KANNUR UNIVERSITY

(Abstract)

BSc Bioinformatics Programme - Revised Scheme, Syllabus& Model Question Papers of Core, Complementary and Open Courses under Choice Based Credit Semester System for Under Graduate Programme - implemented with effect from *2014 admission - Orders Issued.*

ACADEMIC BRANCH

No. Acad/C2/13502/2014 Dated, Civil Station P.O, 24 -10-2014

Read: 1.U.O No. Acad/C2/2232/2014 dated 14-03-2014

2. Minutes of the meeting of the Faculty of Technology held 01-04-2014

3. Letter dated 18-10-2014 from the Chairman, BOS in Biotechnology (Cd)

ORDER

1. The Revised Regulations for UG Programme under Choice based Credit Semester System were implemented in this University with effect from 2014 admission as per paper read (1) above.

2. As per read (2) above the Faculty of Technology held on 01-04-2014 approved Scheme, syllabus & model question papers for core/complementary & open courses of BSc Bioinformatics programme to be implemented with effect from 2014 admission.

3. The Chairman, Board of Studies in Biotechnology (Cd) vide paper read (3) above has submitted the finalized copy of Scheme, syllabus & Model question papers for core/complementary and open courses of BSc Bioinformatics programme for implementation with effect from 2014 admission.

4. The Vice Chancellor, after examining the matter in detail, and in exercise of the powers of the Academic Council as per section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction to implement the revised scheme, syllabus & model question papers of BSc Bioinformatics Programme with effect from 2014 admission.

5. Orders, are therefore issued implementing the revised scheme, syllabus & model question papers for core, complementary& open courses of BSc Bioinformatics programme under CBCSS with effect from 2014 admission subject to report to Academic Council

6. Implemented revised Scheme, Syllabus & Model Question Papers are appended.

Sd/-
DEPUTY REGISTRAR (ACADEMIC)
FOR REGISTRAR

To:

1. The Principals of Affiliated Colleges offering B.Sc Bioinformatics Programme
2. The Examination Branch (through PA to CE)

Contd.....2

Copy To:

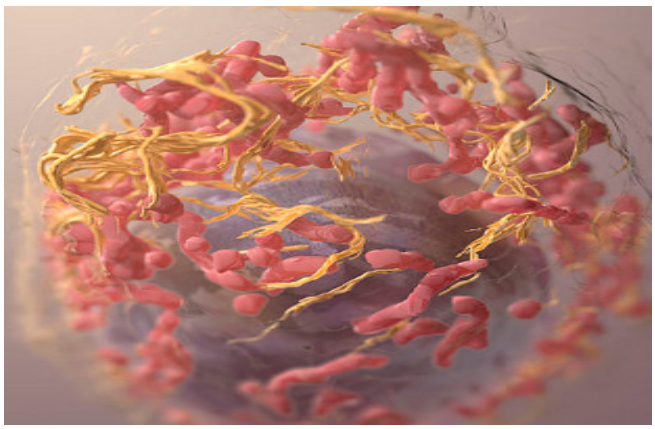
1. The Chairman, BOS in Biotechnology (Cd)
2. PS to VC/PA to PVC/PA to Registrar
3. DR/AR I Academic
4. Central Library
5. SF/DF/FC.
6. Computer Programmer
   (For Uploading in the Web Site)

Approved/By Order

Section Officer

❖ ***For more details log on to www.kannur university.ac.in***

KANNUR UNIVERSITY
KANNUR
PIN-670567
Date:.....
MANGATTUPARA



SCHEME, COURSES, CREDIT DISTRIBUTION & SYLLABUS

B.Sc. BIOINFORMATICS PROGRAMME

In

KANNUR UNIVERSITY

(KUCBSS-UG-2014 ADMISSION ONWARDS)

SCHEME, COURSES & CREDIT DISTRIBUTION FOR B.Sc. BIOINFORMATICS PROGRAMME (KUCBSS-UG-2014 ADMISSION ONWARDS)

CREDIT DISTRIBUTION

Sem	Common Course		Core Course	Complementary Course		Open Course	Total
	English	Additional Language	Bioinformatics	Physics	Chemistry		
I	4+3	4	3	2	2		18
II	4+3	4	3	2	2		18
III	4	4	3	2	2		15
IV	4	4	3+4	2+4	2+4		27
V			3+3+3+3+3			2	17
VI			3+3+3+3+3 4+4+2				25
Total	22	16	56	12	12	2	120

TABLE OF CORE COURSES

Sl.No.	Semester	Course code	Name of the course	Credit	Hours /week	Exam hours	Max. Marks		
							Int	Ext	Total
1	I	1B01BIF	Methodology & perspectives of sciences	3	3	3	10	40	50
2	II	2B02BIF	Computer fundamentals	3	3	3	10	40	50
3	III	3B03BIF	Programming concepts and C language	3	3	3	10	40	50
4	IV	4B04BIF	Informatics and introduction to Bioinformatics	3	3	3	10	40	50
5	IV*	4B05BIF	Bioinformatics Practical I	4	1,1, 2,4	3	10	40	50
6	V	5B06BIF	Introductory Statistics	3	3	3	10	40	50
7	V	5B07BIF	Cell biology	3	3	3	10	40	50
8	V	5B08BIF	Biochemistry	3	3	3	10	40	50
9	V	5B09BIF	Structural Bioinformatics I	3	3	3	10	40	50
10	V	5B10BIF	Biological databases	3	3	3	10	40	50
11	V	5D01BIF/ 5D02BIF	Open Course: Molecular Modeling & Drug Designing / Perl Programming	2	2	3	5	20	25
12	VI	6B11BIF	Molecular Biology	3	3	3	10	40	50
13	VI	6B12BIF	Genetics	3	3	3	10	40	50
14	VI	6B13BIF	Sequence analysis	3	3	3	10	40	50
15	VI	6B14BIF	Genomics and proteomics	3	3	3	10	40	50
16	VI	6B15BIF	Structural Bioinformatics II	3	3	3	10	40	50
17	VI**	6B16BIF	Bioinformatics Practical II	4	4,4	3	10	40	50
18	VI**	6B17BIF	Bioinformatics Practical III	4	4,4	3	10	40	50
19	VI	6B18BIF	Project work	2	2	3	5	20	25

