Swami Ramanand Teerth Marathwada University, Nanded

Syllabus B. Sc. Bioinformatics

Choice Based Credit system (CBCS Pattern)

(With effect from June-2017)

B. Sc. Bioinformatics Second Year (Third Semester)

Course Code No.	Course Title	Periods/ Week	Total Period	CA	ESE	Total Marks	Credits
AECCBI 1C	English and Science Communication Skills- III	03	35	10	40	50	2
CCBI-2C	Molecular Biology	04	45	35	40	75	3
CCBI-3C	Biostatistics & Mathematics	04	45	35	40	75	3
CCBI-4C	Biodiversity and Phylogenetics	04	45	35	40	75	3
CCCBI-5C	Programming in Perl	04	45	35	40	75	3
CCBIP- 1C	Practical Based on CCBI-2C+3C	03+03	20	20	80	100	4
CCBIP-2C	Practical Based on CCBI-4C +5C	03+03	20	20	80	100	4
SECBI-I	Skill Enhancement course (Any one of SECBI-IA / IB) **IA** Metagenomics **IB**: Advance Bioprogramming	01+02	-	25	25	50	2
					Total	600	24

B. Sc. Bioinformatics Second Year (Fourth Semester)

Code No.	Paper Title	Periods/ Week	Total Period	CA	ESE	Total Marks	Credits
AECCBI-1D	English and Science Communication Skills- IV	03	35	10	40	50	2
CCBI-2D	Basics of Immunology	04	45	35	40	75	3
CCBI-3D	Biochemical Techniques	04	45	35	40	75	3
CCBI-4D	Biological Database management	04	45	35	40	75	3
CCCBI-5D	Object oriented Programming	04	45	35	40	75	3
CCBIP- 1D	Lab Course VII Practical Based on (CCBI-2D +3D)	03+03	20	20	80	100	4
CCBIP-2D	Lab Course VIII Practical Based on (CCBI-4D+5D)	03+03	20	20	80	100	4
SECBI-II	Skill Enhancement course any one of SECBI-IIA / IIB - **II A**: Analytical Techniques for Bioinformatics **II B:** Immunoinformatics	01+02	-	25	25	50	2
					Total	600	24

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- III)

BIOINFORMATICS

AECBI-1C English and Science Communication Skills-III Marks: 50

Unit - I Applied Grammar

a) Tense &its application.
b) Transformation of sentences: Voice, Speech & Degree.
c) Usages of Articles, propositions, conjunctions &adjectives.
d) Basic sentence structures based on meanings: Interrogative, exclamatory, declarative, Imperative.
e) Common mistakes in the use of adverb, conjunctions& in general usages, Redundancies in English language.

Unit-II Presentation Skills

a) Preparing a short speech for public speaking.
b) Presentation: pitch, pace, voice, modulation.
c) Body Language and Voice Modulation
d) Role playing on different situations.

Unit-III Soft Skills

a) Interpersonal skills.
b) Negotiation skills.
c) Time management skills.
d) Stress management skills.

Unit- IV Day-to-day Conversation

a) Introducing one and others.
b) Meeting friends, greetings and asking questions and answering them.
c) Debate and extempore
d) Story telling.

Reference Books:

1) English grammar & Composition – Rajendra pal &Suri
2) Objective general English –R. S. Agrawal
3) Macmillan Foundation English – R. K. Dwivedi A. Kumar
4) Developing of Communication Skills – Krishna Monhan&MeeraBanergi
5) Soft Skills –by K. Alex
6) Personality Development & Communicative English – Dr. T. Bharti

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- III)

BIOINFORMATICS

CCBI-2C Molecular Biology Marks: 75

Unit 1: DNA structure, replication & repair.

DNA structure: Structure of DNA, Properties of DNA, Cot curve

DNA replication: Replication in prokaryotic and eukaryotic cells, models & mechanism of DNA replication, Enzymes involved in DNA replication – Primosome, Replisome, Topoisomerase, DNA polymerase, SSBP & Ligase.

