Ph.D., BIOINFORMATICS

REVISED REGULATIONS AND SYLLABI

(Effective from 2013 onwards)

Centre for Bioinformatics
SCHOOL OF LIFE SCIENCES
PONDICHERRY UNIVERSITY
PUDUCHERRY

PONDICHERRY UNIVERSITY
PUDUCHERRY

Ph.D. BIOINFORMATICS

Eligibility: Master's degree in Bioinformatics/Life Sciences/Computer Science/ Physics/ Chemistry/Applied Mathematics/ Statistics/ IT & Engineering or any other relevant areas with a minimum of 55% of marks**.**

Details of the papers and Scheme of Examinations effective from the academic year 2012 onwards

Course Code	Name of the Papers	Duration of Exam	Maximum Marks
Paper I	Research Methodology in Bioinformatics	3 hrs.	100
Paper II	Guide Oriented Paper	3 hrs.	100

PAPER I: RESEARCH METHODOLOGY IN BIOINFORMATICS

UNIT-I **8 hours**

Introduction; Definition; Objectives of research; Types of research; Research approaches; Significance of research; Research methods; Research and scientific method; Importance of knowing how research is done; Research process; Layout of the Research project; Criteria of good research; Need for research design: Features of good design; Important concepts relating to design; Different research designs; Basic principles of Experimental design. Interpretation and Report writing Meaning of Interpretations; Techniques of Interpretation, Precautions in Interpretations, Significance of Report writing; Different steps in Report writing; Types of reports and Oral presentation.

UNIT-II **7 hours**

Hypothesis and Statistical evaluation Basic concepts of Hypothesis; Procedure for Hypothesis testing; Probability: Markov models and Hidden Markov models; Probability distribution. Binomial, Poisson, Normal distribution, and Multiple testing methods. ANOVA; Test of significance: T-test, F-test.

UNIT III **7 hours**

Macromolecules: DNA and RNA, Proteins –Primary, Secondary, super secondary, Teritary and Quaternary structure, Ramachandran Map, Chou Fasman, Lennard –Jones, Exponential-6, Ionic and Polar potentials, Force Fields: AMBER, CHARMM, Merck Molecular Force Field, MM2, MM3 and MM4. Structure based drug design Docking, De Novo Drug Deisgn.NMR, ESR spectroscopy. Systems Biology – Introduction to Systems Biology. Chromatography: TLC, GC, HPLC, Gel filtration, ion-exchange and affinity chromatography; Electrophoresis and Electro focusing, Centrifugation: Ultra centrifugation-velocity & density gradient centrifugation in isolation of cells. Microscopy: fixation, staining; Principle and application of light, phase contrast, fluorescence, scanning and transmission microscopy.
Spectroscopy: Mass spectroscopy, MALDI, infrared spectroscopy, 1- and 2-dimensional NMR spectroscopy. Microarray:

UNIT IV **7 hours**

Sequence Analysis – Methods of sequence alignment: Scoring matrices, Block Substitution Matrices (BLOSUM). Dynamic programming algorithms; Needlman-Wunch and Smith Waterman; Pairwise Sequence Alignment –Programmes (Dot matrix, Dot plot, Dynamic programming) ; Database searching (BLAST and FASTA). Multiple Sequence alignment (MSA) – significance; softwares (PIMA, Clustal, Pileup, ClustalW, Meme, MACAW); Phylogenetics: Phylogenetic analysis, Phylogenetic representations – graphs, trees and cladograms; Steps in phylogenetic analysis; Methods of phylogenetic analysis – similarity and distance tables, distance matrix method; Method of calculation of distance matrix (UPGMA, WPGMA); The Neighbour Joining Method; The Fitch/Margoliash method; Character-based Methods – maximum parsimony, maximum likelihood: Limitations of phylogenetic algorithms; Phylogenetic softwares – PAUP, PHYLIP, MacClade. Databases; Protein sequence and structure databases, nucleotide sequence database.

UNIT V **8 hours**

Regulatory Procedures: Good laboratory practice, Good manufacturing practice and FDA regulations - Regulations for recombinant DNA research and manufacturing process - Bio-safety and Bioethics - Regulations for clinical trials, Documentation and Compliance, in India and selected countries - Rules for import and export of biological materials. IPR - Definition - Forms of IPR Protection, WTO - Definition — Functions- International treaties for IPR Protection. Patents - Definition - conditions for patentablity - test of novelty of patents – composition of a patent - Patenting of Biotechnological discoveries

Recommended Books:

1. Mathews. "Successful scientific writing: A step-by-step guide for Biomedical Scientists", Second edition, Cambridge University Press, 2001.

2. Warren, J., Gregory, E. and Grant, R. (2004) "Statistical methods in Bioinformatics"; First Edition Springer-verlag, Berlin

3. Habert Schildt (2007) "The Complete reference – C", Fourth Edition, The McGrew – Hill Companies, New York.

4. Beginning Perl for Bioinformatics (1st Edition) by Tisdall, J., O' Reilly Publishers. 2004.

5. Fundamentals of Molecular Spectroscopy by C.N.Banwell and Colin. 2000

6. Molecular Modeling principles and Applications (2nd Ed.) by Andrew Leach., Prentice Hall, USA. 2001.

7. Principles of Protein Structure by G.E.Schulz., Springer 2009.

8. Bioethics and Biosafety in Biotechnology by Sree Krishna V., New Age International (P) Ltd., Publ., Mumbai. 2007.

9. Intellectual Property Rights by Deborah E. Bouchoux., Delmar Cenage Learning. 2005

REFERENCE BOOKS

1. Pevzner, P.A. (2004) "Computational Molecular Biology"; Prentice Hall of India Ltd, New Delhi
2. Pevsner, J. (2003) "Bioinformatics and Functional Genomics"; John Wiley and Sons, New Jersey, USA.
3. Lesk, A.M. (2002) "Introduction to Bioinformatics", First edition, Oxford University Press, UK.
4. Sensen, C.W. (2002) "Essentials of Genomics and Bioinformatics"; Wiley-VCH Publishers, USA
5. Mount, D. (2004) "Bioinformatics: Sequence and Genome Analysis"; Cold Spring Harbor Laboratory Press, New York.
6. Baxevanis, A.D. and Francis Ouellellette, B.F. (2004) "Bioinformatics – a Practical guide to the analysis of Genes and Proteins"; Third Edition, John Wiley & Sons, UK.
7. Food Safety and Standards act (Government of India), 2006
8. Intellectual Property Rights on Biotechnology by Singh, KC, BCIL, New Delhi