* Teaching hours are distributed in 1st, 2nd, 3rd and 4th semesters

** Teaching hours are distributed in 5th and 6th semesters

COURSE STRUCTURE

SEMESTER-I

Sl.No.	Course code	Name of the course	Credit	Hours/ week	Exam hours	Max. Marks		
						Int	Ext	Total
1		Common course (English)	4	5	3	10	40	50
2		Common course (English)	3	4	3	10	40	50
3		Common course (additional language)	4	4	3	10	40	50
4	1B01BIF	Methodology & perspectives of sciences	3	3	3	10	40	50
5	4B05BIF	Bioinformatics Practical I		1				
6		Complementary 1 (course 1)	2	2	3	8	32	40
7		Complementary 2 (course 1)	2	2	3	8	32	40
8		Complementary 1 (practical)		2				
9		Complementary 2 (practical)		2				
		TOTAL				56	224	280

SEMESTER II

Sl.No.	Course code	Name of the course	Credit	Hours/ week	Exam hours	Max. Marks		
						Int	Ext	Total
1		Common course (English)	4	5	3	10	40	50
2		Common course (English)	3	4	3	10	40	50
3		Common course (additional language)	4	4	3	10	40	50
4	2B02BIF	Computer fundamentals	3	3	3	10	40	50
5	4B05BIF	Bioinformatics Practical I		1				
6		Complementary 1 (course 2)	2	2	3	8	32	40
7		Complementary 2 (course 2)	2	2	3	8	32	40
8		Complementary 1 (practical)		2				
9		Complementary 2 (practical)		2				
		TOTAL				56	224	280

SEMESTER III

Sl.No.	Course code	Name of the course	Credit	Hours/ week	Exam hours	Max. Marks		
						Int	Ext	Total
1		Common course (English)	4	5	3	10	40	50
3		Common course (additional language)	4	5	3	10	40	50
4	3B03BIF	Programming concepts and C language	3	3	3	10	40	50
5	4B05BIF	Bioinformatics Practical I		2				
6		Complementary 1 (course 3)	2	3	3	8	32	40
7		Complementary 2 (course 3)	2	3	3	8	32	40
8		Complementary 1 (practical)		2				
9		Complementary 2 (practical)		2				
		TOTAL				46	184	230

SEMESTER IV

Sl.No.	Course code	Name of the course	Credit	Hours/week	Exam hours	Max. Marks		
						Int	Ext	Total
1		Common course (English)	4	5	3	10	40	50
3		Common course (additional language)	4	5	3	10	40	50
4	4B04BIF	Informatics and introduction to Bioinformatics	3	3	3	10	40	50
5	4B05BIF	Bioinformatics Practical I	4	2	4	10	40	50
6		Complementary 1 (course 4)	2	3	3	8	32	40
7		Complementary 2 (course 4)	2	3	3	8	32	40
8		Complementary 1 (practical)	4	2	3	8	32	40
9		Complementary 2 (practical)	4	2	3	8	32	40
		TOTAL				72	288	360

SEMESTER V

Sl.No.	Course code	Name of the course	Credit	Hours/week	Exam hours	Max. Marks		
						Int	Ext	Total
1	5B06BIF	Introductory Statistics	3	3	3	10	40	50
3	5B07BIF	Cell biology	3	3	3	10	40	50
4	5B08BIF	Biochemistry	3	3	3	10	40	50
5	5B09BIF	Structural Bioinformatics I	3	3	3	10	40	50
6	5B10BIF	Biological databases	3	3	3	10	40	50
7	6B16BIF	Bioinformatics Practical II		4				
8	6B17BIF	Bioinformatics Practical III		4				
9	5D01BIF/ 5D02BIF	Open Course: Molecular Modeling & Drug Designing /Perl Programming	2	2	3	5	20	25
		TOTAL				55	220	275

SEMESTER VI

Sl.No.	Course code	Name of the course	Credit	Hours/ week	Exam hours	Max. Marks		
						Int	Ext	Total
1	6B11BIF	Molecular Biology	3	3	3	10	40	50
3	6B12BIF	Genetics	3	3	3	10	40	50
4	6B13BIF	Sequence analysis	3	3	3	10	40	50
5	6B14BIF	Genomics and proteomics	3	3	3	10	40	50
6	6B15BIF	Structural Bioinformatics II	3	3	3	10	40	50
7	6B16BIF	Bioinformatics Practical II	4	4	3	10	40	50
8	6B17BIF	Bioinformatics Practical III	4	4	3	10	40	50
9	6B18BIF	Project work	2	2	3	5	20	25
		TOTAL				75	300	375

1B01BIF:
METHODOLOGY AND PERSPECTIVES OF SCIENCES

Module 1: science and science studies
Types of knowledge: Practical, theoretical and scientific –information, what is science? Laws of sciences, basis for scientific laws and factual truth, scientific temper, science disciplines, empiricism, science and technology.

Module 2: Methods and tools for science
Hypothesis: theories and laws in sciences,observations,evidences and proofs ,peer review, posing a question, formulation of hypothesis, hypothetico deductive model, inductive model, significance of verification(proving),corroboration and falsification(disproving),auxiliary hypothesis,adhoc hypothesis.
Revision of scientific theories and laws. Importance of models, simulations and virtual testing, mathematical models versus scientific methods.

