



B.Sc.

BIOCOMPUTING

Curriculum and Syllabus

(Based on choice based credit system)

Effective from the Academic year

2018 - 2019

Department of Bioinformatics

School of Life Sciences

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO-1: An ability to develop the practical knowledge related to Life science, Computer science and information technology in an interdisciplinary manner for providing innovative ideas to solve the biological problems and promote the research globally.

PEO-2: The extraordinary skills to analyze the scientific big data, create a novel objective, implement methodology to derive a key finding and apply this knowledge for welfare of society. Students should be able to develop as computational expert and follow the ethical rules on areas related to Life sciences and Bioinformatics.

PEO-3: Develop as a resource person with interdisciplinary knowledge who can finish the advance tasks related to biology and computer science in a challenging scientific environment.

PEO-4: Update knowledge on programming and database development on biological data and information and help the scientific research community.

PEO-5: U.G. program and its knowledge give confidence to the students and shine in the booming bioinformatics careers related to academics, research and development and industry.

PROGRAM OUTCOME (PO)

The B.Sc. program Biocomputing at VISTAS has documented measurable outcomes that are based on the needs of the programme's stakeholders. The programme outcomes that the department presently adapts to future graduates are as follows:

PO-1: Scientific knowledge: Graduates will acquire Bioinformatics specific knowledge including recent techniques in the respective fields coupled with hands-on skills and leadership skills for a successful career.

PO-2: Problem analysis: Graduates will be able to analyse, solve and troubleshoot problems in implementation of biochemistry/biotechnology/ microbiological protocols.

PO-3: Design/development of solutions: Graduates will develop creative thinking and cooperate with each other to solve problems in the field of biochemistry/biotechnology/bioinformatics/ microbiology.

PO-4: Conduct investigations of complex problems: Graduates will acquire practical skills – which help in planning and designing protocols to validate hypothesis and execute experimental techniques independently as well as assimilate, analyse and interpret subsequent data.

PO-5: Modern tool usage and communication: Graduates will effectively be able to manage resources and time using ICT and computer enabled devices and accomplish ability to understand and communicate all ideas effectively.

PO-6: Environment sustainability and Ethics: Graduates will get adequate knowledge to use information and implement solutions for environmental protection and remediation. Graduates will be aware of their role and responsibility in handling and use of microbes including genetically modified microorganisms.

PO-7: Lifelong learning: Graduates will carry on to learn and adapt in a world of constantly evolving technology.

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO-1: The primary goal is to make the students to understand biological concepts.

PSO-2: To acquire knowledge on the basics of computer and the principles of programming languages.

PSO-3: To understand the levels of programming language and its application in various fields of biology.

PSO-4: To be well versed in handling the biological data from the different database available online at present.

PSO-5: To obtain the knowledge on basics in designing the webpage for a database as well as online tools and softwares.

PSO-6: To gain a sound knowledge on the application of computer techniques in the field of chemistry, plants, microbes, etc.

PSO-7: To implement the computer programming knowledge in the design and maintenance of database to utilize the complex form of biological data in a simpler format.

PSO-8: To utilize the bioinformatics skill to venture in development of fields like pharmaceutical and biotechnological concerns.

Department of Bioinformatics

Board of Studies Members

B.Sc. BIOCOMPUTING

S.No	Name	Post	Contact address	Designation
1.	Dr. Radha Mahendran	Professor/ Head Dept of Bioinformatics	VISTAS P.V. Vaithiyalingam Road Pallavaram Chennai - 117	Chairman
2.	Mrs. Suganya.J	Asst Professor/ Dept of Bioinformatics	VISTAS P.V. Vaithiyalingam Road Pallavaram Chennai - 117	Internal Members
3.	Dr. M.N Ponnusamy	Emeritus professor, Dept of crystallography and biophysics	University of Madras, Guindy Campus, Chennai 600 025 Phone: 044 - 22300122 Email: mspy@hotmail.com	External expert
4.	Dr. J. Senthil Kumar	Asst Professor/ Dept of computer science	Loganatha Narayanasamy Government College (Autonomous). Ponneri. Chennai-204	External expert
5.	Ms. K.Hemamalaini	II Year B.Sc., Biocomputing	VISTAS P.V. vaithiyalingam Road, pallavaram, Chennai -117	Student Member

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES
(VISTAS)**

CHENNAI - 600 117

REGULATIONS

CHOICE BASED CREDIT SYSTEM

B.Sc. BIOCOMPUTING

1. DURATION OF THE PROGRAMME

1.1. Three years (six semesters)

1.2. Each academic year shall be divided into two semesters. The odd semesters shall consist of the period from July to November of each year and the even semesters from January to May of each year.

1.3 There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION

Candidates for admission to the first year of the degree of Bachelor of BioComputing shall be required to have passed the Higher Secondary Examination with Maths/Biology or Computer Science (Academic Stream) conducted by government of Tamilnadu or an examination accepted as equivalent thereof by the syndicate of VISTAS.

3. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in a College affiliated to the University for a period of not less than three academic years and passed the examinations of all the Six Semesters prescribed earning a minimum of 140 credits as per the distribution given in for Part I, II, III, IV & V and also fulfilled such other conditions as have been prescribed thereof.

4. COURSE OF STUDY, CREDITS AND SCHEME OF EXAMINATION

The Course Components and Credit Distribution shall consist Part I, II & III:

(Minimum number of Credits to be obtained)

Credit Assignment Each course is assigned certain number of credits based on the following:

Contact period per week CREDITS

1 Lecture Period - 1 Credit

1 Tutorial Period - 1 Credit

2 Practical Periods - 1 Credit

(Laboratory / Seminar / Project Work / etc.)

5. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

5.1. Eligibility:

Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed therefore by the Board of Management from time to time.

5.2. Attendance:

All Students must earn 75% and above of attendance for appearing for the University Examination. (Theory/Practical)

5.3. Condonation of shortage of attendance:

If a Student fails to earn the minimum attendance (Percentage stipulated), the HODs shall condone the shortage of attendance up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after collecting the prescribed fee towards the condonation of shortage of attendance. Such fees collected and should be remitted to the University.

5.4. Non-eligibility for condonation of shortage of attendance:

Students who have secured less than 65 % but more than 50 % of attendance are NOT ELIGIBLE for condonation of shortage of attendance and such Students will not be permitted to appear for the regular examination, but will be allowed to proceed to the next year/next semester of the program

5.5. Detained students for want of attendance:

Students who have earned less than 50% of attendance shall be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the University from time to time.

5.6. Condonation of shortage of attendance for married women students:

In respect of married women students undergoing UG programs, the minimum attendance for condonation (Theory/Practical) shall be relaxed and prescribed as 55% instead of 65% if they conceive during their academic career. Medical certificate from the Doctor together with the attendance details shall be forwarded to the university to consider the condonation of attendance mentioning the category.

5.7. Zero Percent (0%) Attendance:

The Students, who have earned 0% of attendance, have to repeat the program (by rejoining) without proceeding to succeeding semester and they have to obtain prior permission from the University immediately to rejoin the program.

5.8. Transfer of Students and Credits:

The strength of the credits system is that it permits inter Institutional transfer of students. By providing mobility, it enables individual students to develop their capabilities fully by permitting them to move from one Institution to another in accordance with their aptitude and abilities.

5.8.1. Transfer of Students is permitted from one Institution to another Institution for the same program with same nomenclature. Provided, there is a vacancy in the respective program of

Study in the Institution where the transfer is requested. Provided the Student should have passed all the courses in the Institution from where the transfer is requested.

5.8.2. The marks obtained in the courses will be converted and grades will be assigned as per the University norms.

5.8.3. The transfer students are not eligible for classification.

5.8.4. The transfer students are not eligible for Ranking, Prizes and Medals.

5.8.5. Students who want to go to foreign Universities upto two semesters or Project Work with the prior approval of the Departmental/College Committee are allowed to get transfer of credits and marks which will be converted into Grades as per the University norms and are eligible to get CGPA and Classification; they are not eligible for Ranking, Prizes and Medals.

6. EXAMINATION AND EVALUATION

6.1. Register for all subjects:

Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination. For this purpose, Students shall register for all the arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

6.2. Marks for Internal and End Semester Examinations for PART I, II, III

6.2.1 There shall be no passing minimum for Internal.

6.2.2 For external examination, passing minimum shall be 40% [Forty Percentage] of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-Voce.

6.2.3 In the aggregate [External/Internal] the passing minimum shall be of 40%.

6.2.4. He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practical wherever prescribed as per the scheme of the examinations by earning 140 CREDITS in PartI, II, and III.

7. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAMS TO QUALIFY FOR A DEGREE

A Student who for whatever reasons is not able to complete the programs within the normal period (N) or the Minimum duration prescribed for the programme, may be allowed two years period beyond the normal period to clear the backlog to be qualified for the degree. (Time Span = N + 2 years for the completion of programme)

8. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Academic Council with the approval of the Board of Management.

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES (VISTAS)

B.Sc., BIOCOMPUTING DEGREE COURSE

COURSES OF STUDY AND SCHEME OF ASSESSMENT

(MINIMUM CREDITS TO BE EARNED: 140)

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 1								
LANG	Tamil I/ Hindi / French	5	0	0	5	40	60	100
ENG	English I	5	0	0	5	40	60	100
CORE	Introduction to Computer, Algorithm and Statistics	5	0	0	5	40	60	100
CORE	Cell Biology and Biochemistry	4	0	0	4	40	60	100
CORE	Basic Concepts and Algorithm in Computer Practical	0	0	4	2	40	60	100
CORE	Techniques in Biochemistry Practical	0	0	4	2	40	60	100
		19	0	8	23			
SEMESTER 2								
LANG	Tamil II / Hindi / French	5	0	0	5	40	60	100
ENG	English II	5	0	0	5	40	60	100
CORE	Programming in C	5	0	0	5	40	60	100
CORE	Biological Databases and sequence analysis	4	0	0	4	40	60	100
CORE	Programming in C Practical	0	0	4	2	40	60	100
CORE	Biological Databases and sequence analysis Practical	0	0	4	2	40	60	100
		19	0	8	23			

CA - Continuous Assessment

SEE - Semester End Examination

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

Programme: B.Sc., BIOCOMPUTING DEGREE COURSE

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 3								
LANG	Tamil III / Hindi / French	5	0	0	5	40	60	100
ENG	English - III	5	0	0	5	40	60	100
CORE	Programming in C++	4	0	0	4	40	60	100
CORE	Plant Bioinformatics	4	0	0	4	40	60	100
CORE	Bioinformatics in Microbiology, Immunology and Nanotechnology	3	0	0	3	40	60	100
CORE	Programming in C++ Practical	0	0	3	1	40	60	100
CORE	Plant Bioinformatics Practical	0	0	3	1	40	60	100
SEC	Soft Skills - I	2	0	0	2	40	60	100
		23	0	6	25			
SEMESTER 4								
LANG	Tamil IV / Hindi / French	5	0	0	5	40	60	100
ENG	English IV	5	0	0	5	40	60	100
CORE	Cheminformatics	4	0	0	4	40	60	100
CORE	Operating System and Computer Networks	3	0	0	3	40	60	100
CORE	Medical Coding and Transcription	3	0	0	3	40	60	100
CORE	Cheminformatics Practical	0	0	4	2	40	60	100
AECC	Environmental Studies	2	0	0	2	40	60	100
SEC	Soft Skills - II	2	0	0	2	40	60	100
		24	0	4	26			

CA - Continuous Assessment

SEE - Semester End Examination

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

Programme: B.Sc., BIOCOMPUTING DEGREE COURSE

Code No.	Course	Hour / Week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER 5								
DSE	DSE – 1	4	0	0	4	40	60	100
DSE	DSE – 2	4	0	0	4	40	60	100
DSE	DSE – 3	4	0	0	4	40	60	100
DSE	Programming in Java Practical	0	0	4	2	40	60	100
DSE	Perl and Bioperl Practical	0	0	4	2	40	60	100
GE	Generic Elective - I	3	0	0	3	40	60	100
SEC	NSS	2	0	0	2	40	60	100
		17	0	8	21			
SEMESTER 6								
DSE	DSE – 4	3	0	0	3	40	60	100
DSE	DSE – 5	3	0	0	3	40	60	100
DSE	DSE – 6	3	0	0	3	40	60	100
DSE	Programming in Visual Basics and Python Practical	0	0	4	2	40	60	100
GE	Generic Elective - II	3	0	0	3	40	60	100
SEC		2	0	0	2	40	60	100
DE	Project Work	0	0	12	6	40	60	100
		14	0	16	22			

CA - Continuous Assessment

SEE - Semester End Examination

DISCIPLINE SPECIFIC ELECTIVE COURSES

1. 18BBI101 Programming in JAVA
2. 18BBI102 PROGRAMMING IN JAVA – PRACTICAL
3. 18BBI103 PROGRAMMING IN PERL AND BIOPERL
4. 18BBI104 PERL AND BIOPERL - PRACTICAL
5. 18BBI105 Genomics And Proteomics
6. 18BBI106 PROGRAMMING IN VISUAL BASICS AND RDBMS
7. 18BBI107 PROGRAMMING IN VISUAL BASICS AND PYTHON - PRACTICAL
8. 18BBI108 PROGRAMMING IN PYTHON
9. 18BBI109 Enzymes And Metabolism
10. 18BBI110 MATHEMATICS FOR BIOINFORMATICS
11. 18BBI111 VIROLOGY
12. 18BBI112 BIOPHYSICAL CHEMISTRY
13. 18BBI113 CLOUD COMPUTING BASICS
14. 18BBI114 RECOMBINANT DNA TECHNOLOGY
15. 18BBI115 DATA WAREHOUSING AND DATA MINING

GENERIC ELECTIVE COURSES

1. 18BBI151 INTRODUCTION TO BIOINFORMATICS
2. 18BBI152 CHEMINFORMATICS
3. 18BBI153 MOLECULAR MODELING AND DRUG DESIGNING
4. 18BBI154 STRUCTURAL BIOINFORMATICS
5. 18BBI155 PROGRAMMING IN PERL AND BIOPERL
6. 18BBI156 PYTHON FOR BIOINFORMATICS
7. 18BBI157 CONSUMER AFFAIRS
8. 18BBI158 DISASTER MANAGEMENT

SKILL ENHANCEMENT COURSES

1. 18NSS255 NSS PAPER I
2. 18NSS256 NSS PAPER II
3. 18NSS257 SOFT SKILLS I
4. 18NSS258 SOFT SKILLS II
5. 18NSS259 SWAYAMPRAKASHA I
6. 18NSS260 SWAYAMPRAKASHA II

18CBCM11 INTRODUCTION TO COMPUTER, ALGORITHM AND STATISTICS 5 0 0 5

Course Objectives: (Employability)

To gain a fundamental understanding of the power and limits of basic models of computation, and to gain comfort with associated proof techniques.

