

DEPARTMENT OF BIOCHEMISTRY
KURUKSHETRA UNIVERSITY, KURUKSHETRA
(Established by the State Legislature Act XII of 1956)
(‘A+’ Grade NAAC Accredited)

Ph.D. Course work

Paper: 1

BCH-601 (Research Methodology)

UNIT-1

1. Chromatographic Techniques : paper, thin layer, adsorption, ion exchange, gel filtration, affinity, GLC and HPLC.
2. Enzyme purification and characterisation
3. Basic principles and applications of UV –VIS Absorption Spectrophotometry and Fluorescence spectroscopy, Basics of Mass Spectrometry
4. Radioisotopic techniques: type of radiations, half life, commonly used isotopes in biochemistry, scintillation counting ,applications of radioisotopes in the biological sciences
5. Animal Tissue culture, culture media and mitiation at cell cultures evolution of continuous cell lines, cloning of cell lines (dilution clones), An introduction to somatic cell fusion.

UNIT-2

6. Immunological Techniques: Agglutination, RIA, ELISA, Immunodiffusion, Hybridoma Technology
7. Electrophoresis: Native & SDS-PAGE, Agarose gel & isoelectric focussing
8. Molecular Biology Techniques isolation of DNA (Nuclear & plasmid) and RNA and their quantification sepectrophotometrically of PCR, Primer Designing. RFLP, RAPD & Antisense RNA Technology, Blotting Technique (Southern, Northern, Western and Dot blotting), Automated DNA sequencing DNA fingerprinting, DNA cloning
9. Protein Engineering using site directed mutagenesis, Discuss example of Subtilisin

Subject specific paper:-BCH-602A

Credits: 4

Max. Marks: 100

Section –A

Enzymes of industrial importance: Isolation and screening of microbes producing enzymes of industrial importance such as xylanase, lipase, pectinase and laccase; determination of their catalytic activities; production of these enzymes in submerged and solid state fermentation; optimization of fermentation parameters to maximize production of enzymes; purification of enzymes; characterization of purified enzymes with respect to their molecular weight determination, effects of pH and temperature, determination of K_m and V_{max} , storage stability etc.; immobilization of enzymes and comparison of their characteristics with their soluble counterparts and industrial applications of these enzymes.

Section –B

Plant Protease inhibitors: Introduction, extraction of plant protease inhibitors (PPIs) from legumes; optimization of extraction conditions: purification of PPIs; characterization of purified PPIs with respect to their molecular weight determination, effects of pH and temperature, type of inhibition and K_i determination; identification of amino acids at their active sites; investigation of their insecticidal and antifungal potential and molecular characterization of PPIs (isolation of PPI gene and its characterization using bioinformatics tools).

Enzymes involved in antioxidative defense mechanism in plants: Introduction and assays of enzymes involved in antioxidative defense mechanism in plants such as peroxidase, superoxide dismutase, catalase, ascorbate peroxidase, glutathione peroxidase and glutathione reductase.

UNIT-A

Protein purification: Isolation and purification of proteins. Chromatographic techniques for protein purification criteria of purity molecular weight determination of purified protein. Electrophoresis of protein. Concepts of drug discovery and development.

Introduction to probiotics. Prebiotics and their proposed mechanism of action. Safety assessment and present scenario.

UNIT-B

Protein sequencing methods.

An introduction to proteomics. Mapping protein-protein interactions.

Protein databases (Primary. Composite and secondary). Retrieval methods for protein sequences protein tertiary structure prediction methods. Homology modeling. Fold recognition.

Convergent and divergent evolution of proteins. Phylogenetic and evolutionary relationship of proteins. Orthologous and paralogous proteins.

Subject specific paper:-BCH-602C

UNIT-A

Recombinant DNA Technology: Primers. Design of primers amplification of DNA PCR. Fidelity of thermostable enzymes. DNA polymerases, Types of PCR Multiplex Nested PCR, Hot start PCR. Colony PCR and touchdown PCR. Cloning of PCR products.

Study of Genetic polymorphism in diseased state

Hepatitis B and causative factors

UNIT -B

DNA Sequencing methods. Sanger's chain termination method. Automated DNA sequencing. Sequencing accuracy Introduction to next generation sequencing (NGS)

Multiple Sequence Analysis BLAST. FASTA. Retrieval methods for DNA sequences comparative genomics orthologs paralogous and methods of Phylogenetic analysis Principles and application of RFLP and RAPD

Subject specific paper:-602 D

UNIT-A

Human Ethics: General Principles on ethical considerations involving human participants; obtaining approval from Institutional Human Ethical Committee and an informed consent of participants.

Single Nucleotide Polymorphism (SNP's): Introduction, Types, Applications and importance; SNP's and disease susceptibility with examples.

Polymerase Chain Reaction (PCR): Principle, Oligonucleotide primers, Designing of the oligonucleotide primers; Types: Real-time PCR, RT-PCR (Reverse Transcription PCR), allele specific PCR; Applications of PCR.

Biomarkers of Oxidative Stress: Lipid peroxidation, antioxidant enzyme assays, ROS assays, Oxidative DNA damage (8-OH dG assay).

UNIT-B

Genotoxicity assays: AMES Test and Comet Assay

Cell Viability Assays: Trypan blue assay, Propidium iodide assay, TUNEL assay, MTT assay

Biological Database and Sequence Analysis

Fundamentals of Biostatics for analysis of data: Measurement of variability, Standard deviation, Standard error, coefficient of variation, Test of significances, T-Test, Chi-square test

Hardy- Weinberg Law for determining allele and genotype frequencies in population.

DEPARTMENT OF BIOCHEMISTRY.

K.U.K.

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w.e.f. 2020-21.

Paper : (Biochemistry Ph.D) III (a)

Paper Name : Research and Publication Ethics (RPE)

Total Marks : 50

Time : 3 Hrs.

Note : Attempt five questions in all selecting at least two from each unit. All questions carry equal marks.

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: 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 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