Module 3: Experimentations in science
Design of an experiment: experimentation, observation, data collection, interpretation and deduction Need of units and dimension, repeatability and replication, documentation of experiments, record keeping, connection between measurements and underlying theory.
Types of experiment: experiments to test a hypothesis, to measure a variable or to gather data by preliminary and explorative experiments, Planning of experiments: design, selection of controls, observational requirements, instrumental requirements, Making observations: direct and indirect observations, controlled and uncontrolled observation, human and machine observations, accuracy and precision, robotics

Module 4: data handling
Documentation of experiments ,nature and types of data-typical examples, data acquisition, treatment of data, data interpretation ,significance of statistical tools in data interpretation, errors and inaccuracies ,instrumental errors and variables, human errors(basic idea), Reporting of observational and experimental data, human bias, biased observation, influence of observer on observation, using and acknowledgement observation by others, publication and patents, plagiarism

Module 5:
Ethics in sciences: scientific information, depositories of scientific Information, Primary, secondary and digital sources, sharing of knowledge: transparency and honesty, danger of preconceived ideas.

REFERENCE BOOKS:

1. Gierynt. Cultural Boundaries of Sciences-univ.og Chicago
2. Collins H and T.Pinch .The Golem :what Everyone should know about science-cambridge Univ.press
3. Hewitt,paul GF,Suzannae lyons-wesley,2007
4. Newton R G the truth of science

2B02BIF:
COMPUTER FUNDAMENTALS

Module 1: Introduction to computer : Definition of computer, characteristics, limitations, capabilities of computers, evaluation, generation , classification based on size and purpose, applications of computers in various fields

Module 2: Structure of computer: Block diagram and functions of units, Input Unit – ALU, Memory Unit, Control Unit, motherboard, SMPS, Expansion Slots, Serial and Parallel ports, USB. Concept of Memory: Primary Memory – RAM, ROM, EPROM, PROM. Secondary Storage devices: - Magnetic disk, Magnetic tape, Floppy disk, Pendrive, DVD/CD ROM, Cache memory RAM, ROM, PROM, EPROM.

Module 3: Input and Output Devices: Keyboard, Mouse, Light pen, Joystick, Touch screen, Digitizer, Scanner, MICR, OMR, Barcode reader and Mike. VDU, Printers – Dot-matrix, Inkjet, Laser, Line, Plotters.

Module 4 - Numbering System and Boolean Algebra: BCD, EBCDIC, ASCII, Gray Code, Excess 3- code, Bit, Byte, Word. Number System – Binary, Octal, Decimal, Hexadecimal Conversion of Number, System, Binary Arithmetic – addition, subtraction, multiplication, division, ones and two's nine's and ten's compliment. Boolean Algebra: Postulates of Boolean algebra

Module 5- Logic Gates: AND, OR, NOR, NAND, NOT, EX- OR, Universal gates. Construction of circuit using Logic gates

Module 6 - Introduction to Operating Systems: Definition and Functions of O.S. Types of O.S. –Single user, Multi-user, Graphical User interface. Disk Operating System (DOS): Dos internal and external commands, Batch files commands, concept of directory and file, DOS Commands: Internal-DIR, CLS, TIME, DATE, VOL, VER, DATE, TYPE, REN, ERASE, COPY and External: CHKDSK, FORMAT, DISKCOMP, DISKCOPY.

REFERENCE BOOKS:

1. Computer Today --Basundra
2. Fundamentals of computers --V. Rajaraman.
3. Computer Fundaments -- P.K. Sinha.
4. Computer Fundamentals (Architecture and Organization)– B. Ram
5. Microsoft Office 2000 – Vipra Computers
6. Computers Today – S. Basandra (Galgotia Pub)
7. Digital Fundamentals - Floyd.
8. Digital Principles and Applications - A. P. Malvino & D.P.Leach (TMH).
9. Modern digital Electronics (2nd Edn.) R. P. Jain.

3B03BIF:
PROGRAMMING CONCEPTS AND C LANGUAGE

Module 1: Introduction to programming
Steps involving in problem solving, problem definition ,algorithm, charts, definition, symbol, running and debugging ,computer languages-low , assembly,, high level, compiler and interpreter

Module 2: introduction to C language:
History,character set,C tokens,constants,variables,keywords and comments, instruction:type declaration instruction, arithmetic instruction,integer and float conversion,hierarchy of operation,control instructions in C

Module 3: operators
Arithmetic, logical, relational, bitwise, increment, decrement, conditional operators,special operators,decision control structure –If statement-types of If statements, loop control structures : the while loop,for loop,do while loop,break ,continue,go to label statements,switch statement,case control structure.

Module 4: arrays, strings and function &pointers
Arrays,array initialization,types of array,strings,strlen(),strcmpy(),strcmp(),strcat() ,function definition,declaration,passing values,scopes,call by values,call by reference,pointers,pointer notation,recursion,back to function call,pointers and array,array of pointers to strings(examples)

REFERENCE BOOKS:

1. The C Programming Language (Ansi C Version) (English) 2nd Edition (Paperback) by Brian W. Kernighan, Dennis M. Ritchie
2. Data Structures Through C In Depth 2 Edition (English) 2nd Edition (Paperback) by SRIVASTAVA
3. Let Us C (English) 13th Edition (Paperback) by Yashavant Kanetkar

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4B04BIF:
INFORMATICS AND INTRODUCTION TO BIOINFORMATICS

Module 1: Introduction to Internet: TPC/IP, WWW, FTP, registration with ISP, Internet connection wizard, URL, http, internet access methods:-dial-up, DSL, cable, ISDN, Wi-Fi

Module 2: Web server: Role of web server, a brief introduction to Apache. Introduction to PSW, capabilities of PSW, installation of PSW, role of COI program, Configuring PSW for Perl/CGI, configuring system Data Source Name (DSN)

Module 3: HTML: Introduction, common tags, creation of hyper link, incorporation of images, Tables, Frames, formatting text with font, creating web pages from information contained in a data base, creation of internet database connection file. Introduction to XML and its differences with HTML

Module 4: Introduction to Bioinformatics: History, definition, importance and uses of Bioinformatics, Biological data, databases, protein and nucleic acid sequences.

