DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.ACAD/SU/Sci./B.Sc. & M.Sc. Syll./5/2015

It is hereby notified for information to all the concerned that, on the recommendation of the Faculty of Science the Academic Council at its meeting held on 30-05-2015 has accepted the **revised semester-wise syllabi as mentioned against their names in the Faculty of Science as under** :-

Sr. No.	Name of the Subject	Semester
[1]	B.Sc. Computer Science Degree Course	III & IV
[2]	B.Sc. Information Technology Degree Course	III & IV
[3]	B.C.A. Science Degree Course	III & IV
[4]	B.Sc. Animation Degree Course	III & IV
[5]	B.Sc. Bioinformatics Degree Course	III & IV
[6]	B.Sc. Computer Science [Optional]	III & IV
[7]	B.Sc. Information Technology [Optional]	III & IV
[8]	B.Sc. Computer Applications [Optional]	III & IV
[9]	B.Sc. Computer Maintenance [Optional]	III & IV
[10]	B.Sc. Environmental Science [Optional]	V & VI
[11]	B.Sc. Bio-Chemistry [Optional]	V & VI
[12]	B.Sc. Forensic Science Degree Course	V & VI
[13]	B.Sc. Industrial Chemistry [Optional]	V & VI
[14]	B.Sc. Electronics [Optional]	V & VI
[15]	B.Sc. Zoology [Optional]	V & VI
[16]	B.Sc. Microbiology [Optional]	V & VI
[17]	B.Sc. Instrumentation Practice [Optional]	V & VI
[18]	B.Sc. Statistics [Optional]	V & VI
[19]	B.A. Statistics [Optional]	V & VI
[20]	B.A. / B.Sc. Mathematics [Optional]	V & VI
[21]	B.Sc. Home Science Degree Course	V & VI
[22]	B.Sc. Textile Interior Decoration Degree Course	V & VI
[23]	B.Sc. Fishery Science [Optional]	V & VI
[24]	B.Sc. Dairy Science & Technology [Optional]	V & VI
[25]	B.Sc. Botany [Optional]	V & VI
[26]	B.Sc. Physics [Optional]	V & VI
[27]	M.Sc. Computer Science	III & IV
[28]	M.Sc. I.T.	III & IV

This is effective from the Academic Year 2015-16 & onwards as appended herewith.

All concerned are requested to note the contents of the circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.ACAD/SU/SCI./
2015/3761-4160
Date:- 16-06-2015.

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Director,
Board of College and
University Development.

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Copy forwarded with compliments to:-

1] The Principals, affiliated concerned colleges,
Dr. Babasaheb Ambedkar Marathwada University

Copy to :-

1] The Controller of Examinations,
2] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,
3] The Superintendent, [B.Sc. Unit],
4] The Superintendent, [M.Sc. Unit],
5] The Programmer [Computer Unit-1] Examinations,
6] The Programmer [Computer Unit-2] Examinations,
7] The Record Keeper.

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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Revised Syllabus of

B.Sc. Second Year

THIRD AND FOURTH SEMESTER

BIO-INFORMATICS

THREE YEAR DEGREE COURSE

From the Academic Year 2015-16.

Semester-III	Semester- IV
Paper-XIII- Biomolecules	Paper-XIX Metabolism
Paper-XIV-Database Management System	Paper-XX Introduction to Data Structure & Algorithm
Paper-XV-Molecular structures & Enzyme Kinetics	Paper-XXI- Central Dogma
Paper-XVI- Basic Techniques in Biology	Paper-XXII- Advanced JAVA
Paper-XVII- OOPs using JAVA	Paper-XXIII- Introduction to chemoinformatics
Paper-XVIII- Introduction to Bioinformatics	Paper-XXIV-Genomics & Proteomics
LC-VII-Biomolecules & Biotechniques	LC-X- OOPs using JAVA
LC-VIII-PL/SQL	LC-XI-Techniques in Bioinformatics
LC-IX- Basic Bioinformatics	LC-XII-Structural Bioinformatics

Semester III

Paper No. XIII - Biomolecules

UNIT I – Carbohydrates

Functions of carbohydrates, Types, Structures and Properties of – Monosaccharides, Disaccharides, Polysaccharides, glycoconjugates - Proteoglycans, Glycoproteins, and Glycolipids.