DNA Repair- Direct repair – Photo Reactivation, Excision, mismatch, Recombination repair, SOS repair.

Unit 2: Transcription and RNA processing

Transcription in Prokaryotes: Initiation, Elongation & Termination. Structure of RNA polymerase, Role of sigma factor, Promoter.

Transcription in Eukaryotes: Initiation, Elongation & Termination. Upstream & downstream Promoters, Enhancer. RNA Polymerase I, II & III. Co & Post transcriptional modification in m-RNA- 5'capping, Intron Splicing, polyadynylation. RNA processing & Transport.

Unit 3: Translation

Prokaryotic and Eukaryotic- Mechanism, initiation, elongation, termination.

Co & post translational modifications in proteins, Heat shock proteins, Chaperons & Chaperonins. Properties of genetic code, Role of mRNA, tRNA, rRNA.

Unit 4: Regulation of gene expression

Regulation of transcription in prokaryotes, Operon concept, trp-operon, Lac-operon, Ara-operon.

Reference Books:

1. Upadhya- Molecular Biology- Himalaya pub.
2. Watson – Molecular biology of gene- Pearson pub.
3. David Freifelder- Microbial Genetics – Narosa Pub.
4. David Freifelder– Molecular Biology – Narosa pub.
5. Gardner – Principals of Genetics – Wiley international pub.
6. Albert Bruce- Molecular biology of the cell- garland science.
7. Loddish - Molecular cell biology – W-H. freeman
8. Lewin – Genes X- Oxford
9. Fundamentals of Cell and Molecular biology-Baig, Telang and Ingle-Amruta
10. Genome- T.A. Brown- John Wiley

Practicals :

1. Study of Ames test
2. Study of fluctuation test
3. Isolation and quantitation of DNA from bacteria.
4. Isolation and quantitation of DNA from Yeast.
5. Effect of UV radiation on yeast / bacteria
6. Study of DNA repair mechanism by photo reactivation.
7. Agarose gel electrophoresis of genomic DNA & plasmid DNA
8. Isolation of Lac mutant by using Replica plate method.
9. Determination of Tm value of DNA.

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- III)

BIOINFORMATICS

CCBI -3C Biostatistics and Mathematics Marks: 75

Unit 1: Introduction

Definition; Concept of statistical population; Concept of statistical sample Concept of Data – Discrete and continuous data; Representation of data – Histogram, PolyGram, Frequency curve, Pie Diagram

Measures of Central Tendency

Concept of central tendency; Arithmetic Mean: Definition, Formulae and computation for ungrouped and grouped data; Weighted arithmetic mean; median: Definition, Formulae and Computation for ungrouped and grouped data; Quartiles: definition, formulae and computation for ungrouped and grouped data; Mode: definition, formulae and computation for ungrouped and grouped data.

Unit 2: Measures of Dispersion:

Concept of dispersion; Range: definition, formulae and Computation for ungrouped and grouped data; Standard Deviation: Definition, Formulae and Computation for ungrouped and grouped data. Variance: Definition, Formulae and Computation for ungrouped and grouped data; Coefficient of variance: Definition, Formulae and Computation for ungrouped and grouped data.

Unit 3: Probability

Permutation and combination; Sample space, Events and Types of events; Classical definition of probability and axioms of probability; Theorems on Probability: i) $0 <= P(A) <= 1$ ii) $P(A) + P(A') = 1$ iii) $P(A \cup B) = P(A) + P(B)$ iv) $P(A \cup B) = P(A) + P(B) - P(A B)$ Conditional probability and Bayes' theorem; Problems on Probability

Set Theory

Introduction; Set Notation and Description; Subsets, Venn diagram, Set Operations

Unit 4: Matrix Algebra

Addition, subtraction and multiplication of matrix, transpose of matrix, inverse of matrix, conjugative matrix

Limits and Complex Numbers

Limits of sequences, series, limit of functions, the Fibonacci sequence, complex plane, algebraic operations, exponential function of complex variable, Oscillations

Reference Books:

1. Sheldon M. Ross: Introduction to probability models, 9th Edition, Academic Press, 2007.
2. Gilbert Strang: Linear Algebra and its application, 4th Edition, Cengage Learning, 2006.
3. NCERT class 12 mathematics books.

