

# Applied Biology Syllabus for PET 2021

## **BIOCHEMISTRY AND METABOLISM**

- Structure and Function of Macromolecules (Carbohydrates, Proteins, Lipids)
- Enzyme classification, kinetics, mechanism of action, enzyme inhibition
- Metabolism and Bioenergetics: Carbohydrate and Lipid metabolism (pathways) and its regulation
- Electron transport chain and oxidative phosphorylation
- Nucleic acid structure and metabolism
- Biological membrane architecture and transport (active and passive)

## **INSTRUMENTATION**

- Microscopy, Centrifugation, Chromatographic techniques, Electrophoretic techniques, Spectroscopy (UV, Visible and fluorescence), Radioisotopic techniques and Mass spectrometry (theory, principles and applications)

## **BIOINFORMATICS AND BIOSTATISTICS**

- Basic Bioinformatics and its applications (databases and tools)
- Whole genome and sequence analysis
- Structure visualization and online tools
- Biostatistics (Introduction, scope, applications of statistics)

## **MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY**

- Basics of Life processes of Prokaryotes and Eukaryotes (Replication, Transcription, Translation and gene regulation)
- Protein-protein and protein-DNA interactions
- Essentials of Gene cloning Clone (blunt and sticky end, Cloning and Expression vectors, cosmids, plasmids)
- PCR and Real-time PCR
- Gene Transfer Technology (Bacterial Conjugation, Transformation, Transduction, Microinjection, Electroporation, Transfection, Microprojectile, Shotgun method, Ultrasonication, Liposome fusion, Microlaser)
- Nucleic acid hybridisation
- Antisense technology (RNAi)
- Sequencing technologies (Conventional and next-generation)
- Array technology (microarray and protein arrays)

## **CELL BIOLOGY**

- Cellular architecture and organization (Prokaryotes and Eukaryotes)
- Genome, Chromatin, Gene (Structure and function, including those from organelles)
- Cell cycle, regulation and cell signalling
- Cellular homeostasis
- Cell death and survival (Apoptosis, proliferation, and differentiation)
- Stem cells and embryonic stem cells, progenitor cells

## **GENETICS**

- History and Principles of Genetics
- Chromosomal Linkage and Crossing over
- Allelic Variation and Gene function
- Chromosomal variation
- Human Cyto-Genetics

- Pedigree analysis
- Bacterial and Viral Genetics
- Mechanism of genetic exchange (Conjugation, Transduction, Transformation)
- Genome maintenance and model organisms (nucleic acid damage and repair mechanisms)
- Genetic Recombination (Types and mechanism)
- Types of Mutations and their Notation
- Transposable Elements (Overview, types and mechanisms)
- Genomics (history, comparative genomics, and genome projects of human and other model organisms).

## **RESEARCH METHODOLOGY**

- Research terminology and fundamentals: Definition; Objectives of research, scientific thinking, general characteristics of research, classification and types of research, types of research methods, Research methods versus methodology, Criteria of good research, Identification and formulation of research problems, Study designs.
- Research Formulation: Defining and formulating the research problem, selecting the problem, importance; types of literature review in defining a problem. Critical literature review, Primary and secondary sources of literature: reviews, treatise, monographs-patents. Web as a source, searching the web, Identifying gap areas from literature review.
- Data collection and processing: Definition, scope and limitations of data collection and processing, Methods and techniques of data collection: types of data, methods of primary data collection (observation/experimentation/ questionnaire/ interviewing/ case/pilot study, methods), methods of secondary data collection (internal/ external). Representation of data; Its types and its representations, importance of measurement scales, variables; their measurements
- Sampling and sampling distributions: Sampling frame, importance of probability sampling, simple random sampling, systematic sampling, stratified random sampling, cluster sampling, problems due to unintended sampling, ecological and statistical population in the laboratory.
- Scientific Writing. Structure and components of Scientific Reports – types of Report – Technical Reports and Thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports - Illustrations and tables – Bibliography, Referencing and footnotes –Importance of Effective Communication. Preparing Research papers for journals, Seminars and Conferences – Design of paper using TEMPLATE, Calculations of Impact factor of a journal, citation Index, ISBN & ISSN.
- Preparation of Project Proposal - Title, Abstract, Introduction – Rationale, Objectives, Methodology – Time frame and work plan – Budget and Justification – References
- Ethics: Ethical Issues – Ethical Committees – Commercialization – copyright – royalty – Intellectual, Property rights and patent law – Track Related aspects of intellectual property Rights – Reproduction of published material – Plagiarism – Citation and Acknowledgement – Reproducibility and accountability.

Books for Reference

### **Biochemistry and Metabolism**

1. Principles of Biochemistry; Lehninger, AL. Nelson, David L., Cox Micheal M. (III Ed. 2000, Worth Pub.)

2. Biochemistry and Molecular Biology: Elliott, William H. Elliott, Daphne C.; Oxford, Oxford University Press, 1997
3. Oxford Dictionary of Biochemistry & Molecular Biology; Oxford, Oxford University Press, 1997
4. Proteins – Structures and Molecular Properties; Creighton, T. E.; New York, Freeman and Co., 1993 (2nd Edition)
5. Biochemistry: LubertStryer. W. H. Freeman; 6 editions (2006).
6. Fundamentals of Biochemistry: Voet and Voet
7. Biochemistry: Kuchel and Ralston, 1998. 2nd ed. Schaum's Outlines McGraw Hill.
8. Harper's Biochemistry: Murray, et al. 2003. 28th ed. McGraw Hill.
9. Biochemistry: Zubey, GL WCB Publishers.
10. Protein Engineering and Design: Sheldon Park and Jennifer Cochlan
11. Protein Engineering- Principle and Practice: Jeffrey Cleland
12. Modern Protein Chemistry: Practical Aspects Published: September 12, 2001 by CRC Press - 272 Pages Edited By: Gary C. Howard

### **Instrumentation**

1. Analytical Techniques in Biochemistry and Molecular Biology by Rajan Katoch, Springer 2011.
2. Modern Analytical Biochemistry; Rodney Boyer (3rd Edition)
3. Principles of Instrumental Analysis: Skoog, Holler and Crouch (6th Edition)
4. Instrumentation: Wilson & Walker's Principles and Techniques of Biochemistry and Molecular Biology (2010).