Module 5: Human Genome Project: genes, genomes, Need of Human Genome Project, contribution of various countries, Rough and Final Draft of Human Genome Project, goals of HGP, uses and application.

REFERENCE BOOKS:

1. Internet and World Wide Web- how to program - H. M. Dietel, P. J. Dietel and T. R. Nieto,
2. Pearson Education India
3. Introduction to Bioinformatics By TK Attwood,DJ Parry-Smith and S Phukan
4. Bioinformatics : Sequence and Genome Analysis by David W Mount
5. Bioinformatics: Genes,Proteins,and Computers by CA Orengo,DT Jones and JM Thornton

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4B05BIF:
BIOINFORMATICS PRACTICAL –I

Program to carry out all basic arithmetic operations
Program to find whether the entered numbers are prime or not
Program to check whether the entered number is palindrome
Program to check whether the entered number is Armstrong or not
Program to check whether the entered string is palindrome
Program to find factorial of the number
Program for performing bubble sorting(ascending & descending) for numbers & strings
Program to find factorial of an integer using recursion
Program for matrix addition
Program for matrix multiplication
Program for string copying
Program for string concatenation
Program for reversing a DNA sequence

5B06BIF:
INTRODUCTORY STATISTICS

Module 1: Data collection: Scope of statistics in Biological and Medical sciences. Definition of population and sample, Collection of data: primary and secondary data, attributes and variables, qualitative and quantitative data. Types of data: ungrouped data, grouped data, discrete data and continuous data

Module 2: graphical and diagrammatic representation of statistical data: frequency distribution curve, cumulative frequency distribution, ogives, histogram, bar diagrams, Pi chart.

Module 2: measures of central tendency and dispersion: arithmetic mean, median, mode, (formulae, demerits, merits), Absolute and relative measures of dispersion: range, quartile deviation, variance, standard deviation. Coefficient of variation (examples)

Module 3: correlation
Definition, types of correlation between two variables, scatter diagrams, Karl Pearson's coefficient of correlation and Spearman's rank correlation (with examples)

Module 4: Probability
Random Experiments, sample space, event, elementary event, compound event, impossible events, certain events, equally likely events, mutually exclusive events, and exhaustive events, dependent and independent events, Probability: definition, addition and multiplication laws of probability with illustration, definition of conditional probability

REFERENCE BOOKS:

1. Marcello Pagano and Kimberlee Gauvreau, Principles of Biostatistics
2. Methi J. , Statistical Methods An Introductory Text. New Age international (p) Ltd.
3. Bhat. B. R. ,Srivenkatramana T. & Madhav Rao K. S. (1996) Statistics. A
4. Beginners Text. Vol . I New Age International (p) Ltd.
5. Ithal U. B. And Naik B. U., Statistical MethodS I, Phadake Prakashan, Kolhapur.
6. Ithal U. B. And Naik B. U., Statistical MethodS II, Phadake Prakashan, Kolhapur.
7. Gupta S. C. And V. K. Kapoor Fundamentals of Mathematical Statistics.
8. P.N. Arora and P.K. Malhan,Biostatistics, Himalaya Publishing House
9. RSN Pillai and V. Bagavathi, Statistics, S. Chand and Co Ltd

5B07BIF:
CELL BIOLOGY

Module 1: CELL, classification of cell types
Cell, cell theory, pre-cellular evolution artificial creation of cell, classification of cell, bacteria, PPLO, plant cell and animal cell ,tissue, organ and organism .

Module 2: Biochemical Composition of Cells, Proteins, lipids, carbohydrates, nucleic acid

Module 3: organelles and function
Ultra structure of cell, cell membranes, cytosol, golgi bodies, mitochondria, endoplasmic reticulum (RER,SER), ribosomes, cytoskeleton structure actin, myosin, microtubules, microfilaments, chloroplast, lysosome, peroxysomes,nucleus

Module 4: Chromosome structure
Chromatin reticulum, chromosome morphology, fine structure, chemical composition, nucleoproteins-histones, non-histones, giant chromosomes-salivary gland chromosome, lamp brush chromosome, mitosis, meiosis, significance of mitosis and meiosis, cell division, cell cycle, cell synchrony, cell senescence and death

REFERENCE BOOKS:

1. Cohn, N.S. (1964). Elements of Cytology Brace and World Inc., New Delhi.
2. Darington, C.D.(1965). Cytology, Churchill, London.
3. Darnell, J., Lodish, KL and Baltimore, D (1991). Molecular Cell biology, Scientific American books.
4. De Robertis, E.D.P. and Robertis, E.M.F.(1991). Cell and Molecular biology. Lea
5. and Febiger, Washington.
6. Dobzhansky, B (1961).Genetks$_i$and The origin of species, Columbia University press,New York.
7. J Roy, S.C. and Kalyan Kumar De (1997). Cell Biology. New Central Book Agency,Calcutta

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5B08BIF:
BIOCHEMISTRY

Module 1- Origin of life. Prokaryots, Eukaryotes. Chemical bonds, van der Waal's forces, Properties of water. Acids, bases and buffers, pH and its measurement, making of buffer solutions, laws of thermodynamics. Their significance to 'living'

Module 2 Chemical Reactions: Redox reactions, redox potentials and their role in living system, molarity, molality and normality of solutions and their measurement, expressions for concentrations.