Practicals:

1. Problems based on above statistical methods
2. Problems based on above Mathematical methods

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- III)

BIOINFORMATICS

CCBI-4C Biodiversity and Phylogenetics Marks: 75

Unit 1: Biological Diversity

Biological diversity of life; India as mega biodiversity nation; Hotspots of diversity; Genetic diversity; Species diversity; Ecological / ecosystem diversity. Two, Three, five kingdom classification system; Diversity informatics in India, challenge and potential.

Unit 2: Biodiversity Databases

Species 2000; Tree of life; National Biological Informatics Infrastructure; International Committee on taxonomy of viruses (ICIV) and ICTVDB. Animal Virus Information System (AVIS); Global biodiversity information facility (GBIF); Other biodiversity databases.

Unit 3: Species Identification

Barcode of life;Delta; ITIS; Databases and softwares for identification of species

Metadata

Definition; Metadata standards; Metadata & biodiversity; Need for metadata standards

Unit 4: Phylogenetic Prediction

Introduction; Relationship between phylogenetic analyses and multiple sequence alignment; Genome complexity; Evolutionary trees Rooted & Unrooted trees; Methods for phylogenetic prediction , Maximum parsimony method, Distance based alignment; Soft ware package for phylogeny prediction.

Reference Book

1) Bioformatics sequence and genome analysis – by David W. Mount.
2) Practical taxonomic computing – by Pankhurst R.J

Practicals:

1. Study of different biodiversity databases and retrieval of biodiversity information from them
2. Study of database structures and designing biodiversity databases
3. Study of different species identification systems.
4. Study of different methods for sequence alignment.
5. Study of different methods for phylogenetic prediction

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- III)

BIOINFORMATICS

CCBI-5C Programming in Perl **Marks: 75**

Unit 1: Getting Start With Perl

Introduction , computer program & programming language, Perl's benefits, portability, speed & program maintenance, Installing perl on your computer, how to run perl Program, text editor, finding help.

The Art Of Programming Individual approaches to programming, bio programming strategies, the programming process.

Sequence & Strings

General introductions to DNA & protein sequence, Standard IUB/IUPAC nucleic acid codes, Standard IUB/IUPAC amino acid codes, A program to store a DNA sequence, Concatenating DNA fragments.

Unit 2: Basic Operators

Scalar variables, Arithmetic operators, comparison operators, logical operators, assignment operators, auto increment & auto decrement operators, Concatenating & repeating string operators.

File Handling Opening a file, reading a file, writing a file, closing a file, determining a status of a file.

Lists & Arrays Introduction to lists, storing lists in array variables, more about lists & arrays, Array library function.

Unit 3: Pattern Matching

How pattern matching works, pattern matching operators, anchoring the patterns, patterns matching function, program to calculate the reverse complement.

Control Flow & Looping Statements

If statements, If – else, while, until, single line conditional statement, the 'For' statement the 'for each' statement, the 'do' statement, the last, next, redo, continue statements.

Subroutines & Hashes: Introduction & advantage of subroutines, writing subroutines, use of local variable & passing parameter to subroutines, returning a value from subroutines, passing data to subroutines, hashes & its creations from an array variables.

Unit 4: The Genetic Code

Introduction to genetics code & codon table, translating codons to amino acids (using hashes), translating DNA into proteins, sequence file formats, FASTA format, Transcription:- DNA & RNA. Introduction to BioPerl.

Introduction to Python: Brief introduction of Python; comparison with Perl

Reference Books:-

1.) James Tisdall 2001 "Beginning Perl For Bioinformatics" O'reily & Associates.

2.) Schwartz , Foy and Phoenix, "Learning Perl" sixth Edition

Practicals:

1. write a simple program like program for storing DNA sequence in a variable
2. write programs by using different perl operators.
3. Write programs for file handling.
4. write programs by using lists and arrays.
5. write programs for pattern matching, conditional and looping statements.
6. write programs by using subroutines and hashes.

