Vels Institute of Science, Technology and Advanced Studies

Scheme for Revision of Syllabus 2015-16

B.Sc. – Biocomputing

Sl. No	Name of the Programme under Revision	Courses followed as per Regulation 2012-13	No of Credits	Revision of courses as per Regulation 2015-16	No of Credits	Percentage of Revision
1	First year syllabus and curriculum of B.Sc. Biocomputing revised as per the guideline of AICTE under regulation 2015.	English I	5	Fundamentals of Computer and statistical Analysis	5	45%
2		Fundamentals of Computer and statistical Analysis	6	Basics Concepts in Computer- Practical	5	
3		Basics Concepts in Computer-Practical	4	Computer Networks	5	
4		Fundamentals of Molecular Cell Biology and Biochemistry	6	Operating system	5	
5		Allied Biochemistry Practical	4	Introduction to Perl and Bioperl and CGI	2	
6		Programming in C	5	Introduction to Bioinformatics	4	
7		Programming in C –Practical	4	Python For Bioinformatics	4	
8		Programming with C++ with Data Structure	5	Enzymes and Metabolism	4	
9		Programming with C++ with Data Structure- Practical	3	Biodiversity Basics	4	
10		Computer Networks	3	Project Work		
11		Microbiology and Immunology	4			
12		Programming with Java	5			
13		Introduction to PERL, Bioperl and CGI	5			
14		Python For Bioinformatics	4			

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(Deemed to be University u/s 3 of the UGC Act, 1956)

PALLAVARAM - CHENNAI - INDIA

VELS UNIVERSITY

B.Sc.

BIOCOMPUTING

Curriculum and Syllabus

(Based on Choice Based Credit System)

Effective from the Academic year

2015-2016

Department of Bioinformatics

School of Life Sciences

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BSC BIOCOMPUTING

CURRICULUM

Total No of Credits: 140

SEMESTER I						
Category	**Code**	**Title of the Course**	**Hours / Week**			**Credit**
			Lecture	**Tutorial**	**Practical**	
AECC		LANGUAGE I (TAMIL / HINDI / FRENCH)	5	0	0	4
Core	15LEN001	FOUNDATION COURSE ENGLISH I	5	0	0	4
Core	15BBI001	FUNDAMENTALS OF COMPUTERS AND STATISTICAL ANALYSIS	6	0	0	4
Core	15BBI002	BASIC CONCEPTS IN COMPUTER – PRACTICAL	0	0	4	2
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE I	6	0	0	4
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE II	0	0	4	2
		Total	**22**	**0**	**8**	**20**

SEMESTER II						
Category	**Code**	**Title of the Course**	**Hours / Week**			**Credit**
			Lecture	**Tutorial**	**Practical**	
AECC		LANGUAGE II (TAMIL	5	0	0	4

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		/ HINDI / FRENCH)				
Core	15LEN002	FOUNDATION COURSE ENGLISH II	5	0	0	4
Core	15BBI003	PROGRAMMING IN C	5	0	0	4
Core	15BBI004	PROGRAMMING IN C – PRACTICAL	0	0	4	2
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE III	5	0	0	4
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE IV	0	0	4	2
SEC	----------	SKILL ENHANCEMENT COURSE I	2	0	0	2
		Total	**22**	**0**	**8**	**22**

SEMESTER III						
Category	**Code**	**Title of the Course**	**Hours / Week**			**Credit**
			Lecture	**Tutorial**	**Practical**	
AECC		LANGUAGE I (TAMIL / HINDI / FRENCH)	5	0	0	4
Core	15LEN003	FOUNDATION COURSE ENGLISH III	5	0	0	4
Core	15BBI005	PROGRAMMING WITH C++ AND DATA STRUCTURE	4	0	0	4
Core	15BBI006	PROGRAMMING WITH C++ AND DATA STRUCTURE – PRACTICAL	0	0	3	2
Core	15BBI007	COMPUTER	3	0	0	3

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		NETWORKS				
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE V	4	0	0	4
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE VI	0	0	4	2
GE	----------	GENERIC ELECTIVE I	2	0	0	2
		Total	**23**	**0**	**7**	**25**