UNIT II – Lipids

Definition, Alcohols and fatty acids, simple lipids, compound lipids, derived lipids, properties of fats and oils.

UNIT III – Vitamins

Structure and Properties of - Fat soluble vitamins (A, D, E, K), Water soluble vitamins (B, B_1, B_2, B_3, B_5, B_6, B_7, B_9, B_{12}, C)

UNIT IV – Hormones

Structure, Function and role of - Animal hormones (Thyroid, Parathyroid, Gonadal, Adrenal, and pancreatic), Plant hormones (Auxin, Gibberelin, Cytokinins, Abscisic acid, Ethylene)

UNIT V – Molecular fuels

Structure, Function and role of – ATP, $NADH_2$, $NADPH_2$, $FADH_2$.

Reference Books:

1. Biochemistry by Stryer 5th Edition WH Freeman 2001
2. Cohn & Stump, Outline of Biochemistry Wiley Eastern Ltd.2.
3. Harpers Review of biochemistry Prentice Hall
4. Cregnton Protein Structure & Molecular Properties
5. A.L. Lehninger, D. L. Nelson & M M Cox Principles of Biochemistry.

Paper No-XIV- Database Management System

Unit-I

Introduction of DBMS, Overview, File system Vs DBMS, Describing & storing data (Data models (relational, hierarchical, network)), Levels of abstraction, data independence, Queries in DBMS (SQL: DDL, DML, DCL, TCL), Structure of DBMS, Advantages of DBMS.

Unit-II

File Organization- Physical / logical files, Special characters in files, fields & record organization (fixed, variable length) types of file organization (heap, sorted, indexed, hashed), choosing a file organization.

Unit-III

Indexed File Organization- Overview of indexes, types of indexes (dense, sparse, clustered, primary, secondary, tree (multilevel indexes, B+ tree).

Unit-IV

Conceptual Design (E-R model). Overview of DB design, ER data model (entities, Attributes, entity sets, relations, relationship sets) , Additional constraints (key constraints, participation constraints, weak entities, aggregation / generalization, conceptual design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER).

Unit-V

Relational data model –Relations: concepts, Conversion of ER to Relational model, integrity constraints (key, referential integrity, general constraints).
Relational algebra-Preliminaries, Relational algebra (selection, projection, set operations, renaming, joins, division).

References

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S. Sudarshan, ISBN:9780071289597,Tata McGraw-Hill Education.
2. Database Management Systems ,Raghu Ramakrishnan,ISBN:9780071254342, Mcgraw-hill higher Education.
3. Database Management Systems,Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
4. Database Systems, Shamkant B. Navathe, Ramez Elmasri, ISBN:9780132144988, PEARSON HIGHER EDUCATION
5. Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew.

Paper No-XV-Molecular Structures & Enzyme Kinetics

UNIT I– DNA

Nature of genetic material; evidence that DNA is the genetic material, generalized structural plan of nucleic acid, forms of DNA , features of DNA double helix; role of DNA as genetic material.

UNIT II – RNA

RNA – structure and types of RNA, mRNA , tRNA , rRNA.

UNIT III – Proteins – Basic concepts

Amino acids: Classification, Properties, reactions. Protein classification: Reactions, functions, properties and Solid phase synthesis.

UNIT IV – Structural levels of proteins

Primary Structure: Peptide bond, importance of primary structure. Secondary structure: X ray diffraction, alpha-helix, β - structure, β-helix, super secondary structure. Tertiary Structure: Forces stabilizing, Prediction of tertiary Structure. Quaternary structure – Haemoglobin, Myoglobin, Actin, Torsion angle, Ramachandran plot.

UNIT V – Enzymes

Basic concept, Classification, Nature of enzymes catalysed reaction, active site of enzymes, Michaelis-Menton equation, effect of temp, pH, Enzyme concentration and time of incubation. Role of co-enzymes, prosthetic groups, activator and inhibitors in enzyme catalysed reaction.

