

UNIVERSITY OF MUMBAI

No.UG/221 of 2004

CIRCULAR:-

Attention of Principals of the affiliated Colleges in the faculty of Science is hereby invited to the Ordinances, Regulations and Syllabus relating to the Certificate Course in Bio-informatics and they are hereby informed that the recommendation made by the Faculty of Science at its meeting held on 23rd February, 2004 has been accepted by the Academic Council at its meeting held on 2nd April, 2004 vide item No.4.25 and subsequently approved by the Management Council at its meeting held on 17th April, 2004 vide item No.20 and that in accordance therewith the Certificate course in Bio-informatics has been introduced by the University with effect from the academic year 2004-2005.

They are further informed that in exercise of the powers conferred on the Management Council under Section 54(I) of the Maharashtra Universities Act 1994, the Management Council has made the Ordinance 5409 relating to the syllabus, scheme of papers and standard of passing for the Certificate course in Bio-informatics is as per Appendix and that the same has been brought into force with effect from the academic year 2004-2005.

They are also informed that in exercise of the powers conferred on the Management Council under section 55(1) of the Maharashtra Universities Act 1994, the Management Council has approved the Regulations 4718, 4719, 4720, 4721 and 4722 relating to the syllabus, scheme of papers and standard of passing for the certificate course in Bio-informatics is as per Appendix and that the same has been brought into force with effect from the academic year 2004-2005.

Mumbai 400 032.

2nd June, 2004

To,

for REGISTRAR.

Principals of the affiliated colleges in the faculty of Science.

A.C.4.25/23.02.2004

M.C.20/17.04.2004

No.UG/ 221-A

of 2004

2nd June, 2004.

Copy forwarded with Compliments to the Dean, Faculty of Science, for information.

for REGISTRAR.

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UNIVERSITY OF MUMBAI

Ordinances Regulations & Syllabus relating to the Certificate course in Bioinformatics

(Introduced from the academic year 2004-2005)

UNIVERSITY OF MUMBAI

Ordinances & Regulations relating to the Certificate/Course In Bioinformatics

Preamble :

1. The course is designed as a three-year integrated course and the syllabus of the course expects continuity from first year to second year and to third year.
2. On the successful completion of first year, student will be awarded a certificate, on the successful completion of second year, Diploma and after successful completion of third year, Advance Diploma, as per the directive.
3. Since number of lectures of the course is less, the emphasis is on core Bioinformatics. It is expected that basics of Biology and Chemistry/Biochemistry etc. will be covered in regular B.Sc. course. This will also avoid overlapping syllabi.
4. Biology Part is emphasized in second year, with a view that most of the basics will be introduced in the F.Y. and S.Y. course of respective biological sciences.

Introduction :

O 5409	Eligibility	: All B.Sc. students
R 4718	Fee Structure	: Rs.3000/-
R 4719	No. of Lectures	: 60/ Year
R 4720	No. of Practical (Periods)	: 60/ Year
R 4721	Duration	: One Year
R4722	Details of the Syllabus be as follows :	

First Year : Certificate course in Bioinformatics (60 Lectures)

Theory Syllabus

Title: Introduction to Bioinformatics

I. Nature and Scope of the subject (5)

What is Bioinformatics?:

Various definitions and approaches and objectives proposed in the field
Branches of Biology where Bioinformatics is most fruitfully applied Scope
and future status as Computational Biology

Historical perspective – from genetics, biochemistry and molecular biology
to Bioinformatics with suitable illustrations.

Need based development and applications of informatics

Techniques, role played by Computer Information Internet
technology

Interdisciplinary nature of Bioinformatics – important role played by
mathematical, statistical modeling methods and computational technologies
in solving biological problems

Current Status of the field

Types and range of applications of Bioinformatics

Status of the Bioinformatics in India

Biological Basics: Nature of Biological Information (30)

Defining biological information – information inherent in genetic code and
cellular machinery verses information generated by biological
experimentation (for deciphering the same). (3)

Current understanding of nature of biological information (6)

Describing flow of biological information – Central Dogma of
Molecular Biology. Its reinterpretation as central paradigm of
Bioinformatics

Informational content of DNA, RNA and proteins – discussion on how
sequence of these biomolecules code for specific function - sequence to
structure to function relationship.

Information theory and its use in deciphering of hidden biological
information – theoretical background

Source of Biological Data – How it is acquired? (5)

Nature of experimental data generated in biology, changing trends in this data

generation and management.

Role played by automated techniques and large scale sequencing projects like

HUGO, in compelling use of IT /computational techniques in data acquisition, storage and processing.

Biological Databases : (13)

Need and advantage of computerized data storage

- Linkage of information/ data leading to fast and multifaceted retrieval

- Organization of information / data for discovery of new relationships

- Data mining

NCBI data model – the basis of biological data

Theoretical basis for comparison of biological data – phylogenetic

Typical activities undertaken in manipulating database data – sequence comparison and analysis Study of types of databases with examples and their role

Changing approaches to study of biology (3)

Role of computational techniques in design of experiments

From reductionism approach to holistic approach, discussion of technologies that are making this transition possible,

“Ome” families and their study, Birth of system biology

III. Computer basics

(25)

Brief introduction to computer hardware and software (2)

Types of computers – classification based on hardware and software

(Operating

System), their significance in bioinformatics

Hardware – general construction of a computer, role played by each

component (2)

- Peripherals for data input, output, storage and display; for communication with

other computers and instruments

Software – role of software in computer (16)

- Types of software: operating system, programming software/ language compilers and interpreters, utilities software, databases management software, communication software (3)