SEMESTER IV						
Category	**Code**	**Title of the Course**	**Hours / Week**			**Credit**
			Lecture	**Tutorial**	**Practical**	
AECC		LANGUAGE IV (TAMIL / HINDI / FRENCH)	5	0	0	4
AECC	15EVS201	ENVIRONMENTAL STUDIES	2	0	0	2
Core	15LEN004	FOUNDATION COURSE ENGLISH IV	5	0	0	4
Core	15BBI008	PROGRAMMING WITH VISUAL BASIC AND RDBMS	3	0	0	3
Core	15BBI009	PROGRAMMING WITH VISUAL BASIC AND RDBMS – PRACTICAL	0	0	2	1
Core	15BBI010	OPERATING SYSTEMS	3	0	0	3
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE VII	4	0	0	4
DSE	----------	DISCIPLINE SPECIFIC ELECTIVE VIII	0	0	4	2

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GE	----------	GENERIC ELECTIVE II	2	0	0	2
		Total	**24**	**0**	**6**	**25**

SEMESTER V						
Category	**Code**	**Title of the Course**	**Hours / Week**			**Credit**
			Lecture	**Tutorial**	**Practical**	
Core	15BBI011	PROGRAMMING WITH JAVA	5	0	0	4
Core	15BBI012	PROGRAMMING WITH JAVA – PRACTICAL	0	0	3	2
Core	15BBI013	INTRODUCTION TO PERL, BIOPERL AND CGI	3	0	0	3
Core	15BBI014	INTRODUCTION TO PERL, BIOPERL AND CGI – PRACTICAL	0	0	3	2
Core	15BBI015	INTRODUCTION TO BIOINFORMATICS ALGORITHMS	5	0	0	4
Core	15BBI016	INTRODUCTION TO BIOINFORMATICS – PRACTICAL	0	0	3	2
Core	15BBI017	GENOMICS AND PROTEOMICS	4	0	0	3
GE	----------	GENERIC ELECTIVE III	2	0	0	2
SEC	----------	SKILL ENHANCEMENT COURSE II	2	0	0	2
		Total	**21**	**0**	**9**	**24**

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SEMESTER VI						
Category	**Code**	**Title of the Course**	**Hours / Week**			**Credit**
			Lecture	**Tutorial**	**Practical**	
Core	15BBI018	PYTHON FOR BIOINFORMATICS	4	0	0	4
Core	15BBI019	PYTHON FOR BIOINFORMATICS – PRACTICAL	0	0	3	2
Core	15BBI020	MOLECULAR BIOLOGY DATABASES	4	0	0	3
Core	15BBI021	SEQUENCE ANALYSIS – PRACTICAL	0	0	3	2
Core	15BBI022	INTRODUCTION TO MEDICAL TRANSCRIPTION AND CODING	4	0	0	3
Core	15BBI023	ENZYMES AND METABOLISM	3	0	0	3
Core	15BBI024	BIODIVERSITY BASICS	3	0	0	3
Core	15BBI025	PROJECT WORK	0	0	4	2
GE	----------	GENERIC ELECTIVE IV	2	0	0	2
		Total	**20**	**0**	**10**	**24**

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DISCIPLINE SPECIFIC ELECTIVES

1. 15BBI101 FUNDAMENTALS OF MOLECULAR CELL BIOLOGY AND BIOCHEMISTRY
2. 15BBI102 ALLIED BIOCHEMISTRY PRACTICAL
3. 15BBI103 MICROBIOLOGY AND IMMUNOLOGY
4. 15BBI104 INTRODUCTION TO MICROBIALINFORMATICS – PRACTICAL
5. 15BBI105 FUNDAMENTALS OF PLANT BIOINFORMATICS
6. 15BBI106 PLANT BIOINFORMATICS TECHNIQUES – PRACTICAL
7. 15BBI107 CHEMINFORMATICS
8. 15BBI108 CHEMINFORMATICS - PRACTICAL
9. 15BBI109 ALLIED MATHEMATICS
10. 15BBI110 MATHEMATICS FOR BIOINFORMATICS
11. 15BBI111 VIROLOGY
12. 15BBI112 BIOPHYSICAL CHEMISTRY
13. 15BBI113 CLOUD COMPUTING BASICS
14. 15BBI114 RECOMBINANT DNA TECHNOLOGY
15. 15BBI115 DATA WAREHOUSING AND DATA MINING

