

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(Established under section 3 of UGC Act, 1956)

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.



SYLLABUS

SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOINFORMATICS

BACHELOR OF TECHNOLOGY IN BIOINFORMATICS

REGULATIONS 2015

PROGRAMME: B. TECH BIOINFORMATICS CURRICULUM SEMESTER 1

Sl. No	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SCH1101	Environmental Science and Engineering	3	0	0	3	16-17
2.	SPH1101	Physics of Engineering Materials	3	0	0	3	9-10
3.	SCY1101	Engineering Chemistry	3	0	0	3	12
4.	SMT1101	Engineering Mathematics I /	3	1	0	4	2
	SMT1102	Statistics	3	1	0	4	3
5.	SCS1102	Fundamentals of Programming	3	0	0	3	18
6.	SBT1101	Cell and Molecular Biology	3	0	0	3	74

PRACTICAL

7.	SPH4051	Engineering Physics Lab	0	0	2	1	126
8.	SCY4051	Engineering Chemistry Lab	0	0	2	1	126
9.	SCS4101	Programming in C Lab	0	0	4	2	126

TOTAL CREDITS: 23**SEMESTER- 2**

Sl. No	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SHS1101	English for Science and Technology	3	0	0	3	1
2.	SMT1105	Engineering Mathematics II /	3	1	0	4	4
	SMT1106	Engineering Mathematics II	3	1	0	4	5
3.	SBI1101	Introduction to Bioinformatics	3	0	0	3	33
4.	SBT1102	Biochemistry /	3	0	0	3	75
	SCY1103	Chemistry of Industrial Materials /	3	0	0	3	13
	SCY1104	Bio Organic Chemistry /	3	0	0	3	14
	SCY1105	Physical Chemistry	3	0	0	3	15
5.	SBT1103	Microbiology	3	0	0	3	76
6.	SBT1104	Genetics	3	0	0	3	77

PRACTICAL

7.	SBI4051	Basic Bioinformatics Lab	0	0	4	2	129
8.	SBT4054	Biochemistry Lab	0	0	4	2	139

TOTAL CREDITS: 23**L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS**

SEMESTER- 3

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SMT1201	Engineering Mathematics III /	3	1	0	4	6
	SMT1202	Engineering Mathematics III	3	1	0	4	7
2.	SBI1201	Biomolecular Interactions	3	0	0	3	34
3.	SCS1306	Data Base Management System	3	0	0	3	21
4.	SBT1201	Molecular Biotechnology	3	0	0	3	78
5.	SBI1202	Biological Sequence Analysis	3	0	0	3	35
6.	SBI1203	Molecular Immunology and Immunoinformatics	3	0	0	3	36

PRACTICAL

7.	SBI4052	Immunology Lab	0	0	4	2	129
8.	SBI4053	Biological Sequence Analysis Lab	0	0	4	2	130

TOTAL CREDITS: 23**SEMESTER- 4**

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SBI1204	Introduction to Quantum Chemistry	3	0	0	3	37
2.	SBT1207	Analytical Techniques in Biotechnology	3	0	0	3	84
3.	SBI1205	Phylogenetic Analysis	3	0	0	3	38
4.	SIT1201	Java Programming	3	0	0	3	23
5.	SBI1206	Statistics and Random Models	3	1	0	4	39
6.	SBI1207	PERL Programming	3	0	0	3	40

PRACTICAL

7.	SBI4054	PERL Programming Lab	0	0	4	2	131
8.	SIT4106	Java Programming Lab	0	0	4	2	127
9.	S22PT1	Professional Training-I	0	0	10	5	

TOTAL CREDITS: 28**SEMESTER- 5**

Sl. No	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SCS1313	Data Structures and Algorithms	3	1	0	4	22
2.	SBI1301	Molecular Basis of Diseases	3	0	0	3	42
3.	SBI1302	Nanotechnology	3	0	0	3	43
4.	SBI1303	Molecular Modeling	3	0	0	3	44
5.	SBI1304	Signal Transduction	3	0	0	3	45
6.	SBI1305	Genomics and Proteomics	3	0	0	3	46

PRACTICAL

7.	SBI4055	Molecular Modeling Lab	0	0	4	2	131
8.	SBI4056	Molecular Biology Lab	0	0	4	2	132

TOTAL CREDITS: 23

SEMESTER- 6

Sl. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SIT1301	Data Mining and Data Warehousing	3	1	0	4	24
2.	SCS1609	Oracle and SQL	3	0	0	3	25
3.	SBI1306	Bioinformatics Algorithm	3	0	0	3	47
4.	SBI1307	Gene Expression and Microarray	3	0	0	3	48
5.	SBI1308	Rational Drug Design and QSAR	3	0	0	3	49
6.		Elective I	3	0	0	3	

PRACTICAL

7.	SBI4057	QSAR Lab	0	0	4	2	132
8.	SBI4058	Computational Chemistry and Biology Lab	0	0	4	2	132
9.	S22PT2	Professional Training - II	0	0	10	5	

TOTAL CREDITS: 28**SEMESTER- 7**

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SBI1401	Introduction to Systems Biology	3	1	0	4	52
2.	SBI1402	Quantitative Models in Biological Systems	3	0	0	3	53
3.		Elective II	3	0	0	3	
4.		Elective III	3	0	0	3	

PRACTICAL

5.	SBI4060	Systems Biology Lab	0	0	4	2	133
6.	SBI4061	Molecular Dynamics and Simulation Lab	0	0	4	2	133
7.		PROJECT WORK PHASE-I					

TOTAL CREDITS: 17**SEMESTER- 8**

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
1.	SBI1403	Structural Bioinformatics	3	1	0	4	54
2.	SBA1101	Principles of Management and Professional Ethics	3	0	0	3	20
3.		Elective IV	3	0	0	3	
4.	S22PROJ	PROJECT WORK PHASE-I & II	0	0	30	15	

TOTAL CREDITS: 25**TOTAL CREDITS FOR THE PROGRAMME: 190**

LIST OF ELECTIVES

DEPARTMENT ELECTIVES

S. No.	COURSE CODE	COURSE	L	T	P	C	PAGE No.
Group I (Elective I)							
1.	SBT1403	Concepts in Stem Cell Research	3	0	0	3	94
2.	SBI1601	Cancer Biology and Therapeutics	3	0	0	3	160
3.	SBI1602	Forensic Serology and DNA Profiling	3	0	0	3	161
4.	SBI1603	Comparative Genomics	3	0	0	3	162
5.	SIT1305	Machine Learning	3	0	0	3	153
6.	SIT1606	Big Data	3	0	0	3	154
7.	SIT1614	J2EE	3	0	0	3	155
Group II (Elective II)							
1.	SBI1604	Intracellular Network Analysis	3	0	0	3	163
2.	SBI1605	Python	3	0	0	3	164
3.	SBI1606	Next Generation Sequencing	3	0	0	3	165
4.	SCS1307	Computational Intelligence	3	0	0	3	147
5.	SCS1604	Software Architecture	3	0	0	3	149
6.	SCS1610	C# .Net	3	0	0	3	150
7.	SCS1612	Web Technology	3	0	0	3	152
8.	SIT1615	Web Scripting Languages	3	0	0	3	156

SCH1101	ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to ALL Branches of B.E/ B. Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To impart knowledge on the issues related to environment and to emphasize the importance of a clean environment

UNIT 1 INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10 Hrs.

Definition, scope and importance, need for public awareness, forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, floods, drought, conflicts over water, dams-benefits and problems, mineral resources: use effects on forests and tribal people. water resources: use and over-utilization of surface and ground water, exploitation, environmental effects of extracting and using mineral resources, case studies food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources: Case studies. Land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification, role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.

UNIT 2 ECOSYSTEMS AND BIODIVERSITY 10 Hrs.

Concept of an ecosystem, structure and function of an ecosystem - producers, consumers and decomposers - energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Introduction to biodiversity, definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, biodiversity at global, national and local levels. India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, endangered and endemic species of India, conservation of biodiversity, in-situ and ex-situ conservation of biodiversity.

UNIT 3 ENVIRONMENTAL POLLUTION 9 Hrs.

Definition - causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards. Solid waste management: causes, effects and control measures of urban and industrial wastes, role of an individual in prevention of pollution, pollution case studies, disaster management: floods, earthquake, cyclone and landslides.

UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT 8 Hrs.

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns, case studies, environmental ethics: issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Wasteland reclamation, consumerism and waste products - environment protection act: air (prevention and control of pollution) act - water (prevention and control of pollution) act, wildlife protection act; forest conservation act. Issues involved in enforcement of environmental legislation, Key initiatives of Rio declaration, Vienna convention, Kyoto protocol, Johannesburg summit and public awareness.

UNIT 5 HUMAN POPULATION AND THE ENVIRONMENT 8 Hrs.

Population growth, variation among nations, population explosion, family welfare programme, environment and human health, human rights, value education, HIV / AIDS, women and child welfare, role of information

SPH1101	PHYSICS OF ENGINEERING MATERIALS (Common to ALL Branches of B.E/ B. Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To expose the students to different classes of materials and present the fundamentals of materials science; to develop the understanding of the behaviour of materials, their properties and structures; to facilitate selection of suitable material for particular engineering application.

UNIT 1 CHARACTERIZATION OF MATERIALS**9 Hrs.**

Introduction, Structural characterization - X-ray diffraction, Bragg's law, Determination of crystal structure - powder X-ray diffractometer (Debye Scherrer camera) and Single crystal XRD with principle, construction and working, Microstructural characterization - Introduction, electromagnetic lens system, Determination of surface morphology by Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Atomic Force Microscope (AFM) with principle, construction and working. Microhardness testing -Determination of microhardness by Vickers hardness test, Knoop hardness test and Nanohardness test with principle, construction, and working.

