name of the Program	Ph.D. Course work in Biochemistry	Program Code	BCHPH
Name of the Course	Research Methodology	Course Code	20BCHPH11C1
Hours/Week	4	Credits	4
Max. Marks.	80	Time	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks)

Course Objectives:

1. To understand the fundamentals concepts of research process
2. To understand research models and concept of the report writing
3. To gain knowledge of data collection techniques, structure of the datasets, analysis and interpretation of data.
4. To imbibe the concept of manuscript writing

Course Outcomes:

Understanding of the concept of research, research process, research types, research models, and basic formats of report writing.

1. Ability to identify the differences between measurement and scaling.
2. Understanding of the sample selection keeping all research variable sin account.
3. Insights of the process of the data collection from various sources
4. Development of the presentation skills

Unit - I

Research Methodology:- Meaning, types of research including historical, basic, experimental, descriptive, correlative and applied research and objective of research, Selection of Research, Research methodology- philosophical, descriptive, experimental and genetical methods.

Types of information and sources: primary and secondary sources, overview of research process- phases and steps. Research process planning and conducting.

Unit - II

Data collection:- Types of data, Sources, Methods of data collection, variables, Constructing questionnaire, Establishing reliability and validity, Data processing:- Coding, Editing,

displaying of data by tables and graphs. Importance of publishing research paper

Unit – III

Mechanical and stylistic aspects of scientific writing- Precision and clarity of language, writing process, presentation of numerical data and scientific figures. Constraints on scientific writing- audience, format and mechanics (grammar, word choice, punctuation, tenses),

Unit – IV

Presenting and Publishing paper: Preparation of Scientific paper, Format, choosing Journal, Title, Running Title, Writing Abstract, Keywords, Introduction, Materials and Methods, Result section, Discussion Section, Acknowledgment, Use of appropriate citations, References, copyright and Ethical issues in paper drafting,

Writing review articles: Procedure and steps for preparing review

Thesis layout:- Preliminaries, Text of the thesis-Format and conventions, charts and diagrams, Norms for using Index and Bibliography.

References:

1. Research Methodology: Methods And Techniques By Dr C R Kothari.
2. Research Methodology: An Introduction By Wayne Goddard and Stuart Melville
3. Research methodology: techniques and trends By Y.K. Singh
4. Experimental Design and Data Analysis for Biologists By Gerry P. Quinn and Michael J. Keough. Publisher: Cambridge University Press.
5. Fundamentals of Research Methodology for Health-care Professionals By Hilla Brink, Christa Van der Walt

Ph.D. Course Work syllabus

Name of the Program	Ph.D. Course work in Biochemistry	Program Code	BCHPH
Name of the Course	Research and Publication Ethics	Course Code	20MPCC1
Hours/Week	2	Credits	2
Max. Marks.	40	Time	1.5 Hours

Note: The examiner has to set a total of five questions (two from each unit and one compulsory question consisting of short answer from all units). The candidate has to attempt one question each from each unit (2 x 18 = 36 marks) along the compulsory question of 14 marks

Course Objectives:

1. To understand the fundamentals concepts of research publications
2. To understand conduct and ethics in research
3. To gain knowledge of open access publishing and database metrices
4. To imbibe the concept of publication misconduct issues
5. To learn how to identify predatory journals and use of plagiarism tools

Course Outcomes:

1. Understanding of the concept of ethical publishing and database accessing.
2. Ability to resolve issues on publication misconduct.
3. Understanding of various ways of unethical publishing and violations by them.
4. Insights of the journals which are predatory and publications which are redundant
5. Development of the ethical publication skills

THEORY

RPE 01: Philosophy and Ethics

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

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

1. definition, introduction and importance of publication ethics
2. Best practices/standards setting initiatives and guidelines (COPE, WAME etc.)
3. Conflicts of Interest
4. Publication misconduct- definitions, concept, problems that lead to unethical

behaviour and vice versa
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication ethics, authorship, complaints and appeals
7. Predatory publishers & journals.

PRACTICE

RPE 04: Open Access Publishing

1. Open access publications & 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

RPE 05: Publication Misconduct

A. Group Discussions

1. Subject specific ethical issues/FFP/authorship
2. Conflicts of interest
3. Complaints & appeals (Examples of fraud from India & abroad).

B. Software tools

Use of plagiarism softwares like Turnitin, Urkund and other open source software tools

RPE 06: Database and Research metrics

A. Databases

1. Indexing databases
2. Citation databases- Web of Science, Scopus

B. Research Metrices

1. Impact Factor of journal as per Journal Citation Reports, SNIP, SJR, IPP, Cite Score
2. Metrices→ h-index, g-index, i10 index, altmetrices

References:

1. Philosophy of Science By A Bird (2006)
2. A Short of History of Ethics (1967) By McIntyre, Alasdair
3. Ethics in Competitive Research: Do not get scooped, do not get plagiarized (2018) By P Chaddah.
4. On Being a Scientist: A guide to responsible conduct in research (3rd Ed; 2009). National Academy of Sciences, National Academy of Engineering and Institute of Medicine.
5. What is ethics in research & why is it important. (2011) By DB Resnik. National Institute of Environmental Health Sciences, pp 1-10.
6. Predatory publishers are corrupting open access (2012) By J Beall. Nature, 489 (7415), 179-179.
7. Ethics in Science Education, Research and Governance (2019). Indian National Science Academy (INSA). http://www.insaindia.res.in/pdf/Ethics_Book.pdf

Ph.D. Course Work syllabus

Name of the Program	Ph.D. Course work in Biochemistry	Program Code	BCHPH
Name of the Course	Bioinformatics and Biostatistics	Course Code	20BCHPH11C2
Hours/Week	4	Credits	4
Max. Marks.	80	Time	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks)