This course is designed to provide the non- science/ mathematics/ engineering/ business student a intense foundational introduction to the fundamental concepts in statistics.

After completing the course the student should be able to work basic problem and word problems in logic, set theory, counting methods, probability, and statistics.

UNIT I INTRODUCTION TO COMPUTERS 10

History of computer - Computer Generations, Types of computer, Computer components – CPU – I/P Devices and O/P devices, Functionalities of a Computer, Advantages and disadvantages, Applications of computer. Memory and memory types RAM and RAM types, ROM and ROM types, Mother Board, Memory Units, Ports.

UNIT II COMPUTER HARDWARE AND SOFTWARE 12

Hardware – Types – Working methods, Software – System software and application software (MS Word, Excel and PowerPoint), Operating system, Example of Operating System. Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Introduction to Internet, Working of Internet, Internet Services, Internet addressing, - E Mail Basics- Web Development Tools, Introduction TO HTML.

UNIT III INTRODUCTION OF PROGRAMMING CONCEPTS 18

Introduction of programming concepts-Input, process and output-Programs and programmingLanguages-Tools Used in problem Solving - Representing the Programming logic UsingFlowcharts and Algorithms-Problem Solving Using Flowcharts & Algorithm - Processes in a Flowchart - Representing the Programming logic Using Flowcharts-Problem Solving Using Flowcharts -Representing Decision and Repetition Processes in a Flowchart.

UNIT IV PROGRAMMING LOGIC USING ALGORITHM 15

Representing the Programming Logic Using Algorithm/Pseudocode-Problem Solving UsingPseudocode-Variables and Constants-Data Types-Using Operators-Conditional Execution -Understanding Iterations and Modular Programming-Implementation Iterative Processes-Modular Approach to programming-Dividing Programs into Modules-Types of modules -Working with Large Volumes of Data-Working with Arrays.

UNIT V STATISTICAL ANALYSIS 20

Statistics: Classification- Quantitative, Geographical, Chronological.Tabulation, Frequency, Distribution, **Diagrammatic Representation-** Bar diagram, Percentage Bar Diagram, Pie Diagram, Pictogram, Graphical representation, Frequency curve, Cumulative Frequency, Ogive,LorenzCurve.**Measures of Averages-** Introduction, Arithmetic Mean, Weighted Arithmetic Mean, Formula for calculating AM in a frequency distribution, Properties of AM, Combined Mean (CM), Geometric Mean (GM), Harmonic Mean (HM), Median, Quartiles and Deciles, Mode, Merits and Demerits. Quartile Deviation, Its Merits and Demerits, Mean Deviation, Definition, Relative Measures, Merits and Demerits, Standard Deviation (SD), Formula for calculating SD, Merits and Demerits, Relative Measure, combined Mean and SD.

Total: 75 Hours

Text Books:

1. Anita Goel, “Computer Fundamentals”, Pearson Education India, 2010.
2. P.R.Vittal, “Mathematical Statistics”, Margham Publication, 3rd Edition, 2012.

Reference Books:

1. SangheraKamaljeet, “Fundamentals of Computing”, Kendall Hunt Publishing Company, 2nd Edition, 2007.
2. AnuragSeetha, “Introduction To Computers And Information Technology”,Ram Prasad & Sons, McGraw Hill, 2011
3. S.K.Basandra, “Computers Today”, Galgotia Publications, 2006
4. Alexis Leon & Mathews Leon, “Fundamentals of Information Technology”, Vikas Publishing House, New Delhi, 2009.

Course Objective: (Employability)

- This course covers basic properties of cells and cell organelles.
- To examine the properties of differentiated cell systems and tissues.
- The principal aim of the course is to equip students with a basic knowledge of the structural and functional properties of cells.
- To understand the biological principles, and the ability to make connections across different levels of biological organization, from molecules to cells, to whole organisms, populations and ecosystems.

UNIT I Cell and Cell Cycle 16

Cell: Cells as a unit of life, structure of prokaryotic and eukaryotic cells. An overview of organelles (Mitochondria, Chloroplasts, ER, Golgi, Ribosomes, Lysosomes and Peroxisomes, Nucleus and Nucleolus). **Cell Cycle: Mitosis - Phases of mitosis** (Early Prophase, Later Prophase, Metaphase, Anaphase, Telophase), Cytokinesis. **Meiosis - Phases of meiosis**, Meiosis I (Prophase I, Metaphase I, Anaphase I, Telophase I), Meiosis II (Prophase II, Metaphase II, Anaphase I, Telophase II).

UNIT II Cell Signaling and Central Dogma 16

Cell Signaling: Overview of cell signaling, Forms of signaling, Paracrine signaling, Synaptic signaling, Autocrine signaling, Endocrine signaling, signaling through cell-cell contact. **DNA replication** (Replication Fork Formation, Primer Binding, Elongation, Termination), Replication Enzymes. **Transcription** (RNA polymerase, Initiation, Elongation, Termination), Eukaryotic RNA modifications. **Translation** (Getting started: Initiation, Extending the chain: Elongation, Finishing up: Termination), genetic code.

UNIT III Molecules of Life: Protein and Amino Acids 12

Protein: Definition, properties, occurrence and biological importance of protein, Different levels of organization-Primary, secondary tertiary and Quaternary structures. Amino acids: Definition, composition, structure, properties, stability and biological importance of Amino Acid, **Formation Peptide bond**, Identification of C and N terminal residues of amino acids

UNIT IV Molecules of Life: Carbohydrates and nucleotides**12**

Introduction to carbohydrates-Monosaccharides and their derivatives, Disaccharides, Polysaccharides. Nucleic acids – Purines, pyrimidines, Nucleosides and Nucleotides. Types of Nucleoside – DNA (deoxyribonucleic acid), RNA (Ribonucleic acid)

UNIT V Mutation and Chromosomal**14**

Mutation – Types of mutations, types of mutagenic agents and their molecular mechanism; DNA repair; Chromosomal types and structure; Mechanism by which genome undergoes changes, recombination, mutation, inversion, duplication, and transposition

Total: 70 Hours**Text Books:**

1. Channarayappa, “Cell Biology”, Universities Press, 2010.
2. P.S.Verma& V.K. Agarwal, “Cell Biology (Cytology, Biomolecules and molecular biology”, S. Chand Publishing, 2015.

Reference Books:

1. Lehninger, A. L. 1984. Principles of Biochemistry. CBS publishers and distributors, New Delhi, India
2. Horton, Moran, Ochs, Rawn, Scrimgeour Principles of Biochemistry Prentice Hall Publishers.
3. David. E. Sadava Cell Biology: Organelle Structure and Feunction Jones & Bartlett publishers.

18PBCM11 PRACTICAL - BASIC CONCEPTS AND ALGORITHM IN COMPUTER 0 0 4 2

Course Objective: (Skill Development).

- To Train the students to operate computer systems and make use of application software.
- To understand and learn the concept of MS Word, MS Excel and MS PowerPoint and its applications.
- To ensure the clear practical knowledge on HTML tags.

1. Hands-On experience: - Utilities of Windows (XP) – Browsers (I.E., Chrome, Mozilla Firefox) – Surfing the Internet – Search Engines – E-Mail (Sending and Receiving mail, attaching folders on mail) **05**
2. Downloading and installing software/plugin-ins on Windows – Searching / Surfing on the WWW. **05**
3. **Word Processing** (Notepad and MS Word) **10**
 - Creating, Saving & Opening a document
 - Editing, Inserting, Deleting, Formatting, Moving & Copying Text
 - Find & Replace, Spell Checker & Grammar Checker (Thesaurus), Document Enhancement (Borders, Shading, Header, Footer), Printing document (page layout, Margins)
 - Introduction to the use of Wizards & Templates, Working with Graphics (Word Art), working with Tables & Charts, Inserting pictures and files.
4. **Spreadsheet Applications** (MS Excel) **15**
 - Worksheet Basics - Entering information in a worksheet, Saving & Opening a worksheet, Editing, Copying & Moving data, Inserting, Deleting & Moving Columns & Rows, Clearing Cells & Formatting cells
 - Working with workbooks, Working with formulae and functions, Printing worksheets
 - An introduction to the use of advanced spreadsheet concepts, sorting records, Finding records, Adding & Deleting records, Filtering records in a worksheet.
 - Working with Macros, Creating and using multiple worksheets.

5. **Presentation Applications (MS PowerPoint)** **10**
- Creation of slides, Rapid Presentation design using wizards
 - Inserting graphs & charts Action buttons
 - Transitions, Build and Animation effects.
6. **HTML BASICS** **10**
- Creating Sample HTML page using Editors, Basic, Elements, Attributes, Headings and Paragraphs. Creating Sample HTML page using Styles, Formatting, Quotations and Comments. Creating Sample HTML page using Links, Images, Tables and Lists.
7. Solving problems using algorithm and flowchart **05**

Total: 60 Hours

Text Book:

1. Anita Goel, “Computer Fundamentals”, Pearson Education India, 2010

Reference Books:

2. SangheraKamaljeet - Fundamentals of Computing –. Kendall Hunt Publishing Company, 2007
3. Introduction To Computers And Information Technology By AnuragSeetha, Ram Prasad McGraw Hill 2011.

Course Objective: (Skill Development)

The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.

1. Qualitative analysis of monosaccharides – Aldose.	05
2. Qualitative analysis of monosaccharides – Ketose.	05
3. Qualitative analysis of disaccharides.	05
4. Qualitative analysis of polysaccharides.	05
5. Qualitative analysis of aromatic amino acids.	05
6. Qualitative analysis of sulphur containing amino acids.	05
7. Qualitative analysis of basic amino acids.	05
8. Estimation of glycine by Sorrenson's Formal Titration.	05
9. Estimation of ascorbic acid by 2,3 Dichlorophenol Indophenol.	05
10. Estimation of glucose by Ortho Toluidine method.	05
11. Estimation of protein by Lowry's method.	05
12. Separation of amino acids by thin layer chromatography.	05

Total: 60 Hours

Text Book:

1. Horton, R, Moran, L, Scrimgeour, G, Perry, M, Ravon, D "Principles of Biochemistry", 4th edition, Prentice-Hall of India. 2005.

References:

1. Voet, D., and J.G. Voet. "Biochemistry" 3rd edition. Hoboken, NJ: Wiley. 2004.

Course Objective: (Employability)

- To provide the clear concepts on programming methodology.
- To make the students to understand the various programming concepts in C language.
- To make clear understanding on C applications and make use of c programming for various calculation methods.

Unit I Introduction to C 16

Introduction:History of C Language, C Programming structures and building blocks.
Fundamentals:Character set, Tokens, Keywords, Identifiers, Data Types - Integer, float, character and double, Variables , Constant, Comments – Single line comment and multiline comment.

Unit II Introduction to Programming 15

Operators and Built in Functions:Arithmetic, Unary, Relational and logical, Assignment and Conditional Operators, precedence and Associative - Library functions - Data input and output functions. Writing C Programs: Declarations - Expressions – Statements - Simple C programs

Unit III Control Structures 16

Control Structures:Flow of control –Decision making, loop control - if, if-else, while, do-while, for loop, Nested control structures – switch, break and continue, go to statements – comma operator. Solving Problems:Problem solving concepts and techniques - Steps in problem solving - Algorithms and flowcharts – Examples.