UNIT 2 MAGNETIC MATERIALS**9 Hrs.**

Introduction, Origin of magnetic moment - orbital, spin and nuclear magnetic moments; Bohr magneton; Classification of magnetic materials based on spin- dia, para, ferro, antiferro and ferri- Curie temperature, Neel temperature.; Magnetic domains- Domain theory of Ferro magnetism (Weiss theory) - Observation of domain (bitter powder pattern), Energies involved in domain formation - magnetostatic energy, anisotropic energy, magnetostrictive energy and domain wall energy; Hysteresis Curve -based on domain theory; Types of magnetic materials - soft and hard magnetic materials; Magnetic bubbles - formation and propagation of magnetic bubbles-T-bar, read/write operation.

UNIT 3 SUPERCONDUCTING MATERIALS**9 Hrs.**

Introduction to superconductivity- Properties of superconductor - electrical resistance, Meissner Effect, effect of heavy magnetic field, effect of heavy current (Silsbee's rule), effect of high pressure, isotope effect, entropy, specific heat capacity, energy gap, London Penetration depth, Coherence Length, Ginzburg Landau Parameter, Flux Quantization and thermal conductivity. Theory of superconductivity - London Theory (Macroscopic), Bardeen, Cooper and Schrieffer Theory (Microscopic) - explanation based on formation of Cooper pairs and existence of energy gap. Types of superconductors - Type I and Type II superconductors, D.C. and A.C Josephson Effect, I-V Characteristics and applications of Josephson junction. Applications - cryotron, magnetic levitation train and SQUIDS. Problems of Part-A type.

UNIT 4 OPTICAL MATERIALS**9 Hrs.**

Introduction, refractive index, absorption and dispersion, reflections. Classification of optical materials, absorption in metals, semiconductors and insulators (dielectrics), Excitons- Frenkel and Mott-Wannier excitons, Point defects -Frankel and Schottky defects, Traps - trapping and recombination centres - Colour Centres - types - F-Centre, R-Centre, V-Centre (V1 and V2), M -Centre. Luminescence - Principle and classification - Mechanism and working of Photo luminescence (Fluorescence and Phosphorescence). Problems of Part-A type.

UNIT 5 SEMICONDUCTING MATERIALS**9 Hrs.**

Introduction - Band theory (qualitative), types of semiconductors- intrinsic semiconductor - carrier concentration and Fermi level in intrinsic semiconductor - extrinsic semiconductor - carrier concentration and Fermi level in extrinsic semiconductor (p type and n type) - Experimental determination Band gap of semiconductor -Hall Effect - experimental determination of Hall Voltage, Applications of Hall effect. Problems of Part-A type.

MAX. 45 HOURS

SCY1101	ENGINEERING CHEMISTRY (Common to ALL Branches of B.E/ B. Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the properties and various synthetic methods for the preparation of nanomaterials and their applications.
- To know about the quality parameters of water and methods to estimate the toxic elements and softening methods.
- To give an overview about types of batteries and fuel cells, corrosion mechanisms and preventive methods.
- To have a basic idea about polymers and various moulding techniques.

UNIT 1 SYNTHESIS OF NANOMATERIALS**9 Hrs.**

Introduction: Nanomaterials: Definition - Classification based on dimensions - Size dependent properties. Types of nanomaterials: Nanoparticles: Synthesis by chemical reduction method. Nanoporous materials: Synthesis by sol-gel method. Nanowires: Synthesis by VLS mechanism. Carbon Nanotubes (CNTs): Single walled and multi walled nanotubes - Mechanical and electrical properties of CNTs - Applications of CNTs - Synthesis of CNTs by electric arc discharge method and laser ablation method.

UNIT 2 WATER TECHNOLOGY**9 Hrs.**

Introduction: Water quality parameters - Contamination of water by arsenic, lead, fluoride, mercury and their removal. Hardness: Types - Expression - Units. Estimation of hardness of water by EDTA method - Problems. Estimation of iron, calcium and magnesium: AAS method. Water softening: Zeolite process - Demineralization process. Desalination: Reverse osmosis - Electrodialysis.

UNIT 3 ELECTROCHEMICAL POWER SOURCES**9 Hrs.**

Electrochemistry: Galvanic cell - Electrochemical cell representation - EMF series and its significance. Batteries: Terminology - Lead-acid accumulator - Nickel-cadmium batteries. Lithium batteries: Li/SOCl₂ cell - Li/I₂ cell - Lithium ion batteries. Fuel Cells: Hydrogen-oxygen fuel cells - Solid oxide fuel cell (SOFC).

UNIT 4 CORROSION SCIENCE**9 Hrs.**

Introduction: Definition. Types: Dry corrosion: Mechanism - Pilling-Bedworth rule - Wet Corrosion: Mechanism. Types: Galvanic corrosion and differential aeration cell corrosion. Galvanic series and its significance. Factors influencing corrosion. Corrosion prevention: Material selection and design - Cathodic protection. Protective coatings: Paints - Constituents. Mechanism of drying of drying oils.

UNIT 5 POLYMER CHEMISTRY**9 Hrs.**

Introduction to polymers: Nomenclature - Functionality. Types of polymerization. Mechanism of polymerization: Free radical mechanism - Cationic mechanism - Anionic mechanism. Plastics: Types - Thermoplastics and thermosetting plastics. Properties: Strength - Crystalline and amorphous state - Average molecular weight - Polydispersity. Compounding of plastics. Moulding of plastics: Compression moulding - Injection moulding - Extrusion moulding. Introduction to conducting polymers.

MAX. 45 HOURS**TEXT / REFERENCE BOOKS**

1. Jain P.C. and Monica Jain, Engineering Chemistry, 15th Edition Dhanpat Rai Publishing Co., 2009.
2. Dara S.S., Text Book of Engineering Chemistry, S. Chand & Co, 2008.
3. Sheik Mideen A., Engineering Chemistry (I & II), 13th Edition, Shruthi Publishers, 2010.
4. Kuriakose J.C. and Rajaram J., Chemistry in Engineering and Technology'. Vol.1 & 2, 5th reprint, Tata McGraw Hill Publishing Company (P) Ltd., 2010.
5. Sharma B.K., Engineering Chemistry, 2nd Edition, Krishna Prakasam Media (P) Ltd., 2001.
6. Mars G Fontana, Corrosion Engineering, 3rd Edition, Tata McGraw Hill, 2008.
7. David Linden, Thomas B Reddy, Handbook of Batteries, 4th Edition, McGraw-Hill, 2010.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 Questions of 2 marks each-No choice**PART B :** 2 Questions from each unit of internal choice, each carrying 12 marks.
(Out of 80 marks, maximum of 10% problems may be asked)**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SMT1101	ENGINEERING MATHEMATICS - I (Common to ALL branches except BIO GROUPS)	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments. Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 MATRICES**12 Hrs.**

Characteristic equation of a square matrix - Eigen values and Eigen vectors of a real matrix- properties of Eigen values- Cayley-Hamilton theorem (without proof) - verification , finding inverse and power of a matrix - Diagonalisation of a matrix using orthogonal transformation - Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS**13 Hrs.**

Curvature -centre, radius and circle of curvature in Cartesian co- ordinates - Evolutes - Envelope of family of curves with one and two parameters. - Evolute as envelope of normals.

UNIT 3 FUNCTIONS OF SEVERAL VARIABLES**11 Hrs.**

Introduction to partial derivatives - Jacobians - Taylor's expansion - Maxima and minima of functions of two variables - Constrained maxima and minima using Lagrange's multiplier method.

UNIT 4 ORDINARY DIFFERENTIAL EQUATIONS**11 Hrs.**

First order exact differential equations - Second order linear differential equations with constant coefficients - Particular Integral for e^{ax} , $\sin ax$ or $\cos ax$, x^n , $x^n e^{ax}$, $e^{ax} \sin bx$ or $e^{ax} \cos bx$ - Equations reducible to linear equations with constant co-efficients using $x = e^t$ - Simultaneous first order linear equations with constant coefficients - Method of Variation of Parameters

UNIT 5 THREE DIMENSIONAL ANALYTICAL GEOMETRY**13 Hrs.**

Direction cosines and ratios - Plane - Plane through intersection of two planes - Straight Line - Coplanar lines - Planes and Straight lines - Shortest distance between two Skew lines - Sphere -Plane section of a sphere - Great Circle.

Max. 60 Hours**TEXT / REFERENCE BOOKS**

1. Veerarajan T, Engineering Mathematics for First Year, II Edition, Tata McGraw Hill Publishers, 2008.
2. Kandaswamy P & co., Engineering Mathematics for First Year, IX revised edition, S.Chand & Co Pub., 2010.
3. Moorthy M.B.K, Senthilvadivu K, Engineering mathematics-I, Revised Edition, VRB Pub., 2010,
4. Arumugam S & co. Engineering Mathematics Vol-I , Revised Edition, SciTech Pub., 2010
5. Venkataraman M.K., Engineering Mathematics - First Year (2nd edition), National Publishing Co., 2000.
6. Kreyszig. E, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, Singapore, 2012.
7. Grewal B. S, Higher Engineering Mathematics, 41th Edition, Khanna Publications, Delhi, 2011.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

SMT1102	STATISTICS (Common to BIO GROUPS)	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments. Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 DESCRIPTIVE STATISTICS 13 Hrs.

Measures of central tendency: Mean, Median, Mode - Measures of dispersion: Quartile Deviation and Standard deviation-Coefficients of variation, Skewness and Kurtosis (Pearson's and Bowley's)

UNIT 2 CORRELATION AND REGRESSION 11 Hrs.

Karl Pearson's Correlation Coefficient, Spearman's Rank Correlation Coefficient, Tied ranks - Linear Regression Analysis - Fitting of straight line and parabola by the method of least squares.

UNIT 3 PERMUTATIONS AND COMBINATIONS 12 Hrs.

Fundamental principal of counting - Permutation - Circular permutation - Combination - Relation between Permutation and Combination (simple problems) - Binomial Theorem (positive Integral Index only) - General term - Term independent of x - Coefficient of x^n .