Module 3 Structure of proteins: Amino acids and their classification, primary, Secondary, tertiary and quaternary structure of proteins, Fibrous proteins globular proteins. Conjugate proteins.

Module 4 Structure of nucleic acids: Nucleosides, nucleotides and their constituents. Chemical properties of nucleotides, Oligo and poly nucleotides. Watson - Crick base pairing, Double helical structure in nucleic acids. Structure and function of different RNAs.

Module 5 Monosaccharides, oligosaccharides and poly saccharides molecular conjugates with oligo and poly saccharides.

Module 6 Fats and fatty acids, Lipid classification properties of lipid aggregates, Biological membranes. Conjugate forms of lipids. Lipid nutrition. Lipid digestion and absorption. Fatty acid oxidation. Fatty acid biosynthesis.

REFERENCE BOOKS:

1. Principles of Biochemistry -Lehninger
2. Outlines of Biochemistry - Conn & Stumpf
3. Text book of Biochemistry -West, Todd et al.
4. Biochemistry - Voet and Voet

5B09BIF:
STRUCTURAL BIOINFORMATICS-1

Module 1: Principles of protein structure, classification of proteins, aminoacid, dihedralangle, Ramachandran plot, structural organization of protein, primary, secondary, tertiary and quaternary structures, motifs and domains.

Module 2:DNA and RNA, type of base pairing,Watson-Crick and Hoogstein, types of double helices A,B,Z and their geometrical as well as structural features, structural and geometrical parameters of each and their comparison

Module 3: Protein –protein interaction, protein-DNA interaction, DNA binding proteins, types of interaction of DNA with protein and small molecule, different forces involved in the interaction,

Module 4: Basic principles of protein structure prediction, chou-fasman method, GOR method, Ab initio method, homology modeling, different steps in homology modeling

REFERENCE BOOKS:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press

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5B10BIF:
BIOLOGICAL DATABASES

Module 1:Basic concept of open access bibliographic resources related to life sciences, the significances and the need for such resources , the major content o the databases, how to search and use these resources/databases with special references to Pub Med

Module 2: Contents and formats of databases entries, retrieval of data using text based search, sources of data, method for deposition of data to databases

Module 3: Nucleic acid sequence databases, GenBank, EMBL, DDBJ. Protein Sequence Databases: SWISSPROT, Tr-EMBL, PIR-PSD, Genome Databases at NCBI, EBI , TIGR, SANGER

Module 4: VIRAL GENOME, Archeal and Bacterial Genomes, Eukaryotic genome with special references to model organism (Yeast, Drosophilla, C.elegans, Rat, Mouse), human, plants such as Arabidopsis thaliana Rice etc

Module 5: PDB, NDB, CCSD, PROSITE, RODOM, Pfam, PRINTS, CATH, SCOP, DSSP, SSP, DALI

REFERENCE BOOKS:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.

6B11BIF:
MOLECULAR BIOLOGY

Module I: History and development of Molecular biology- Nucleic acids - DNA and RNA as genetic materials. Nature of genetic code- deciphering genetic code- wobbles hypothesis

Module II: DNA replication in prokaryotes, DNA replication in eukaryotes, types of replication, Unit of replication, enzymes involved, replication origin and replication fork, DNA damage and repair mechanisms- photo activation - excision repair- recombination repair, gene mutations- point, frame shift- physical and chemical mutagens, hotspot, oncogenes

Module III: Transcription in prokaryotes and eukaryotes - transcription unit, promoter, terminator sequence- RNA polymerases, RNA processing - capping, splicing, polyadenylation, structure and functions of different types of RNA

Module IV: Translation in prokaryotes and eukaryotes- aminoacylation of tRNA. Formation of initiation complex, elongation and elongation factors, termination, gene, cistron, muton, polysome, one gene one polypeptide hypothesis

Module V: Regulation of gene expression in prokaryotes- operons - negative and positive control - lac and trp operon, catabolic repression, chromatin activity and gene regulation in eukaryotes

REFERENCE BOOKS:

1. Cell and molecular biology- Concepts and experiments. Gerald Karp.
2. John Wiley and sons.Inc.
3. Molecular biology of the Gene. James D Watson, Tania A Baker,
4. Stephen P Bell, Alexander Gann, Michael Levine, Richard Losick.
5. Pearson Education.
6. Genes IX. Benjamin Lewin. Jones and Bartlett Publishers.
7. Molecular cell biology. Lodish, Berk, Matsudara, Kaiser, Krieger,
8. Scott, Zipursky, Darnell. W H Freeman& Co. New York.

6B12BIF:
GENETICS

Module I: Mendel's work – selection of experimental plant, procedure, experimental observations and results, monohybrid and di-hybrid crosses, law of segregation, law of independent assortment, back cross, test cross. Modification of mono-hybrid and di-hybrid ratio – incomplete, dominance, co-dominance, lethality, penetrance – complete and incomplete penetrance, expressivity, pleiotropism, polygenetic effect

Module II: Inter genetic interactions – epistasis – dominant epistasis, recessive epistasis, duplicate genes with cumulative effect, complementary genes or duplicative recessive genes, duplicative dominant genes, non-epistatic interactions, atavism or reversion.

