

UNIVERSITY OF MUMBAI
No.UG/446 of 2009

CIRCULAR:-

The Directors/Heads of the recognized Science Institutions concerned and the Principals of the affiliated Colleges in Science are hereby informed that the recommendation made by the Faculty of Science at its meeting held on 3rd August, 2009 has been accepted by the Academic Council at its meeting held on 17th September, 2009 vide item No.4.11 and subsequently approved by the Management Council at its meeting held on 25th September, 2009 vide item No.21 and that, in accordance therewith, the Diploma Course in Bioinformatics (Add-on-Course) has been introduced from the academic year 2009-2010.

Further that in exercise of the powers conferred upon the Management Council under Section 54(1) and 55(1) of the Maharashtra Universities Act, 1994, it has made Ordinances 5888 and 5889 and Regulations 8177, 8178, 8179, 8180, 8181, 8182 and 8183 including syllabus for the Diploma Course in Bioinformatics (Add-on-Course) is as per Appendix and that the same has been brought into force with effect from the academic year 2009-2010.

MUMBAI-400 032
1st December, 2009

PRIN. K. VENKATARAMAN
REGISTRAR

To,

The Directors/Heads of the recognized Science Institutions concerned and the Principals of the affiliated colleges in Science.

A.C./4.11/17.09.2009
M.C./21/25.09.2009

No. UG/446-A of 2009, MUMBAI-400 032 1st December, 2009

Copy forwarded with compliments for information to :

- 1) The Dean, Faculty of Science.
- 2) The Controller of Examinations.
- 3) The Co-ordinator, University Computerization Center.


12/12/09



UNIVERSITY OF MUMBAI



ORDINANCES, REGULATIONS AND SYLLABUS FOR THE DIPLOMA COURSE IN BIOINFORMATICS

(Add-on course)

(To be introduced with effect from the academic
year 2009-2010)

CAREER ORIENTED ADD ON DIPLOMA COURSE IN BIOINFORMATICS

A candidate seeking admission to the Diploma Course should have passed the Career Oriented Add-on Certificate Course in Bioinformatics of ~~13~~ credits.

- Minimum 1 Year
- ~~13~~ Credits (Total 300 Hours)

Rs.3,500/-

30 – 40 Students Per Batch

6 Credits (90 Hours)

~~3~~ Credits (90 Hours)

~~4~~ Credits (120 Hours)

Examination

Total Marks	250
Theory	Paper I : 50 Marks Paper II : 50 Marks
Practical	Practical I (Experiments, Journal And Viva) : 50 Marks Practical II (Experiments, Journal And Viva) : 50 Marks
Project	Report : 40 Marks Presentation: 10 Marks

Each student will have a project of 8 Credits (120 hours) during the course per year. The student will prepare a report on the same. The report duly signed by the candidate and the supervisor under whom the work was carried out, will be submitted for evaluation by the examiner during the examination, during which the candidate will also make a presentation on the same.

Passing Criteria 40% Marks in Theory and Practicals

Students can be given Grades -

A Grade	Above 75%
B Grade	60 – 74%
C Grade	40 – 59%

Eligibility, No. of Seats, Distribution of Credits to theory, practical, projects, passing and grading criteria are according to the guidelines given by UGC in the XIth plan.

Infrastructure Requirement

- Classrooms and laboratory space for conducting lectures and practical
- A computer lab with needed softwares, internet facility and uninterrupted power supply to conduct on line bioinformatics practical. No. of computers should be proportional to the students (1 : 2).

Staff Requirement

1. A coordinator who will be responsible for the smooth conduct of the course. Co-ordinator of the course may be paid an Honorarium of Rs.5000/- per year out of the seed money.
2. A lab assistant cum computer technician who is a computer literate.
3. Lectures and practical can be conducted by the core faculty or visiting faculty having expertise in concerned field. Guest Faculty / Internal Faculty may be remunerated @Rs.250/- per lecture of 1 hr. duration.