UNIT 4 INTRODUCTION TO PROBABILITY 11 Hrs.

Definitions, Sample Space, Events, Addition Law of probability, Multiplication law of probability - Conditional probability - Baye's theorem (without proof).

UNIT 5 RANDOM VARIABLES 13 Hrs.

Definition of a random variable - Discrete and continuous random variables, Probability Mass function, Probability Density Function, Cumulative Distribution Function (Definition only) - Mathematical expectation - Mean and Variance (Definition and properties only) - Binomial Distribution, Poisson Distribution and Normal Distribution - Mean, Variance and applications only.

Max. 60 Hours**TEXT / REFERENCE BOOKS**

1. John E Freund, Irvin Miller & Marylees Miller Mathematical Statistics, Edition-6, Prentice Hall, 1999.
2. Irvin Miller, John E Freund, Probability and Statistics for Engineers, Prentice Hall, 1997.
3. Veerarajan T, Probability, Statistics and Random Process, 4th Edition, Tata McGraw Hill, 2008.
4. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Probability and Statistics, McGraw Hill, 1975.
5. Vittal P R, Allied Mathematics, Margham Publications, 3rd Edition, 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

SCS1102	FUNDAMENTALS OF PROGRAMMING (Common to ALL Branches of B.E/ B. Tech.)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basic programming concepts.
- To understand the concept of arrays, functions and pointers.
- To gain knowledge about memory management.

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction: Algorithms, Pseudocodes & flowcharts, Overview of C, features of C, Structure of C program, Compilation & execution of C program. Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, and local and global variables. Operators: arithmetic, logical, relational, conditional and bitwise operators. Special operators: sizeof () & comma (,) operator. Precedence and associativity of operators & Type conversion in expressions.

Basic input/output and library functions: Single character input/output i.e. getch(), getchar(), getche() & putchar(). Formatted input/output: printf() and scanf().

UNIT 2 CONTROL STRUCTURES AND FUNCTIONS**9 Hrs.**

Control structures: Conditional control (if, nested if, switch case), Loop control (for, while, do while) and Unconditional control structures (goto)

Functions: The Need of a function, user defined and library function, prototype of a function, calling of a function, function argument, passing arguments to function, return values, nesting of function, recursion.

Library Functions: Concepts, mathematical and string functions.

UNIT 3 ARRAYS AND STRINGS**9 Hrs.**

Arrays: Single and multidimensional arrays, array declaration and initialization of arrays, array as function arguments.

Strings: Declaration, initialization and string handling functions.

Structure and Union: Defining structure, declaration of structure variable, accessing structure members, nested structures, array of structures, structure assignment, structure as function argument, function that returns structure, union.

UNIT 4 STORAGE CLASSES AND POINTERS**9 Hrs.**

Storage class specifier - auto, extern, static & register

Pointers: The '&' and '*' operators, pointers expressions, pointers Vs arrays

UNIT 5 MEMORY MANAGEMENT**9 Hrs.**

Pointer to functions, Function returning pointers

Direct Memory Access functions: malloc(), calloc(), sizeof(), free() and realloc(). Preprocessor directives.

Command line arguments

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Balaguruswami. E., Programming in C, TMH Publications, 1997
2. Yashavant P. Kanetkar., Let us C, Fifth Edition, .2013
3. Gottfried, Programming with C, Schaums Outline Series, TMH publications, 1997
4. Mahapatra, Thinking in C, PHI publications, 2nd Edition, 1998.
5. Subburaj . R, "Programming in C", Vikas Publishing, First Edition, 2000

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBT1101	CELL AND MOLECULAR BIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Pre-requisite-Basic knowledge in Life sciences. At the end of the course, the students would have gained extensive knowledge in cell structure, functions, cell signaling pathways and transfer across membranes in cells.
- The course aims to develop skills of the students in the area of Molecular biology. This will be necessary for studies of genetic material and also a prerequisite for other biology etc.,

UNIT 1 CELL STRUCTURE AND CELL DIVISION 11 Hrs.

Structure and function of Prokaryotic and Eukaryotic cells. Structure and functions of cell organelles - Mitochondria, ER, Ribosome, Golgi bodies, Nucleus. Organization of Plasma membrane, Membrane models. Cell division-Mitosis & Meiosis, Cell cycle and its Regulation

UNIT 2 TRANSPORT ACROSS CELL MEMBRANE 11 Hrs.

Passive and active transports, Permeases, Sodium -potassium pumps, Ca^{2+} ATPase pump, ATP dependant proton pumps, co-transport, symport, antiport, Endocytosis and Exocytosis. Introduction to intra and extra cellular products of medicinal use (Eg: Insulin, mAb).

UNIT 3 CELL RECEPTORS AND CELL SIGNALING 9 Hrs.

Membrane bound, cytosolic and nuclear receptors, autocrine, paracrine and endocrine signaling, signal amplification, CAMP, role of IP_3 , CAMP and G-protein role in signal transduction, Ca^{2+} influx and its role in cell signaling.

UNIT 4 NUCLEIC ACIDS & REPLICATION 7 Hrs

Structure of DNA - Watson & Crick model, Base equivalence in DNA, different forms of DNA; RNA and its types including miRNA, siRNA. DNA Replication - Conservative, Semi-Conservative and bidirectional

UNIT 5 GENE REGULATION 7 Hrs.

Genetic code, Prokaryotic Transcription, Translation and post translational modifications, Operon Concept- Lac, gal, trp operon.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Ajoy Paul, A text Book of Cell and Molecular Biology, Books and Allied Publishers 2007.
2. Darnell J Lodish, H. Baltimore, Molecular cell biology, Free Man, 1990.
3. David Freifelder, Molecular Biology- 2nd Edition, Narosa publishing house, 1998.
4. De Robertis and De Robertis. JR, Cell and Molecular Biology- BI publications, 1987.
5. Stryer, L., Biochemistry, 4th Edition, W.H. Freeman & Co., 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SPH4051	ENGINEERING PHYSICS LAB (Common for all branches of B.E/B.Tech)	L	T	P	Credits	Total Marks
		0	0	2	1	50

SUGGESTED LIST OF EXPERIMENTS

1. Quincke's method – Determination of magnetic susceptibility of a liquid.
2. Semiconductor diode - Determination of the forbidden energy gap.
3. Optical Fibre – Determination of Numerical aperture and attenuation loss.
4. Torsional pendulum – Determination of Moment of inertia and Rigidity modulus of the wire.
5. Young's modulus – non-uniform bending- Determination of Young's modulus of the material of beam.
6. Spectrometer – Hollow prism – Determination of Refractive index of a liquid.
7. Copper Voltameter – determination of electrochemical equivalent of copper.
8. Lees Disc – Determination of thermal conductivity of bad conductor.
9. LASER grating – Determination of wavelength of laser light.
10. Newton's Rings – Determination of Radius of Curvature of convex lens.

SCY4051	ENGINEERING CHEMISTRY LAB (Common for all branches of B.E/B.Tech)	L	T	P	Credits	Total Marks
		0	0	2	1	50

SUGGESTED LIST OF EXPERIMENTS

1. Estimation of ferrous ion by potentiometric method.
2. Determination of pKa value of glycine using pH meter.
3. Estimation of mixture of acids by conductometric method.
4. Estimation of Nickel by using photocolormeter.
5. Determination of viscosity of polymers by using Ostwald's viscometer.
6. Estimation of total hardness of water sample by EDTA / AAS method.

SCS4101	PROGRAMMING IN C LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Program to understand the basic data types and input/output functions.
2. Program for Looping and decision statements.
3. Program on Functions.
4. Program on Arrays.
5. Program on String Manipulations
6. Program on Structures and Union.
7. Program on Pointers.
8. Program to demonstrate the Command Line Arguments.
9. Program using Dynamic memory allocation.
10. Program to implement the Random Access in Files.
11. Program to implement math function.
12. Program to Implement sorting algorithms
13. Program to Implement searching algorithms
14. Programs to solve some of the Engineering applications.

SMT1106	ENGINEERING MATHEMATICS - II (Common to BIO Groups)	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments.

UNIT 1 MATRICES 12 Hrs.

Rank of a Matrix - Consistency of linear Algebraic equations - Characteristic equation of a matrix - Eigenvalues and Eigen vectors of a real matrix- Properties of Eigenvalues and Eigenvectors, Cayley-Hamilton theorem (without proof) verification - Finding Inverse and Power of a matrix using Cayley-Hamilton Theorem .

UNIT 2 DIFFERENTIAL CALCULUS 11 Hrs.

Definitions - Derivative of standard functions (Results only) - Addition, subtraction, Multiplication and Quotient rules of differentiation - Differentiation of function of function - Logarithmic derivatives - Derivatives of implicit function, Successive differentiation ,Partial derivatives (Simple Problems only)

UNIT 3 INTEGRAL CALCULUS 13 Hrs.

Integral of standard functions (Results only) -Integration by the method of substitution- Integration using partial fractions - Integration by parts -Generalization of integration by parts (Bernoulli's formula) - Definite integral - Properties - Simple problems.

UNIT 4 VECTOR CALCULUS 12 Hrs.

Scalar field and Vector field - Differentiation of a vector function - Gradient, Divergence and Curl - Directional Derivative - Identities (without proof) - Irrotational and Solenoidal fields

UNIT 5 THEORY OF SAMPLING AND TESTING OF HYPOTHESIS 12 Hrs.

Test of Hypothesis - Test of significance - Large samples - Z test - Single proportion - Difference of proportions - Single mean - Difference of means - Small samples - Student's t test - Single mean - Difference of means -Test of variance - Fisher's test - Chi square test - Goodness of fit - Independence of attributes.