Module III: Multiple allelism – examples coat colour in rabbits, blood group inheritance in man (ABO and Rh-antigen), Linkage and crossing over - complete and incomplete linkage, linkage groups, significance of linkage, mechanism of crossing over, types of crossing over, factors effecting crossing over, two point cross, three point cross, linkage map

Module IV: Sex linked genes and its inheritance, inheritance of XY linked genes, of X- linked genes, of Y- linked genes, sex limited genes, sex influenced genes, extra chromosomal inheritance in mitochondria and chloroplast

Module V: Numerical and structural chromosomal aberrations – euploidy, aneuploidy, non-disjunction in autosomes and sex chromosomes (example from human), Population genetics – hardy-Weinberg equilibrium, gene frequencies and genotype frequencies

REFERENCE BOOKS:

1. Genetics – from genes to genomes, Leland H. Hartwell et al., McGrawHill
2. Genetics, Monroe W. Strickberger, Prentice Hall of India
3. Principles of Genetics, Sinnot, E.W., Dunn, LC and Dobzhansky, T,
4. Principles of Genetics, Gardner, E.J. and Snustad, D.P. John Wiley
5. Genetics, P.S.verma and V.K.Agarwal, S.Chand publishers

6B13BIF:
SEQUENCE ANALYSIS

Module 1: various file format for Bio-molecular Sequences: GenBank, FASTA, GCG, MS, NBRF-PIR, basic concept of sequence similarity, identity and homology, definition of homologous, paralogous

Module 2: Scoring matrices
Basic concept of scoring matrix, matrices for nucleic acid and protein sequences, PAM and BLOSOM series, principles based on which these matrices are derived. Differences between distance & similarity matrix

Module 3: Sequence based database search:
What are Sequence based database search, BLAST, FASTA Algorithm, various version of BLAST and FASTA, use of these methods for sequence analysis including the online use of the tools and interpretation of results

Module 4: PAIRWISE and MULTIPLE SEQUENCE Alignments
Basic concept o sequence alignment, Needleman&Wunch , Smith waterman algorithm, use of pairwise alignment or the analysis of Nucleic acid and Protein sequences and interpretation of the results, need of MSA, basic concept of various approaches for MSA (progressive, hierarchical) algorithm of CLUSTALW &Pileup and their application for sequence analysis, dendogram and its interpretation.

Module 5: Taxonomy and Phylogeny, sequence patterns and profiles
Basic concept in Taxonomy and Phylogeny, molecular evolution, nature of data used in Taxonomy and Phylogeny, Definition and description of phylogenetic trees and various types of trees, concept of sequence patterns , motifs, profiles, various types of pattern representation viz. consensus, regular expression (prosite-type), and profiles, profile based searches using PSI-BLAST, analysis interpretation of profile based searches

REFERENCE BOOKS:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
8. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan Kafman publishers

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6B14BIF:
GENOMICS AND PROTEOMICS

Module 1: Introduction to genomics, genetic mapping, types of genetic mapping, genetic markers, application of genetic markers, application of gene mapping, DNA polymorphism, SNP, DNA typing, pharmacogenomics

Module 2: Cytogenetics, chromosome painting, FISH, isolation of genes from genomic DNA- cDNA, exon trapping, chromosome walking, gene prediction, transgenes, DGGE in mutation detection

Module 3: DNA sequencing, sequencing strategies, Sanger method, in situ hybridization, Southern blotting, Northern blotting, short gun method, DNA micro array, working of micro array, application

Module 4: proteomics: definition, types of proteomics, method for the analysis of proteomes, 2D gel electrophoresis, MALDI TOF MS. Tools for the analysis

REFERENCE BOOKS:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.

6B15BIF:
STRUCTURAL BIOINFORMATICS-II

Module 1: introduction to X-ray crystallography
x-rays, crystal systems, Braggs law, diffraction of crystals, structure factor, atomic scattering factor, crystallization, data collection, structure solution and refinement, structure validation

Moule 2: Spectroscopic methods for structure determination
NMR spectroscopy: shielding constant, chemical shift, application of NMR in protein structure determination. Structural information from UV-visible and IR spectroscopy.

Module 3: structure visualization tools
Rasmol, SPDBV,WEBMOL, Cn3D, VMD, molmol, chime

Module 4: drug discovery
Drug, target, ligand, substrate, drug discovery pipeline, HTS, mass screening, combinatorial chemistry, combinatorial library, CADD, QSAR, SBDD, In-vitro, in-silico methods, pharmacophore modeling, docking, De NOVO, ADME property prediction.

REFERENCE BOOKS:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.

3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
8. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan Kafman publishers
9. Introduction to Protein structure by Brandel C. and Tooze, J.
10. Structure and Mechanism in Protein science – Fersht WH freeman & Co
11. Protein folding – Creighton TE (ed) WH Freeman & Co.

6B16BIF:
BIOINFORMATICS PRACTICAL –II

1. 1 Literature minimg using pubmed central
2. literature mining using Medline
3. browse the ExPASY sites and write information received in your record
4. to retrieve metabolic pathways using KEGG PATHWAY Database
5. to retrieve metabolic pathway using Reactom
6. Retrieving protein and DNA sequences using Entrez at NCBI
7. Retrieving protein and DNA sequences using SRS at EBI
8. Web browsing at SwissProt
9. Web browsing at PIR PSD
10. Web browsing at UNIPROT
11. Nucleotide BLAST
12. Protein BLAST
13. BLAST-X
14. multiple sequence Alignment-CLUSTAL W
15. Details of PDB files

6B17BIF:
BIOINFORMATICS PRACTICAL-III

1. 1.Protparam:physic o–chemical parameters of a protein sequence
2. compute pI/Mw;compute the theoretical isoelectric point and molecular weight from Uniprot knowledge base wntry or for a user sequence
3. ScanSite pI/Mw-compute the theoretical pI/Mw and multiple phosphorylation states
4. Helix wheel/Helix draw: representation of a protein fragment as a helical wheel