Reference Books:

1. Biochemistry by Stryer 5th Edition WH Freeman 2001
2. Cohn & Stump, Outline of Biochemistry Wiley Eastern Ltd.2.
3. Harpers Review of biochemistry Prentice Hall
4. Cregnton Protein Structure & Molecular Properties
5. A.L. Lehninger, D. L. Nelson & M M Cox Principles of Biochemistry.
6. David Friefieder Essentials of Molecular Biology, jones &Barlett publications
7. J.D.Watson, N.H.Hopkins ,J.W Roberts,et al Molecular Biology of the Gene, Benjamin Cummings publ.co.inc.,California
8. Zuby Biochemistry 4th edition

Paper No-XVI-Basic Techniques in Biology

UNIT I

Isolation, purification and criteria of purity of proteins and enzymes, Centrifugation-Analytical and Differential.

UNIT II

UV and visible Spectrophotometry.

UNIT III

Membrane filtration and dialysis: Nitrocellulose, Polycarbonate filters, dialysis and Concentration, freeze drying and lyophilization.

UNIT IV

Chromatography techniques: Partition and adsorption Chromatography- GLC, gel filtration, Molecular exclusion, HPLC.

UNIT V

Electrophoretic techniques: Types of electrophoresis: (paper, celluse-acetate electrophoresis, gel Electrophoresis (starch gel, native PAGE, disc PAGE, gradient PAGE, SDS-PAGE, agarose gel electrophoresis, Isoelectric focusing, 2D gel electrophorosis).

Reference Books:

1. Physical Biochemistry:Applicationto Biochemistry and Molecular Biology –Freilder.
2. Biochemical Technique : Theory and Practice, -Robyt & White
3. Principle of Instrumental Analysis –Skoog & West
4. Principle & Technique –Practical Biochemistry 5thEd. (2000) -Walker J. & Wilson K.
5. Biochemical Techniques Theory and Practice: J.R. Robyt and B.J. White. 1990
6. Principle of Instrumental Analysis–Skoog et al., 7th edition

Paper No-XVII- Object Oriented Programming using JAVA

Unit-I

Fundamentals of Object Oriented programming: Object Oriented paradigm - Basic concepts of Object Oriented Programming - Benefits of OOP - Applications of OOP. Java Evolution: Java Features - How Java differs from C and C++. - Java and Internet - Java and World Wide Web - Web Browsers - Hardware and Software Requirements - Java Environment.

Unit-II

Overview of Java Language: Simple Java Program - Java Program Structure - Java Tokens-Java Statements - Implementing a Java Program - Java Virtual Machine - Command Line Arguments. Constants, Variables and Data types: Constants - Variables - Data types - Declaration of Variables-Giving Values to variables- Scope of Variables-Symbolic Constants-Type Casting.

Unit-III

Operators and Expressions, Decision Making and Branching: Decision Making with If statement - Simple If Statement-If else Statement-Nesting If Else Statement- the ElseIf Ladder-The switch Statement - The?: operator. Decision Making and Looping: The while statement - The do statement - The for statement - Jumps in Loops, Class , Objects and Methods: Defining a Class - Fields Declaration - Methods Declaration - Creating Objects - Accessing class members - Constructors .

Unit-IV

Methods Overloading - Static Members - Nesting of Methods - Inheritance - Overriding Methods - Final Variables and Methods - Final Classes - Abstract Methods and Classes - Visibility Control.

Unit-V

Arrays, Strings and Vectors: One-dimensional Arrays-creating an Array - Two dimensional Arrays - Strings - Vectors - Wrapper Classes - Enumerated Types
Interfaces: Multiple Inheritance: Defining Interfaces - Extending Interfaces - Implementing Interfaces - Accessing Interface Variables.

References

1.Programming with Java A Primer, E. Balaguruswamy Tata McGrawHill Companies.
2.Java Programming John P. Flynt Thomson 2nd.
3.Java Programming Language Ken Arnold Pearson.
4.The complete reference JAVA2, Hervert schildt. TMH.
5.BigJava, Cay Horstmann 2ndedition, Wiley India Edition.
6.Core Java, Dietel and Dietel.
7.Java–Balaguruswamy.

Paper No-XVIII-Introduction to Bioinformatics

Unit I

Introduction to Bioinformatics, History of Bioinformatics, Scope and applications of Bioinformatics. Data generation-Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray).