Max. 60 Hours

TEXT / REFERENCE BOOKS

1. Vittal P R, Allied Mathematics, Margham Publications, 3rd Edition, 2002
2. Venkataraman M.K., Engineering Mathematics - First Year, 2nd Edition, National Publishing Co., Chennai, 2000.
3. Frank Ayres and NBSP Elliot Mendelson, Schaum's Outline of Theory and Problems of Differential and Integral Calculus, Tata McGraw Hill, 1990.
4. Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I, 2nd Edition, S.Viswanathan Printers and Publishers, 1992.
5. Kreyszig, E, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, Singapore, 2001.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

PART A : 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBI1101	INTRODUCTION TO BIOINFORMATICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To enable the students to understand the tools used in Bioinformatics & how to use them. This will facilitate the students to undertake projects in modern biology.

UNIT 1 INTRODUCTION 9 Hrs.

Introduction to bioinformatics, biological information, the Central Dogma, Bioinformatics: Definition and overview Bioinformatics, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Genome projects, human genome project- Databases and human chromosomes, role of Bioinformatics in biological sequences. Biological data- DNA sequence protein sequence, macromolecular structure. Challenges in bioinformatics.

UNIT 2 COMPUTING IN BIOINFORMATICS 9 Hrs.

Introduction to internet-facilities used on the internet-www- web browsers, introduction to network basics- LAN, wan, network topology, protocol. Basic principles of computing in bioinformatics - database system, programming languages for bioinformatics- Perl, python. Introduction to computational biology.

UNIT 3 BIOLOGICAL DATABASES 9 Hrs.

Databases and programs, Information retrieval from databases of nucleic acid and proteins. Pair wise alignment and database searching, Multiple Sequence Alignment database searching, DNA analysis, protein analysis, Data information and Knowledge Management, Concepts in Bioinformatics, Databases and Data Warehouses in Bioinformatics. Challenges, combining multiple types of data, Information Retrieval system in bioinformatics.

UNIT 4 TOOLS APPLICATIONS IN BIOINFORMATICS 9 Hrs.

Bio-algorithms and Tools- Identifying genes, Overview of sequence annotation. Gene prediction methods- Human variation and disease identification, Visualizing and comparing nucleic acids and Protein Introduction to Phylogenetic analysis definition, concepts of tree, steps in constructing Phylogenetic analysis. Introduction to microarray.

UNIT 5 SOFTWARES IN BIOINFORMATICS 9 Hrs.

Basic software tools used in bioinformatics - Sequence analysis- GCG, Emboss - On3D viewer- Rasmol, Swiss pdb viewer, Pymol, Jmol. Modeling- Discovery studio 2.0, Docking -Auto dock, HEX.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Des Higgins and Willie Taylor, Bioinformatics sequence structures and databases, by Oxford University press, 1st ed., 2000.
- Atwood, Paey Smith, Introduction to bioinformatics, Woodhead Publisher Ltd., 2001.
- Arthur M.Lesk, Introduction to bioinformatics, Oxford University Press, 2002.
- David W. Mount, Bioinformatics: Sequences and genome analyses, Cold Spring Harbor Laboratory press, 2000.
- Westhead, Parish and Twyman, Instant notes: Bioinformatics, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam duration : 3 Hrs.****20 Marks****60 Marks**

SBT1102	BIOCHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To give an insight into the chemical aspects of biological macromolecules and their importance

UNIT 1 CARBOHYDRATES**9 Hrs**

Introduction. Classification, Properties and Biological importance. Isomers, epimers, enantiomers, mutarotation, open chain and closed chain structures of glucose.

UNIT 2 AMINOACIDS AND PROTEINS**9 Hrs.**

Aminoacids: classification- essential and non-essential amino acids, protein and non-protein amino acids, Zwitter ions. Proteins: Classification- based on i) shape and solubility and ii) increasing complexity of structure. Structure of proteins: primary, secondary, tertiary and quaternary, biological significance. Concept of isoelectric point and its significance.

UNIT 3 LIPIDS**9 Hrs.**

Introduction, Classification, Properties and Biological importance. Fatty acid nomenclature and structure, Lipids in cell membrane
Cholesterol and Steroids, Hormones - structure and function

UNIT 4 NUCLEIC ACIDS**9 Hrs**

Introduction- Nitrogenous bases - Purines and Pyrimidines - Nucleosides and Nucleotides -- Structure of nucleic acids - DNA, RNA: m-RNA, t-RNA, r-RNA - Biological importance of nucleic acids. 16s rRNA and its significance.

UNIT 5 VITAMINS AND MINERALS**9 Hrs**

Vitamins: fat soluble and water soluble vitamins. Minerals: Micro and Macro minerals. Biological importance of vitamin and minerals, deficiency symptoms

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Lehninger, Nelson and Cox, Principles of Biochemistry, W.H.Freeman, 4th Edition, 2005
- Donald Voet, Judith Voet and Charlotte Pratt, Principles of Biochemistry, John Wiley and Sons, 2008
- Pamela C.Champe, Richard A.Harvey and Denise R.Ferrier, Biochemistry, Lippincott's Illustrated reviews, 4th edition, 2007
- Stryer, L., Biochemistry, 4th Edition, W.H. Freeman & Co., 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SCY1103	CHEMISTRY OF INDUSTRIAL MATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To know the different types of coal, their analysis and gaseous fuels.
- To have a basic understanding about terms related to phase rule and its applications to various systems.
- To understand the requirements, classification of explosives and propellants used in aerospace industries.
- To provide an idea about lubrication mechanisms, properties and to learn the science of composites and abrasives.

UNIT 1 FUELS**9 Hrs.**

Fuels: Introduction - Classification of fuels - Characteristics of a fuel - Determination of calorific value of a fuel by Bomb calorimeter. Coal: Classification of coals based on energy content. Chemistry and analysis of coal: Proximate analysis and ultimate analysis. Manufacture of metallurgical coke: Otto-Hoffmann's method. Cracking: Fluidized bed catalytic cracking. Knocking in compression ignition and spark ignition engines. Gaseous fuels: CNG - LPG - Producer gas. Ethanol as a fuel.

UNIT 2 PHASE EQUILIBRIA**9 Hrs.**

Introduction: Definition of phase rule - Terms involved in phase rule with examples. One component system: Water system. Two component alloy systems: Classification - Reduced phase rule - Thermal analysis. Simple eutectic system: Lead-silver system. Congruent system: Zinc-magnesium system. Incongruent system: Sodium-potassium system.

UNIT 3 EXPLOSIVES AND ROCKET PROPELLANTS**9 Hrs.**

Explosives: Requirements - Classification of explosives: Low explosives - Primary explosives - High explosives. Assessment of explosives: Sand bomb test - Drop height - Velocity of detonation. Rocket propellants: Types of rocket engines - Basic principle of rocket propulsion system - Specific impulse (I_{sp}) - Thrust: Momentum thrust and pressure thrust. Requirements of a good propellant. Classification of chemical propellants - Liquid fuels - Liquid oxidizers - Solid fuels - Solid oxidizers.

UNIT 4 LUBRICANTS**9 Hrs.**

Introduction: Requirements and functions of lubricants. Mechanism of lubrication: Hydrodynamic lubrication - Boundary lubrication - Extreme pressure lubrication. Properties of lubricants: Viscosity index - Cloud point - Pour point - Flash point - Fire point - Oiliness - Slight oxidation test - Aniline point. Classification of lubricants: Liquid lubricants - Semisolid lubricants - Solid lubricants.

UNIT 5 COMPOSITES AND ABRASIVES**9 Hrs.**

Introduction: Definition. Constituents of composites: Matrix phase and dispersed phase - Examples. Metal matrix composites: Al matrix; Mg matrix and Ti matrix composites. Ceramic matrix composites: SiC matrix and Alumina matrix composites. Polymer matrix composites: Fiber reinforced plastics (FRP) and its types. Application of composites. Cermets: Oxide base cermets - Carbide base cermets - Properties and applications. Abrasives: Definition - Properties: Moh's scale of Hardness. Classification: Natural and synthetic abrasives. Manufacture of abrasive paper and abrasive cloth.

MAX. 45 HOURS**TEXT/REFERENCE BOOKS**

1. Jain P. C., and Monica Jain, Engineering Chemistry, 15th Edition, Dhanpat Rai Publishing Co., 2009.
2. Sheik Mideen A., Engineering Chemistry (I & II), 13th Edition, Shruthi Publishers, 2010.
3. Dara.S.S., Text Book of Engineering Chemistry, S.Chand & Co, 2009.
4. Kuriakose J. C., and Rajaram. J, Chemistry in Engineering and Technology, Vol.1 & 2, Tata McGraw Hill Publishing Company (P) Ltd., 2009.
5. Puri Br., Sharma Lr., Madhan S Pathania, Principles of Physical Chemistry, 41st Edition, Vishal Publishing Co., 2004.
6. Uppal M.M., Engineering Chemistry, 6th Edition, Khanna Publishers, 2006.
7. Agarwal O.P., Engineering Chemistry, 3rd Edition, Khanna Publishers., 2003.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 Questions of 2 marks each-No choice**PART B :** 2 Questions from each unit of internal choice, each carrying 12 marks.
(Out of 80 marks, maximum of 10% problems may be asked)**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SCY1104	BIO ORGANIC CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamentals of classification, synthesis, properties and structural elucidation of carbohydrates, amino acids and proteins.
- To know the classification and properties of lipids and enzymes.
- To have overall idea about the structure and biological aspects of steroids, hormones, vitamins and nucleic acids.

UNIT 1 CARBOHYDRATES**9 Hrs.**

Introduction: Classification: Sugars and Non-sugars. Building up of the sugar series: Aldoses. Conversion of higher to lower homologue and vice versa: Ascending and descending series - Kiliani Fischer synthesis - Ruff degradation. Glucose: Physical properties - Chemical properties: Epimerization - Mutarotation. Structural elucidation of glucose: Open chain and closed chain structure. Structure and biological importance of disaccharides: Sucrose - Maltose - Lactose. Structure and biological importance of polysaccharides: Starch - Cellulose - Chitin - Heparin - Peptidoglycan.