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- III)

BIOINFORMATICS

SECBI-IA Metagenomics Marks 50

Unit I: Introduction to Metagenomics

What is metagenomics; Types of metagenomes: Amplicon, Shotgun, Functional; Amplicon metagenomics: History, phylogenetic marker, examples; Shotgun metagenomics: History and examples; Functional metagenomics: Examples

Practice: Amplicon metagenomics, Shotgun metagenomics, Functional metagenomics

Unit II: METAGENOMICS CASE STUDIES

Metagenomic analysis of soil microbial communities; Metagenomic Analysis of Bacteriophage; Metagenomics and Its Applications to the Study of the Human Microbiome; Archaeal Metagenomics: Bioprospecting Novel Genes and Exploring New Concepts.

Practice: Metagenomic analysis of soil microbial communities, Metagenomic Analysis of Bacteriophage, Study of the Human Microbiome.

Unit III: LIBRARY CONSTRUCTION & ANALYSIS OF METAGENOMIC LIBRARIES

Cataloging microbes: phylogenetic tree and construction - Construction of a metagenomic library; Analysis of Metagenomic Libraries; Sequence-based Metagenomics Analysis; Function based Metagenomics Analysis; Phylogenetic analysis and Comparative genomics Softwares & Tools

Practice: Construction of a metagenomic library, Analysis of Metagenomic Libraries, Sequence-based Metagenomics Analysis, Phylogenetic analysis and Comparative genomics Softwares & Tools.

Unit IV: METAGENOMICS IN ENVIRONMENTAL STUDIES

Application of Metagenomics to Bioremediation ; Applications of Metagenomics for Industrial Bioproducts; Escherichia coli host engineering for efficient metagenomic enzyme discovery; Next-generation sequencing approaches to metagenomics; Stable isotope probing: uses in metagenomics; DNA sequencing of uncultured microbes from single cells

Practice: Applications of Metagenomics for Industrial Bioproducts, Stable isotope probing, etc.

References: -

1) Diana Marco Universidad Nacional de Cordoba, Argentina, “Metagenomics: Theory, Methods and Applications”, Caister Academic Press,2010.
2) Diana Marco Universidad Nacional de Cordoba,Argentina “Metagenomics: Current Innovations and Future Trends”,Caister Academic Press,2011.

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- III)

BIOINFORMATICS

SECBI-IB Advance Bioprogramming Marks 50

Objectives: To create expertise in advance programming language python which is essential skills for programming with python

Unit I : Python Basic

Introduction: what is python? Features, comparing python with other languages, installing python,testing python, basic input output, mathematical operations, data types

Practice: Installing Python, testing Python virsion

Unit II control statements

If-else, for loop ,while loop, break, dealing with files, functions and module creation, error handling

Practice: Practice programming based on conditional statements,control statements.

Creating modules and programming using python modules.

Programs using file handles.

Unit III Python and Object oriented programming

Object paradigm and python , creating classes,inheritance,creating new datatypes,making our code private,additional resources and self revaluation

Practice: Creating class, new data types. Programs on Inheritance.

Unit IV regular expressions

Introduction to regular expression(REGEX) regex syntax the re module: compiling a pattern, REGEX examples, pattern replace, REGEX in bioinformatics: cleaning up a sequence , additional resources, introduction to biopython .

Practice: Programming using regular expressions

References: -

1) Python for Bioinformatics ,Sebastian bassi ©2010 by Taylor and fancies group,LLC
2) Programming Python, Mark Lutz, 4th Ed. O'Reilly Pub.

AECCBI-1D: English and Science Communication Skills-IV **Marks: 50**

Objective: To have effective communication & preparation of different competitive exam.

Unit - I Sentence Building – (Advanced Level)
1)Conditionals
2) Modals
3) Time expressions
4)Describing places, things, talking more about actions

Unit – II Personality Development (Grooming)
1) Developing Confidence and killing nervousness.
2) Attitude management and personality enhancement
3) Grooming for professional etiquettes and manners.