Unit II

Nature of biological data, Overview of Bioinformatics resources on the web-NCBI/EBI/SIB etc, Introduction to biological databases, Nucleic acid sequence database-GENBANK/EMBL/DDBJ, Protein sequence database- PIR, UniprotKB, Structural database-PDB and other derived databases, Biological information search engine-Concept and Applications.

Unit III

Overview of sequence analysis, Concept of pairwise sequence alignment, Local and Global sequence alignment method, Matrices-PAM & BLOSUM, Significance of pairwise alignment, Sequence similarity search tools- BLAST, FASTA.

Unit IV

Multiple sequence alignment, Its types and significance, CLUSTAL-W, Phylogenetic analysis-Phylogenetic data, substitution models, Tree Building methods, Tree Evaluation Method-Bootstrap, MEGA, PHYLIP.

Unit V

Protein structure, Secondary structure prediction-Chou-Fasman, GOR method with algorithm, 3D structure prediction, Molecular modelling methods-Homology, Threading (fold recognition) and Ab initio.

References

1. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins -By: Andreas D. Baxevanis (Ed), B. F. Francis Ouellette (Ed) Publisher: Wiley, John & Sons, Incorporated ISBN: 0471478784
2. Introduction to Bioinformatics- By: Arthur M. Lesk Publisher: Oxford University Press, ISBN: 0199251967
3. Introduction to Bioinformatics, (Atwood, T. K. and Parry-Smith, D. J).
4. David W Mount Bioinformatics - sequence and genome analysis 2nd edition
5. Bioinformatics and functional genomics by Pevzner J, 2nd edition, Wiley

Semester IV

Paper No-XIX-Metabolism

(Treat it as base of Metabolomics and not as Biochemistry)

UNIT I – Basic concepts

Definition, Anabolism, Catabolism, Amphibolism, Intermediary metabolism, Metabolic pathways, Anaplerotic pathways, Regulation of metabolic pathways, Bioenergetics.

UNIT II – Carbohydrate metabolism

Glycolysis, Gluconeogenesis, Glycogen synthesis, glycogenolysis, TCA cycle, Glyoxylate bypass, HMP pathway,.

UNIT III – Carbohydrate metabolism

Calvin cycle, ETC, oxidative phosphorylation, substrate level phosphorylation.

UNIT IV – Lipid metabolism (Oxidation)

Activation of fatty acid and transport in mitochondria,
Oxidation of fatty acids (Even, odd, α, β, ω)

UNIT V – Metabolomes
KEGG, BRENDA, ENZYME, ECOCYC and METACYC databases.

Reference Books:

1. Biochemistry by Stryer 5th Edition WH Freeman 2001
2. Cohn & Stump, Outline of Biochemistry Wiley Eastern Ltd.2.
3. Harpers Review of biochemistry Prentice Hall
4. Cregnton Protein Structure & Molecular Properties
5. A.L. Lehninger, D. L. Nelson & M M Cox Principles of Biochemistry.
6. Lippincott's Biochemistry 4th edition
7. Basic Medical Biochemistry: A Clinical Approach, 3rd edition,by Lieberman and Marks

Paper No-XX-Introduction to Data structure & Algorithm

Unit-I

Basic concept of data structure, Stacks, Queues, Linked Lists, Double-ended Queues. Abstract Data Type (ADT), The List ADT, Simple Array Implementation of Lists, Linked Lists, Programming Details, Common Errors.

Unit-II

Doubly Linked Lists, Circularly Linked Lists, Examples, Cursor Implementation of Linked Lists, The Stack ADT, Implementation of Stacks, Applications, The Queue ADT, Array Implementation of Queues, Applications of Queues.

Unit-III

Tree, Implementation of Trees, Tree Traversals with an Application, Binary Trees, Expression Trees, the Search Tree ADT-Binary Search Trees, AVL Trees, Single Rotation, Double Rotation, Red-Black Trees, External searching in B-Trees, Tree Traversals, B-Trees.

Unit-IV

Insertion Sort, Shell sort, Heap sort, Quick sort, Bucket Sort, Merge Sort and radix Sort, and A Lower Bound on comparison-based Sorting and radix Sort, the complexity of some sorting algorithms, comparison of Sorting Algorithms, The Set ADT and union / file Structures.

