

# **COURSES OF STUDIES**

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**FOR Ph.D PROGRAM**

**Of Biotechnology**



**GANGADHAR MEHER UNIVERSITY,  
SAMBALPUR, ODISHA**

## SEMESTER SYSTEM OF Ph.D

Sl No.	Paper	Code	Credit	(Maximum Marks) Mid Term + Term End	Teaching Hours
1	Recent Trends in Biotechnology	BT-711	4	100 (20+80)	60 Hrs
2	Research Methodology - I	BT-712	4	100 (20+80)	60 Hrs
3	Research Methodology - II	BT-713	4	100 (20+80)	60 Hrs
4	Dissertation or Review writing/ presentation/viva-voce	BT-714	8	200 (150+25+25)	120 Hrs
5			20	500	300 Hrs

**Revised Syllabus of pre-registration course work for Ph.D. in GMU.**

### **Paper BT-711 Recent Trends in Biotechnology**

#### **Unit 1: Biochemistry and metabolism (MK)**

Classification, factors affecting rate of enzyme action- pH, temperature, concentration, oxidation, Coenzymes. Kinetics of single substrate reactions, MM equation and its modifications, LB plots and their significance, significance of  $K_m$  and  $V_{max}$ . Enzyme inhibition- competitive, non-competitive, uncompetitive and allosteric. Specificity and mechanism of enzyme action.

Structure and functional group properties; Peptides and covalent structure of proteins; Elucidation of primary and higher order structures; Evolution of protein structure; Structure function, relationships in model proteins like ribonuclease A, myoglobin, hemoglobin, chymotrypsin.

Bases, nucleosides, nucleotides, physicochemical properties of nucleic acids, cleavage of nucleic acids by enzymatic methods, non – enzymatic transformation of nucleotides and nucleic acids, methylation, Sequencing, chemical synthesis of DNA. Three-dimensional structure of DNA. Different forms of DNA – circular DNA and Supercoiling.

#### **Unit 2: Genetic engineering & Plant Biotechnology (ST)**

Prokaryotic and Eukaryotic Transcription and post transcriptional modifications. Protein synthesis and translational control. Control of gene expression in prokaryotes. Nucleic Acid Sequencing. Restriction enzymes, ligases,  $S_1$  nuclease, terminal deoxynucleotidyl transferase, Poly A polymerases, Reverse Transcriptase, Alkaline phosphatase. Gene Cloning Vectors: Plasmids, phagemids, cosmids, Artificial chromosomes. cDNA Synthesis and cDNA library preparations. Cloning mRNA enrichment, reverse transcription, DNA primers, Linkers, adaptors, Library construction and screening. Genomic libraries (complete sequencing projects). Cloning interacting genes- Two-and three hybrid systems, cloning differentially expressed genes. Basis of tumor formation, Mechanism of DNA transfer, Features of

Ti and Ri plasmids, role of virulence genes, use of Ti and Ri as vectors, binary vectors, markers, use of reporter genes, 35S and other promoters, use of scaffold attachment regions, multiple gene transfers, particle bombardment, electroporation, microinjection

### **Unit 3: Bioinformatics (RS)**

Concepts of molecular modeling, physical and computer models, different representations of computer models, Generation of 3D coordinates—using X-ray crystallography. Concepts of Force Fields, Quantum and Molecular mechanical force fields Energy-Minimizing Procedure, Ab initio Methods, Semi-empirical Molecular Orbital Methods.

Steps involved in Homology Modeling. Fold Recognition and ab-initio methods, Derivation and significance of Ramachandran Plot, Root Mean Square Deviation (RMSD), Energy Plot based on Potential of mean force, Packaging Quality.

Concepts in 3D structure comparison, purpose of structure comparison, Algorithms for structure comparison (FSSP, VAST & DALI), Identifying Putative Drug Targets and Potential Drug Leads: Starting Points for Virtual Screening and Docking Receptor Flexibility for Large-Scale In-silico Ligand Screens: Chances and Challenges, Molecular Docking.

### **Unit 4: Advanced Microbial Biotechnology (SKS)**

Tools and techniques of microbial diversity, metagenomics. A brief outline of processes for the production of some commercially important Organic acids (e.g., Citric acid, Lactic acid); Amino acids (Glutamic Acid, and Phenylalanine); and Alcohols (Ethanol, 2,3-butanediol) secondary metabolites: Antibiotics-beta-lactams (Penicillin), aminoglycosides (Streptomycin).

Fermentation Microbial Growth and Death Kinetics; Media for Industrial Fermentation; media optimization; Air and Media Sterilization; Types of fermentation processes - Analysis of batch, Fed-batch and continuous bioreactions, bioreactors, specialized bioreactors (pulsed, fluidized, photobioreactors etc. Concept of SSF, downstream processing, product recovery.