Unit IV Functions, Arrays, Structures and Unions 14

Functions:Basic types of function, Declaration and definition, Function call, Types of function, Parameter passing, Call by value, Call by reference, Scope of variable, , Recursion.
Arrays:Arrays- Defining and processing Arrays,Structures & Unions.

Pointers:Declarations, Pointer Variables, Operation on Pointers- **Files:**File Input / Output -
Creating, Reading and Writing files, processing, opening and closing file data.

Total: 75 Hours

Text Book:

1. E. Balagurusamy, Programming in ANSI C, 6th Edition, Tata Mc-Graw Hill, 2015.

References:

1. Kanetkar Y., Let us C, BPB Publication, New Delhi, 1999.
2. H. Schildt, C: The Complete Reference, 4th Edition, TMH Edition, 2000.
3. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education, 2006.

Course Objective: (Employability)

- This course will enable the students to understand the nature of biological data and need for biological databases.
- To explore major **biomolecular sequence databases (organization and contents)**.
- To search and retrieve data from the databases using their respective search engines.
- To understand and appreciate the need and significance of sequence analysis and the bioinformatics approaches, algorithms for sequence analysis, the application of methods for analysis of the biomolecular sequence data.

Unit I Bioinformatics and Databases 14

Introduction to Bioinformatics, Bioinformatics: Applications and research, Present bioinformatics scenario in India – Government Organizations, Private Organizations, Informatics Research, Academic Scenario in India, Characteristics of Bioinformatics databases, Types of database, Data source, Data Access, **navigating databases, Information Retrieval system, storage system of Database.**

Unit II Sequences Databases and Structural Database 16

Sequences Databases: Nucleotide Sequence databases, Secondary Nucleotide databases, Protein databases, secondary and specialized protein sequence database, **Information Retrieval System: Entrez and SRS.** Structural Database: Structural File format, Protein structural database collaboration, PDB, MMDB, CATH, FSSP, DALI, SCOP.

Unit III Data Submission Tool and Analysis Tools 10

Data Submission Tool: Nucleotide sequence submission tools, Protein submission tools, command line tools for Genbank. Sequence Analysis Tools: Tools for Nucleotide sequence analysis, Tools for Protein sequence analysis.

Unit IV Prediction tools and Modelling Tools 14

Prediction Tools: Phylogenetic Trees and phylogenetic analysis - Phylip, Phyml. Gene Prediction – Genscan, GrailEXP. **Protein structure and Function Prediction** – Prosite,

Course Objective: (Skill Development).

- To provide the clear concepts on programming methodology.
- To make the students to understand the various programming concepts in C language.
- To make clear understand on C applications and make use of c programming for various calculation methods.

1. Simple Arithmetic Calculation 07
 - a) Program to demonstrate the Simple Arithmetic Calculation
 - b) Program to find the Simple Interest

2. If Control 07
 - a) Program to find even/odd number.
 - b) Program to determine whether given year is leap year or not using 'if' and 'if else'
 - c) Program to find the sum of digits of given number using 'else-if ladder'.

3. While and Do While 07
 - a) Program to find the factorial value of given number using while.
 - b) Program to find the Fibonacci series for given number using do-while.

4. Arrays and For control 07
 - a) Program to find the number of alphabets in given word sequence.
 - b) Program to find the frequency of Nucleotides in given DNA sequence.
 - c) Program to find the G-C content value of given DNA sequence.

5. Switch and Functions 07
 - a) Program to find the complement and reverse complement of given DNA sequence using functions.

- | | |
|--|-----------|
| 6. Structures and Unions: | 07 |
| a) Program to create student data using Structures/Unions. | |
| b) Program to create ‘cm – feet’ converter using Structures/Unions. | |
| c) Program to concatenate the two DNA sequences using Structures/Unions. | |
|
 | |
| 7. Pointers: | 09 |
| a) Arithmetic operations using pointers. | |
|
 | |
| 8. File: | 09 |
| a) Sample Program to read and write an external file. | |

Total: 60 Hours

Text Book:

1. E. Balagurusamy, Programming in ANSI C, 6th Edition, Tata Mc-Graw Hill, 2015.

References:

1. Kanetkar Y., Let us C, BPB Publication, New Delhi, 1999.
2. H. Schildt, C: The Complete Reference, 4th Edition, TMH Edition, 2000
3. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education, 2006.

Course Objectives: (Skill Development).

- To understand various computational techniques employed to analyze biological data with the use of sequence information.
 - Finally acquire skills to use different approaches for prediction of protein structure.
 - This course also aims to provide students with a practical and hands-on experience with common bioinformatics tools and databases.
 - Students will be trained in the basic theory and application of programs used for database searching, protein and DNA sequence analysis.
1. Retrieval of DNA Sequence using Sequence Databases: NCBI, DDBJ, EMBL. 04
 2. Gene prediction using GenScan tool. 04
 3. Retrieval of Protein Sequence using Sequence Databases: UNIPROT, Tr-EMBL. 04
 4. Retrieval of Protein Structural information using SCOP, CATH. 04
 5. Protein sequence analysis (ExpASy proteomics tools). 04
 6. Retrieval of 3D Protein Structure Using Protein Data Bank. 04
 7. Molecular visualization of Protein Structure Using Pymol, Rasmol. 04
 8. Sequence similarity searching (NCBI BLAST). 04
 9. Multiple sequence alignment (Clustal). 04
 10. Protein function prediction Tools – Introscan, Phobius, Pratt, RADAR. 04
 11. Molecular phylogeny (PHYLIP). 05

Total: 45 Hours**Text Book:**

1. D. Higgins and W.Taylor, (Eds), 'Bioinformatics: Sequences, Structures and databanks' Oxford University Press, Oxford, UK. 2008.
2. V. R. Srinivas, "Bioinformatics: Sequences and genomics analysis" Cold Spring Harbor Laboratory press, Cold Spring harbor, USA, 2005.

Reference Books:

1. N.Gautham, "Bioinformatics", Narosa Publishing Company, New Delhi, 2006.
2. D.Higgins and W.Taylor, "Bioinformatics: Sequences, Structures and databanks", Oxford University Press, Oxford, UK, 2008.

Course Objective: (Employability)

- To provide hands on experience on Programming.
- To make clear understand on Object Oriented Program methodology.
- To make the students to think and write their own C++ program by understanding the concepts of programming clearly.
- To be familiar with writing recursive methods.

Unit I Introduction to C++ 05

Introduction: Basic Elements of C++ Programming, I/O Streams. Control Structures: Control and Looping Statements.

Unit II Object Oriented Methodology 14

Object Oriented Methodology: Basic Concepts/Characteristics of OOP. Advantages and Application of OOPs, Procedural Programming Vs OOP. Classes and Objects: Specifying a Class, Creating Objects, Private & Public Data Members and Member Functions

Unit III Functions 13

Functions: Function Prototyping, Call and Return by Reference, Inline Function, Defining Inline Member Functions Default and Const Arguments, Function Overloading, Arrays, Static Data Members and Member Functions, Arrays within Class.

Unit III Constructors and Destructors 13

Introduction Parameterized Constructors, Multiple Constructors in A Class, Constructors With Default Arguments, Dynamic Initialization of Objects, Copy Constructors, Dynamic Constructors, Const Objects, and Destructors.

Unit IV Operator Overloading and Inheritance 14

Course Objective: (Employability)

- This understanding is fundamental to allow efficient exploitation of plants as biological resources in the development of new cultivars with improved quality and reduced economic and environmental costs.
- This knowledge is also vital for the development of new plant diagnostic tools.
- To understand the genetic and molecular basis of all biological processes in plants that are relevant to the specie.

Unit I Plant 12

Plant cell architecture, Photosynthesis, Respiration, Plant growth regulator: auxins, gibberellins, cytokinins, ethylene abscisic acid. Primary structure of stem, leaf and root of Dicotyledons and monocotyledons. Economic importance of plants.

Unit II Plant Kingdom 12

Plant Kingdom- Definition and Classification, of Plant Kingdom – Thallophyta: Algae (Chlorophyceae, Phaeophyceae, Rhodophyceae), Bryophytes: Life cycle, Economic Importance of Bryophytes, Pteridophytes, Phanerogams, Gymnosperms, Angiosperms (Dicot and Monocot). Five Kingdom Classification, Three domains of life, Eight Kingdom model, Cavalier-Smith's systems, Viroids and Viruses.

Unit III Plant Genetics 12

Introduction to Plant genetics – DNA, Gregor Mendel, Modern ways to genetically modify plants, Genetically engineered crops, Benthan and Hooker's classification of plants – Summary, Families and orders in the Bentham & Hooker system – Dicotyledons, Monocotyledons. Types of classifications – artificial – natural – phylogenetic. Biosystematics – binomial nomenclature – herbarium and its uses, herbarium and computer data.

18CBCM33 BIOINFORMATICS IN MICROBIOLOGY, IMMUNOLOGY AND NANOTECHNOLOGY

3 0 0 3

Course Objective: (Employability)

- The subject provides an insight into the concepts of microbiology, immunology and nanotechnology.
- The understanding of basic concepts and mechanism aids the bioinformaticians in developing the right tools and software for the biological problems.

Unit I Microbiology- An Introduction 12

Introduction to Microbiology, History of Microbiology, Morphology of bacteria and Physiology of bacteria , Sterilization and Disinfection, Culture Technique, Culture Media, Culture Methods, Identification of Bacteria, Normal Microbial Flora of the Human Body, Bacteriology of Water, Milk & Air, **Laboratory Control of Antimicrobial Therapy**, Hospital Infection.

Unit II Databases for Microorganisms 12

Saccharomyces Genome Database (SGD), Ensembl genome database - Ensembl bacteria, fungi, Metazoa, plants, protists. **Microbial Genome database** – Bacteria, Archaea, Eukaryota. MLST (Multi locus sequence Typing) databases, BacDive, ECMDB, Integrated Microbial Genomes (IMG), Streptome DB, SporeWeb

Unit III Immunology 12

Organs of the immune system: Primary Lymphoid organs - Thymus, Bone Marrow and secondary Lymphoid organs- Lymph nodes, Spleen, MALT, Tonsils. Classification of immune system – innate and adaptive immunity, Immune Cells - T Cells & B Cells, **Antigens**, **Antibodies and their structure** – IgM, IgG, IgA, IgD, IgE.

Unit IV Antigens and Antibodies 12

AbMiner, AlgPred, Antibodies Online -- **Antibodies Database**, AntigenDB -- Pathogen Antigens Database, BCipep, CEP, CytoSVM, Epitome, ExactAntigen, FRED, GPX,

Course Objectives: (Skill Development)

- To provide the hands on experience on Programming.
- To make the studentsto think and write their own C++ program by understanding the concepts of programming clearly.
- Make the student to create the program using classes and objects methods of OOPS.

1. Program to implement classes; create object and member functions.	04
2. Program to implement the concept of function in Classes.	04
3. Program to implement the concept of function overloading.	04
4. Program to implement the concept of Inline function.	04
5. Program to implement the concept of Static member functions.	04
6. Program to implement the concept of Operator overloading.	04
7. Program to implement the concept of Single Inheritance.	04
8. Program to implement the concept of Multiple Inheritance.	04
9. Program to implement the concept of Constructors & Destructors.	04
10. Program to implement Arrays using Functions.	04
11. Program to implement file handling concepts.	04

Total: 45 Hours**Text Book:**

1. E.Balagurusamy, "Object Oriented Programming with C++", 6thEdition, Tata McGraw Hill, Publishing Company Limited, New Delhi, 2013.

Reference Books:

1. K.R.Venugopal, Rajkumar, T. Ravishankar, "Mastering C++", Tata McGraw Hill, NewDelhi, 1999: 25thReprint, 2006.
2. D. Ravichandran, "Programming with C++", Third Edition, Tata McGraw Hill, 2010.
3. Horowitz, Sahni& Mehta, "Fundamentals of Data Structures in C++", 2ndEdition,Silicon Press, 2006.

Course Objective: (Skill Development)

- This understanding is fundamental to allow efficient exploitation of plants as biological resources in the development of new cultivars with improved quality and reduced economic and environmental costs.
- This knowledge is also vital for the development of new plant diagnostic tools.
- To understand the genetic and molecular basis of all biological processes in plants that are relevant to the specie.