Unit-V

Graphs-The graph Abstract Data Type, Data Structures for Graphs, Graph Traversals, Directed Graphs, Weighted Graphs, Shortest Paths, and Minimum spanning Trees. Applications of DFS and BSF, Shortest-Path Algorithms, Dijkstra's Algorithm, Graphs with Negative Edge Costs, Acyclic Graphs, Network Flow Problems, Minimum Spanning Tree.

References:

1. Data structure and Alrgorithm:Adamson lain
2. Data structure and Alrgorithm; Aho Alpred
3. Elliot Koffman, Paul Wolfgang, Objects, Abstraction, Data Structures and Design Using C++, Wiley, 2005.
4. M. A. Weiss, Data Structures and Algorithm Analysis in C++, Addison Wesley, 2006.
5. Cormen, Leiserton, Rivest, Introduction to Algorithms, MIT Press, 2001.
6. Sahni, Data Structures, Algorithms and Applications in C++, McGraw-Hill, 1998.
7. Horowitz, Sahni, Rajasekaran, Computer Algorithms, Computer Science Press, 1998.

Paper No-XXI-Central Dogma

(Overview in the perspective to make use in Computational Biology)

UNIT I – Replication of DNA

Possible modes of replication, Meselson Stahl experiment, origin of replication in E. coli, major proteins and enzymes involved in replication process: DNA replication in nut shell, rolling circle model of replication.

UNIT II – DNA mutations

Definition, Characteristics of mutation, types of mutations- base pair substitutions and frame shift mutations, Point mutations - missense, nonsense, silent, null, lethal mutations, Physical and chemical mutagenic agents. Suppression of mutations.

UNIT III – Repair and Recombination

Excison, Mismatch, SOS, Photoreactivation, Recombination repair, Eukaryotic repair Mechanisms, Recombination between heteroduplex, Holiday intermediate, Proteins involved in Recombination.

UNIT IV – Transcription

Mechanism of transcription, DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/Pribnow box, chain termination and the role of the protein, split genes and post transcriptional processing of RNA in eukaryotes, inhibitors of transcription

UNIT V – Genetic code & Translation

Discovery, Characteristics of genetic code, Deciphering the code, Wooble hypothesis, codon bias. Mechanism of Translation: Ribosome structures, A and P sites, Charged tRNA, f-met tRNA, initiator codon, Shine-Dalgarno consensus sequence, formation of 70S initiation complex, role of EF-Tu, EF-Ts, EE-G and GTP, Non-sense codons and release factors, RF1 and RF2. Post translational modifications (general treatment), inhibitors of protein synthesis.

Reference Books:

1. Benjamin Lewin -Gene VI,Gene VII,Gene IX,Gene X Oxford University press
2. David Friefieder Essentials of Molecular Biology, jones &Barlett publications
3. J. Kendrew Encyclopedia of Molecular Biology Blackwell Scientific publications.
4. Weaver Molecular Biology
5. J.D.Watson, N.H.Hopkins ,J.W Roberts,et al Molecular Biology of the Gene, Benjamin Cummings publ.co.inc.,California
6. J.Darnell., et al molecular biology of the cell(2nd edition) Garland Publishing Inc.
7. Meyers R.A (ed) ., Molecular biology and biotechnology.VCH publishers NY Inc.
8. Alberts B et al Molecular biology of the cell. Garland Publishing Inc.
9. Watson J.D ., Recombinant DNA.
10. Malacimski;Essentials of Molecular Biology.
11. Stansfield; Molecular and cell biology.
12. Walker Molecular biology and Biotechnology.

Paper No-XXII-Advanced JAVA

Unit-I

Packages: Java API Packages - Using system Packages - Naming Conventions - Creating Packages - Accessing a Package - Using a Package - Adding a Class to a Package - Hiding Classes - Static Import

Unit-II

Multithreaded Programming: Creating Threads - Extending the Thread Class - Stopping and Blocking a Thread - Life Cycle of a Thread - Using Thread Methods - Thread Exceptions - Thread Priority – Synchronization,

Unit-III

Managing Errors and Exceptions: Types of Errors - Exceptions - Syntax of Exception Handling Code - Multiple Catch Statements - Using Finally Statement - Throwing our own Exceptions - Using Exceptions for debugging.