Unitized Question Paper Pattern

Theory Question Paper Pattern

Question 1	From Unit 1	10 Marks
Question 2	From Unit 1	10 Marks
Question 3	From Unit 2	10 Marks
Question 4	From Unit 2	10 Marks
Question 5	From Unit 1 And Unit 2	10 Marks
Total		50 Marks

Practical Question Paper Pattern

Question 1	One Major Expt.	15 Marks
Question 2	One Major Expt.	15 Marks
Or		
Question 2 A	Minor Expt.	8 Marks
Question 2 B	Minor Expt.	7 Marks
Question 3	Journals	10 Marks
Question 4	Viva	10 Marks
Total		50 Marks

CAREER ORIENTED ADD ON DIPLOMA COURSE IN BIOINFORMATICS SYLLABUS

PAPER I

Unit I - BIOINFORMATICS -

25 Lectures

1. Protein classification and structure visualization: Overview of protein structure, protein structure visualization, structure-based protein classification, protein structure databases, protein structure visualization databases and tools.
2. Domain Assignment and Searching: CATH and SCOP, FSSP, Uniprot, PFAM, PROSITE, SMART, INTERPRO.
3. Genome sequencing: Sanger method, Shot gun method, Human genome, genome annotation
4. Data generation and data flow (DNA sequencing, Generation of Scaffolds and contigs, mapping, data storage), Large-scale genome sequencing, Recognisable patterns in DNA sequences, promoter regions, Exons, Introns, ORF regions
5. Genome analysis and Gene mapping: Genome analysis, mapping, Genetic mapping and linkage analysis, physical maps, SNP and HAP maps
6. Gene identification and prediction: Introduction, Basis of gene prediction, pattern recognition, gene prediction methods.
7. Gene Expression and Microarrays : introduction, working with microarray, Clustering gene expression profiles, data sources and tools for microarray analysis, application of microarray technology.
8. Introduction to Drug discovery: Areas influencing drug discovery, pharmacogenetics and pharmacoconomics applications, analysis of SNPs, Important parameters in drug Discovery.

1. Elements of programming in C – Pointers, Pointers to functions
Macros definition
2. Graphs, Data structure-linked list, stack, queue; binary trees, threaded binary trees; file handling, exception handling C
3. Use of Internet and world wide web, searches on Medline, bibliographic databases
4. Networking-LAN, WAN, MODEM, optical versus electronic networking, security of networks, firewalls.
5. Hierarchical networks, Ethernet and TCP/IP family protocols, transport protocol design. UNIX: Unix architecture, Unix file system, Unix commands, Pipes and filters, Shell programming, Useful utilities, Vi editor, communication and networking.
6. An overview of JAVA, Tools for JAVA, Examples in JAVA, Brief analysis of swing program. Bio Java: Writing the Programs based on basic problems in Biotechnology

Reference Books

1. Computer Networks- fourth Edition by Andrew S. Tanenbaum
Prentice Hall India 2003 Edition
2. Linux in a Nutshell, Fourth Edition – Ellen Siever-Oreilly (2002)
3. Computer Fundamentals III edition – Pradeep sinha & Priti sinha BPB
publication(1999)
4. Let us C by Yeswanth Kaetkar VI Edition, 2004 BPB Publication
5. Programming in C by E. Balagurusamy Tata McGraw Hill publication
6. The complete reference C, fourth edition, 2002 by Schildt Tata
McGraw Hill publication
7. Computer Networks- fourth Edition by Andrew S. Tanenbaum
Prentice Hall India 2003 Edition
8. Linux in a Nutshell, Fourth Edition – Ellen Siever-Oreilly (2002)

9. Computer Fundamentals III edition – Pradeep sinha & Priti sinha BPB publication(1999)
10. Programming with Java - A Primer by E. Balaguruswamy ; Prentice Hall - 2004
11. Building Java Applets for Netscape 2.0 - Tim Ritchey ;O'Reilly - 2002
12. Hooked on Java - Arthur Van Hoff; O'Reilly – 2003
13. Internet World 60 Minute Java - Ed Tiittel ;WROX - 2004
14. Learning Java by Patrick Niemeyer, Jonathan Knudsen - O'reilly – 2003
15. Sequence and Genome Analysis by David W. Mount - Cold Spring Harbor Laboratory ;2004
16. Fundamental Concepts of Bioinformatics by Dan E. Krane, Michael L. Raymer; Benjamin Cummings Released: 12 September, 2002
17. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Third Edition;by Andreas D. Baxevanis, B. F. Francis Ouellette Wiley-Interscience; Released: 15 October, 2004
18. A Primer of Genome Science, 2nd Edition by Greg Gibson, Spencer V. Muse; Sinauer Associates Released: 01 December, 2004
19. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Third Edition; by Andreas D. Baxevanis, B. F. Francis Ouellette Wiley-Interscience; Released: 15 October, 2004
20. An Introduction to Bioinformatics Algorithms (Computational Molecular Biology);by Neil C. Jones, Pavel A. Pevzner The MIT Press; Released: 01 August, 2004