1. Collecting and Creating Herbarium of 5 different kinds of plants	08
2. Creating computer data for Herbaria.	08
3. Biological Data retrieval system using Entrez for plants.	08
4. Exploring the integrated database system at NCBI server and querying the PUBMED.	08
5. Exploring and querying the TAIR database.	07
6. Exploring and accessing the plant genome specific databases, Eg. MaizeGDB	07
7. Accessing and querying the SSR Locator, Eg. Gramene	07
8. Explore and access the plant microarray datasets, Eg. GeneIndex, PLEXdb, GEO.	07

Total: 60 Hours**Text Book:**

1. David Edwards. "Plant Bioinformatics – Methods and Protocols". Springer. 2007.

Reference Books:

1. Gurcharan Singh." Plant Systematics: An Integrated Approach". Science Publishers, 2004.
2. Susheela M. Das "A Textbook of Plant Taxonomy: Theory & Objectives" Hardcover – Wisdom Press, 2013.

Excretion and Toxicity). **Chemical Structure Based Search Techniques**: Exact, Sub-Structure and Similar Structure Searches.

Unit V Combinatorial Chemistry, Library Design and QSAR 12

Combinatorial Chemistry and Library Design- Library Enumeration, Design Strategies- Monomer based and Product based selection. **Pharmacophore modeling strategies, Molecular Docking studies**, Molecular Matched Pair Analysis (MMPA), Quantitative Structure Activity Relationship.

Total: 60 Hours

Text Books:

1. Gasteiger Johann, Engel Thomas. "Chemoinformatics: A Textbook". Publisher: Wiley VCH; 1st edition. 2003.

Reference Books:

1. Bunin Barry A. Siesel Brian, Morale Guillermo, Bajorath Jürgen. Chemoinformatics: Theory, Practice, & Products Publisher: New York, Springer. 2006.
2. Leach Andrew R., Valerie J. Gillet. An introduction to Chemoinformatics. Publisher: Kluwer academic, 2003.
3. Gasteiger Johann, Handbook of Chemoinformatics: From Data to Knowledge (4 Volumes), Publisher: Wiley-VCH, 2003.
4. Thomas Engel. Chemoinformatics – A Textbook Publisher: Kluwer academic, 2005.

Course Objectives: (Employability)

- To explain the following terms: computer network, LAN, WAN, MAN, internet, protocol, topology, media, peer-to-peer network, server based network.
- Aim to give clear view of operating system structure, Processing and its memory.
- Also to make the student to clear understand on OS memory management system.
- To implement on computer programming structures, application of operating systems and its uses etc.

Unit I Introduction to Operating System 10

Introduction, Views, Goals and types of operating systems, Structure, Components, services, Uses and Types of Operating Systems, Process concepts, process scheduling, scheduling criteria, scheduling algorithms. Memory Management, Single and multiple partitioned allocation, paging, segmentation, internal & External Fragmentation.

Unit II Files and I/O Systems 09

File concept, Access methods, Directory structure, file system mounting, Protection. File-System Implementation, Directory implementation, Allocation methods, Free-space management, efficiency and performance, File system in Linux and Windows, I/O Systems, I/O Hardware, I/O interface, Kernel I/O subsystem, streams, performance. Disk management, Swap-space management, RAID, disk attachment, stable storage, tertiary storage.

Unit III Introduction to Computer Networks 08

Introduction: Computer Networks Definition, advantages of computer networks, Client and Server, Network hardware and software, LAN, WAN, MAN. Reference Models: OSI and TCP/IP Models. Example Networks: Internet, ATM, Ethernet and Wireless LANs.

Unit IV Communication Media 08

Communication Media: Definitions, Data communications and Networking, Theoretical basis for data communication, guided transmission media, Wireless transmission,

Communication Satellites. Telephones structure: Definition, local loop, trunks and multiplexing, switching.

Unit V **Computer Network Layers** **10**

Data Link Layer: Logical Link Control, Services of DLL, DLL Protocol, Network Layer: Services of network layer, routing, Network layer in the internet, IP protocol, IP address. Transportation Layer: services of transportation layer, addressing, flow control. Application layer: Definition, Application Layer Protocols, DNS, name space, resource. Email, architecture and services.

Total: 45 Hours

Text Books:

1. Andrew S. Tanenbaum, “Computer Networks”, Fourth Edition, Pearson Education, 2003.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004

Reference Books:

1. Behrouz A Forousan, “Computer Networks: A Top Down Approach”, Tata McGraw Hill, 2012.
2. Larry L. Peterson, “Computer Networks: A System Approach”, Morgan Kaufmann Publications, 2010
3. Davis Rajkumar, “Operating System: A Systematic View”, Pearson Education, 2007.
4. H. M. Deitel, “Operating System”, Second Edition, Pearson Education, 1990

Course Objective: (Employability)

- The Human Anatomy course involves the study of the structure of the human body.
- To provide a sound knowledge of **medical coding guidelines and regulations including compliance**
- To reimbursement and to make the student to learn about **ICD-10 (Diagnosis code), CPT code and medical terminologies.**

Unit I Introduction to Human Anatomy - I 12

Basics of Human Anatomy and Physiology, Cell, Tissues and Membrane, The integumentary system, Skeletal system, Muscular system, Endocrine system, Nervous system.

Unit II Introduction to Human Anatomy - II 12

Cardiovascular system, Respiratory system, Digestive system, Urinary system and Reproductive system. **Coding medical procedures** What to code and how to prepare the forms.

Unit III Claim Information and Medical Records 12

Professional claim information How to set up medical claims for Medicare, Medicaid, private insurance companies, HMOs, PPOs, workers' compensation and personal injury cases. **Documenting Medical Records:** The role medical records play in a coding specialist's job. The importance of documentation in medical records and to recognize the various types of dictation formats and manage medical records. **Medical Ethics Concepts of ethics,** compliance, fraud and abuse. The importance of confidentiality when dealing with medical records and insurance audits and the legal concepts involved.

Unit IV CPT Codes 12

CPT Coding: CPT Coding from the Integumentary System, from the Reproductive Systems to the Operating Microscope, for Radiology, Pathology, Medicine and Anesthesia, Evaluation and Management Services, Comprehensive CPT Evaluation and Management, Surgery Coding, Digestive System Coding, Urology system coding, Cardiovascular coding.

Diagnostic Coding - ICD-9-CM Coding Manual Introduction, Diagnosis Coding: Guidelines and Rules, from Infections to Blood Diseases, from Mental Disorders to the Respiratory System, from the Digestive System to Pregnancy, from the Skin to Conditions of the Perinatal Period, from Symptoms to Complications, **V Codes, E Codes and ICD-9-CM** Coding Practicum.

Total: 60 Hours

Text Book:

1. Beth A. Rich, "Medical Coding: A Journey", Prentice Hall, 2013. ISBN – 13: 9780132541770
2. Martini and Nath. 2018. Fundamentals of Anatomy and Physiology 11th ed.+ Modified Mastering A&P Access Code. Pearson, San Francisco, CA.

Reference Books:

1. Karen Smiley, "Medical Coding And Billing for Dummies", Second Edition, 2012.
2. Perez. 2008. Anatomy (Flash Cards). Bar Charts Publishing, Boca Raton, FL.
3. Kapit and Elson. 2013. Anatomy Coloring Book 12th ed. Pearson Education, Boston, MA.

Course Objective: (Skill Development)

- This course will enable the students to understand the fundamentals and complementary aspects of chemo informatics and bioinformatics for design of bioactive molecules.
- To get hands-on experience in chemical structure representation, storage and analysis of small molecular data.

1. Chemical Structure representation for the following categories, **06**
 - 1 Dimension Structures,
 - 2 Dimension Structures
 - 3 Dimension Structures
2. Accessing and retrieving information about drugs **04**
3. Exploring and accessing the chemical structure databases **10**
 - Pubchemdatabase
 - Chemical Structure Database (CSD)
4. Analyzing Molecular file formats for the following, **12**
 - SMILES,
 - WLN
 - SDF
 - MOL
5. Prediction and analysis of Molecular Properties and descriptors **08**
6. Exploring Molecule structure drawing tool **10**
7. Perform and analyze exact, substructure search using Pubchem through NCBI portal **05**
8. Exploring the Quantitative Structure Activity Relationship **05**

Total: 60 Hours**Text Book:**

Gasteiger Johann, Engel Thomas. Chemoinformatics: A Textbook. Publisher: WileyVCH; 1st edition. 2003.

Reference Books:

Bunin Barry A. Siesel Brian, Morales Guillermo, Bajorath Jürgen. Chemoinformatics: Theory, Practice, & Products Publisher: New York, Springer. 2006.

Course Objective: (Employability)

To inculcate the importance of environmental pollution, preservation of nature and environmental management for human welfare.

Unit I Environmental Awareness 06

Definition, scope and importance of environmental studies. Public awareness regarding environment.

Unit II Energy Resources 06

Renewable and non-renewable energy sources. Forest resources, water resources, mineral resources, food resources, energy and land resources. Conservation of natural resources.

Unit III Pollution and Control 06

Environmental pollution-Definition, causes, effects and control measures of air, water, soil, marine, noise and nuclear pollution. Solid waste management and disaster management.

Unit IV Environmental Management 06

Social issues and the environment-unsustainable and sustainable development. Urban problems related to energy. Water conservation, rain water, and harvesting and watershed management.

Unit V Environmental Protection 06

Climate change-Global warming, acid rains, ozone layer depletion, nuclear accidents, waste land reclamation and maintenance. Environment protection act, wildlife, forest conservation act.

Total: 30 Hours

Text Book:

1. Subramaniam.V. Text Book in environmental Science, Narosa. 2002.

Reference Books:

1. Subramaniam.V.. Text Book in environmental Science, Narosa. 2002
2. Balu.V, Environmental Studies, Srivenkateshwara.2004
3. Moo Young. M. et al. Environmental biotechnology, Principles and application, Springer. 1996
4. Bharucha, E. Text Book of environmental Studies for undergraduates, University Press (India) Pvt. Ltd. 2005.
5. Sinha and Saradha , Text Book of Environmental Studies, AITBS Publication. 2005
6. Vijaya Ramesh K. Environmental Microbiology. MJP Publication.2004
7. Demain, A.L. Manual of Industrial Microbiology, ASM. 2004
8. RajanMisra, A Text Book on environmental Studies. University Science Press. New Delhi. 2009
9. Mohapatra P.K. Text Book of Environmental biotechnology. I.K. International Publishing House Pvt.Ltd. 2006

DISCIPLINE SPECIFIC
ELECTIVES

Course Objectives: (Employability)

- To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- Be aware of the important topics and principles of software development. Have the ability to write a computer program to solve specified problems

UNIT I FUNDAMENTALS OF JAVA**15**

Fundamentals of Object – Oriented Programming:- Introduction, Object-Oriented Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, Applications of OOP, Java Evolution:- Java History, Java Features, Java and C/C++, Java and Internet, Java and WWW, Java Environment, Overview of Java Language:- Simple java Program, java Program Structure, Java Tokens, Java Statements, Java Virtual Machine, command Line Arguments, Constants, variables and Data Types in Java.

UNIT II OPERATORS AND DECISION MAKING**20**

Operators and Expressions:- Arithmetic, Relational, Logical, Assignment, Increment, Decrement, Conditional, Bitwise and Special operators, Arithmetic Expressions, Evaluation of Expressions, Arithmetic operator Precedence, Mathematical Functions. Decision Making and Branching:- if, if...Else, nesting of if...else, else if ladder and Switch statement, the ?: operator, Decision Making and Looping:- while, Do While and For statements, Jumps in Loops and Labeled Loops, Classes, Objects and Methods:- Defining a Class, fields declaration, methods declaration, creating objects, accessing class members, Constructors, methods overloading, Extending a Class (Inheritance), Overriding Methods, final variables and methods, final classes.

UNIT III ARRAYS AND PACKAGES**20**

Arrays, Strings and Vectors:- Introduction, One-dimensional Arrays, Creating an Array, Two-Dimensional Arrays, Strings, Vectors, Wrapper Classes, Enumerated Types, Strings and Regular Expressions:- Java's Regular Expression API, Introduction to Regular Expressions, Sorting Array of Strings, Ignore Case Difference When Sorting, Replacing Substrings with case difference ignorance, Splitting a String using split(), Multiple Inheritance:- Defining Interfaces, extending interfaces, implementing interfaces, Accessing interface Variables, Packages:- Java API packages, using system packages, Naming conventions, creating packages, accessing a package, using a package, hiding classes.

UNIT IV ERRORS AND MULTITHREAD PROGRAMMING

12

Errors and Exceptions:- Types of errors, Exceptions, Syntax of Exception Handling code, Multiple Catch Statements, **Using Finally Statement, Throwing Exceptions, Exceptions for Debugging, File Handling:-** Overview of File Handling, Reading characters from a file, Writing characters to a file, **Read and write Random-Access files, Obtaining File Attributes, Formatting Data:-** Overview of Formatter, NumberFormat and DateFormat – Four Simple Numeric Formatting Techniques using formatter, Format Time and Date Using formatter, **Multithreaded Programming:-** Introduction, Creating Threads, Extending the thread class, Stopping and Blocking a Thread, Life Cycle of a thread.

UNIT V APPLET PROGRAMMING

8

Applet Programming:- Introduction, preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable Applet, Designing a Web Page, Applet Tag, Applet to HTML, running the Applet, **Graphics Programming:-** Graphics class, Lines and Rectangles, Circles and Ellipses, Drawing Arcs, Drawing Polygons, Drawing Graphs, Using Control Loops in Applets.