ABILITY ENHANCEMENT COMPULSORY COURSES

1. 15LTA001 TAMIL I
2. 15LTA002 TAMIL II
3. 15LTA003 TAMIL III
4. 15LTA004 TAMIL IV
5. 15LHN001 HINDI I
6. 15LHN002 HINDI II
7. 15LHN003 HINDI III
8. 15LHN004 HINDI IV
9. 15LFR001 FRENCH I
10. 15LFR002 FRENCH II
11. 15LFR003 FRENCH III
12. 15LFR004 FRENCH IV

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GENERIC ELECTIVES

1. 15BBI151 INTRODUCTION TO BIOINFORMATICS
2. 15BBI152 CHEMINFORMATICS
3. 15BBI153 MOLECULAR MODELING AND DRUG DESIGNING
4. 15BBI154 STRUCTURAL BIOINFORMATICS
5. 15BBI155 PROGRAMMING IN PERL AND BIOPERL
6. 15BBI156 PYTHON FOR BIOINFORMATICS

SKILL ENHANCEMENT COURSES

1. 15NSS255 NSS PAPER 1
2. 15NSS256 NSS PAPER 2
3. 15NSS257 NSS PAPER 3
4. 15NSS258 NSS PAPER 4
5. 15NSS259 NSS PAPER 5
6. 15NSS260 NSS PAPER 6
7. 15BPD251 PERSONALITY DEVELOPMENT PAPER I

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Fundamentals Of Computers And Statistical Analysis 6 0 0 4

Course Objectives:

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

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 TO STATISTICS 18

Statistical method- Definition and Limitations of Statistics, Misuses. Collection of Data-

Purpose of Inquiry, Scope of Inquiry, Sources of information, Sources of Secondary Data,

Collection of Primary Data, Direct Personal Investigation, Information through correspondents, Questionnaire by Mail, schedule sent through Investigators, Techniques to be followed by Field Investigators, Precautions for preparing Questionnaire, Statistical unit, Standard of Accuracy, Sample Questionnaire.

UNIT IV STATISTICAL CLASSIFICATION **15**

Classification- Quantitative Classification, Geographical Classification, Chronological Classification ,Tabulation, Frequency, Distribution, Diagrammatic Representation- Bar

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diagram, Percentage Bar Diagram, Pie Diagram, Pictogram, Graphical representation, Frequency curve , Cumulative Frequency (Ogive), Ogive,Lorenz Curve.

UNIT V MEAN, MEDIAN AND MODE **20**

Measures of Averages- Introduction, Arithmetic Mean, Weighted Arithmetic Mean, Formula for calculating AM in a frequency distribution, Properties of AM, Combined Mean, Geometric Mean Harmonic Mean , Merits and Demerits of AM, GM, HM, Median, Quartiles and Deciles, Mode , Its Merits and Demerits- mean, Median & Mode. Measures of Dispersion Introduction, Range, Its Merits and Demerits , Quartile Deviation , Its Merits and Demerits , Mean Deviation , Definition, Relative Measures, Its Merits and Demerits, standard Deviation, Formula for calculating SD , Merits and Demerits of SD, 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 3 edition, 2012

References:

1. SangheraKamaljeet, "Fundamentals of Computing", Kendall Hunt Publishing Company, 2007

2. Introduction To Computers And Information Technology By AnuragSeetha, Ram Prasad , 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.

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15BBI002 BASIC CONCEPTS IN COMPUTER - PRACTICAL

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: - Regular Usage – 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) 5

2. Downloading and installing software/plug-ins on Windows – Searching / Surfing on the WWW. 5

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

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• 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 15

• 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.

Total: 60 Hours

Text Book:

Anita Goel, "Computer Fundamentals", Pearson Education India, 2010

Reference Books:

1. SangheraKamaljeet - Fundamentals of Computing –. Kendall Hunt Publishing Company, 2007

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2. Introduction To Computers And Information Technology By AnuragSeetha, Ram Prasad , McGraw Hill 2011.

15BBI007 COMPUTER NETWORKS 3 0 0 3

Course Objectives: (Employability)

• To describe the following terms: computer network, LAN, WAN, MAN, internet, protocol, topology, media, peer-to-peer network, server based network.

UNIT I INTRODUCTION TO COMPUTER NETWORKS

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 II COMMUNICATION MEDIA 8

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 III DATA LINK LAYER 10

Data Link Layer: Logical Link Control, Media Access Control, Services of DLL – framing – flow control – error control – Error detection codes – Error correction codes – Multi Access. DLL Protocol: – Stop and Wait protocol –sliding window protocol - DLL in the internet.