Paper II

Unit I - Fundamentals of Biology

Cell Biology: 5 Lectures

- Prokaryotic and eukaryotic cells:
- Membranes and cellular compartments
- Organelles like mitochondria ER, Golgi complex, chloroplasts, lysosomes and peroxisomes ,
- Nucleus and nucleolus
- Signal sequences, protein sorting, translocation in ER and other organelles. Signal transduction

Molecular Biology: 5 Lectures

- Central dogma of life, replication, transcription, translation
- Genetic code, mutations, transposition
- Prokaryotic and Eukaryotic gene organization and gene expression
- Operons, promoters and regulatory sequences,
- Positive and negative control,
- Gene regulation, sigma factors, transcription factor
- Processing of RNA
- Recombination maps & restriction maps
- Molecular markers, RFLP, RAPD, AFLP, STS, EST, repetitive DNA, micro and minisatellites, SNP and their uses

Genetics and Evolution: 5 Lectures

- Origin and evolution of life:
 - Classical experiments and current concepts
 - Various theories of evolution and origin and of life
 - Genomic and molecular evolution
- Mendelian Genetics:
 - Mendel's Law
 - Chromosomal basis of heredity
 - Chromosomal analysis, karyotyping, chromosome mapping
 - Allelic Variation
 - Linkage and crossing over Gene interaction
- Non- Mendelian genetics → Cytoplasmic inheritance

• Microbial Genetics:

- Genetic recombination in bacteria (Transformation, conjugation, general and specialized transduction)
- Bacteriophage lambda (lytic / lysogenic cycle)
- Human Genetics: Pedigree analysis (e.g. Haemophilia and colour blindness)
- Sex determination
- Genetic disorders and chromosomal abnormalities
- Somatic cell hybridization for chromosome mapping

Immunology: 10 Lectures

• Overview of Immune System:

- Acquired (specific) Immunity, Innate (non specific) Immunity
- Cells and organs of the immune system
- Antigens – factors influencing immunogenicity, Epitopes,
- Haptens and Mitogens
- Immunoglobulins : i) Structure ii) Function iii) Types
- Antigenic determinants : Idiotypic, Allotypic, Isotypic

• Major Histocompatibility complex:

- Class I and II molecules
- Inheritance of MHC, Tissue distribution of MHC, MHC functions

Ag-Ab Interaction

- Primary Interaction
- Ag Recognition, Processing of Ag, Activation of T-cell, Activation of B-cell
- Idiotypic network and Immunological tolerance
- Ontogeny of B & T cells
- Detection and Application
- Strength of Ag-Ab Interaction, affinity, avidity, cross- reactivity
- Precipitation reactions, Agglutination reaction, Radio Immuno Assay (RIA) ELISA and its Types, Immunofluorescence
- Introduction to Hypersensitivity, Transplantation Immunity and Autoimmune disease

Unit II - Recombinant DNA Technology : 20 Lectures

- Gene Cloning
 - Cutting and joining of DNA

- DNA-RNA modifying enzymes, restriction enzymes and their target, rare and frequent cutters, End modification strategies, end filling
- Mechanism of DNA joining: Ligation of cohesive termini, homopolymer tailing, linkers and adaptors

Cloning vehicles:

- Plasmids: properties, purification, construction and characterization of pBR322, pUC, and other vectors
- Virus based vectors : Bacteriophage: features, promoters and control circuits, Improved lambda vectors (λ Zap)
- Filamentous coliphages, M13 and specificity of T3 and T7 polymerase
- Cosmid
- Large insert capacity vectors: YAC and BAC vectors,

Cloning Strategies:

- Genomic DNA and cDNA libraries
- Chromosomal walking
- Chromosomal jumping
- Use of random primers in cloning
- Positional cloning, reporter genes, quantification of gene expression

Recombinant selection and screening:

- Colony and plaque hybridization
- Library screening : PCR screening, hybrid selection, immunochemical methods and Screening for DNA binding proteins
- Plus and minus screening and HRT and HART methods
- Applications of recombinant DNA technology

Practical - I

1. Elements of programming in "C" – pointers, pointers to the functions, Macros, graphs, data structure – linked list, stack, queue, binary trees, threaded binary trees; file handling and exception handling.
2. Familiarization with DOS, Windows, NT, UNIX operating systems.
3. Searches on MEDLINE, bibliographic databases
4. Database Searching using Entrez and SRS.
5. Protein and nucleic acids sequence analysis using FASTA and BLAST
6. Multiple Sequence Alignment using ClustalW
7. Phylogenetic Analysis using ClustalW and Phylip
8. Application of softwares: Rasmol, BioEdit, spdbv etc.
9. Use of virus information system coding and analysis of virus data.
10. Usage of TAXON in classifying microbes and viruses.
11. Usage of Animal cell Line information system.
12. Conversion of EMBL, NCBI data in GCG format and vice versa using Readseq software
13. Secondary Database search: Pattern Matching, Motif searching, Profile Analysis.
14. RNA and Protein Structure analysis.
15. Application of spdbv viewer in protein structure manipulation.