Total Hours: 75

Text Book:

E Balagurusamy, “Programming with Java: A Primer”, Fourth Edition, Tata McGraw Hill, 2010

References:

1. P. Naughton and H.Schildt- Java2 (The Complete Reference) - Third Edn.TMH 1999.
2. Deital & Deital, “How to Program Java”, Pearson Education, 1999.
3. Cays Horstmann, Gary Cornell, “Core Java 2: Advanced Features”, Sun Micro System, 2007

Course Objective: (Skill Development)

- To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc. Be aware of the important topics and principles of software development.
- Have the ability to write a computer program to solve specified problems

1) Operators and Expressions	3
2) Branching and Looping	3
3) Classes and Objects	3
4) Packages	3
5) Formatting Data	3
6) <u>Sort</u> an Array of Strings in Reverse Order	4
7) Implementing Case Differences Ignorance	4
8) Applet Example	5
9) Drawing Circle, rectangle using Java Graphics.	4
10) <u>Reading or writing Fasta files using Biojava?</u>	5
11) Comparing two Sequences.	4
12) Translating DNA sequence into Protein sequence in Java	4

Total: 45 Hours**Text Book:**

E Balagurusamy, "Programming with Java: A Primer", Fourth Edition, Tata McGraw Hill, 2010

References:

1. P. Naughton and H.Schildt- Java2 (The Complete Reference) - Third Edn.TMH 1999.
2. Deital & Deital, "How to Program Java", Pearson Education, 1999.

Course Objective :(employability)

- To learn the fundamentals of the Perl programming language and how it can be used to write data reporting and systems administration applications.
- To discover how to use of the DBI.pm module and related DBD (driver) files with Perl to build database- driven applications.

Unit I Introduction to PERL 08

Introduction:- PERL, Features, IDE, Syantx, Output with print, Identifiers, Data typers, Scalar, Array, Hashes, Getting User Input, The.chomp operator, undef Value, List Literals, List Assignment, Subroutines:- Defining a subroutine, Invoking a subroutine, Perl References.

Unit II Expressions and Files 08

Input and Output:- Input from Standard Input, Input from the diamond operator, Invocation arguments, Output to Standard Output, Filehandles, Opening a Filehandle, Hashes:- Hash Element Access, Hash Functions,.

Unit III Operators 10

Operators, types, Precedence, Regular Expressions, Matching with Regular Expressions: Matches with m//, Option Modifiers, Anchors, The Binding operator, =~, Interpolating into Patterns, The match Variables, General Quantifiers. Processing Text with Regular Expressions: Substitutions with s//, The split Operator, The join Function, m// in List context, More Powerful Regular Expressions.

Unit IV Control Structures 09

Control Structures: Conditional statement, If, If- Else, if-elsif-else, unless, unless-els, switch, Conditional operator. Autoincrement and Autodecrement, The for Control Structure, Loop Controls, Logical Operators, File Tests:- File Test Operators, The local time function, Bitwise Operators, Using the Special Underscore

Unit V Packages, Modules and BIOPERL

10

Perl packages, Begin and End block, Modules, Require function, Use function, Finding Modules, Installing Modules, Using Simple Modules. CPAN, Introduction, Bioperl, Installing Bioperl, Classes, Sequences (Bio::Seq Class, Sequence Manipulation), Extracting sequences, Accessing databases.

Total: 45 Hours

Text Book:

1. Martin C Brown, “Perl The Complete Reference”, Second Edition, Tata McGraw Hill, 2001

Reference Books:

1. Erick Storm, “Perl CGI Programming”, BPB Publication, 1998.
2. Steven Holzner, “Per: Black Book”, Second Edition, Dreamtech Publication, 2007.
3. Ed Peschko& Michele Dewolf, “Perl Developer’s Guide”, Tata McGraw Hill, 2000.

Course Objective: (Skill development)

- To learn the fundamentals of the Perl programming language and how it can be used to write data reporting and systems administration applications.
- To discover how to use of the DBI.pm module and related DBD (driver) files with Perl to build database- driven applications.

1. Calculating the true length of a Sequence?	05
2. Program to find the length of the given sequence?	05
3. Program to reverse and concatenation of the given sequence?	05
4. Program to complement and reverse complement of DNA sequence?	05
5. Program to calculate GC content in the given DNA sequence?	05
6. Program to translate DNA into Protein Sequence?	04
7. Program to Implement BioPerl	04
8. Retrieving DNA Sequence from the Database and Translating it into Protein Sequence using Perl and BioPerl.	08
9. Parsing PDB and FASTA file using BioPerl?	04

Total: 45 Hours**Text Book:**

1. Martin C Brown, “Perl The Complete Reference”, Second Edition, Tata McGraw Hill, 2001.

Reference Books:

1. Erick Storm, “Perl CGI Programming”, BPB Publication, 1998.
2. Steven Holzner, “Per: Black Book”, Second Edition, Dreamtech Publication, 2007.
3. Ed Peschko& Michele Dewolf, “Perl Developer’s Guide”, Tata McGraw Hill, 2000.

Course Objectives: (Employability)

- This course will enable the students to appreciate the importance and understanding of full genome and to explore the genomics databases & various algorithms used for comparisons of full genome and gene order.
- It also useful for understanding the concepts of SNPs and their significance with increase in value of proteomics concepts and technology.

Unit I Introduction to Genomics 12

Definition of Genome, Genome sequencing, genome composition & genome evolution
Genome map: Types of Genome maps and their uses, High and low-resolution map, Map elements, Polymorphic markers Line, sine, Restriction Fragment Length Polymorphism, (RFLP), single nucleotide polymorphism (SNP), Finding Specific Genes. **Gene prediction in prokaryotes, Gene prediction in eukaryotes.**

Unit II Types of Mapping 12

Types of maps: Cytogenetic, Linkage map, Transcript map, Physical map, Comparative map, Integrated map, STS content maps, Map repositories: **NCBI – Entrez Human genome map viewer, OMIM – Online Mendelian Inheritance in Man.** Linkage map resources: CEPH reference pedigree, CHLC – Cooperative human linkage center.

Unit III Protein Classification and Structure Prediction 12

Structural elements and terminology: Helix, Sheet, Strand, Loop and coil, Active site, Architecture, Blocks, Class and Domains, Fold, Motif, PSSM. Principles of classification: Based on structural features, Phylogenetic relationship. Use of sequence pattern, leucine zipper, **coiled coil, transmembrane, signal peptide,** cleavage site. Secondary structure prediction: GOR 4, SOPMA, tertiary structure prediction-threading, modeling.

Course Objective: (Employability)

- To identify the differences between the procedural languages and event – driven languages.
- To define and modify the properties and methods associated with an object.
- To load, modify, and save changes made to forms and projects in the Visual Basic Environment. Make clear understand on RDBMS concepts and Database languages such as Oracle and PL/SQL.

Unit I Introduction to Visual Basic 10

Introduction to Visual Basic: IDE, working with forms, developing an application, variables, datatypes and modules, procedures and control structures, arrays in VB. Working with VB Controls: Creating and using controls, working with control arrays - ODBC and Data Access Objects.

Unit II User Interfaces 08

Menus Events and Dialog Boxes: Menu and Events definition, Event model in VB, Menu Interfaces, Mouse Events, Dialog Boxes: Definition, Types of Dialog Boxes, Applying dialog. Graphics, MDI and FlexGrid: Graphics for application, Multiple Document Interface and Using the FlexGrid Control

Unit III VB Classes and Objects 08

Classes: Definition, advantages of classes, class methods. Objects: Definition and methodology. Introduction to VB Classes and Objects, Creating various forms, Objects and projects. Working with objects, Classes and class modules, Creating VB objects.

Unit IV Introduction to DBMS 10

Advantages and Components of a Database Management Systems - Feasibility Study - Class Diagrams - Data Types - Events - Normal Forms - Integrity - Converting Class Diagrams to Normalized Tables - Data Dictionary. Query Basics - Computation Using Queries -

Subtotals and GROUP BY Command - Queries with Multiple Tables Subqueries – Joins, Testing Queries.

Unit V Introduction to Oracle 09

ORACLE - Introduction to Oracle, Data definition languages - Data Manipulation language, Data Control Language, Data types in Oracle. Constraints in Oracle, Data and String **Functions, Union and Intersect operator, Sub queries, Introduction to PL / SQL, Simple PL / SQL programs.**

Total: 45 Hours

Text Books:

1. Steven Holzner, “Visual Basic 6 Programming: Black Book”, Dreamtech Press, 2000.
2. C. J. Date, A. Kannan, “Database Systems”, Pearson Education Publication, 2006.

Reference Books:

1. Noel Jerke, “Visual Basic 6: The Complete Reference”, Tata McGraw Hill, 1999.
2. Kevin Loney, George Kuch, “Oracle – The complete Reference”, Tata McGraw Hill Publication, 2005.
3. C. J. Date, “Database Systems”, Addison Wesley Publication, 1990.

Course objective: (Employability)

- To read and understand the Python syntax and be familiar with Python's fundamentals to develop simple applications.
- Apply the principles and techniques of object-oriented programming.
- To use sophisticated techniques and Python modules that are particularly useful for bioinformatics programming.
- To build new Python software tools for life science research. Summarize text patterns using regular expressions.

Unit I Introduction to Python 06

Introduction to Python, History of Python, Python Features, Python Development Tools, Writing Python Program, Values and Variables:- Numeric Values, Variables and Assignment, Keywords, Identifiers, print function, Statements, Indentation and Comments, Namespace.

Unit II Expression 06

Expressions and Arithmetic: Operator Precedence and Associativity, Errors (Syntax, Run-time errors, Logic Errors), Arithmetic Examples, Variables, Constants and Literals, Data types, Type Conversion and Type Casting, Input, Output and Import, File I/O, File Methods, Directory and Files Management.

Unit III Conditional Execution 06

Conditional Execution: Conditional statement in Python, Simple if Statement, if/else statement, else – if ladder, While Statement, For Statement, Nested Loops, the break statement, the continue statement, Pass. Infinite Loops,

Unit IV Functions 06

Function: Introduction, Docstring, return statement, Scope and Lifetime of variables, Types of Functions, Built-in functions, User-defined functions, Arguments, Recursion, Global, Local and Nonlocal variables, Global Keyword.

Modules: Definition, import modules, import statement, Module Search Path, Reloading a module, dir () built-in function, Packages, Importing module from a package.

Total: 30 Hours

Text Book:

1. Jason Kinser, “Python for Bioinformatics”, Jones and Bartlett Publishers, Sudbury, Massachusetts, 2009.

Reference Books:

1. Richard L., Halterman, “Learning to Program With Python”, 2011.
2. Kent D. Lee, “Python Programming Fundamentals: Second Edition”, Springer, 2010.
3. Cody Jackson, “Learning to Program Using Python”, Second Edition, 2013.
4. Mark Lutz, “Learning Python”, Third Edition, O’Reilly, 2007.

Course Objectives: (Skill Development)

- To identify the differences between the procedural languages and event – driven languages. Define and modify the properties and methods associated with an object.
- To load, modify, and save changes made to forms and projects in the **Visual Basic Environment**. Read and understand the **Python syntax**. Be familiar with Python's fundamentals and develop simple applications.
- To use sophisticated techniques and Python modules that are particularly useful for bioinformatics programming. Apply **different strategies for error handling of applications**. Write applications in one of the most simplistic languages available.

1. Creating Simple application forms in Visual Basic. **01**
 - a. Creating a form for simple Arithmetic Calculations
 - b. Creating a form for simple Biological applications
2. Creating application forms using Variables, Data Types and Control structures. **02**
 - a. Creating Factorial Calculator
 - b. Creating GC – Content Calculator
3. Creating application forms using different types of “Objects” in VB. **02**
 - a. Creating form to find
 - i. Leap Year,
 - ii. Currency Exchange,
 - iii. Octal, Decimal, Hexadecimal Calculation
 - iv. Scroll Bar
 - b. **Creating form to find**
 - i. **The Complement of given sequence**
 - ii. **The reverse of given sequence**
 - iii. **The frequency of Nucleotides.**
4. Creating application forms using Menus, Mouse Events. **02**
5. **Creating applications forms using Graphics in VB.** **02**

ORACLE, PL/SQL

- a) Creation of student information records containing Roll number, Name,
Subject Code Marks etc., **01**
- b) Finding the total and average marks, result for each student table. **01**
- c) Record Manipulations such as Deletion, Modification, Addition and
Counting the Record. **01**
- d) **Creating table that demonstrates simple biological applications.** **02**
- e) **Creating table to demonstrate applications with biological sequences.** **02**

Total Hours:30 hrs

Text Book:

1. Steven Holzner, "Visual Basic 6 Programming: Black Book", Dreamtech Press, 2000. ISBN:13: 9788177220537

PROGRAMMING IN PYTHON 0042

Course Objective: (Skill Development)

- To read and understand the Python syntax. Be familiar with Python's fundamentals and develop simple applications.
- Apply the principles and techniques of object-oriented programming. Use sophisticated techniques and Python modules that are particularly useful for bioinformatics programming.
- Build new Python software tools for life science research. Summarize text patterns using regular expressions. Apply different strategies for error handling of applications. Write applications in one of the most simplistic languages available.