Unit – III Creative writing

1) Narrating the situations / Describing different situations
2) Elaborating pictures
3) Business E-mail : Invitation, Complaint, Appreciation , For Job.

Unit – IV Real life conversation
1) Talking about self and expressing feelings
2) Oratory Skills (Public speaking skills / techniques)
3)Body language & Dress code

Reference Books :

1)Developing of communication skills – Krishna Mohan & Meera Banerji
2)A Practical English Grammar – A.J.Thomson-Oxford
3)Soft Skills – by K. Alex
4)English Grammar and Composition – Rajendra Pal & Suri
5)Macmillan foundation English – R.K. Dwivedi A.Kumar

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- IV)

BIOINFORMATICS

CCBI-2D Basics of Immunology Marks: 75

Unit 1: Overview of immune system

History, innate and acquired immunity, passive immunity, infection.

Immunoglobulin

Antibodies: Antibody – structure and function, antigen, antigen-antibody Reaction, Complement fixation

Unit 2: Cells of immune system

Differentiation of stem cell, structure of B-cell, T-cell, Microphage, nature killer cell, Organs of immune system.

Unit 3: Immune response

Humoral immune response, Cellular immune Response, MHC I &II complex. Concept of Graft rejection

Unit 4: Immunodeficiency Diseases

Primary immunodeficiency, secondary immunodeficiency, Autoimmunity.

Reference Books:-

1.) Eli Benjamini, coico, sunshine, immunology (fourth edition)
2.) N.V. shastri, Principles of immunology (himalaya publication house)
3.) Immunology – Kuby- W.H. Freeman
4.) Essentials of Immunology- Roitt I. M.- Blackwell
5.) Immunology- Nandini Shetty- New Age International
6.) Textbook of Microbiology – Anantnarayan and Panikar-Orient Longman
7.) Immunology- A.K. Abbas- Elsevier

Practicals:

1. Immunodignostics (demonstration using Kits- Widal, VDRL)
2. Determination of Blood Group
3. Immunodiffusion, Immuno Electrophoresis, Western Blotting,
4. Differential Leukocyte Count
5. Lymphoid organ, Cell and their microscopic observation
6. Immunization, collection of Serum
7. Purification of antibody from Serum

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- IV)

BIOINFORMATICS

CCBI-3D Biochemical Techniques Marks: 75

Unit 1: Microscopy & Spectroscopy:

Light Microscopy: Simple & Compound Microscope, Phase contract Microscope, Electron Microscope (TEM/SEM) (Principle, Theory, ray diagram, Image formation and applications). Spectroscopy: General principle, Electromagnetic Spectrum, Basic law of absorption, Visible & Ultraviolet Spectroscopy, application in biology.

Unit 2: Chromatography

Adsorption chromatography, Partition chromatography: Paper Chromatography, TLC, Column Chromatography, Ion exchange chromatography, GC.

Unit 3: Centrifugation

Centripetal Force, Centrifugal force, basic principle of centrifugation, centrifuge type, types of rotor density gradient centrifugation, Nature of density gradient,
preparative centrifugation, Differentials centrifugation & applications.

Unit 4: Electrophoresis Techniques

General Principles, Factors affecting on Electrophoretic Mobility, Agarose PAGE & SDS PAGE. Isoelectric focusing (IEF), Pulse field gel electrophoresis

Reference Books:

1. Biophysical Chemistry- Upadhyay, Upadhyay and Nath-Himalaya
2. Practical Biochemistry- Wilson & Walker -Cambridge
3. Practical Biochemistry- David Plummer- Tata McGraw Hill
4. Principles of Biochemistry- Lehninger –Kalyani Publications
5. Light Microscopy in Biology-A.J. Laccy.
6. Instrumental Methods of Chemical Analysis- Chatwal Anand- Himalaya
7. Instrumental Methods of Chemical Analysis –B.K. Sharma-Goel
8. Physical Biochemistry- David Freifelder

Practicals:

1. Study and Care of Microscope, Observation of Microscopic samples
2. Study of Colorimeter and determination of Lambda Max.
3. Study of UV-Visible Spectrophotometer
4. Study of Paper Chromatography/ TLC.
5. Separation of Pigments/ Biomolecules by Chromatography.
6. Separation of pigments by column chromatography
7. Demonstration of GC/ HPLC/ HPTLC
8. Principals and working of different centrifuges.
9. UV Spectroscopic Analysis of DNA, RNA & Proteins
10. Study of Paper/PAGE/ SDS-PAGE/ Agarose Gel Electrophoresis

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- IV)

BIOINFORMATICS

B.Sc. Bioinformatics (Semester Pattern) IV Semester

CCBI-4D Biological Database Management Marks: 75

Unit 1: Relational Database

Introduction; Codd's 12 rules; Principles of RDBMS; Comparison between HDB-NDB-RDB; Concept of domain; Tuple; Cardinality; Oracle data type; Interactive SQL; Oracle & client server technology; Data manipulation in Database Management system (DML commands); DDL commands; Creating Tables; Insertion of Data in to table; Viewing data in Table; Renaming table , Destroying tables; Examining the objects created by Users; Working with ASCII file from the SQL prompt.

Unit 2: Manipulation On Oracle Tables

Competition on table data; Oracle table; Dual, Sys- date; Oracle functions; Data Constraint; Data constraints; Defining different constraints on table; User constraints table; defining dropping integrating constraints in the Alter table command; default value concept.

Unit 3: SQL , PL/SQL

Grouping data from table in SQL; Sub queries, joins, using the Union.
Introduction; Generic PL/SQL; PL.SQL execution environment.
Oracle transaction; Processing PL/SQL for block; What is cursor?; cursor for loops.

Unit 4: Database Objects

Store procedure and functions; Where do stores procedure and function resides; How oracle engine execute procedure and function; Advantage using procedure and function; procedure V/S function; Syntax of creating procedure and function.

Reference Books:-

1) Database System Concept –By Koarth
2) Modern Database Management –Iv-Edition By Fred R.Meffadden, Jeffrey, A. Hoffer(Aw)
3) Principle Of Database Management – By James Martin.
4) Database Management System – By Bipin Desai
5) Plsql – The Programing Language Of Oracles By Ivan Bay Rows – Ii Edition Bpb Publication

Practicals:

1. Creating and manipulating tables by using DDL and DML commands
2. Study of different oracle functions.
3. Study of different oracle constraints.
4. Study of grouping data from tables with SQL.
5. Study of sub queries and joins with SQL.
6. Study of PL/SQL

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- IV)

BIOINFORMATICS

CCBI-5D Object Oriented Programming Marks: 75

Unit 1: Introduction Oops

Object oriented programming, basic concept of oops , benefits of oops Tokens, keywords, identifier data types, constants, operation precedence and associating, I/O – statements, structure of c++ program, Control statements, looping statements, Type casting, array, pointer, structure & unions.

Unit 2: Functions In C++

Function, function prototype, Call by value, call by reference, Return by reference, Inline function, friend function, Default argument, function overloading.

Class & Objects

Defining class, members, objects, visibility mode, static data members, static member function, pointer to members, array of objects.

Unit 3: Constructiors And Destructors

Introduction to constructors, Parameterized constructors, Multiple constructors in a class, copy Constructors, Destructors.

Operators Overloading

Defining operator overloading, overloading unary operators, overloading binary operators, rules of overloading operators.

Unit 4: Inheritance & Polymorphism

Concept of inheritance, type of inheritance, polymorphism, virtual class, virtual functions, rules for virtual function, pure virtual function.

Console I/O Operations

C++ streams, C++ streams classes, unformatted I/O operations, formatted I/O operations.