### **Cell Biology**

1. Molecular Biology of Cell, 5th edition (2008): B. Alberts
2. Molecular Cell Biology, 6th edition (2000): H. Lodish
3. Cellular and Molecular biology, 6th edition (2009): Karp G
4. Cell Biology, 2nd edition (2008): Pollard, Earnshaw and Lippincot Schwartz
5. The Cell: A Molecular Approach, 4th edition: Cooper & Hausman
6. Cell Biology by C. B. Pawar; Himalaya Publishing House

### **Molecular Biology & Recombinant DNA Technology**

1. Molecular biology, 5th edition (2011): Weaver
2. Molecular biology of Cell 5th edition (2008): Alberts
3. Molecular Cell Biology - Harvey Lodish et al; New York: W. H. Freeman; 2000.
4. Cell and Molecular Biology (Concepts & Expts) Gerald Karp; John Wiley & Sons
5. Cellular and Molecular biology, 6th edition (2009): Karp G
6. Molecular Biology, 2nd edition (2013): D. Clark and N. Pazdernick
7. Principles of Protein Structure: Schulz and Schirmer
8. Proteins: Structures and Molecular Properties: Thomas E. Creighton Publisher: W. H. Freeman 1992 Edition: Second Edition
9. Protein Engineering Protocols (Methods in Molecular Biology) Kristian Müller (Editor), Publisher: Humana Press; Softcover reprint of hardcover 1st ed. 2007 edition (November 10, 2010)
10. Molecular biology: Robert F. Weaver McGraw Hill 4 edition (2007) 2. Advanced molecular biology: R. M. Twyman, (1998)
11. Genes XI: B. Lewin Oxford University Press, Cell Press, London (2000).
12. Enzymes: Dixon and Webb, Academic Press (1964)
13. Enzymes: Boyer. Academic Press; 3rd edition (November 1983)
14. DNA Structure & Function: R. R. Sinden (Academic Press)

15. Analysis of Genes and Genomes: Richard J Reece, JOHN WILEY& SONS, LTD., 2004

### **Genetics**

1. Genetics: A Conceptual Approach, 4th edition (2012) : Benjamin Pierce
2. Genes XI (2013): Krebs, Lewin and Goldstein
3. Introduction to Genetic Analysis (2008): A. Griffith, et. al
4. Genetic: Analysis & Principles, 4th edition (2012) : R. J. Brooker

### **Bioinformatics & Biostatistics**

1. Bioinformatics and Molecular Evolution: Higgs & Attwood
2. Bioinformatics for Biologists, eds. Pavel Pevzner and Ron Shamir, Cambridge University Press, 2011.
3. M. Zvelebil and J. O. Baum, Understanding Bioinformatics, Garland Science, 2008
4. Bioinformatics for Biologists, eds. Pavel Pevzner and Ron Shamir, Cambridge University Press, 2011
5. D.E. Krane and M.L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2003.
6. C.A. Orengo, D.T. Jones and J.M.Thornton, Bioinformatics: Genes, Proteins and Computers, Routledge, 2003.
7. A. M. Lesk, Introduction to Bioinformatics, Oxford University Press, 2002. D. Mount, Bioinformatics: Sequence and genome analysis, Cold Spring Harbor Laboratory Press, 2001.
8. Baxevanis, A.D. and Francis Ouellette, B.F. 2004 Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Second Edition, Wiley
9. Hassan, A.S. 2004 Bioinformatics: Principles and Basic Internet. Trafford Publishing.
10. Kohane, I.S., Kho, A. and Buthe, A.J. 2002 Microarrays for an Integrative Genomics. Barnes & Noble, MIT Press.
11. Stan Tsai, C. An Introduction to Computational Biochemistry 1st Edition. John Wiley & Sons., Inc.

### **Research Methodology**

1. Kothari, C.R.,1985, Research Methodology- Methods and Techniques, New Delhi, Wiley Eastern Limited.
2. Das, S.K. , 1986, An Introduction to Research, Kolkata, Mukherjee and Company Pvt. Ltd.
3. Misra R.P., 1989, Research Methodology: A Handbook, New Delhi, Concept Publishing Company
4. Kumar, R., 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd.ed.), Singapore, Pearson Education.
5. Bhattacharya, D.K., 2006, Research Methodology,(2nd.ed.),New Delhi, Excel Books.
6. Panneerselvam R.,2012, Research Methodology, New Delhi, PHI Learning Pvt. Ltd.
7. Khan, Irfan Ali, 2008, Fundamentals of Biostatistics, Ukaaz Publications
8. Rosner B.A., 2011, Fundamentals of Biostatistics, Cengage Learning
9. Katz J.M., 2009, Form Research to Manuscript: A guide to scientific writing, USA, Springer Science
10. Saravanavel, P. 1990. Research methodology. Allahabad, Kitab Mahal
11. Introducing Research Methodology: Thinking Your Way Through Your Research Project (2011): Uwe Flick