UNIT IV NETWORK LAYER 10

Network Layer: Services of network layer - routing – shortest path routing - Network layer in the internet – IP protocol –IP address – subnets – internet control protocol. Transportation Layer: services of transportation layer – addressing – flow control – buffering –Multiplexing.

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UNIT V APPLICATION LAYER 9

Application layer: Definition, Application Data and Information, Application Layer Protocols, DNS – name space – resource – records – name Servers - Email – architecture and services – user agent – message Format and transfer. WWW client and Server sides – locating information on the web.

Total: 45 Hours

Text Book:

Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, Pearson Education, 2003.

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. Andrew S. Tanenbaum, "Computer Networks", Third Edition, Eastern Economy Publication, 1996

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15BBI011 PROGRAMMING WITH JAVA 5 0 0 4

Course Objectives: (Employability)

• To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.

UNITI 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

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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 PROGRMMING 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

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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

15BBI012 PROGRAMMING WITH JAVA AND BIOJAVA – PRACTICAL 0 0 3 2

Course Objective: (Skill Development)

• To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.

• Have the ability to write a computer program to solve specific problems

1) Operators and Expressions 3

2) Branching and Looping 3

3) Classes and Objects 3

4) Packages 3

5) Formatting Data 3

6) Sort 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)Reading or writing Fasta files using Biojava? 5

11)Comparing two Sequences. 4

12) Translating DNA sequence into Protein sequence in Java 4

Text Book:

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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.

15BBI013 INTRODUCTION TO PERL, BIOPERL AND CGI 3 0 0 3

Course Objectives:

• 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 8

Introduction:- Scalar Data- Numbers, Strings, Scalar Variables, Output with print, Getting User Input, The chomp operator, undef Value, defined function, The if and while control structures, Lists and Arrays:- Accessing elements of an array, Special Array indices, List Literals, List Assignment, Subroutines:- Defining a subroutine, Invoking a subroutine, Return values, Arguments, Private variables in subroutines, the return operator.

UNIT II EXPRESSIONS AND FILES 8

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, 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.

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UNIT III CONTROL STRUCTURES AND PERL MODULES 10

Control Structures:- The unless Control Structure, The until Control Structure, Expression

Modifiers, The Naked Block Control Structure, The else if Clause, Auto Increment and Auto Decrement, The for Control Structure, Loop Controls, Logical Operators, File Tests:- File Test Operators, The stat and lstat functions, The localtime function, Bitwise Operators, Using the Special Underscore Filehandle, Strings and Sorting:- Finding a Substring with index, Manipulating a Substring with substr, Formatting Data with sprint, Advanced Sorting, Perl Modules:- Finding Modules, Installing Modules, Using Simple Modules.

UNIT IV INTRODUCTION TO BIOPERL 9

Bioperl:- Introduction, Installing Bioperl, General Bioperl Classes, Sequences (Bio::Seq Class,

Sequence Manipulation), Features and Location Classes (Extracting CDS), Alignments

(AlignIO), Analysis (Blast, Genscan), Databases (Database Classes, Accessing a local database),

Implementing REBASE.

UNIT V COMMON GATEWAY INTERFACE 10

Common Gateway Interface:- Web Servers and Browsers, HTML tags, table, frames, form

elements, GET, POST & HEAD Method, URL Encoding, CGI Environment Variables, Handling

forms, Accessing form Input, Extra Path Information, CGI.pm Module, Passing Parameters via

CGI, Less Typing, Sever Side Includes, Debugging CGI programs, Stepping through programs,

Breakpoints, Line Action

Total: 45 Hours

Text Book:

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

2001

References:

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.

INTRODUCTION TO BIOINFORMATICS ALGORITHMS

UNIT I Algorithms and Complexity

Algorithms and Complexity:- What Is an Algorithm?, Biological Algorithms versus Computer Algorithms, The Change Problem, Correct versus Incorrect Algorithms, Recursive Algorithms, Iterative versus Recursive Algorithms, Big-O Notation, Molecular Biology Primer:- What Is Life Made Of?, the Genetic Material, What Do Genes Do?Molecule Codes for Genes?Structure of DNA, How Are Proteins Made?, Analyzing DNA:- Copying DNA, Cutting and Pasting DNA, Measuring DNA Length, Probing DNA. Anatomy of Proteins-Primary sequences, Secondary structure, Motifs, Domains, Tertiary and quaternary structures.