1. Program to convert DNA to RNA using python.	01
2. Program to calculate the frequency of aminoacid.	01
3. Program to frequency of DNA.	01
4. Program to reverse of DNA sequence.	01
5. Program to complement of DNA sequence.	01
6. Program to reverse complement of DNA sequence.	01
7. Program to open a FASTA file.	01
8. Program to find the GC content given sequence in the existing sequence.	01
9. Program to sum two matrices.	02
10. Program to transpose the matrix.	02
11. Program to find the sequence matcher.	02

Total: 30 Hours

Text Books:

1. Steven Holzner, "Visual Basic 6 Programming: Black Book", Dreamtech Press, 2000.
2. C. J. Date, A. Kannan, "Database Systems", Pearson Education Publication, 2006.

3. Jason Kinser, "Python for Bioinformatics", Jones and Bartlett Publishers, Sudbury, Massachusetts, 2009.

Reference Books:

1. Noel Jerke, "Visual Basic 6: The Complete Reference", Tata McGraw Hill, 1999.
2. Kevin Loney, George Kuch, "Oracle – The complete Reference", Tata McGraw Hill Publication, 2005.
3. C. J. Date, "Database Systems", Addison Wesley Publication, 1990.
4. Richard L., Halterman, "Learning to Program With Python", 2011
5. Kent D. Lee, "Python Programming Fundamentals: Second Edition", Springer, 2010
6. Cody Jackson, "Learning to Program Using Python", Second Edition, 2013.

Course Objective: (Employability)

This course will enable the students to understand the fundamentals and complementary aspects of enzyme and metabolism action involved in bioinformatics and wide range of enzymatic activities of different protein classes and their metabolism's which responsible for causing Disorder.

Unit I Introduction to Enzymes 10

Introduction to enzymes, nomenclature, classification, ribo-enzyme, general characteristics of theories of enzyme catalysis, substrate specificity, isozymes, coenzymes, cofactors, regulation of enzyme activity, chemical kinetics and enzyme kinetics, Michaelis-Menten equation, effect of various factors on rate of reactions, inhibition of enzymatic reactions and kinetics, multi-enzyme system and bi-substrate reactions, catalytic mechanisms, regulatory enzymes and immobilized enzyme.

Unit II Introduction to Metabolism 10

Introduction to metabolism- Overview of anabolic and catabolic pathways of carbohydrates, proteins and lipids. Role of ATP, NAD, FAD and CoA in metabolism. Nucleic Acid Metabolism: Biosynthesis and degradation of purines and pyrimidines, nucleosides and nucleotides. Clinical correlation of purine and pyrimidine metabolism. Nucleotides as coenzymes.

Unit III Carbohydrate Metabolism 08

Digestion and absorption of carbohydrates. Glycolysis and its significance, Fermentation, Fate of pyruvate, Citric acid cycle, Gluconeogenesis, Cori cycle, Glycogenesis, Glycogenolysis Glycogen storage diseases. HMP shunt, Uronic acid pathway, Metabolism of hexoses other than glucose, Regulation of glycogen metabolism, Glyoxylate pathway, Biosynthesis of oligosaccharides and glycoproteins,

Course Objective: (Employability)

Accordingly, the objective of this course isn't to increase your knowledge but rather to expand your ignorance. After all, the process of science occurs at the boundary of what is known, which, as it grows, generates a greater interface with what is not known. The prime objective of this course is to help you **develop skills to play the game of science** - to greet confusion with joy, to withstand it, organize it, and chart a path through it.

Unit I Genetic Code and Mathematics 12

Introduction, Genetic Code and Mathematics, Mathematical Background, Converting Data to Knowledge, **The Big Picture: Informatics, Challenges and Perspectives**, Genetic Codes and Matrices.

Unit II Mathematical Sequences 12

Symmetrical Patterns, Molecular Genetics, and Bioinformatics, Mathematical Sequences, Sequence Alignment, Structures of DNA and Knot Theory – Introduction, **Knot Theory Preliminaries, DNA Knots and Links, Challenges and Perspectives.**

Unit III Protein Structures, Geometry and Topology 12

Protein Structures, Geometry, and Topology: Introduction, Computational Geometry and Topology Preliminaries, Protein Structures and Prediction, **Statistical Approach and Discussion, Biological Networks and Graph Theory – Introduction, Graph Theory Preliminaries and Network Topology, Models of Biological Networks.**

Unit IV Genetic Matrices 12

Matrix Genetics, Hadamard Matrices, and Algebraic Biology: Introduction, Genetic Matrices and the Degeneracy of the Genetic Code, **The Genetic Code and Hadamard Matrices**, Genetic Matrices and Matrix Algebras of Hypercomplex Numbers, Some Rules of Evolution of Variants of the Genetic Code, Challenges and Perspectives

Unit V**Denotational Mathematics and Cognitive Informatics****12**

Bioinformatics, Denotational Mathematics, and Cognitive Informatics: Introduction, Emerging Pattern, Dissipative Structure, and Evolving Cognition, Denotational Mathematics and Cognitive Computing, Challenges and Perspectives.

Total: 60 Hours**Text Book:**

1. Matthew He, Sergey Petoukhov, “Mathematics of Bioinformatics: Theory, Practice, And Applications”, Wiley Series of Bioinformatics, 2010.

Reference Books:

1. Ahmed N and Rao K, “Orthogonal Transforms for Digital Signal Processing”. New York, Springer – Verlag, 1975.
2. B.S.Vatssa- WishwaPrakashan, “Discrete Maths”, A Division of Wiley Eastern Ltd. Chennai, 1993.
3. P.R.Vittal, “Mathematical Foundations” – Margham Publication, Chennai, 2012

Course Objective: (Employability)

- This course will enable the students to describe at the molecular level the replication strategies of representative DNA and RNA viruses and the effects of virus infection on cell growth control and survival.
- To elucidate individual steps in virus life cycles and their interactions with host cells and their vaccine.

Unit I Introduction of Virus 15

Introduction of virus, History and principles of virology, virus taxonomy, introduction to replication strategies. Virus structure and morphology, viruses of veterinary importance and plant viruses. Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory.

Unit II Cellular Receptors 10

Cellular receptors and virus entry – Definition, structure and methods of discovery of viral receptors (polio, herpes, VSV, HIV). Kinetics of receptor binding. Cellular interactions - clathrin coated pits, lipid rafts, caveolae, endocytosis and virus uncoating mechanisms Nuclear localization signals and nuclear pore transit, virus –cytoskeletal interactions, chaperons.

Unit III Virus Morphogenesis 10

Virus morphogenesis Replication sites and their characterization, IRES, replicons, transport of viral proteins. Mechanism of host cell damage- Host cell ‘shut off’, apoptosis, necrosis, stress response, alteration of signaling pathways, cellular basis of transformation, types of cytopathic effects, ultrastructural cytopathology.

Unit IV Virus Replication 15

Virus Replication: RNA viruses: General strategies, replication of plus stranded RNA virus (polio), negative strand. RNA viruses (VSV and influenza). Other RNA viruses. Replication of double stranded RNA virus (rota), ambisense RNA (LCM) and retroviruses (HIV and

HTLV). DNA viruses Replication of double stranded DNA viruses (SV40, pox), ssDNA virus (AAV). Miscellaneous (Prion proteins, replication of plant virus (Poty))

Unit V Antivirals and Viral Vaccines

10

Antivirals and Viral Vaccines: Viral Vaccines – Conventional vaccines – killed and attenuated, modern vaccines—recombinant proteins, subunits, DNA vaccines, peptides, immune modulators (cytokines), vaccine delivery and adjuvants. **Antivirals- Interferons**, designing and screening for antivirals, mechanisms of action, anti-viral libraries, anti- retrovirals— mechanism of action and drug resistance. **Modern approaches of virus control anti-sense RNA, siRNA, ribozymes, *in silico* approaches for drug designing.**

Total: 60 Hours

Text Book:

1. P. Saravanan, “Virology”, Neha Publishers & Distributors, 2009.

Reference Books:

1. Antiviral Agents, Vaccines, and Immunotherapies. Stephen K. Tyring. Latest edition / Pub. Date: October 2004. Publisher: Marcel Dekker.
2. Antiviral Drug Discovery for Emerging Diseases and Bioterrorism Threats. Paul F. Torrence (Editor). Latest edition / Pub. Date: July 2005. Publisher: Wiley, John & Sons, Incorporated
3. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka Latest edition / Pub. Date: December 2003 Publisher: American Society Microbiology.
4. DNA Virus Replication. Alan J. Cann. Latest edition / Pub. Date: March 2000. Publisher: Oxford University Press.

Course Objective: (Employability)

This course will enable the students to be familiar with the Physics, chemistry of different classes of biomolecules and their interactions in an aqueous environment and also understand the **structure-function relationships of macromolecules**, the principles of enzyme catalysis and regulation.

Unit I Classical and Quantum Mechanics 15

Classical mechanics: History, Description of the theory, Limits of validity. Quantum mechanics- History, Interactions with other scientific theories, Philosophical implications, Applications, Examples. Elementary introduction to Lagrangian and Hamiltonian formulation of mechanics — **Planck theory of blackbody radiation – photoelectric effect – Bohr model of the atom – atomic spectra – De Broglie theory of matter waves** – Schrodinger wave equation – interpretation of wave function .

Unit II Thermodynamics 10

Thermodynamics And Energetics: Thermodynamics Systems – Laws Of Thermodynamics First Law Of Thermodynamics, Second Law Of Thermodynamics, Third Law Of Thermodynamics – Statement And Applications – Concepts Of Entropy And Enthalpy – Chemical Potentials – Free Energy – **Gibbs And Helmholtz Free Energy** – ATP (Adenosine triphosphate) As Energy Currency In Biological Systems.

Unit III Molecular Mechanics and Dynamics 15

Molecular Mechanics – Functional form, Areas of application, Environment and alvation, Software packages Molecular Dynamics: History, Areas of application and limitations, Basic Principles – **Molecular Representations** – Force Fields – Atom-Atom Pair Potentials – Bond Length, Bond Angle, Torsion Angle Potential – Van Der Waals And Electrostatic Potential – Hydrogen Bonding Terms.

Unit IV X-ray Crystallography 10

X-ray crystallography – History, Contributions to chemistry and material science, Relationship to other scattering techniques, Methods – Procedure, Limitations, Crystallization, Data collection, Data analysis, Diffraction theory, Advantages of a crystal, Elementary description of crystallography- Unit cell – Miller indices – Crystal growth, X-ray diffraction- Refinement and interpretation- Concept of resolution.

Unit V Spectroscopy Techniques 10

IR spectroscopy – Theory, Practical IR spectroscopy, Absorption bands, Uses and applications
UV-Visible spectroscopy – Principle of ultraviolet-visible absorption, Applications, Beer-Lambert law, Ultraviolet-visible spectrophotometer, Microspectrophotometry, Additional applications
Raman spectroscopy – Theoretical basis, History, Raman shift, Applications, Microspectroscopy, Polarized analysis, Variations. NMR(Nuclear magnetic resonance) spectroscopy.History, Basic NMR techniques, Correlation spectroscopy, Biomolecular NMR spectroscopy.

Total: 60 Hours

Text Books:

1. VasanthaPattabhi and N. Gautham, ‘Biophysics’, Narosa Publishing Company, New Delhi. (2001).
2. P.Narayanan. ‘Introductory Biophysics’ New Age Publishing Co., Mumbai, India (1999).

Reference Books:

1. C.R. Cantor and P. Schimmel, ‘Biophysical Chemistry, (Vol I, II and III), W.H. Freeman and Company, New York, USA. (1985).
2. D. Freifelder, ‘Physical Biochemistry’, W.H.Freeman and Company, New York, USA. (1982).
3. E.Ackerman, L.B.M.Ellis and L.E.Williams, ‘Biophysical Science’ Prentice Hall Inc., New Jersey, USA. (1979).

Course Objective: (Employability)

Aims to Provide: World-leading IT technology with high international standard of service.
Implementation service with a quality control from project imitation to production.

A commitment of quality of work delivered to the public . Continuously strengthen our business rapport among IT vendors, manufacturers, resellers, and distributors, is also our main focusing area in running the business.

Unit I Introduction to Cloud Computing 10

Introduction to cloud computing: Collaborative to Cloud – A Short History, Functioning of Cloud computing, Cloud Architecture, Cloud Storage and Cloud Services, Industrial Applications, Business Values :- Introduction, Service Modeling, Infrastructure as a Service, Platform as a Service.