UNIT 2 AMINOACIDS AND PROTEINS**9 Hrs.**

Aminoacids: Classification - α , β , and γ aminoacid - acidic, basic and neutral amino acids - Essential and non essential amino acids. Preparation: HVZ reaction - Strecker synthesis - Gabriel Phthalimide synthesis. Physical properties: Isoelectric point. Chemical properties: Reaction of amino group - Carboxyl group and both. Proteins: Classification based on shape and solubility - Classification based on increasing complexity of structure. Structure of proteins: Primary - Secondary - Tertiary - Quaternary.

UNIT 3 LIPIDS AND ENZYMES**9 Hrs.**

Lipids: Occurrence and classification of lipids - Simple lipids: Fats - Distinction between fats and oils - Occurrence - Properties: Hydrolysis - Auto oxidation - Addition reactions. Analysis of fats and oils: Saponification value and Iodine number. Compound Lipids and Derived lipids.

Enzymes: Classification and nomenclature - Enzyme Kinetics: Michaelis-Menton equation. Enzyme activity - Mechanism of enzyme action.

UNIT 4 STEROIDS, HORMONES AND VITAMINS**9 Hrs.**

Steroids: Introduction - Nomenclature. Cholesterol: Constitution (excluding synthesis) and biological importance.

Hormones: Introduction - Difference between hormones and vitamins. Classification - Structure and functions of steroid hormones: Androsterone - Progesterone - Testosterone - Estrone. Adrenocortical hormones: Cortisone.

Vitamins: Structure and importance of Vitamin D - Folic acid - Nicotinamide.

UNIT 5 NUCLEIC ACIDS**9 Hrs.**

Introduction: Purines and Pyrimidines - Nucleosides and Nucleotides - Nitrogenous bases - Structure of nucleic acids - DNA, RNA, m-RNA, t-RNA, r-RNA - 70s and 80s - Biological importance of nucleic acids - Sequencing of nucleic acids - Maxam-Gilbert's method and Sanger's method.

Max. 45 HOURS**TEXT / REFERENCE BOOKS**

1. Jain J. I., Nitin Jain, Sunjay Jain, Fundamentals of Biochemistry, 6th Edition, S. Chand and Sons, 2013.
2. David L. Nelson, Michael M. Cox, Lehninger Principles of Biochemistry, 6th Edition, W. H. Freeman, 2013.
3. Gurdeep R Chatwal, Organic Chemistry of Natural Products Vol II, 2nd Revised Edition, Himalaya Publishing House, 1986.
4. Tewari K.S., Vishnoi N.K. and Mehrotra S.N., A Text Book of Organic Chemistry, 2nd Revised Edition, Vikas Publications, 2004.
5. Rastogi S.C., Biochemistry, 6th Reprint, Tata McGraw Hill Publishing Limited, 2007.
6. Stryer L., Biochemistry, . 4th Edition, W.H. Freeman & Co, 1995.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 Questions of 2 marks each-No choice

PART B : 2 Questions from each unit of internal choice, each carrying 12 marks.
(Out of 80 marks, maximum of 10% problems may be asked)

Exam Duration : 3 Hrs.**20 Marks****60 Marks**

SCY1105	PHYSICAL CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamentals related to the phase diagrams and their applications.
- To know about the types and properties of solutions.
- To expose the students for various separation techniques for the purification of compounds.
- To provide an idea about the chemical kinetics in terms of order, molecularity and their derivations involved.
- To give an overview about the advanced electrochemical applications.

UNIT 1 PHASE RULE**9 Hrs.**

Phase diagram - Information from phase diagram - Terminology used in phase diagram. Gibb's phase rule - Derivation. One component system: Water system. Two component alloy systems: Classification - Reduced phase rule - Thermal analysis. Simple eutectic system: Lead-silver system. Congruent System: Zinc-magnesium system. Incongruent system: Sodium-potassium system. Phase diagram of simple three component system.

UNIT 2 SOLUTIONS**9 Hrs.**

Introduction: Solid solution - Hume Rothery's rule. Types of solid solutions: Liquid solutions: Solubility of partially miscible liquids - Phenol-water system. Colligative properties: Lowering of vapour pressure. Raoult's law. Derivation - Osmotic pressure - Isotonic solution - Relationship between osmotic pressure and vapour pressure. Depression in freezing point - Derivation. Elevation in boiling point - Derivation - Problems.

UNIT 3 SEPARATION TECHNIQUES**9 Hrs.**

Distillation techniques: Fractional distillation - Steam distillation - Vacuum distillation. Chromatography: Elution analysis - Paper chromatography - Thin layer chromatography - Liquid chromatography - High performance liquid chromatography (HPLC) - Gas chromatography (GC).

UNIT 4 CHEMICAL KINETICS**9 Hrs.**

Introduction: First and second order reactions: Integration - Integration of n^{th} order reaction. Methods of determining order and molecularity. Collision theory of bimolecular gaseous reactions - Activated complex of bimolecular reactions - Lindemann theory of unimolecular equation - Kinetics of complex reactions: Reversible reaction - Consecutive reaction - Chain reactions - Autocatalysis - Problems.

UNIT 5 ADVANCED ELECTROCHEMISTRY**9 Hrs.**

Introduction: Cell constant - Equivalent conductance - Molar conductance. Ionic mobility: Transport number - Moving boundary method - Hittorf's method. Debye Huckel theory of strong electrolytes. Concentration cells: Types - Concentration cells without transference and with transference. Potentiometric titrations: Redox titration. Polarography - Applications of polarography.

Max. 45 HOURS**TEXT / REFERENCE BOOKS**

1. Puri B.R., Sharma L. R., Madan. S.Pathania, Principles of Physical Chemistry, 41st Edition, Vishal Publishing co., 2004.
2. Keith J. Laidler, Chemical Kinetics, Third Edition, Pearson education limited, 2004.
3. Atkins P. W., Physical Chemistry, 6th edition, Oxford University press, 1998.
4. Barrow G. M., Physical Chemistry, 5th edition, McGraw-Hill, 1988.
5. Glasstone S., A Text book of Physical Chemistry, Macmillan Ltd, 1976.
6. Jayakumar V., Engineering Metallurgy, ARS publications, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 Questions of 2 marks each-No choice**20 Marks****PART B :** 2 Questions from each unit of internal choice, each carrying 12 marks.**60 Marks**

(Out of 80 marks, maximum of 10% problems may be asked)

SBT1103	MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable students to learn about the principles of Microbiology to emphasize structure and biochemical aspects of various micro organisms.
- To know the control and preventive measures of microbial infections and environmental pollutions.

UNIT 1 INTRODUCTION TO MICROBIOLOGY 11 Hrs.

Introduction, History and scope of microbiology, Contributions of Leewenhoek, Pasteur, Koch, Jenner and Fleming, Microbial classification: Classical and Current systems, Methods of identifying microbes.

Basics of Microscopy, Staining: simple, differential (Gram staining, Acid fast staining), special staining (flagella, capsule, endospore)

UNIT 2 MICROBIAL STRUCTURE AND REPRODUCTION 9 Hrs.

Morphology and Reproduction: Bacteria - General structure and forms, Reproduction methods - Fission, budding and sporulation, Virus - TMV, HIV & T4 bacteriophage - lytic, lysogenic cycle, Fungi - Fungal morphology - Mycelial and yeast forms - sexual and asexual Reproduction, Actinomycete

UNIT 3 MICROBIAL GROWTH AND PHYSIOLOGY 7 Hrs.

Microbial Growth and Nutrition, Types of media - Based on Consistency, Nutritional components, Functional uses and application, Microbial types based on nutrition, Growth of microbes in culture - Pure culture techniques, Batch & Continuous - Growth curve - Enumeration methods, Types of fungal growth media. Aerobic and Anaerobic metabolism of sugars, mixed acid fermentation.

UNIT 4 CONTROL OF MICROORGANISMS 9 Hrs

Definitions of frequently used terms - Pattern or Rate of Microbial Death, Physical methods of Microbial Control: Heat (Moist & Dry), Low temperature, Filtration, High pressure, Desiccation, Osmotic pressure, Radiation. Chemical methods of Microbial Control: Liquids - Alcohols, Aldehydes, Phenolics, Halogens - Heavy metals, Surface active agents & Dyes, Gases - Formaldehyde, Ethylene Oxide, Plasma - Physico-chemical methods - Chemotherapeutic agents - Evaluation of effectiveness of antimicrobial agents. Difference between cleaning - sanitizing - sterilizing agents. Moist heat sterilization: D, Z and F Values and significance.

UNIT 5 APPLICATIONS OF MICROBIOLOGY 9 Hrs.

Microbial ecology: Microbe-Microbe interaction - Mutualism, Commensalism, Altruism, Microbe - host interactions - Colonization and Infection- Causes and Transmission of Infectious Diseases, Emerging and re-emerging infectious diseases - Mechanism and examples, Multidrug resistance - MRSA, Diagnostic Microbiology, Childhood and adult vaccinations - MMR, Polio, Rabies etc, bioterrorism agents, Biofilm - Quorum sensing,

Max. 45 Hours.

TEXT / REFERENCE BOOKS

- Pelczar, Jr E.C.S Chan and Noel R.Krieg, Microbiology, 5th edition Tata McGraw-Hill -2006
- Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton, Prescott's Microbiology, 8th Edition, McGraw-Hill Higher Education, 2008
- Jawetz, Melnick and Adelberg's Medical Microbiology . McGraw-Hill Medical, 2007
- University of South Carolina School of Medicine (<http://pathmicro.med.sc.edu/book/bact-sta.htm>)

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBT1104	GENETICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce a fascinating and controversial area of contemporary science, this course presents basic terms, principles, and research methods used in the study of genetics.
- To learn about the transmission, distribution, arrangement, and alteration of genetic information and how it functions and is maintained in populations.