UNIT II MAPPING ALGORITHMS 15

Exhaustive Search:- Restriction Mapping, Impractical Restriction Mapping Algorithms, A

Practical Restriction Mapping Algorithm, Regulatory Motifs in DNA Sequences, Profiles, The Motif Finding Problem, Search Trees, Finding Motifs, Greedy Algorithms:- History of Genome Rearrangements, Sorting by Reversals, Approximation Algorithms, A Greedy Approach to Motif Finding.

UNIT III DYNAMIC PROGRAMMING ALGORITHM 15

Dynamic Programming Algorithms:- Sequences- The Power of DNA Sequence Comparison,

The Manhattan Tourist Problem, Homology, similarity- Sequence alignment- Pair wise sequence alignment- Global alignment- Local alignment- Multiple Sequence alignment-

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Multiple alignment programs, Scoring Alignments, Gene Prediction, Similarity-Based Approaches to Gene Prediction, Spliced Alignment.

UNIT IV DIVIDE AND CONQUER, PATTERN MATCHING 15

Divide-and-Conquer Algorithms:- Divide-and-Conquer Approach to Sorting, Space-Efficient

Sequence Alignment, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Subquadratic Time, Combinatorial Pattern Matching:- Repeat Finding, Hash

Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, BLAST: Comparing a Sequence against a Database.

UNIT V HIDDEN MARKOV MODELS 10

Hidden Markov Models:- History, Architecture , Inference, A Concrete Example, Learning,

The Fair Bet Casino And Hidden Markov Models, Types, Extensions, Decoding Algorithm,

HMM Parameter Estimation, Profile HMM Alignment Applications, Randomized Algorithms:- History, Motivation, Computational complexity, The Sorting Problem Revisited, Gibbs Sampling, Random Projections, Examples, Derandomization.

Total: 75 Hours

Text Book:

Ignacimuthu, S, “Basic Bioinformatics”, 1st Edition, Narosa Publishing House, New Delhi,

India. 2005

Reference:

1. IstvánMiklós, “Introduction to algorithms in bioinformatics”, Rényi Institute, Spring,

2010.

2. Krane, DE; Raymer, ML, “Fundamental concepts of Bioinformatics”, Benjamin

Cummings, 2003

3. Lesk, A.M. “Introduction to Bioinformatics:, 1st Edition, Oxford University Press,

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Oxford, UK, 2002

4. N. Gautham, “Bioinformatics”, Narosa Publishing Company, New Delhi, 2006.

15BBI107 Programming in Python

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.

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

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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.

Unit V Modules and Packages 06

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.

15BBI019 PYTHON FOR BIOINFORMATICS - PRACTICAL 0 0 3 2

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

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techniques and Python modules that are particularly useful for bioinformatics programming.

1. Program to find complement and reverse complement for given DNA Sequence. 3

2. Program to find Frequency of amino acids in the given protein sequence. 3

3. Program to translate the given DNA sequence into protein sequence. 3

4. Program to find the simple similarities between the given two DNA or Protein Sequences. 3

5. Program to compute the sum of the given two matrices. 3

6. Program to compute transpose of a matrix. 3

7. Extract the author from the Genbank file using Biopython. 3

8. Extract the accession number from the Genbank file using BioPython. 3

9. Program to find the given sequence in the existing sequence. 3

10. Program to implement the various math operations. 3

11. Program to find the Gene Location 3

12. Program to read the Genbank file. 4

13. Program to read DNA sequence from the Genbank file and make complement it and save the complemented sequence in separate file. 4

14. Program to find two Protein sequence from PDB and compare it. 4

Total: 45 Hours

Text Book:

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

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References:

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

15BBI020 MOLECULAR BIOLOGY DATABASES 4 0 0 3

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).

• To search and retrieve data from the databases using their respective search engines.