Unit II Service Administration 09

Inside Cloud Computing: Introduction, Sensational Feeling about Organization, Deciding on Strategy, Governance Issues, Monitoring Business Process, IT Cost Management, Cloud **Service Administration:-** Introduction, Service Level Agreements and Monitoring, Support Services, Resource Management, Service Management.

Unit III Computing Technology 10

Cloud Computing Technology: Introduction, Clients – Hardware clients, software clients, cloud clients, Security, Network – Basic public internet, The accelerated internet, Site-to-Site VPN, cloud providers, Cloud consumers, Pipe size, Redundancy, Services – Identity, Integration, Mapping, Payments, Search, **Accessing the Cloud:-** Introduction, Platforms – Web application frame work, web hosting service, propriety methods, Web applications, API in cloud computing, browsers for cloud computing.

Unit IV Data Management

08

Cloud Data Management: Data Security, Data Location, Data Control, Securing data for Transport, Scalability and cloud services – Large scale data processing, Databases and data stores and data archival, Storage as a Service, **Information Storage in Cloud computing** – Storage Providers, Storage Security, Merits and Demerits of Cloud Storage.

Unit V Private and Hybrid Clouds

08

Discovery of Private and Hybrid clouds: Need for privacy, comparing public, private and hybrid, **examining the economics of the private cloud**, The Up Key Vendors, Cloud Computing Standards – Best Practices and Standards, Practical Issues, Standards Organizations and Groups.

Total: 45 Hours

Text Book:

1. Dr. Kumar Saurabh, “Cloud Computing”, 2ndEdition, Wiley India Private Ltd., 2012.

Reference Book:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGrah Hill, 2014.

Course Objective: (Employability)

This course will enable the students to understand the knowledge in genetic engineering, vectors in gene cloning, transformation in higher organisms and the applications of rDNA technology and to introduce the Bioinformatician to application of rDNA technology.

Unit I Cloning and RDNA Technology 09

Introduction to cloning and rDNA technology, Recombinant DNA, Cloning DNA, Cloning vectors: Plasmids (pUC 18 and Ti plasmids), Bacteriophages, Plasmids, Cosmids, SV40, retrovirus and Artificial Chromosomes (BAC, YAC), Amplification of Recombinant DNA.

Unit II Gene Cloning 09

Strategies in gene cloning: restriction, ligase, insertion into vector, cloning, transformation into host cell, Enzymology of Recombinant DNA. Screening for recombinant (Insertional inactivation, Colony/in situ hybridization, radioactive antibody test, Xgal, complementation and physical methods).

Unit III Genome Sequencing 09

Methods of gene transfer and genome sequencing: CaPO₄ mediated gene transfer, liposomes, electroporation, electro fusion, micro-injection, particle bombardment. DNA sequencing (Sanger and Coulson method; Maxam and Gilbert method and Automated method) – Chromosomal walking, transposons, construction of genomic and cDNA libraries; molecular markers- RAPD, RFLP.

Unit IV Transgenic Plants 09

Transgenic plants: Definitions, types of Transgenic plants, benefits, public concern and future, high yielding, salt, draught, herbicide, disease resistant. Genetically modified crops, Transgenic animals –for improved livestock production.

rDNA in medicine: Recombinant DNA Therapy in Medicine, Vaccines, enzymes, blood factors, interferon, gene therapy, DNA fingerprinting and its applications in forensic sciences, Application of Recombinant Technology – Gene mapping, Diagnosis of Molecular disease, Application in forensic medicine.

Total: 45 Hours

Text Book:

1. Primrose. Principles of genetic manipulation; 6thEd., Blackwell Science publication.

Reference Books:

1. Keya Chaudhuri Recombinant DNA Technology, Paperback, July 19, 2013 b.
2. T. A. Brown. A Introduction to Gene Cloning, Chapman and Hall publications, 3rd Ed., 1995.
3. Sardul Singh Sandhu. Recombinant DNA Technology, Hardcover – Import. Oct 2010.
4. Monika Jain. Recombinant DNA Techniques: A Textbook, 1st Ed. Paperback.2011.

Course Objective: (Employability)

Students will be enabled to understand and implement classical models and algorithms in data warehousing and data mining. They will learn how to analyze the data, identify the problems, and choose the relevant models and algorithms to apply. They will further be able to assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

Unit I Introduction to Data Warehousing 09

Data Warehousing:- Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

Unit II Business Analysis 09

Business Analysis:- Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Online Analytical Processing (OLAP) – Need –Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multi relational OLAP – Categories of Tools – OLAP Tools and the Internet.

Unit III Data Mining 09

Data Mining:- Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of patterns – Classification of Data Mining Systems – Data Mining Task Primitives –Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

Unit IV Association Rule Mining and Classification 09

Association Rule Mining and Classification:- Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts.

Clustering and Applications and Trends in Data Mining:- Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K means – Partitioning Methods – **Hierarchical Methods** – Density-Based Methods – Grid Based Methods – Model-Based Clustering Methods- Clustering High Dimensional Data – Constraint – Based Cluster Analysis.

Total: 45 Hours

Text Book:

1. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Tenth Reprint 2007.

Reference Books:

1. Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier, 2007.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.
4. Data Mining Data Warehousing and Olap, S K Kataria, Paperback 2010.

GENERIC ELECTIVE
COURSES

Course Objective: (Employability)

- This course will enable the students to understand the nature of biological data and need for biological databases and also to explore major biomolecular sequence databases (organization and contents); search and retrieve data from the databases using their respective search engines.
- To understand and appreciate the need and significance of sequence analysis and the bioinformatics approaches, algorithms for sequence analysis, the application of methods for analysis of the biomolecular sequence data.

Unit I Introduction to Computers**15**

Basics of computing: Introduction to operating systems – WINDOWS, UNIX, LINUX; Advantages of security installation; Use of internet; Graphics – visualization techniques; softwares and hardwares; Computer networking – LAN, WAN, MODEM, Optical vs electronic networking, firewalls; Ethernet and TCP/IP family of protocols.

Unit II Introduction to Biological Databases**20**

Nucleotide databases (Genbank, EMBL, DDBJ); Protein databases (Swiss-Prot, Tr-EMBL, PIR_PSD, ExPasy); Derived Databases (Prosite, PRODOM, Pfam, PRINTS) Specialized Genome databases: (NCBI, EBI, TIGR, SANGER).

Unit III Biological Databases II**10**

Sequence submission Methods and tools (Sequin, Sakura, Bankit); Sequence retrieval systems (Entrez& SRS); Sequence File Formats and Conversion tools; Metabolic Pathway database (KEGG, EMP, EcoCyc, BioCyc and MetaCyc); Specialized database (IMGT, Rebase, COG, LIGAND, BRENDA); Structural database (CATH, SCOP, and PDBsum).

Unit IV Sequence Analysis**15**

Analysis of protein and nucleic acid sequences, multiple alignment programs, Development of programs for analysis of nucleic acid sequences, Pair wise Sequence Alignment - Similarity, Identity and Homology, Global Alignment, Local Alignment; database search methods- Multiple Sequence Alignment - Multiple alignment programs, Development of programs for

analysis of nucleic acid sequences, Conversion of various file formats; Phylogenetic Analysis - Concept of dendrograms; Strings and Evolutionary trees.

UNIT V Structural analysis

15

Analysis of structures and correctness of structures, Submission of data to PDB: atomic coordinates and electron density maps; Anatomy of Proteins - Ramachandran plot, Secondary structures, Motifs, Domains, Tertiary and quaternary structures; Calculation of conformational energy for bio-macromolecules; **Methods for Prediction of Secondary and Tertiary structures of Proteins.**

Total: 75 Hours

Text Book:

1. Baxevanis A.D., Davison D.B., Page R. D. M. & Petsko G.A. Current Protocols in Bioinformatics. New York, John Wiley & Sons Inc., 2004. ISBN: 0555015254 Syllabus draft: BoS April 26, 2010 Dr. Urmila Kulkarni-Kale 15

Reference Books:

1. Korf Ian, Yandell Mark, Bedell Joseph. BLAST: an essential guide to the basic local alignment search tool. Shroff Publishers and Distributors Pvt. Ltd., 2003. ISBN: 8173665125.
2. Baxevanis Andreas D. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition. Publisher: New York, John Wiley & Sons, Inc. 2002, ISBN: 9814126756
3. Lesk, A.M. (2002) "Introduction to Bioinformatics:", 1st Edition, Oxford University Press, Oxford, UK , , ISBN: 9042112221
4. Teresa Attwood, Parry-Smith David J. Introduction to Bioinformatics. Publisher: Pearson Education (Singapore) Pte.Ltd., 2001. ISBN:8178085070
5. Mount David W. Bioinformatics: Sequence and Genome Analysis. Publisher: Cold Spring Harbor Laboratory Press; 1st edition 2001. ISBN: 0879695978
6. Gibas Cynthia, Jambeck Per. Developing Bioinformatics Computer Skills. Publisher: Shroff Publishers and distributors O'Reilly Media, Inc., 2001. ISBN: 8173662428.

Course Objective: (Employability)

This course will enable the students to understand the fundamentals and complementary aspects of chemo informatics and bioinformatics for design of bioactive molecules.

To get hands-on experience in chemical structure representation, storage and analysis of small molecular data.

Unit I Basics of Chemistry 12

Introduction to Atoms, Ions, Elements, Molecules, Properties of atoms- Protons, neutron and electrons, p-Block and s-Block elements, periodic table, Chemical Bonding and Molecular Structure, Types of bonds, Resonance structure and Hybridization, Stereochemistry, Isomerism, Enantiomers.

Unit II Introduction to Cheminformatics 12

Introduction to cheminformatics: Aim, Scope, History, Applications (Storage and Retrieval, Virtual Libraries, Virtual Screening, Quantitative Structure-Activity Relationship (QSAR)); Role of cheminformatics in Pharmaceutical/Chemical Research. Chemical Structure Representation- 1D, 2D and 3D Structures. Molecular File Formats (SMILES, WLN, SDF, and MOL).

Unit III Molecular Descriptors 12

Molecular Descriptors- An Introduction, Invariance Properties of Molecular Descriptors, Types of Molecular Descriptors, Descriptors calculated from 2D structure- physicochemical properties, molar refractivity, Topological, Electrotopological and Shape Indices, Fingerprints and MACCS Keys. Molecular Similarity and Molecular Diversity Analysis.

Unit IV Molecular Database Screening 12

Introduction to Molecular Database, Screening Methods (Ligand-Based and Structure-Based), Lipinski's Rule: Drug/Lead like Molecules (Absorption, Distribution, Metabolism,

Excretion and Toxicity).Chemical Structure Based Search Techniques: Exact, Sub-Structure and Similar Structure Searches.

Unit V Combinatorial Chemistry, Library Design and QSAR 12

Combinatorial Chemistry and Library Design- Library Enumeration, Design Strategies- Monomer based and Product based selection. Pharmacophore modeling strategies, Molecular Docking studies, Molecular Matched Pair Analysis (MMPA), Quantitative Structure Activity Relationship.

Total: 60 Hours

Text Books:

1. Gasteiger Johann, Engel Thomas. “Chemoinformatics: A Textbook”. Publisher: Wiley VCH; 1st edition. 2003.

Reference Books:

1. Bunin Barry A. Siesel Brian, Morale Guillermo, Bajorath Jürgen. Chemoinformatics: Theory, Practice, & Products Publisher: New York, Springer. 2006.
2. Leach Andrew R., Valerie J. Gillet. An introduction to Chemoinformatics. Publisher: Kluwer academic, 2003.
3. Gasteiger Johann, Handbook of Chemoinformatics: From Data to Knowledge (4 Volumes), Publisher: Wiley-VCH, 2003.
4. Thomas Engel. Chemoinformatics – A Textbook Publisher: Kluwer academic, 2005.

Course Objective: (Employability)

- This course will enable the students to understand the critical relationship among biomolecular structure, function and force field models.
- To utilize basic modeling techniques to explore biological phenomena at the molecular level.
- To emphasize Modelling drug/receptor interactions in detail by molecular mechanics, molecular dynamics simulations and homology modeling.

Unit I Molecular Modeling and Mechanics 15

Basic Concepts of Molecular Structure: Bond Length, Bond Angle, Torsion Angle, Non-Covalent Interactions and force field parametrisation and transferability – Molecular Structure and Internal Energy – Energy Minimization, Derivative and Non-Derivative Methods, Local and Global Minima.

Unit II Quantum Mechanics 10

Introduction to Computational Quantum Mechanics: One Electron Atom, Poly Electronic Atoms and Molecules, HartreeFock Equations, Molecular Properties calculation using Ab initio and Semi Empirical Methods, Density Functional Theory, Moller and Plesset Perturbation Theory.

Unit III Molecular Modeling and Docking 20

Molecular Modeling in Drug Discovery, Sequence Analysis, Secondary structure prediction, Tertiary Structure prediction- Homology Modeling, Threading and *ab-initio* methods, Structure validation, Molecular Docking – Introduction, Approaches (Simulation and Shape complementarity approach), Molecular Docking Algorithm, Docking Optimization- Scoring functions, Molecular Docking Application.