Unit-IV

What is an applet, applet lifecycle, applet class, applet context class, passing parameters to applet , use of java .awt graphics class and its various methods in an applet ,Java Swing Working with JFrame, JApplet, Jpanel, JTextfield, JPasswordField, Jbutton,Jcheckbox, Jradiobutton, Jlist, Jscrollpane, Jcombobox, Jmenu, Jmenubar,JMenuItem, JpopupMenu, JTree, JTable

Unit-V

Introduction to Servlets: Need for Servlets, Introduction to Servlets , The Javax.servlet Package, Life Cycle of a Servlet, Accessing a Servlet using an HTML page.

References:

1.Programming with Java A Primer, E. Balaguruswamy Tata McGrawHill Companies.
2.Java Programming John P. Flynt Thomson 2nd.
3.Java Programming Language Ken Arnold Pearson.
4.The complete reference JAVA2, Hervert schildt. TMH.
5.BigJava, Cay Horstmann 2ndedition, Wiley India Edition.

Paper No-XXIII-Introduction to Chemoinformatics

Unit -I

Introduction to chemoinformatics-History and Evolution of chemoinformatics, application of chemoinformatics in pharmaceutical research, Molecular Modeling and Structure Elucidation, chemical databases.

Unit -II

Introduction to medicinal chemistry, lead compounds, natural resources of lead compounds, physical and chemical properties of lead molecules, insilico drug discovery pipeline, pharmacokinetics, pharmacodynamics, biological concept about drug metabolism & elimination.

Unit -III

Representation of Molecules and Chemical Reactions-Nomenclature, Different types of Notations, SMILES coding; InChi notation,Structure of Molfiles and Sdf files, Libraries and toolkits, Different electronic effects, Reaction classification.

Unit -IV

Searching Chemical Structure-Full structure search, sub structure search, basic ideas, similarity search, Three dimensional search methods, Basics of Computation of Physical and Chemical Data and structure descriptors, Chemical data visualization.

Unit-V

Computer Assisted Virtual screening design- Structure Based Virtual Screening- Protein Ligand Docking, Scoring Functions for Protein Ligand docking, Practical aspects of structure based Virtual Screening, Prediction of ADMET Properties, 2 D and 3D data searching.

References

1. An Introduction to Chemoinformatics-Andrew R. Leach, Valerie J. Gillet
2. Chemoinformatics in Drug Discovery (Methods and Principles in Medicinal Chemistry)-byMannhold, Raimund, Wiley-VCH Verlag publication
3. Chemoinformatics: A Textbook-by Johann Gasteiger, Thomas Engel
4. Basic Cheminformatics: A Textbook-By Mercato Inglese
5. Chemoinformatics: Theory, Practice & Products (2009) Barry A. Bunin , Brian Siesel, Guillermo Morales Jürgen Bajorath, Springer
6. Pharmaceutical Data Mining: Approaches and Applications for Drug Discovery (2009) Konstantin V. Balakin Sean Ekins (Series Editor) , Wiley
7. Chemoinformatics: An Approach to Virtual Screening (2008), Alexandre Varnek Alexander Tropsha (Editor) , Royal Society of Chemistry
8. Chemoinformatics: Concepts, Methods, and Tools for Drug Discovery (Methods in Molecular Biology), (2004) J. bajorath (ed.) Humana Press

Paper No-XXIV-Genomics & Proteomics

(Technical / Analytical – Introductory level)

UNIT I

Introduction of genomics, Organization of genomes: main features of bacterial and eukaryotic genome organization. Need of genome sequencing, Genome sequencing strategies-Chain termination method, automated sequencing, Clone contig and shotgun approaches. pyro-sequencing.

UNIT II

Introduction to Next Generation Sequencing Platforms, sample preparation and analysis, applications of NGS. Locating the genes: ORF scanning, homology searches. Tools for genome analysis-RFLP, DNA fingerprinting, RAPD,PCR, Linkage and Pedigree analysis-physical and genetic mapping.

UNIT III

Introduction to Proteomics, protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing);2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid system.