UNIT I DATABASE CONCEPTS 12

Database in general – definitions and examples – Computerized databases – advantages and disadvantages – need for database models and systems – examples of logical models – hierarchical, network and relation models – RDBMS – objected oriented models – primary and secondary (derived)database – structure and sequences database – growth of databases, Gene Ontology classifications

UNIT II MOLECULAR BIOLOGY DATA TYPES 12

Brief descriptions of the various types of data used in modern Molecular Biology and how they are obtained, stored, represented and retrieved – organisms – genome maps – DNA,RNA and protein sequences – RNA secondary structure – protein secondary and tertiary structure – DNA and protein sequence motifs – protein and RNA structure motifs – RNA and protein-

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protein interaction data – mutations and polymorphiosms in sequences and structures – tissues and cells – populations.

UNIT III PRIMARY SEQUENCES DATABASES 12

DNA sequence databases – GenBank, EMBl, DDBJ – details of structure of GenBank – Difference with and links to other databases – protein sequence databases – Swissprot, PIR – details of arrangement of data in Swissprot – differences and links to other databases – TrEMBL database

UNIT IV DERIVED SEQUENCE DATABASE 12

Subcollections of data – Flybase – AceDB, Wormbase – comprehensive microbial genome, omniome – organelle genome database, GOBASE – eukaryotic promoter database – Codon usage table database – Exon-Intron database – examples of protein sequence sub collections – GPCR sequence database – human unidentified gene – encoded large protein sequence database; HUGE – CluSTr and COGS – database of protein sequence patterns and motifs - PRINTS,ROSITE,Pfam,ProDom.

UNIT V STRUCTURAL DATABASE 12

Nature of structural data – coordinate systems – primary structure database – PDB,CSD – details of arrangement of data in PDB with examples – access to PDB and CSD – derived structure database, NDB – structural patterns and motifs – SCOP – CATH – FSSP – PALI – DSSP, Drug bank, ligand depot, Querying chemical database.

Text Book:

D.Higgins and W.Taylor.(eds), 'Bioinformatics: Sequences, Structues and databanks'oxford University Press, Oxford, UK. 2008.

References Books:

1. N.Gautham, "Bioinformatocs" Narosa Publishing Company, New Delhi, 2006

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2. V.R.Srinivas, ”Bioinformatics: Sequences and genomics analysis” cold Spring Harbor Laboratory press,Cold Spring harbor,USA, 2005

15BBI021 SEQUENCE ANALYSIS - PRACTICAL 0 0 3 2

Course Objective: (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.

1. Sequence similarity searching (NCBI BLAST). 6

2. Protein sequence analysis (ExPASy proteomics tools). 6

3. Multiple sequence alignment (Clustal). 6

4. Molecular phylogeny (PHYLIP). 5

5. Analysis of protein and nucleic acids sequences. 5

6. Sequence analysis using EMBOSS or GCG Wisconsin Package. 5

7. Development of programs in the analysis of nucleic acid sequences – such as protein coding regions in prokaryotes. 6

8. Programs to calculate potential energy of regular structures such as Collagen triple helix, DNA double helix, and their visualization in wire and stick model as well as space filling model. 6

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Total: 45 Hours

Text Book:

D.Higgins and W.Taylor.(eds), 'Bioinformatics: Sequences, Structues and databanks'oxford University Press, Oxford, UK. 2008.

References Books:

1. Nucleic Acids Research (January 2008) NUMBER 1. Database Issue, this issue is available online for free and open access at the following url http://nar.oxfordjournals.org/content/vol34/suppl_1/index.dtl)

2. N.Gautham(2006)"Bioinformatocs" Narosa Publishing Company, New Delhi.

3. V.R.Srinivas (2005)"bioinformatics: Sequences and genomics analysis" cold Spring Harbor Laboratory press,Cold Spring harbor,USA

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15BBI023 ENZYMES AND METABOLISM 3 0 0 3

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 a wide range of enzymatic activities of different protein classes and their metabolism which are responsible for causing Disorder.

UNIT I INTRODUCTION TO ENZYMES 10

Introduction to enzymes, nomenclature, classification, riboenzyme, 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, multienzyme system and bisubstrate reactions, catalytic mechanisms, regulatory enzymes and immobilised 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 pyramidines, neucleosides and nucleotides. Clinical correlation of purine and pyrimidine metabolism. Nucleotides as coenzymes.

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UNIT III CARBOHYDRATE METABOLISM 8

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,

UNIT IV LIPID METABOLISM 8

Digestion and absorption of lipids. Introduction to lipid metabolism, β-Oxidation of fatty acids, Ketogenesis. Biosynthesis of fatty acids, Triacylglycerols and prostaglandins. Metabolism of phospholipids, glycolipids and cholesterol. Lipoproteins: Metabolism of HDL, Disorder of Plasma Lipoproteins, Fatty liver, Obesity, Atherosclerosis, Tay – Sachs disease, Gaucher's disease, Niemann – Pick disease.