Primary and Secondary screening. Strain improvement by Physical, Chemical and Molecular techniques. Emerging techniques (genome shuffling etc), screening techniques.

### **Recommended Books**

1. A.L. Lehninger, Principles of Biochemistry, 4th edition, W.H Freeman and Company,
2. L.Stryer, Biochemistry, 5th Edition
3. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004.
4. "Molecular Biology of the gene" by Waston et al 4th ed.
5. "Genes IX" by Benjamin Lewin.
6. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
7. DNA Cloning: a Practical Approach, M. Glover and B.D. Hames, IRL Press, Oxford, 1995.
8. Molecular modeling basic principles and applications-Hans-Dieter Holtje and Folkers, Wiley 2003.
9. Molecular modeling of Proteins-edited by Andreas Kukol, Humana Press, Apr 2008 3
10. Introduction to Protein Architecture, Arthur M. Lesk., Oxford University Press, 2001
11. Molecular Biotechnology: Principles and Application of Recombinant DNA 3rd edition, B.R. Glick & J.A. Pasternak, 2005.

**PAPER-712**  
**RESEARCH METHODOLOGY-I**

Unit-I

**SCOPE, PHILOSOPHY AND ETHICS OF RESEARCH AND ETHICS**

- i) Introduction and Scope
- ii) Introduction to philosophy: definition, nature and scope, concept, branches
- iii) Ethics: definition, moral philosophy, nature of moral judgments and reactions, Research ethics, Institutional ethics committee.
- iv) Ethics with respect to science and research
- v) Intellectual honesty and research integrity

Unit-II

**SCIENTIFIC CONDUCT**

- i) Research problem: Identification, Selection, Formulation of research objectives
- ii) Research design: Components, Types and Importance
- iii) Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
- iv) Redundant publications: duplicate and overlapping publications, salami slicing
- v) Selective reporting and misrepresentation of data

Unit-III

**TECHNICAL WRITING**

- i) Literature search technique, using SCOPUS, Google Scholar, PUBMED, Web of science, Indian Citation Index, and RG
- ii) Types of technical documents; Full length research paper, Short/Brief communications, Letters to editor, Book chapter, Review, Conference report, Project proposal Components of a full length research paper; , Rationale of the paper, Aims and objectives, Hypothesis building, Work plan, Materials and methodology, Results and discussion, Conflict of interest statement,
- iii) Components of a research proposal; Project summary Key words, Origin of the proposal, Major objectives Methodology, Instrument facility available in the PI's department, Overview of status of Research and Development in the subject, Importance of the proposed project in the context of current status.
- iv) Styles of referencing; APA, MLA, Oxford, Harvard, Chicago, Annotated bibliography, Tools for citing and referencing, Grammarly, Endnote etc, How to cite and how to do referencing

Unit-IV

**PUBLICATION ETHICS**

- i) Publication ethics: definition, introduction and importance
- ii) Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
- iii) Conflicts of interest
- iv) Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
- v) Violation of publication ethics, Subject specific ethical issues, FFP, authorship,
- vi) Identification of publication misconduct, complaints and appeals
- vii) Predatory publishers and journals
- viii) Plagiarism-Pitfall
- ix) Use of plagiarism software like Turnitin, Urkund and other open source software tools, . Complaints and appeals: examples and fraud from India and abroad

**PAPER-713**  
**RESEARCH METHODOLOGY-II**

Unit-I

**IPR AND CYBER LAW.**

- i) Patents, Patent laws, process of patenting a research finding
- ii) Intellectual property (IP), Intellectual property right (IPR)
- iii) Copyright, Trademarks, GI
- iv) Cyber laws
- v) COPE

Unit-II

**QUANTITATIVE DATA ANALYSIS**

- i) Types of Data, Data Collection – Methods and Tools
- ii) Hypothesis testing
- iii) Normal and Binomial distributions and their property
- iv) Tests of significance: Student *t*- test, *F*- test, *Chi-square* test
- v) Correlation and Regression
- vi) ANOVA – One-way and Two-way, Multiple-range test

Unit-III

**COMPUTER FUNDAMENTALS**

- i) Introduction to MS-Office software: MS-Word (Track change)
- ii) MS-Excel
- iii) MS-Power Point
- iv) Features for Statistical Data Analysis Tool Pack, SPSS
- v) Tables, Figures and Pictures using Excel
- vi) Preparation of Posters
- vii) Electronic submission of manuscripts
- viii) Communication skills, oral and poster

Unit-IV

**ADVANCED TOOLS & TECHNIQUES IN RESEARCH**

- i) Indexing databases
- ii) Citation databases: Web of Science, Scopus, etc.
- iii) Research Metrics
- iv) Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
- v) Metrics: h-index, g index, i10 index, altimetric
- vi) Open access publications and initiatives
- vii) SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
- viii) Software tool to identify predatory publications developed by SPPU
- ix) Journal finder /journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.