UNIT 1 MENDELIAN PRINCIPLE**9 Hrs.**

DNA as hereditary material, Mendel and his experiments, laws of inheritance, variations in Mendel's Theme: incomplete dominance, co-dominance and multiple allele, Gene interactions; Epistasis, Duplicate, Complementary, Supplementary and Lethal genes

UNIT 2 CHROMOSOMES**9 Hrs.**

Structural organization, variation in the number and structure of chromosome; Haploids, missing and extra chromosome (Euploid and aneuploid); Deletion, Duplication, Translocation and other structural rearrangements. Chromosomal studies - karyotyping. Chromosomal theory of inheritance; clues from inheritance of sex, linkage, crossing over.

UNIT 3 GENETIC MATERIAL AND MUTATION**9 Hrs.**

Evidence for DNA and RNA as genetic material; Mutations - types and causes of mutation, DNA repair Mechanisms. Physiochemical properties of DNA: Denaturation, Annealing and C-value paradox.

UNIT 4 BACTERIAL GENETICS**9 Hrs.**

Bacterial gene transfer; conjugation, transformation, transduction - general, restricted and abortive transductions; Bacterial plasmids: structure, properties and its types; transposons, types of transposons.

UNIT 5 HUMAN GENETICS**9 Hrs.**

Human Chromosomes, Dosage Compensation, Chromosomal abnormalities - sex chromosomal and autosomal. Inherited disorders, Genetic engineering, gene therapy, inborn errors of metabolism and Genetic counseling. Knock down and gene silencing.

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

- David Friefelder, Molecular Genetics, Narosa publishing house, India, 2006.
- Kavita B Ahluwalia, Genetics, New age international publishers, India. 2008.
- Gardner, E.J, Simmons, Shustad, Principles of Genetics, 8th Edition John Wiley & Sons Ltd, 1991.
- Griffith, Fundamentals of Genetics analysis, 7th Edition, W.H. Freeman & Company, Newyork, 2000.
- Robert Tamarin, Principles of Genetics, 7th Edition, Tata McGraw-Hill Edition, New York.2002.
- Molecular Biology of Genes - Watson, 7th Edition, Benjamin Cummings, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI4051	BASIC BIOINFORMATICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Structural Databases – PDB, MMDB
2. Retrieval of Protein sequence – Uniprot, PIR
3. Retrieval of Nucleic acid sequence- Genbank, EMBL, DDBJ
4. Blast and FASTA - Similarity Search
5. Pairwise alignment
6. Multiple Sequence Alignment - CLUSTALW, MUSCLE
7. Secondary structure Prediction
8. ExPASy Tools for Genomics and Proteomics
9. NCBI ENTREZ
10. Small molecule databases – Pubchem, Zinc, KEGG Ligand
11. Gene Prediction tools – Genscan, GEO.

SBI4052	IMMUNOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. ABO Blood Grouping,
2. Differential leukocyte count,
3. Complement fixation test,
4. Widal – Agglutination test,
5. Radial Immunodiffusion,
6. Ouchterlony Double Immuno Diffusion – Antibody titration,
7. Rocket Immuno electrophoresis,
8. Immuno electrophoresis and
9. ELISA – Quantification of Immunoglobulins.

SBT4053	MICROBIOLOGY & BIOCHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS**Microbiology Lab**

1. Study and Handling of Microscope
2. Laboratory rules and regulations
3. Staining Procedures
 - a). Smear preparation
 - b). Simple staining
 - c). Grams staining
 - d). Capsule staining
4. Sterilization procedures and preparation of solid and liquid media
5. Streak plate method
6. Decimal dilution method
7. Spread plate method
8. Pour plate method
9. Antibiotic Sensitivity test

Biochemistry Lab

1. Estimation of Protein by Lowry's Method
2. Preparation of casein from milk
3. Preparation of Aspirin from salicylate
4. Amino acid Analysis
5. Carbohydrate Analysis

SBT4054	BIOCHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Units, Volume and weight measurements, concentration units,
2. pH measurement & calibration of pH meter
3. Preparation of buffers
4. Working principle and standardization of colorimeter
5. Working principle of centrifuge
6. Qualitative analysis of Carbohydrates
7. Qualitative analysis of amino acids
8. Titrimetric estimation of Ascorbic acid
9. Quantitative estimation of Protein by Lowry's method
10. Quantitative estimation of Urea by DAM method
11. Determination of saponification number

SMT1202	ENGINEERING MATHEMATICS - III (Common to BIOTECHNOLOGY, BIOINFORMATICS and BIOMEDICAL)	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

The ability to identify, reflect upon, evaluate and apply different types of information and knowledge to form independent judgments. Analytical, logical thinking and conclusions based on quantitative information will be the main objective of learning this subject.

UNIT 1 ORDINARY DIFFERENTIAL EQUATIONS 12 Hrs.

Formation of ODE - Solution of first order exact equations - Solution of second order linear differential equations with constant coefficients - Particular integrals for e^{ax} , $\sin ax$, $\cos ax$, x^n , $x^n e^{ax}$, $e^{ax} \sin bx$, $e^{ax} \cos bx$.

UNIT 2 PARTIAL DIFFERENTIAL EQUATIONS 13 Hrs.

Formation of equations by elimination of arbitrary constants and arbitrary functions - Lagrange's linear equations

UNIT 3 INTERPOLATION AND NUMERICAL SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL LINEAR EQUATIONS 11 Hrs.

Interpolation - Newton's Method - Lagrange's Method. Numerical solution of Algebraic and Transcendental equations - Newton Raphson method - Gauss Jordan method - Crout's Method - Gauss Seidel method.

UNIT 4 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12 Hrs.

Numerical Solution of first order ordinary differential equations - Taylor's series method - Modified Euler's method - Runge-Kutta method of fourth order.

UNIT 5 NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 12 Hrs.

Classification of PDE - Elliptic Equations - Poisson's equations - Leibmann's Iteration Process - Parabolic Equations - Bender Schmidt Scheme - Hyperbolic Equations.

Max. 60 Hours

TEXT / REFERENCE BOOKS

1. Veerarajan T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. Kandasamy P., Thilagavathy K., Engineering Mathematics, Volumes II & III (4th revised edition), S. Chand & Co., New Delhi, 2001.
3. T. Veerarajan, Probability, Statistics and Random Process, 4th Edition, Tata McGraw Hill, 2008.
4. Irvin Miller John E Freund, Probability and Statistics for Engineers, Prentice Hall, 1977.
5. Grewal B.S., Higher Engineering Mathematics, 35th Edition, Khanna Publishers, Delhi, 2000.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Part A : 10 questions of 2 marks each - No choice

Part B : 2 questions from each unit of internal choice, each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBI1201	BIOMOLECULAR INTERACTIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To ensure the students have a strong knowledge in structures and the nature of the functional groups of biomolecules involved in biological reactions.

UNIT 1 ENZYME KINETICS**9 Hrs.**

Kinetics of enzyme catalyzed reaction, Enzyme kinetics: derivation of Michealis Menton equation, Line Weaver Burk plot, Factors influencing enzyme activity, Inhibitor kinetics (Competitive, Non-competitive and Uncompetitive). Mechanism of enzyme action - active site definition. Lock and Key hypothesis, Induced fit hypothesis, Allosteric enzymes, Feed-back inhibition.

UNIT 2 CHEMICAL BONDING**9 Hrs.**

Chemical bonding - Non-bonding Interactions - Electrovalent bond, stability of Electrovalent bond - Conformational features - Bond shapes; hybridization - Molecular geometry, Partial ionic character, Co-ordination, Vanderwaals forces, Metallic bond. Theory of Atomic & Molecular orbitals - linear combination of atomic orbitals - Quantitative treatment of valency, bond theory, Resonance Structures.

UNIT 3 RAMACHANDRAN MAP**9 Hrs.**

Main chain and side chain, Planarity of the peptide bond, Definition: ϕ , ψ , ω and τ . End protected alanine: model system. Contact or limiting distances. Special cases: proline, glycine and preproline. Allowed versus preferred conformation. Geometry dependence. "Periodic" or "helical" conformations: definition, location in the Ramachandran map. Main chain and side chain conformations: dependency / correlation. Distribution of (ϕ , ψ) values observed in high-resolution protein structures. Deviation from the "ideal" Ramachandran map: reasons. Ramachandran map as a general conformational analysis tool. Pseudotorsion angles: definition, application in conformation analysis: nucleic acids and protein backbone conformation using α atom coordinates

UNIT 4 TRANSITION METAL COMPLEXES**9 Hrs.**

Transition Metal Complexes and their interaction with nucleic acids -Structures of Nucleic acids, Interactions of Metal complexes with Nucleic Acids - Fundamental Reactions with Nucleic Acids - Nuclease Activity of Classical TRIS (Phenanthroline), Applications of Nuclease Activity of Metal complexes, Nucleic Acid Interactions in Nature.

UNIT 5 MACROMOLECULAR INTERACTIONS**9 Hrs.**

Weak Interactions - Pi-Pi Interactions, molecular interactions: Protein - protein , Protein-DNA, DNA- Drug, Protein - Lipid, Protein - Ligand, protein - Carbohydrate, Intercalation, Metalloproteins.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Kuhn Hans, Försterling Horst-Dieter and Waldeck David H, *Principles of Physical Chemistry*, 2nd Ed., Wiley(2009).
- Atkins P W and de Paula Julio, *Physical Chemistry*, Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
- Silbey Robert J, Alberty Robert A, Bawendi Mounji G, *Physical Chemistry*, (4th Ed.), Wiley (2006).

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam duration : 3 Hrs.****20 Marks****60 Marks**

SCS1306	DATABASE MANAGEMENT SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Design of database for any given problem
- Design Logical Database Schema and Mapping it to implementation level schema through Database Language Features.
- Understand the practical problems of Concurrency control and its solutions Gain knowledge about failure and Recovery mechanisms

UNIT 1 INTRODUCTION TO DATABASES**9 Hrs.**

Databases and Databases users - Database system concepts and architecture - Data modeling using Entity Relationship (ER) Model. **Relational Model** -The Relational Data Model and Relational Database Constraints-The Relational Algebra and Relational Calculus.