Unit IV Pharmacophore 15

Pharmacophore – Historical Perspective and Features, Viewpoint of Pharmacophore, Pharmacophore modeling- Molecular alignments, handling flexibility, alignment techniques,

scoring and optimization, conformational expansion, validation and usage, Applications of pharmacophore model in medicinal chemistry.

Unit V Molecular Dynamics 15

Molecular Dynamics- Introduction, MD using simple models, MD with continuous potentials, setting up and running a molecular dynamics simulation, Constraint Dynamics, Monte Carlo Simulation Methods- Monte Carlo simulation of molecules, Simulation Analysis.

Total: 75 Hours

Text Book:

1. Andrew R. Leach. Molecular Modelling: Principles and Applications, second edition.
Pearson Education EMA, January 2001 ISBN 0-582-38210-6

Reference Books:

1. D. C. Rapaport, The Art of Molecular Dynamics Simulation, 2004, ISBN 0-521-82568-7
2. M. P. Allen, D. J. Tildesley, Computer simulation of liquids, 1989, Oxford University Press, ISBN 0-19-855645-4.
3. R. J. Sadus, Molecular Simulation of Fluids: Theory, Algorithms and Object-Orientation, 2002, ISBN 0-444-51082-6
4. J.M.Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
5. Satya Prakash Gupta, QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008.
6. Guy H. Grant and W. Graham Richards. Computational Chemistry Oxford Chemistry Primers, 291995. 9780198557401

Course Objective: (Employability)

This course will enable the students to explore primary and derived databases in the field of computational structural biology and to visualize macromolecular structures using various visualization tools. Finally acquire skills to use different approaches for prediction of protein structure.

Unit I Introduction to Proteins 12

Fundamentals of X-ray diffraction, NMR spectroscopy of macromolecules Protein Structure: Primary, Secondary, Super Secondary, Domains, Tertiary, Quaternary, Ramachandran plot.

Unit II Protein secondary databases 12

Protein secondary structure classification databases: HSSP, FSSP, CATH, SCOP. Protein secondary structure prediction methods: GOR, Chou-Fasman, PHD, PSI- PRED, J-Pred.

Unit III Protein Tertiary databases 12

Protein Tertiary structure prediction methods: Homology Modeling, Fold Recognition, Abintio Method. Protein folding, Molecular Dynamics of Protein, Molecular Docking of Protein, Small molecule and Nucleotide, Concepts of Force Field

Unit IV Introduction to HMM 12

Motif and Domain: Motif databases and analysis tools. Domain databases (CDD, SMART, ProDom) and Analysis tools. HMM (Hidden Markov Model): Introduction to HMM, its application in Sequence alignment and Structure prediction, HMM based Softwares (HMMER and HMMSTR)

Unit V Structural features of RNA

12

Structural features of RNA: Primary, Secondary, Tertiary. Introduction to RNA Secondary structure prediction, **Methods for RNA Secondary structure prediction**, Limitation of RNA Secondary structure prediction

Total: 60 Hours

Text Book:

1. Webster David (Editor). Protein Structure Prediction: Methods and Protocols (Methods in Molecular Biology) Volume 143. Publisher: New Jersey Humana Press. 2000. ISBN: 0896036375.

References:

1. Cesareni Giovanni, Gimona Mario, Sudol Marius, Yaffe Michael (Editors). Modular Protein Domains. Publisher: Weinheim Wiley-VCH. 2005. ISBN: 352730813X.
2. Höltje Hans-Dieter, Sippl Wolfgang, Rognan Didier, Folkers Gerd. Molecular Modeling: Basic Principles and Applications. Publisher: New York, Wiley-VCH. 2003. ISBN: 3527305890.

Course Objective: (Employability)

To learn the fundamentals of the Perl programming language and how it can be used to write data reporting and systems administration applications. To discover how to use of the DBI.pm module and related DBD (driver) files with Perl to build database-driven applications.

Unit I Introduction to PERL 08

Introduction:- PERL, Features, IDE, Syantx, Output with print, Identifiers, Data typers, Scalar, Array, Hashes, Getting User Input, The.chomp operator, undef Value, List Literals, List Assignment, Subroutines:- Defining a subroutine, Invoking a subroutine, Perl References.

Unit II Expressions and Files 08

Input and Output:- Input from Standard Input, Input from the diamond operator, Invocation arguments, Output to Standard Output, Filehandles, Opening a Filehandle, Hashes:- Hash Element Access, Hash Functions,.

Unit III Operators 10

Operators, types, Precedence, Regular Expressions, Matching with Regular Expressions: Matches with m//, Option Modifiers, Anchors, The Binding operator, =~, Interpolating into Patterns, The match Variables, General Quantifiers. Processing Text with Regular Expressions: Substitutions with s//, The split Operator, The join Function, m// in List context, More Powerful Regular Expressions.

Unit IV Control Structures 09

Control Structures: Conditional statement, If, If- Else, if-elsif-else, unless, unless-els, switch, Conditional operator. Autoincrement and Autodecrement, The for Control Structure, Loop Controls, Logical Operators, File Tests:- File Test Operators, The local time function, Bitwise Operators, Using the Special Underscore

Unit V Packages, Modules and BIOPERL

10

Perl packages, Begin and End block, Modules, Require function, Use function, Finding Modules, Installing Modules, Using Simple Modules. CPAN, Introduction, Bioperl, Installing Bioperl, Classes, Sequences (Bio::Seq Class, Sequence Manipulation), Extracting sequences, Accessing databases.

Total: 45 Hours

Text Book:

2. Martin C Brown, “Perl The Complete Reference”, Second Edition, Tata McGraw Hill, 2001

Reference Books:

4. Erick Storm, “Perl CGI Programming”, BPB Publication, 1998.
5. Steven Holzner, “Per: Black Book”, Second Edition, Dreamtech Publication, 2007.
6. Ed Peschko& Michele Dewolf, “Perl Developer’s Guide”, Tata McGraw Hill, 2000.

Course Objective: (Employability)

Read and understand the Python syntax. Be familiar with Python's fundamentals and develop simple applications. Apply the principles and techniques of object-oriented programming. Use sophisticated techniques and Python modules that are particularly useful for bioinformatics programming. Build new Python software tools for life science research. Summarize text patterns using regular expressions.

Unit I Introduction to PYTHON**12**

Introduction to Python, History of Python, Python Features, Python Development Tools, Writing Python Program, Values and Variables:- Numeric Values, Variables and Assignment, Identifiers, Control codes within Structure, Controlling the print Function

Unit II Expression**12**

Expressions and Arithmetic:- Operator Precedence and Associativity, Comments, Errors (Syntax, Run-time errors, Logic Errors), Arithmetic Examples, Conditional Execution:- Simple if Statement, if/else statement, Compound Boolean Expressions, Nested Conditionals, Multi-way Decision Statements, Conditional Expressions.

Unit III Conditional Execution**12**

Conditional Execution:- What is conditional statement in Python, Simple if Statement, if/else statement, nested if condition, else – if ladder, Compound Boolean Expressions, Nested Conditionals, Multi-way Decision Statements, Conditional Expressions.

Unit IV Iteration**12**

Iteration:- While Statement, For Statement, Nested Loops, the break statement, the continue statement, Infinite Loops, Computing Square roots, Drawing a Tree, Using Functions – mathematical functions – time Functions, reading the files from existing database using Python.

Unit V Sequence Analysis through PYTHON

12

Sequence Alignment:- Alphabets, Matching Sequences – Perfect Matches – Insertions and Deletions – Rearrangements – Global Versus Local Alignments – Sequence Length, Simple Alignment (Direct Alignment), **Statistics:- Simple Statistics, Distributions, Normalizations, Multivariate Statistics, Probabilities, Odds.**

Total: 60 hours

Text Book:

1. Jason Kinser, “Python for Bioinformatics”, Jones and Bartlett Publishers, Sudbury, Massachusetts 2009.

Reference Books:

1. Richard L., Halterman, “Learning to Program With Python”, 2011
2. Kent D. Lee, “Python Programming Fundamentals: Second Edition”, Springer, 2010
3. Cody Jackson, “Learning to Program Using Python”, Second Edition, 2013
4. Mark Lutz, “Learning Python”, Third Edition, O’Reilly, 2007

Course Objective: (Employability)

This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards. The student should be able to comprehend the business firms' interface with consumers and the **consumer related regulatory and business environment.**

Unit I Conceptual Framework**13**

Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to **Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale,** Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology.

Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

Unit II The Consumer Protection Law in India**13**

Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, **Consumer goods, defect in goods, spurious goods and services, service,** deficiency in service, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, **State Commissions, National Commission:** Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

Unit III Grievance Redressal Mechanism under the Indian Consumer Protection Law 13

Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

Unit IV Role of Industry Regulators in Consumer Protection 13

- i. Banking: RBI and Banking Ombudsman
- ii. Insurance: IRDA and Insurance Ombudsman
- iii. Telecommunication: TRAI
- iv. Food Products: FSSAI
- v. Electricity Supply: Electricity Regulatory Commission
- vi. Real Estate Regulatory Authority

Unit V Contemporary Issues in Consumer Affairs 13

Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview

Total: 65 Hours

Text Books:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, Regal Publications

Reference Books:

1. Suresh Misra and SapnaChadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi
2. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
3. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
4. E-books :- www.consumereducation.in
5. Empowering Consumers e-book,
6. ebook, www.consumeraffairs.nic.in
7. The Consumer Protection Act, 1986 and its later versions.

Course Objective: (Employability)

To provide students an exposure to disasters, their significance and types. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction. To gain a preliminary understanding of approaches of disaster risk reduction. To gain a preliminary understanding of approaches of disaster risk reduction (DRR). To enhance awareness of institutional processes in the country and To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Unit I Introduction to Disasters 06

Introduction to Disasters: Concepts and Definitions (Disaster, Hazard, Vulnerability, Resilience, Risks)

Unit II Disasters: Classification, Causes, Impacts 12

Disasters: Classification, Causes, Impacts: (Including social, economic, political, environmental, health, psychosocial, etc.). Differential impacts- in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, Climate change.

Unit III Approaches to Disaster Risk Reduction 10

Approaches to Disaster Risk Reduction: Disaster Cycle – its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural-nonstructural measures, roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders.

Unit IV Inter-relationship between Disasters and Development 06

Inter-relationship between Disasters and Development: Factors affecting vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources.

Unit V Disaster Risk Management in India

08

Disaster Risk Management in India: Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation).

Unit VI Project Work: (Field Work, Case Studies)

08

The project /fieldwork is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located. A few ideas or suggestions are discussed below.

Several governmental initiatives require Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) to be proactive in preparing DM Plans and community based disaster preparedness plans. Information on these would be available with the district Collector or Municipal Corporations. The scope for students to collaborate on these initiatives is immense. Teachers may explore possibilities.

Teachers could ask students to explore and map Disaster prone areas, vulnerable sites, vulnerability of people (specific groups) and resources. The students along with teachers could work on ways of addressing these vulnerabilities, preparing plans in consultation with local administration or NGOs.

Students could conduct mock drills in schools, colleges or hospitals. They could also work on school safety, safety of college buildings) training in first aid.

Other examples could be- identifying how a large dam, road/ highway or an embankment or the location of an industry affects local environment and resources or how displacement of large sections of people creates severe vulnerabilities may be mapped by student project work.

Text Books:

1. Alexander David, Introduction in 'Confronting Catastrophe', Oxford University Press, 2000

2. Andharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social Sciences Working Paper no. 8, 2008
3. Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.
4. Coppola P Damon, 2007. Introduction to International Disaster Management,
5. Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
6. Cuny, F. 1983. Development and Disasters, Oxford University Press.

Reference Books:

1. Document on World Summit on Sustainable Development 2002.
2. Govt. of India: Disaster Management Act 2005, Government of India, New Delhi.
3. Government of India, 2009. National Disaster Management Policy,
4. Gupta Anil K, Sreeja S. Nair. 2011 Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi
5. Indian Journal of Social Work 2002. Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April.
6. Kapur, Anu & others, 2005: Disasters in India Studies of grim reality, Rawat Publishers, Jaipur
7. Kapur Anu 2010: Vulnerable India: A Geographical Study of Disasters, IIA Sand Sage Publishers, New Delhi.
8. Parasuraman S, Acharya Niru 2000. Analysing forms of vulnerability in a disaster, The Indian Journal of Social Work, vol 61, issue 4, October.
9. Pelting Mark, 2003 The Vulnerability of Cities: Natural Disaster and Social Resilience Earthscan publishers, London
10. Reducing risk of disasters in our communities, Disaster theory, Tearfund, 2006.
11. UNISDR, Natural Disasters and Sustainable Development: Understanding the links between Development, Environment and Natural Disasters, Background Paper No. 5. 2002.
12. IFRC, 2005. World Disaster Report: Focus on Information in Disaster, pp.182-225.