- Operating systems platforms commonly used in bioinformatics their advantages and disadvantages – Unix (Linux – RedHat, Suse, Solaris), DOS and windows (4)
- Software commonly used in biology – Browsers (IE, Netscape, Opera), Data management software (FoxPro, Access, {SQL}, oracle), Structure display and manipulation software (SPDB viewer, VMD, Viewer Light, RasMol, Cn3D), programming languages-(Perl, Python, C, Visual Basic), (6)
- Socialized integrated services, their role and importance in Bioinformatics (Entrez, EMBOSS, SRS, Bioedit, Biology Workbench) (3)

Internet and World Wide Web – backbone of Bioinformatics movement (5)

- History of Internet and WWW, difference between them
- Structure of internet and how it works: communication protocols (TCP/IP, HTTP, FTP) web pages (HTML, VRML) – their role as interface between user and computer/database.
- Advantages and disadvantages of internet system, problems and their solutions.
- Practical aspects – how to use internet effectively for biological data search
- Important bioinformatics related websites and services offered by these sites for bioinformatics activity – NCBI, EBI, EMBL, KEGG, PDB, SRS Sanger Institute, Weizman Institute etc.

List of Books – Text Books and Reference Books

Text Books

1. T.K. Attwood, D.J. Parry-Smith; "Introduction to Bioinformatics", Pearson Education, (2001, Indian Edition)
2. C. Gibas and P. Jambeck; "Developing Bioinformatics Computer Skills", O'Reilly Publishers, (April 2001 Indian Edition)
3. A.M. Lesk; "Introduction to Bioinformatics", Oxford University Press; (2002, Indian edition)
4. A.D. Baxevanis, B.F. Francis Ouellette; "Bioinformatics", John Wiley and Sons, Inc, (2002, Indian edition)
5. D.E. Kmac and M.L. Raymer; "Fundamental Concepts of Bioinformatics", Pearson Education, (2003, Indian Edition)
6. B. Bergeron; "Bioinformatics Computing"; Printice-Hall Pvt. Ltd., (2002, Indian Edition)

Reference Books

1. D.W. Mount; "Bioinformatics, Sequence and Genome Analysis", Cold Spring Harbour Laboratory Press; (2001, Indian Edition)
2. R. Durbin, S. Eddy, A. Krogh, G. Mitchison; "Biological Sequence Analysis, probabilistic models of proteins and nucleic acids"; Cambridge University Press, (2003 Indian Edition)

Note: Students are also expected to extensively use along with text and reference books, information available at various sites like NCBI, EBI, PDB etc. on Internet.

Practical syllabus
(60 periods)

I. Computer Science Setting up your computer for bioinformatics work. [20]

Computer Background and familiarization: Familiarity with installed hardware and software of available computer systems, LAN, Internet connectivity etc., available operating system (Windows Versions, Linux, DOS etc) (3)

Installation of various programs and utilities – (10)

Operating systems and related systems installation- Windows, Unix (Linux: Red Hat or SUSE) installation, MS Office or Star Office suit installation, Winzip, Download accelerator, Web reapers, Adobe PDF readers

Directory creation, File management, retrieval, storage

Installation of Perl, Python, JAVA

Installation of Bioinformatics Utilities – Bioedit, Viewerlite, SpdbViewer, VMD, Hex or equivalent

Accessing Internet, surfing World Wide Web and collecting desired information (3)

- Downloading programs mentioned in 2nd topic
- Opening an email account
- Preparing webpage – eg. Geocities or equivalent
- Utilizing FTP servers for file downloads
- Obtaining PDB files

Introduction to utilities like “E-Note” for electronic recording of scientific data and it's sharing. (1)

Introduction to Visual basic macro facility for automation of repetitive tasks.

Recording Macros on Excel and playback of such macros (3)

II. Introduction to Biological Database (40)

- Visiting NCBI, EBI, KEGG, DDBJ, PDB sites and prepare a comprehensive power point presentation for each (5)
- Bioedit Exercises (15)

Exploring sequences various utilities available with Bioedit, by checking each option in pull down menus

Installing E.coli database and studying following operations:

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- i. Opening an 4290 proteins and selecting specific protein
 - ii. Mutating that protein with point mutation and sequencing
 - iii. Demonstration of setting up of local Blast with Bioedit
 - iv. Sequencing alignment for randomly selected sequence
 - v. Translation and reverse transcription of Nucleic acid sequences to amino acid sequences in protein
 - vi. Generating restriction map or possible restriction enzyme sites in a given nucleic acid sequence
3. Construction of nucleic acid or protein sequence Database for specific data collected from various sources (e.g. proteins structure, specific enzyme families – nucleic acid sequences etc), its manipulation and sorting for ease of analysis and use. (5)
4. Use of molecular modeling software – VMD, SPDB viewer, Viewer-light or Cn3D (15)
- a. Familiarity with major menu options and effortless navigation
 - b. Opening PDB files and visualization of various structural features of the protein molecule – domains, secondary structure, hiding and showing side chains, modifying molecules by changing amino acids, Ramachandran Plot, sequencing alignment and threading of molecules.
- i. Opening an 4290 proteins and selecting specific protein
 - ii. Mutating that protein with point mutation and sequencing
 - iii. Demonstration of setting up of local Blast with Bioedit
 - iv. Sequencing alignment for randomly selected sequence
 - v. Translation and reverse transcription of Nucleic acid sequences to amino acid sequences in protein
 - vi. Generating restriction map or possible restriction enzyme sites in a given nucleic acid sequence
3. Construction of nucleic acid or protein sequence Database for specific data collected from various sources (e.g. proteins structure, specific enzyme families – nucleic acid sequences etc), its manipulation and sorting for ease of analysis and use. (5)
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• Spc Bioinformatics