UNIT 2 DATABASE DESIGN**9 Hrs.**

Overview of the QBE Language-Overview of the Hierarchical Data Model-Overview of the Network Data Model-SQL-99: Schema Definition, Constraints, Queries, and Views- Functional Dependencies and Normalization for Relational Databases.

UNIT 3 QUERY PROCESSING**9 Hrs.**

Algorithms for Query Processing and Optimization - Introduction to Transaction Processing Concepts and Theory - Concurrency control techniques.

UNIT 4 RECOVERY AND SECURITY**9 Hrs.**

Database Recovery Techniques - Database Security - Distributed databases and Client-Server Architecture

UNIT 5 OBJECT DATABASE**9 Hrs.**

Concepts for Object Database - Enhanced Data Models for Advanced Application Emerging Database Technologies and Application

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Elmasri & Navathe - Fundamentals of Database Systems - 3rd Edition, 2nd Reprint, Addison Wesley, 2000
2. Abraham Silberschatz, Henry.F.Korth and S. Sudharshan "Database System Concepts", 4th Edition, 2002.
3. C.J.Date, "Introduction to database systems", Addison Wesley, 7th Edition, 2001.
4. Jan L.Harrington, "Object oriented database design", Harcourt India private limited 2000.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each- No choice**PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBT1201	MOLECULAR BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The course introduces the basic concepts of cloning and its application in various fields of biotechnology.

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction to rDNA technology- Scope and milestones. Isolation of plasmid DNA and genomic DNA from bacteria, phage, isolation of RNA. Separation by agarose gel electrophoresis. Enzymes involved in rDNA technology- restriction enzymes -types and their uses, polymerases, ligases, DNA modifying enzymes. Blunt and cohesive end ligation- use of linkers and adaptors, homopolymer tailing.

UNIT 2 CLONING VECTORS**9 Hrs.**

Cloning vectors - plasmid and phage vectors for E.coli- pBR 322 and its derivatives, λ vectors, cosmids, phagemids, M13 phages. Yeast vectors and their types, Yeast artificial chromosomes. BAC, Shuttle Vector, Broad Host range vectors. Vectors for plants - Ti plasmids, CaMV, Geminiviruses. Vectors for animals - SV 40 vectors, Adenovirus, Retrovirus. Mammalian expression vectors. Model organisms - E coli, CHO.

UNIT 3 GENE TRANSFER TECHNOLOGY**9 Hrs.**

Gene transfer technology- chemical transfection methods: calcium chloride, PEG, polyplex, DEAE dextran. Physical methods: electroporation, microinjection, particle bombardment, ultrasonication, liposome mediated transfer. Biological methods: use of vectors. Gene cloning strategies- genomic and cDNA library construction, PCR based cloning.

UNIT 4 SELECTION & SCREENING OF RECOMBINANTS**9 Hrs.**

Methods for clone identification-direct screening (insertional inactivation of marker gene, visual screening methods), indirect screening (immunological techniques, rescue techniques, colony hybridization and dot blot hybridization), hybridization techniques - Southern blotting, Northern blotting, Western blotting.

UNIT 5 APPLICATIONS OF rDNA TECHNOLOGY**9 Hrs.**

Application of rDNA technology - Antisense and ribozyme technology, Human genome project and its application, Gene therapy prospects and future, DNA vaccine, Transgenic plants, Transgenic animals, current production of rDNA products, Bio-safety measures and regulations for rDNA work- Outline of cell line characterization (Ref:www.biooutsource.com)

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Primrose SB and R. Twyman Principles Of Gene Manipulation & Geneomics, Blackwell Science Publications, 2006.
- Principles of Genome Analysis and Genomics by S.B.Primrose and R.M.Twyman, Third Edition (Blackwell Publishing), 2003.
- Anselm FM, Brent R, Kingston RE, Moore DD, Current Protocols In Molecular Biology, Greene Publishing Associates, NY, 1988.
- Berger SI, Kimmer AR, Methods In Enzymology, Vol 152, Academic Press, 1987.
- Brown T.A., Genomes, 3 by Third Edition (Garland Science Publishing), 2007.
- US FDA guidelines on the genetically modified organisms

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1202	BIOLOGICAL SEQUENCE ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Enables the student to understand the nature of sequence and ways of analysis to get maximum alignment.

UNIT 1 PAIRWISE ALIGNMENT**9 Hrs.**

Introduction to sequence similarity, Dot matrix sequence comparison, Pairwise alignment techniques - Global alignment, Local alignment methods, Dynamic programming Algorithm of Pairwise alignment, Measures of sequence alignment - Scoring schemes - Log odds scoring system - PAM and BLOSUM substitution matrices, Gap penalty, Exercises.

UNIT 2 MULTIPLE SEQUENCE ALIGNMENT**9 Hrs.**

Multiple sequence alignment - Goals of multiple sequence alignment, progressive methods, Iterative methods, Hidden Markov Models in multiple sequence alignment. Specific scoring matrices, Tools for multiple sequence alignment - CLUSTAL W, PILEUP

UNIT 3 DATABASES SEQUENCE SIMILARITY**9 Hrs.**

Heuristic algorithms - FASTA and BLAST, Gapped BLAST & PSI-BLAST, PHI-BLAST, E-value - Significance of sequence alignment.

UNIT 4 PREDICTIVE METHODS ON PROTEIN SEQUENCES**9 Hrs.**

Predictive methods: Different secondary structure prediction methods - Chou fasman method, GOR method, Algorithm behind the methods - Tools used for secondary structure prediction - Prediction methods using Protein sequences - PRPSEARCH, MOWSE, TGREASE, SAPS, BLOCKS, mnpredict, PredictProtein, PREDATOR, PSIPRED, JPRED, SOPMA

UNIT 5 PREDICTIVE METHODS ON NUCLEIC ACID SEQUENCES**9 Hrs.**

Prediction methods using DNA sequences - Michael Zhan's Exon Finder, Gene scan, Morgan, Genie, Gene finder, Gene parser. Predictive methods using protein sequences- Prediction of RNA secondary structure- Expressed sequence tags (ESTs).

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Durbin R., Eddy S., Krogh A. & Mitchison G., Biological Sequence Analysis: Probabilistic Models of Proteins & Nucleic Acids, Cambridge University Press, 1999.
- Des Higgins, William Taylor. Bioinformatics Sequence Structure & Data Banks. A practical approach. 2010
- Gusfield D., Algorithms on Strings, Trees & Sequences: Computer Science & Computational Biology, Cambridge University Press, 1997.
- Stephen Misener & Stephen A. Krawetz. Bioinformatics methods and protocols. Humana Press. 2000.
- Pevzner P., Computational Molecular Biology: An Algorithmic Approach, MIT Press, 2000.
- Setubal J. & Meidanis J., Introduction to Computational Molecular Biology, PWS Publishing Company, 1997.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI1203	MOLECULAR IMMUNOLOGY AND IMMUNOINFORMATICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To enable the student to learn the mechanism by which a human body interacts with a pathogenic microbe & the process of elimination.

UNIT 1 INTRODUCTION TO IMMUNE SYSTEM 9 Hrs.

Introduction and overview of the immune System, Organs of Lymphatic System-Primary and secondary lymphoid organs, Cells of the immune System- Types of Immunity -Innate and Acquired, Self and Non-Self, Humoral and Cell Mediated Immune Response, Active Immunity and Passive Immunity, Mediators of immune system- Complement, Inflammation

UNIT 2 IMMUNOGENS 9 Hrs.

Immunogens -Antigens -Epitope or Antigenic Determinant-Factors Influencing Immunogenicity -Antigenicity - Method of Administration- Chemical Nature of Immunogens - Types of Antigens-T-Independent Antigens - T-Dependent Antigens -Hapten:Carrier Conjugates - Adjuvants-Superantigens - Cross Reactivity,Antibody - Immunoglobulins-Structure, Function and classes - of Immunoglobulins Structure/Function Relationships -Isotypes, Allo types and Idiotypes Genetics of Immunoglobulins - Light Chain Gene Families - Heavy Chain Gene Family - Mechanism of DNA Rearrangements - Origin of Antibody Diversity .

UNIT 3 ANTIGEN PROCESSING, PRESENTATION & IMMUNE RESPONSE 9 Hrs.

T Cell Receptor For Antigen -B cell receptor, Major Histocompatibility Complex (MHC) Structure of Class I And Class II MHC Molecules, MHC and T&B-Cell Receptors-Important Aspects of MHC-Cytokines- Monokines - Lymphokines Interleukins and Interferons, Auto Immunity, APC (Antigen Presenting Cells), Macrophages, Phagocytosis, endocytosis, Immunosuppression - Transplantation. Auto graft, Allograft, Isograft, Organ Rejection

UNIT 4 ANTIGEN - ANTIBODY INTERACTIONS 9 Hrs.

Antigen - Antibody interactions - Blood Grouping and Rh Typing - Agglutination - Precipitation - Immunodiagnostic techniques - Immunofluorescence - Immunodiffusion - Immuno-electrophoresis - ELISA - RIA - Monoclonal antibodies production, Polyclonal antibodies production, Hypersensitivity reactions - Tumor immunology, Primary and Secondary immuno deficiency disorders-AIDS - Immunization - Vaccines.

UNIT 5 IMMUNOINFORMATICS 9 Hrs.