UNIT V PROTEIN METABOLISM 9

Digestion and absorption of proteins. General aspects of amino acids metabolism; deaminaton, transamination, transmethylation, transpeptidation, and decarboxylation. Metabolism of ammonia: urea cycle and its regulation, Nitrogen balance, biosynthesis of non-essential amino acids. Metabolic breakdown of individual amino acids. Clinical correlations of protein metabolism. Integration of metabolism.

Text Book

Lehninger, A. L. 1984. Principles of Biochemistry. CBS publishers and distributors, New Delhi,

India

Reference books:

1. C. K. Mathews, K. E. Van Holde, & K.G. Ahern, "Biochemistry", Third Edition,

Prentice Hall, 1999.

2. Shanmughavel P, "Principles of Bioinformatics", Pointer Publishers, Jaipur, India. 2005.

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15BBI024 **BIODIVERSITY BASICS**

Course Objective: (Employability)

• To make the students to understand the protection, preservation, management or restoration of natural resources.

• Encourage students to utilize the natural resources in a sustainable way and to make them to know about preservation of all varieties of old and new flora, fauna and microbes.

UNIT I INTRODUCTION TO BIODIVERSITY 9

Definitions, Basic Concept Of Biodiversity Distribution - Latitudinal Gradients, Hotspots, Evolution And History - Evolutionary Diversification, Biodiversity And Ecosystem Services -The Balance Of Evidence, Biodiversity And Agriculture, Biodiversity And Human Health, Biodiversity, Business And Industry, Biodiversity, Leisure, Cultural And Aesthetic Value, Biodiversity And Ecological Services

UNIT II PATTERNS OF BIODIVERSITY 9

Global Patterns Of Biodiversity – Measuring Biodiversity, Cataloging And Discovering Species, Geographical Patterns Of Species Richness, Biogeography, Importance Of Distribution Patterns(Local Endemics, Sparsely Distributed Species, Migratory Species),

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GAP Analysis. Why Should We Conserve It, Elements Of Biodiversity - Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity, Patterns Of Species Diversity,

UNIT III BIODIVERSITY CONSERVATION 9

Biodiversity & Conservation – Overexploitation Threatening Living Species, International

Trade, Animals Threatened By International Trade, Controlling International Trade(Enforcement, Reservations, Illegal Trade), Free Trade & The Environment, Free Trade & Conservation, Common Patterns Of Overexploitation, Number Of Species, Species Loss Rates, Resource Allocation, Analytical Limits - Taxonomic And Size Relationships.

UNIT IV EXOTIC SPECIES 9

Exotic Species – Plants, Invertebrates, Fishes, Amphibians, Reptiles, Birds, Mammals, Detrimental. Effects Of Exotic Species. Endangered Species Conservation – The US Endangered Species Act, State Endangered Species Acts Successes And Failures Of The Endangered Species Act, Role Of ESA In Habitat Protection, Critical Habitat. Biodiversity In India.

UNIT V ETHICS OF CONSERVATION 9

Introduction of Biodiversity, Terminology of Biodiversity, Practice of Biodiversity Ethics of

Conservation – Values of Biodiversity, Biopiracy, Hybridized plants, GM crops (benefits &

criticism), Economic Value of Biodiversity & Legal issues related to uses of biodiversity, Ethical issues related to uses of biodiversity and Conservation issues related to uses of biodiversity, Global Conservation Issues.

Text Book:

1. James Maclaurin and Kim Sterelny, “What is Biodiversity?”, University of Chicago

Press, 2008. ISBN:9780226500812

References:

1. John Spicer. Biodiversity. Oneworld Publications 2009 ISBN: 1851684719

2. Prakash Chandra. India Biodiversity & Wildlife Sanctuaries Neha Publishers &

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Distributors 2010. ISBN: 9789350531860.

3. Balakishan , Biodiversity Conservation. Neha Publishers & Distributor 2004

ISBN: 9789350531860

4. Pullaiah, T. and Reddy, K. Jaganmohan, “Biodiversity in India: Volume 6”, ASTRAL

Publishers, 2013.

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