Unit IV

Pharmacogenetics High throughput screening in genome for drug discovery-identification of gene targets, Pharmacogenetics and drug development.

Unit V

Functional genomics and proteomics, analysis of microarray data; Protein and peptide microarray-based technology; PCR-directed protein in situ arrays; Structural proteomics, comparative genomics and proteomics.

References:

1. Genomes-3-By Brown T.A.
2. Discovering Genomics, Proteomics and Bioinformatics: By Campbell
3. Introduction to Bioinformatics, (Atwood, T. K. and Parry-Smith, D. J).
4. An introduction to Computational Biochemistry. (C. Stain Tsai, A. John Wiley and Sons, Inc., publications).
5. Bioinformatics; Methods and applications; Genomics, Proteomics and Drug Discovery; (Rastogi, S. C. and Mendiratta and Rastogi, P.
6. Bioinformatics; A practical guide to the analysis of genes and proteins.; Edited by, Andreas D. Baxevanis and Francis Oulelette

LC VII – Biomolecules and Biotechniques

- Estimation of carbohydrates by qualitative methods
- Estimation of carbohydrates by quantitative method (DNSA / Anthrone / GODPOD)
- Purification of polysaccharides
- Acid values Iodine number& Saponification values of fats (commercial samples)
- Isolation and purification of lipids from microbes and eukaryotes
- Simple assays for vitamins and hormones
- Preparation / isolation of biomolecules from natural resource (Starch, glycogen, Lecithin, Cytochrome)
- Paper Chromatography of amino acids- Ascending and Descending methods.
- Separation of sugars by chromatography.
- TLC of lipids and sugars.
- Column chromatography for proteins, pigments using sephadex G-50
- Paper electrophoresis.
- Agarose electrophoresis-separation of bromophnol blue and xylenecynol.
- Determination of molecular weight by PAGE- native and SDS
- Immunoelectrophoresis- serum proteins

LC VIII – PL/SQL

- Create a table Student-master with the following fields client_no,name, address, city, state,pincode,remarks,bal_due with suitable data types.
  a) Create another table supplier_table from client_master. Select all the fields and rename client_no with supplier_no and name with supplier_name.
  b) Insert data into client_master
  c) Insert data into supplier_master from client_master.
  d) Delete the selected row in the client_master.

- Create a table sales_order with s_order_no and product_no as primary key. Set other fields to store client number, delivery address, delivery date,order status.
  a) Add a new column for storing salesman number using ALTER Command.
  b) Set the s_order_no as foregin key as column constraints.
  c) Set the s_order_no as foreign key as table constraints.
  d) Enforce the integrity rules using CHECK.

- Create a table student_master with the following fields name, regno, dept and year with suitable data types. Use Select command to do the following.
  a) Select the student's name column.
  b) Eliminate the duplicate entry in table.
  c) Sort the table in alphabetical order.
  d) Select all the Students of a particular department.

- Create a table sales_order_details with the s_order_no as primary key and with the following fields: product_no, description, qty_ordered, qty_disp,product_rate, profit_percent, sell_price, supplier_name.
  a) Select each row and compute sell_price*.50 and sell_price*1.50 for each row selected.
  b) Select product_no, profit_percent, Sell_price where profit_per is not between 10 and 20 both inclusive.
  c) Select product_no, description, profit_percent, sell_price where profit_percent is not between 20 and 30.
  d) Select the suppliername and product_no where suppliername has 'r' or 'h'as second character.

- Create a table master_book to contain the information of magazine code, magazine name, publisher. Weekly/biweekly/monthly, price. Write PL/SQL block to perform insert, update, delete operations on the above table.
- Create a table to contain phone number, user name, address of the phone user. Write a function to search for a address using phone numbers.

- Create a table stock to contain the itemcode, itemname, current stock, date of last purchase. Write a stored procedure to seek for an item using itemcode and delete it, if the date of last purchase is before 1 year from the current date. If not, update the current stock.