Reference Books

1. Object oriented programming with c++ By :- E. Balaguruswami.
2. Object oriented programming with c++ by :- Richard Johnsonburg & Martin Kalin.
3. C++ Complete Reference By: - H. Dhieldt

Practicals:

1. Study of structure of C++ program.
2. Write C++ programs using control and looping statements.
3. Write C++ programs using arrays, pointers, structures and unions.
4. Write C++ programs using class and objects.
5. Write C++ programs for operator overloading.
6. Write C++ programs for inheritance and polymorphism
7. Write C++ programs using consol I/O functions

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- IV)

BIOINFORMATICS

SECBI-II A Analytical Techniques for Bioinformatics Marks 50

Unit-I

Spectroscopy: UV Visible, NMR, ESR, Atomic Absorption, Raman Spectroscopy

Practice: practical based on Spectroscopic analysis of biomolecules

Unit II

Protein isolation, Estimation, Protein sequencing methods, detection of post translation modification of proteins.

Practice: Practical based on protein isolation and analysis

Unit III

Proteome-General Account; Tools of proteome analysis. DNA microarray: understanding of microarray data and correlation of gene expression
Methods of Genome sequencing, EST, STS, GSS database and their generation
Whole Genome comparison.

Practice: 1) Tools of proteome analysis
2) Practical Study of EST, STS, GSS database.

Unit IV

Sequencing methods: Genome sequencing: High-throughput sequencing, shot-gun sequencing. sequence alignment
pair-wise, multiple sequence alignment along with molecular phylogenetics

Practice: 1) Tools for sequence alignment.
2) Gene prediction and Protein Structure Prediction

Reference Books

1. .Wilson, K, Walker, J.: Principles and Techniques of Practical Biochemistry. 5th Ed. - Cambridge University Press,. Cambridge 1999.
2. Biotechniques: Theory & Practice: Second Edition by SVS Rana, Rustogi Publications.
3. Biochemical Methods of Analysis : Saroj Dua And Neera Garg : Narosa Publishing House, New Delhi.
4. Bioanalytical Techniques : M.L. Srivastava ; Narosa Publishing House, New Delhi.
5. Hobert H Willard, D.L. Merritt and J.R.J.A. Dean, instrumental methods of analysis, CBS Publishers and Distributors, 1992
6. Handbook of Analytical Techniques Published Online: 2008. Helmut Günzler, Alex Williams. Wiley Interscience.
7. Analytical Tools for DNA, Genes & Genomes: by Arseni Markoff, New Age.

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Choice Based Credit System (CBCS) Course Structure

B. Sc. Second year (Semester- IV)

BIOINFORMATICS

SECBI-II B Immunoinformatics Marks 50

Unit I :Introduction to Immunoinformatics and Immunological Databases

Introduction to immunology & Bioinformatics, immunoinformatics, the immune system, cellular immunity, antibody mediated immunity. Immunological databases-dbMHC-MHC database at NCBI, T-cell epitope databases, B-cell epitope databases

Practice: Immunological Databases, T-cell epitope databases, B-cell epitope databases

Unit II Descriptors/Topics: Immunological Tools

Experimental and theoretical description of peptide-MHC binding, selection of epitopes using bioinformatics, prediction of proteasome processing, Predictions of Class I and Class II MHC Epitopes, IEDB analysis Resourse, CTLPred, Population Coverage analysis, Epitope conservancy analysis

Practice: Predictions of Class I and Class II MHC Epitopes, IEDB analysis Resourse, CTLPred

Unit III Descriptors/Topics: Computational Vaccinology

Introduction to vaccines, Different generations of Vaccines, Concepts of reverse vaccinology, case study of Reverse Vaccinology with Meningococcus B, Comparision of Traditional Vaccinology and Reverse Vaccinology,

Practice: case study of Reverse Vaccinology, Vaccine databases

Unit IV regular expressions

Tools & servers for computational Vaccine design-from Genome to Vaccine.

Practice: Tools & servers for computational Vaccine design-from Genome to Vaccine

References: -

1) Kuby IMMUNOLOGY. 2007 by W. H. Freeman and Company.

2) Immunoinformatics: Bioinformatic Strategies for Better Understanding of Immune (2008), Wiley Publications.

3) Predicting Immunogenicity In Silico Series(2013): Methods in Molecular Biology, Flower, Darren R.