Course Objectives:

1. To learn various statistical analysis techniques for data analysis and hypothesis testing.
2. To understand the concepts of measurement and scaling & their various techniques and sample size determination.
3. To educate young researchers to identify appropriate statistical method for their research work
4. To extend first-hand knowledge about bioinformatics resources
5. To develop an understanding of biological databases and their information resources

Course Outcomes:

1. Knowledge of statistical analytic techniques for data analysis and testing of hypothesis.
2. Insights of bioinformatics resources and their usefulness in solving their research problems

Unit – I

Biological databases, Resources available at Nucleic acid sequence databases (GenBank, EMBL, DDBJ), Protein sequence databases (SWISS- PROT, TrEMBL, PIR, PDB), Genome Databases (NCBI, EBI, TIGR, SANGER), Gene and protein network databases, Open Reading Frames, Pairwise and Multiple sequence alignment, Phylogenetics.

Unit – II

Tests of significance – concepts of null and alternative hypothesis, level of significance, type-I and type-II errors – power of the test. Measures of central tendency (Mean, Median, Geometric/harmonic means) and dispersion (Standard/mean deviations, CV). Probability Distributions and applications probability laws.

Measurement of skewness and kurtosis, Graphical presentation of data

Unit – III

Non-parametric tests: Chi-square test, Wilcoxon signed rank test, Wilcoxon rank sum test (Mann-Whitney U-test), Sign test, Runs test, Kruskal-Wallis H-test, Spearman's & Kendall rank correlations and Friedmann Test.

Unit – IV

Parametric Tests of large samples by Z test. Small sample tests- t-test. Coefficient of correlation & regression. ANOVA- one way and two way techniques. LSD, Duncan's Multiple Range and Dunnett's tests.

References:

1. Essential Bioinformatics (Paperback) By Jin Xiong. Cambridge University Press.
2. Bioinformatics: Methods & Protocols By Stephen Misener and Stephen A. Krawetz, Humana Press.
3. Bioinformatics, 4th Edition By Baxevanis, Bader and Wishart.
4. BIOSTATISTICS: A Foundation for Analysis in the Health Sciences 10th Ed By Wayne Daniel; Wiley Pub.
5. STATISTICS for the Life Sciences 4th Ed By ML Samuels, JA Witmer and AA Schaffner; Prentice Hall.
6. Biostatistics: a guide to design, analysis and discovery By Ronald Forthofer, Eun Sul Lee and Michael Hernandez.

Ph.D. Course Work syllabus

Name of the Program	Ph.D. Course work in Biochemistry	Program Code	BCHPH
Name of the Course	Advanced Techniques in Biochemistry	Course Code	20BCHPH11C3
Hours/Week	4	Credits	4
Max. Marks.	80	Time	3 Hours

Note:The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks)

Course Objectives:

1. To introduce basic information of biochemical research techniques
2. To introduce the concept of genome biology and Microbiome research
3. To describe concept of enzyme technology and biosensor technology
4. To introduce about antimicrobials research and drug discovery involving in-vitro, in-vivo techniques followed by safety and efficacy leading to clinical trials.
5. To describe role of importance of safety is emphasized in drug research

Course Outcomes:

1. Researchers will be familiarized with recent biochemical techniques
2. Researcher will develop a better understating of Genomics concept and could plan genome based discoveries
3. Students would gain knowledge about drug discovery and drug launch.
4. It would connect the bench work to bed- side discovery and thus emphasize on the demands of industry from students.
5. Researcher will understand the concept of biosensor and their potential applications in clinical diagnostics

Unit - I

Microbiome (Human, Plant and environmental), Microbial symbiosis, Metagenomes,

Function and Sequence Driven Metagenomics, De Novo Genome sequencing, Comparative Genomics, Gene Cloning, Screening and selection of recombinants clones, Polymerase chain reactions, Recombinant protein Purification.

Unit – II

Immobilization of enzymes/proteins on organic and inorganic supports including artificial and natural membranes, Study of kinetic properties of immobilized enzymes, Co-immobilization of enzymes and their analytic applications

Unit - III

Analytical and preparative methodology, Possible Drug resistance mechanisms, Drug susceptibility testing: Minimum inhibitory conc., Disc diffusion, Spot assay, Time kill

kinetics, Combinatorial drug testing-introduction to synergy, antagonism and additive,FIC index, Hodge test, Drug-drug interactions, CYP interaction, inhibition and induction, SAR studies, drug discovery cycle, drug safety(CYP, glutathione etc), trials and its phase.

Toxicokinetics and toxicodynamics, Transport and accumulation of xenobiotics, bioactivation of xenobiotics, xenobiotic-induced oxidative stress. ADME studies, Introduction to GLP/GMP, SOP and CRO.

Unit - IV

Centrifugation and its applications, purification of proteins using ion-exchange, gel-filtration, gas chromatography and affinity chromatography; SDS-PAGE and western blotting, Isoelectric focusing of proteins

Electron microscopy: Specimen interaction in TEM and SEM, Immunohistochemistry

References:

1. Principles of Gene Manipulation and Genomics, ***By*** S.B. Primrose & Richard M. Twyman, Blackwell Publishing.
2. Molecular Biology of the Gene VI ***By*** Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R.
3. Handbook of Enzyme Biotechnology ***By*** Alan Wiseman
4. Nature of Enzymology ***By*** RL Foster
5. Disinfection, sterilization, and preservation ***By*** Seymour Stanton Block
6. Pharmacodynamics and drug development: perspectives in clinical pharmacology ***By*** Neal R. Cutler, John J. Sramek, Prem K. Narang
7. Modern Experimental Biochemistry ***By*** Rodney Boyer