LC IX - Basic Bioinformatics

- Exploring and accessing of resources-NCBI/EBI/SIB.
- Exploring of biological search engine-Entrez & SRS
- Exploring and accessing of biological information of given sequence entry from GenBank database.
- Exploring and accessing of biological information of given sequence entry from DDBJ database.
- Exploring and querying the Swissprot/TrEMBL database.
- Exploring and querying the PIR database
- Exploring and usingthe derived databases: PRO SITE, PRINTS, BLOCKS, Pfam and Prodom for pattern searching.

LC X – OOPs using JAVA

- Programs based on basic arithmetic operations.
- Programs using constructor and destructor.
- Creation of classes and use of different types of functions.
- Write programs on interfaces.
- Write programs on packages.
- Write programs using function overloading.
- Programs using inheritance
- Programs using IO streams.
- Programs using files.
- Write a program using exception handling mechanism.
- Programs using AWT
- Programs on swing.
- Count the number of objects created for a class using static member function.

LC XI - Technique's in Bioinformatics

- Pairwise sequence alignment & sequence analysis with BLAST, FASTA and study of various BLAST programs and assignments.
- Multiple sequence alignment and analysis with CLUSTAL X and CLUSTAL W
- Phylogenetic analysisPhylogenetic analysis with PHYLIP, MEGA software using different phylogenetic methods.
- Structure visualization softwares RasMol,RasTop , Cn3D, SpdbViewer etc.
- Molecular Docking using online server Swissdock and other molecular docking tools.

LC – XII Structural Bioinformatics

- Exploring the PDB & NDB: Database searches, understanding entry contents and file formats
- Visualization of tertiary structures, quaternary structures, architectures and topologies of proteins and DNA using molecular visualization software such as RasMol, Cn3D, SPDBViewer.
- Prediction of secondary structures of proteins using at least 5 different methods with analysis and interpretation of the results. Comparison of the performance of the different methods for various classes of proteins.
- Prediction of tertiary structures of proteins using Homology Modeling approach: SWISSMODEL, Geno3D, 3D JIGSAW.
- Prediction of tertiary structures of proteins using at least 3 methods for fold recognition along with analysis and interpretation of results.

B.Sc. Bioinformatics Vth & VIth Semester Syllabus

Semester-V	Semester-VI
Paper-XXV-Molecular Cell Biology	Paper-XXV-Introduction to PERL
Paper-XXVI-Immunology	Paper-XXVI-Metabolomics
Paper-XXVII-Bioinformatics Method	Paper-XXVII- Advanced Molecular Genetics
Paper-XXVIII-Phylogenetics and Molecular evolution	Paper-XXVIII-Molecular Phylogeny
Paper-XXIX -Virology	Paper-XXIX-RDT
Paper-XXX - Molecular Modeling and Drug Designing	Paper-XXX-Drug Regulatory Affairs and IPR
LC-XIII- Chemical databases & Analysis	LC-XIII- Introduction to PERL
LC-XIV- Seminar's on emerging areas in Bioinformatics	LC-XIV-Phylogeny
LC-XV-Minor Project	LC-XV-Major Project

Semester V

Paper No.	Subject Name	Theory Marks	Practical Marks	Total
Paper-XXV	Molecular Cell Biology	50	00	50
Paper-XXVI	Immunology	50	00	50
Paper-XXVII	Bioinformatics Method	50	00	50
Paper-XXVIII	Phylogenetics and Molecular evolution	50	00	50
Paper-XXIX	Virology	50	00	50
Paper-XXX	Molecular Modeling and Drug Designing	50	00	50
LC-XIII	Chemical databases & Analysis	00	50	50
LC-XIV	Seminar's on emerging areas in Bioinformatics	00	50	50
LC-XV	Minor Project	00	50	50
	Total			**450**

Semester VI

Paper No.	Subject Name	Theory Marks	Practical Marks	Total
Paper-XXV	Introduction to PERL	50	00	50
Paper-XXVI	Metabolomics	50	00	50
Paper-XXVII	Advanced Molecular Genetics	50	00	50
Paper-XXVIII	Molecular Phylogeny	50	00	50
Paper-XXIX	RDT	50	00	50
Paper-XXX	Drug Regulatory Affairs and IPR	50	00	50
LC-XIII	Introduction to PERL	00	50	50
LC-XIV	Phylogeny	00	50	50
LC-XV	Major Project	00	50	50
	Total			**450**