5. use visualization tools like Swiss Pdb viewer, Jmol, Rasmol, MolMol, Rasmol, VMD
6. Download protein and DNA from PDB and display using above program and analyze the structural features
7. APSSP-ADVANCED PROTEIN SECONDARY STRUCTURE PREDICTION SERVER
8. GOR
9. 9.HOMOLOGY MODELLING—SWISS MODEL-An automated knowledge based protein modeling server
10. Threading –Phyre-the Phyre automatic fold recognition server for predicting the structure and/function of your protein
11. Ab initio- HMMSTR-prediction of the protein structure from sequence assessing tertiary structure prediction
12. PROCHECK- verification of the stereochemical quality of a protein structure
13. What If –protein structure analysis program for the mutant prediction .structure verification,molecular graphics
    (NB: perform all programs)

6B18BIF:
PROJECT WORK

Carry out a small research project on any topic related to BIOINFORMATICS and submit a brief dissertation at the end of 6th semester .The dissertation will be valued by the external

5D01BIF:

OPEN COURSE 1

MOLECULAR MODELING AND DRUG DESIGNING

Module I - Introduction to the concept of molecular modeling
Molecular structure and internal energy, application of molecular graphics, energy minimization of small molecules, empirical representation of molecular energies, uses of force field, the molecular mechanics method, local and global energy minima

Module II – molecular dynamics
The techniques of molecular dynamics and Monte Carlo simulations analysis, Ab Initio, DFT and semiempirical method

Module III - Macromolecular modeling
Homology modeling, Basic principles for fold recognition, 1D profiles and threading approaches, secondary structure prediction, basic principles of ab initio structure prediction

Module IV – Introduction to Drugs
Definition of drugs, Absorption, distribution, Metabolism and excretion of drugs. Drug targets : Receptors, enzymes, structural proteins and nucleic acids as the drug targets.

Module V– Drug design using bioinformatics
Design of ligands for known macromolecular target sites, drug-receptor interactions, Classical SAR/QSAR studies and their implications to the 3D modeler, pharmacophore identification and novel drug design, High through put combinatorial approaches, structure based drug design, enzyme inhibition strategies.

REFERENCE BOOKS:

1. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
2. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
3. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan Kafman publishers
4. Introduction to Protein structure by Brandel C. and Tooze, J.
5. Structure and Mechanism in Protein science – Fersht WH freeman & Co
6. Protein folding – Creighton TE (ed) WH Freeman & Co.
7. Basic pharmacology – Cox F, Butterworths
8. Pharmacology &Pharmacotherapeutics – Sataskar, Bhandakan & ainapur, Popu;ar Prakashan Mumbai
9. Principles of Medicinal chemistry – William O & Foye BI , Waverks Pvt. Ltd
10. Medicinal Chemistry – Patrick G, Viva Books Pvt Ltd.

5D02BIF:

OPEN COURSE 2

PERL PROGRAMMING

Module 1. Getting started with perl
Alow and long learning curve, perl's benefits, installing perl on your computer, how to run perl programs, text editors, finding help
Module 2. The art of programming
Individual approaches to programming, edit-run-revise (and save), an environment of programs, programming strategies, the programming process
Module 3. Sequences and strings
Representing sequence data, a program to store a dna sequence, concatenating DNA fragments, transcription: DNA to RNA using the perl, documentation, calculating the reverse complement in proteins, files and arrays, reading proteins in files, arrays, scalar and list context
Module 4. Motifs and loops
Flow control code layout finding motifs counting nucleotides exploding strings into arrays, operating on strings, writing to files.
Module 5. Subroutines and bugs
Subroutines, scoping and subroutines command-line arguments and arrays passing data to subroutines, modules and libraries of subroutines, fixing bugs.
Module 6. Mutations and randomization
Random number generators a program using randomization a program to simulate DNA mutation generating random DNA, analyzing DNA
Module 7. The genetic code
Hashes data structures and algorithms for biology the genetic code, translating DNA into proteins reading dna from files in FASTA format reading frames

REFERENCE BOOKS:

1. James Tisdall, 200I "Beginning Perl for Bioinformatics", O'Reilly & Associates, (2001) Learning Perl, 3rd Edition.

COURSE STRUCTURE& SYLLABUS FOR BIOINFORMATICS (COMPLEMENTARY)

2014 ADMISSION ONWARDS

SCHEME BIOINFORMATICS (COMPLEMENTARY)

No	Semester	Course Code	Title
1	I	**1C01BIF**	Introduction to Bioinformatics
2	I	**4C05BIF**	Bioinformatics Practical
3	II	**2C02BIF**	Biological Databases
4	II	**4C05BIF**	Bioinformatics Practical
5	III	**3C03BIF**	Sequence Analysis
6	III	**4C05BIF**	Bioinformatics Practical
7	IV	**4C04BIF**	Structural Bioinformatics
8	IV	**4C05BIF**	Bioinformatics Practical

1C01BIF:
INTRODUCTION TO BIOINFORMATICS

Module 1: Introduction: background , various definition in Bioinformatics, history of Bioinformatics, HGP, its need and application, goals of HGP

Module 2: internet and intranet, definition, history of internet, role of internet and intranet in Bioinformatics, WWW

Module 3: introduction to HTML, tags, attributes types of HTML tags, HTML tag head, body, Meta, font, anchor, img, hr, align, listing, forms, frames, tables

Module 4: introduction to SQL
A)sql commands –alter, create, drop, update, delete, order by, distinct, rename, inbuilt functions, b) sql constraints- check unique not null ,default ,primary key,foreign key, c) Introduction to index and types of index

REFERENCE BOOKS:

1. Introduction to Bioinformatics: by T.K. Altwood, D.J. Parry-Smith and S. Phukan.
2. Bioinformatics: Sequence and Genome Analysis David. W. Mount.
3. Bioinformatics: Genes, Proteins, and Computers by C.A. Orengo, D.T. Jones and J.M. Thornton

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2C02BIF:
BIOLOGICAL DATABASES

Module 1:
Basic concept of open access bibliographic resources related to life sciences, the significances and the need for such resources, the major content o the databases, how to search and use these resources/databases with special references to Pub Med

Module 2
Contents and formats of databases entries, retrieval of data using text –based search tppls, sources of data(e.g. sequencing projects, individual scientist , patent oices),method for deposition of data to databases

Module 3
Nucleic acid sequence databases, GenBank, EMBL, DDBJ, Protein Sequence Databases: SWISSPROT, Tr-EMBL, PIR-PSD, Genome Databases at NCBI, EBI, TIGR, SANGER

Module 4

VIRAL GENOME, Archeal and Bacterial Genomes,Eukaryotic genome with special reerences to model organism(Yeast,Drosophilla,C.elegans,Rat,Mouse), human,plants such as Arabidopsis thaliana Rice etc

Module 5
PDB, NDB, CCSD,PROSITE,PRODOM,Pfam,PRINTS,CATH,SCOP,DSSP,SSP,DALI

REFERENCE BOOKS:

1. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
2. Essential Bioinformatics-Jin Xiong, Cambridge University Press
3. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
4. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.

3C03BIF:
SEQUENCE ANALYSIS

Module 1: various file format for Bio-molecular Sequence
GenBank,FASTA,GCG,MS,,NBRF-PIR,basic concept of sequence similarity, identity, and homology, definition of homologous, paralogous

Module 2: SCORING MATRICES
Basic concept of scoring matrix, matrices for nucleic acid and protein sequences, PAM and BLOSOM series, principles based on which these matrices are derived. Differences between distance & similarity matrix

Module 3: Sequence based database search
What are Sequence based database search, BLAST,FASTA Algorithm, various version of BLAST and FASTA, use of these methods for sequence analysis including the online use of the tools and interpretation of results

Module 4: PAIRWISE and MULTIPLE SEQUENCE Alignments
Basic concept o sequence alignment, Needleman & Wunch ,Smith waterman algorithm, use of pairwise alignment or the analysis of Nucleic acid and Protein sequences and interpretation of the results, need of MSA, basic concept of various approaches for MSA(progressive, hierarchical) algorithm of CLUSTALW &Pileup and their application for sequence analysis, dendogram ,its interpretation.

Module 5: Taxonomy and Phylogeny, sequence patterns and profiles
Basic concept in Taxonomy and Phylogeny, molecular evolution, nature of data used in Taxonomy and Phylogeny, Definition and description of phylogenetic trees and various types of trees, concept of sequence patterns ,motifs, profiles, various types of pattern representation viz. consensus, regular expression(prosite-type),and

profiles, profile based searches using PSI-BLAST, analysis interpretation of profile based searches

REFERENCE BOOKS:

1. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
2. Essential Bioinformatics-Jin Xiong, Cambridge University Press
3. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
4. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
5. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan Kafman publishers

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4C04BIF:
STRUCTURAL BIOINFORMATICS-II

Module 1:
Principles of protein structure,classification of Proteins,aminoacid, dihedralangle, Ramachandran plot, structural organization of protein,protein sequences

Module 2: protein structure prediction
Basic principles on protein structure prediction,chou-fasman method,GOR method,Ab initio method,homology modeling, different steps in homology modeling

Module 3: structure visualization tools
Rasmol, SPDBV, WEBMOL, Cn3D, VMD,molmol, chime

Module 4: drug discovery
Drug, target, ligand substrate, drug discovery pipeline, HTS, mass screening, combinatorial chemistry, combinatorial library, CADD, QSAR, SBDD, in-vitro, in-silicomethod, pharmacophoremodeling, docking, De NOVO,ADME property prediction

REFERENCE BOOKS:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Edu
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
6. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan

Kafman publishers
7. Introduction to Protein structure by Brandel C. and Tooze, J.
8. Structure and Mechanism in Protein science – Fersht WH freeman & Co
9. Protein folding – Creighton TE (ed) WH Freeman & Co.

4C05BIF:
BIOINFORMATICS PRACTICAL

1 Protparam: physico–chemical parameters of a protein sequence
2. compute pI/Mw; compute the theoretical isoelectric point and molecular weight from Uniprot knowledge base wntry or for a user sequence
3. ScanSite pI/Mw-compute the theoretical pI/Mw and multiple phosphorylation states
4. Helix wheel/Helix draw: representation of a protein fragment as a helical wheel
5. use visualization tools like Swiss PDB viewer, Jmol, Rasmol, MolMol, Rasmol, VMD
6. download protein and DNA from PDB and display using above program and analyze the structural features
7. APSSP-ADVANCED PROTEIN SECONDARY STRUCTURE PREDICTION SERVER
8. GOR
9. HOMOLOGY MODELLING—SWISS MODEL-An automated knowledge based protein modeling server
10. Threading –Phyre-the Phyre automatic fold recognition server for predicting the structure and/function of your protein
11. Ab initio- HMMSTR-prediction of the protein structure from sequence assessing tertiary structure prediction
12. PROCHECK- verification of the stereochemical quality of a protein structure
13. What If –protein structure analysis program for the mutant prediction. structure verification,molecular graphics
14. (NB:perform all programs)

Sd/-
Dr. K. Sreejith
Chairman, BoS in Biotechnology
Department of Biotechnology & Microbiology
Kannur University