Practical - II

1. Sterilization of glass ware & Preparation of media.
2. Inoculation & growing of Microorganism in liquid & solid media.
 - Pour plate method.
 - Streak plate method.
 - Stab culture method.
 - Serial dilution method.

3. Effect of pH on amylase.
4. Effect of temperature on amylase.
5. Problems in genetics
6. problems in pedigree
7. Karyotype analysis
8. Antigen – antibody reaction: Blood Group Analysis
9. Agglutination Reaction- RA test
10. Isolation of Plant Genomic DNA.
11. Isolation of Animal Genomic DNA.
12. Isolation of Plasmid by mini prep method.
13. Isolation of Plasmid by maxi prep method.
14. Restriction endonuclease & Digestion of Plasmid.
15. Purity testing of Plasmid on Agarose gel Electrophoresis,
Spectrophotometric quantification of DNA
16. PCR- setting the PCR and demo

Reference Books

1. Genes VII by Benjamin Lewin.
2. Advanced Molecular Biology by R.M. Twyman.
3. Molecular Biology by David Freifelder
4. Instant notes in Molecular Biology by Turner
5. Molecular Biology of the cell by Alberts
6. Principles of gene manipulation by Primerose
7. Genetics. P.K Gupta; Rastogi Publications 1st Edition (2004-2005).
8. Instant Notes in Genetics; P.C. Winter, G.I. Hickey and H.L. Fletcher;
Viva Books Pvt. Ltd. 2nd Edition (2003).
9. Basic Genetics; G.S. Miglani; Narosa Publishing House, 1st Edition
(2002).

10. Microbial Genetics; David Freifelder; Narosa Publishing House, 2nd Edition (2004).
11. Human Genetics; S.D. Gangane; Elsevier Publishers, 2nd Edition (2004).
12. Genetics; C. Sarin; Tata McGraw Hill Publishing, 1st Edition (2004).
13. Principles of Genetics; R.H. Tamarin; Tata McGraw Hill Publishing, 1st Edition (2004).
14. Biological Science; D.J. Taylor, N.P.O. Green and G.W. Stout; Cambridge University Press, 3rd Edition (2003).
15. Immunology; Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne, Janis Kuby; W.H. Freeman & Company, 5th edition (2003)
16. Roitt's Essential Immunology; Ivan M. Roitt, Peter J. Delves Blackwell Science Ltd., 10th Edition (2001)
17. An Introduction to Immunology; C.V. Rao; Narosa Publishing House, 1st Edition (2004)
18. Instant Notes in Immunology; P.M. Lydyard, A. Whelan, M.W. Fanger BIOS Scientific Publishers Ltd, 1st Edition (2003)
19. Textbook of Microbiology ;R. Ananthnarayan, C. K. J. Panicker, Orient Longman , 6th Edition (2003)
20. Immunology: Introductory textbook; Nandini Shetty, New Age International Pvt. Ltd. 1st Edition (2003)
21. Molecular Cloning lab manual; Joseph Sambrook, David W. Russell, cold Spring Harbor Laboratory Press (2001)
22. Essential Molecular Biology (volume I & II) Practical Approach; Edited By T. A. Brown; Oxford University Press (2001).
23. Principles of Gene Manipulation; S. B. Primrose, R. M. Twyman & R. W. Old; Blackwell Science, 6th Edition (2001).

24. Human genetics; S. D. Gangane; Elsevier (2004).
25. Principles & Techniques of Practicals Biochemistry; Keith Wilson & John Walker, Cambridge University press (2003).
26. Recombinant DNA; J. D. Watson, M. Gilman, J. Witkowski & M. Zoller, Scientific American Books, 2nd edition (1992)
27. Molecular Biotechnology; Principles & applications of Recombinant DNA, B. R. Glick, J. J. Pasternak, ASM Press (2005)

————— ✕ —————