Immunoinformatics - Strategies for better understanding of immune function -Future of computational modeling and prediction systems in clinical immunology - Role of immunoinformatics in personalised medicine Reverse vaccinology- Epitope mapping - Vaccine design tools. Epitope prediction tools-Epitope, epitome, MHCPreD, Epitope database:IMGT,IEDB.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Roitt, I. M. Essential Immunology, 8th Edn. Blackwell science, 1977
2. Roitt I.M. Immunology, 3rd Edn. Blackwell science, 1977
3. Stites, Fudenberg, Basic and immunology, 5th Edn. Lange Medical Publication. USA, 1984
4. Weir, D.M., Immunology, 5th Edn. Longman Singapore Pub. 1983
5. Bowry, T.R, Immunology Simplified, ELBS. 1984
6. Janis Kuby: Immunology, W.H. Freeman & company, N. Y. 2nd Edn 1992
7. P. M. Lydyard. A. Whelan and M. W. Fanger. Instant notes in Immunology. Viva Books Pvt. Ltd New Delhi. 2000

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI4051	BASIC BIOINFORMATICS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Structural Databases – PDB, MMDB
2. Retrieval of Protein sequence – Uniprot, PIR
3. Retrieval of Nucleic acid sequence- Genbank, EMBL, DDBJ
4. Blast and FASTA - Similarity Search
5. Pairwise alignment
6. Multiple Sequence Alignment - CLUSTALW, MUSCLE
7. Secondary structure Prediction
8. ExPASy Tools for Genomics and Proteomics
9. NCBI ENTREZ
10. Small molecule databases – Pubchem, Zinc, KEGG Ligand
11. Gene Prediction tools – Genscan, GEO.

SBI4052	IMMUNOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. ABO Blood Grouping,
2. Differential leukocyte count,
3. Complement fixation test,
4. Widal – Agglutination test,
5. Radial Immunodiffusion,
6. Ouchterlony Double Immuno Diffusion – Antibody titration,
7. Rocket Immuno electrophoresis,
8. Immuno electrophoresis and
9. ELISA – Quantification of Immunoglobulins.

SBI4053	BIOLOGICAL SEQUENCE ANALYSIS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS**Genetics Computing Group (GCG) - Version 10-UNIX**

1. Database Searching and Retrieval
2. Reference Searching
 - i. Fetch
 - ii. LookUp
3. Sequence Searching
 - i. BLAST
 - ii. FastA
4. Importing and Exporting
 - i. Reformat
5. Pairwise Comparison
 - i. Gap
 - ii. BestFit
 - iii. FrameAlign
 - iv. Compare
 - v. DotPlot
6. Multiple Sequence Comparison
 - i. PileUp
 - ii. SeqLab Editor
 - iii. HmmerBuild
 - iv. HmmerCalibrate
7. Gene Finding and Pattern Recognition
 - i. Gene finder
 - ii. Motifs
 - iii. FindPatterns
8. Mapping
 - i. Map
 - ii. Restriction Mapping
 - iii. Vector mapping (Vector contamination)
9. Primer Selection
 - i. Prime
10. DNA / RNA Secondary Structure Evolution
 - i. MFold
 - ii. PlotFold
11. e-PCR, Gene Ontology
12. Sequence Submission in repository

SBI1204	INTRODUCTION TO QUANTUM CHEMISTRY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Enables the student to understand the concept of chemical bonding and reactivity with the theoretical basis for optical spectroscopy.

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction - chemistry as a branch of mechanics - operators - definition and examples - algebra of operators - basic properties - linear operators - eigen function and values - Hermitian operator - unary operator - commutators.

UNIT 2 QUANTITATIVE PROPERTIES**9 Hrs.**

Wave properties of EM radiation - Blackbody radiation - Wien's law - Raleigh-Jeans's law - Planck's law - photoelectric effect - quantisation of matter - drawbacks of old quantum theory - Bohr's model for Hydrogen atom - Matter waves:- group velocity - relation between group velocity and phase velocity - de-Broglie's relation - uncertainty principle - significance.

UNIT 3 SCHRODINGER WAVE FUNCTION**9 Hrs.**

Postulates of quantum mechanics - Hamiltonian - Schrodinger wave equation - importance of Schrodinger equation - physical interpretation of wave function - properties of wave function - normalization of wave functions - three dimensional wave equation - time dependent and time independent.

UNIT 4 SCHRODINGER WAVE FUNCTION - PARTICLE IN A BOX**9 Hrs.**

Free particle in one dimension - particle in a one dimensional box - probability and probability density - orthogonality - particle in three dimensional box - energy levels in cubic box - Particle in a ring - Particle in a sphere.

UNIT 5 SCHRODINGER WAVE FUNCTION - HYDROGEN ATOM**9 Hrs.**

Schrodinger equation for hydrogen atom - solution of f equation - solution of q equation - solution of R equation - angular momentum - shape of orbitals.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- M. Satake, Y. Mido, H. Yasuhisa, S. Taguchi, M.S.Sethi, S.A.Iqbal, Introduction to quantum chemistry - Discovery Publishing House, New Delhi, 2003.
- A.K. Chandra, Introductory Quantum Chemistry- Tata McGraw Hill, New Delhi, 2001.
- S.P.Singh, M.K.Bagde, Quantum Mechanics - S. Chand and Co, New Delhi, 1983.
- R.K.Prasad, Quantum chemistry New Age Science, 2006.
- Manas Chanda, Quantum mechanics Tata McGraw Hill, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBT1207	ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To give an insight into the working principles of optical methods, radioisotopes, spectroscopy and separation methods. This will enable the students to carry out the research work innovatively

UNIT 1 BASIC INSTRUMENTATION**9 Hrs.**

Cell disruption techniques, Basics of Microscope and its types - Bright field Microscope, Dark field Microscope, Phase contrast Microscope, Fluorescent Microscope, Electron Microscope (TEM, SEM, Tunnelling EM) & Confocal Microscope, Microtechnique, pH meter.

UNIT 2 BASIC SPECTROSCOPY**9 Hrs.**

Principles and Working of colorimetry, Spectroscopy : Basic principles, nature of electromagnetic radiation, Beer-Lambert laws- UV- Visible Spectrophotometry, Fluorescence Spectrophotometry, Atomic Absorption Spectrophotometry, FTIR, Raman Spectroscopy, Mass Spectrometry, Nuclear Magnetic Resonance (NMR) -Electron Spin Resonance(ESR).

UNIT 3 SEPARATION AND PURIFICATION TECHNIQUES**9 Hrs.**

Centrifugation - Principles & types - Differential, Rate zonal and Isopycnic centrifugation. Electrophoresis of nucleic acids - Agarose, PAGE and Pulse field Electrophoresis. Electrophoresis of proteins - SDS-PAGE, IEF and 2D PAGE. Protein purification methods, Chromatography - Principles, methodology and applications of chromatography: paper, Thin layer, column (gel filtration, ion exchange, affinity), GC and HPLC. Basics of flow cytometry

UNIT 4 RADIO ISOTOPE TECHNIQUES**9 Hrs.**

Radioactive isotopes - storage, safety, handling and radioactive waste management. Liquid Scintillation counter - α -counter and β -counter. X- ray Diffraction, Crystallography, Autoradiography. Magnetic Resonance Imaging (MRI) and CT scan.

UNIT 5 MOLECULAR TECHNIQUES**9 Hrs.**

Quantification of proteins, DNA and RNA. Blotting techniques - Southern, Northern and Western blotting. Gene transfer and transfection methods. PCR and its types. Biosensors and types Biosensors

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

- David T. Plummer, An introduction to Practical Biochemistry, Tata McGraw Hill Edition, 1988
- Keith Wilson and John Walker, Practical Biochemistry - Principles and techniques, Cambridge University Press, U.K; 5th Edition, 2003.
- Rapley and Walker, Molecular Biomethods Handbook, Humana Press, Totowa, NewYork, 2003.
- Biophysical chemistry : Principles and Techniques - Upadhyay and Nath - Himalaya publishing house , 2nd Review Edition, 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI1205	PHYLOGENETIC ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Students will understand the concept of reconstructing the evolutionary relationship between species.

UNIT 1 MOLECULAR BASIS OF EVOLUTION**9 Hrs.**

Molecular basis of evolution - Evolutionary tree of life - Mechanisms of evolution - Mutation and codon age. Evolutionary changes in amino acid sequences - Differences and proportion - Amino acid substitution matrix - Mutation rate and substitution rate. Evolutionary changes in DNA sequences - Nucleotide differences - Estimation of number of nucleotide substitutions - Gamma distances - Numerical estimation - alignment - Handling of sequence gaps in the estimation of evolutionary distances. Software tools for Sequence alignment - ClustalW, BioEdit, Hmmer, T-coffee, MAFFT, MultiAlign.

UNIT 2 PHYLOGENETIC TREES**9 Hrs.**

Synonymous and Non-Synonymous Nucleotide substitutions - Evolutionary pathway methods - Methods based on Kimura's 2 - Jones-Taylor-Thornton (JTT) model, Parameter Models - Nucleotide substitutions at different codon positions - Likelihood methods with codon substitution models. Phylogenetic trees - Types of phylogenetic trees - Topological differences - Tree building methods. Horizontal gene transfer.

UNIT 3 PHYLOGENETIC TREE BUILDING METHODS**9 Hrs**

Phylogenetic Inference - Tree building methods - Distance methods - UPGMA - Minimum Evolution method - Neighbor Joining method - Distance measures to be used for phylogenetic reconstruction - Maximum Parsimony methods - Finding MP trees - Strategies for searching - Consensus trees - Estimation of branch lengths - Weighted parsimony - Maximum Likelihood methods - Computational procedure - Models - Protein likelihood - Theoretical foundation - Parameter estimation

UNIT 4 OPTIMIZATION PRINCIPLES**9 Hrs.**

Accuracies and Statistical tests - Optimization principle and topological errors - Interior branch tests - Bootstrapping and Jack-knifing. Advantages and disadvantages of different tree building methods - Molecular clocks - Hypothesis - Relative rate tests - Linearized trees - Ancestral nucleotide and amino acid sequences - Bayesian approach - convergent and parallel evolution.

UNIT 5 APPLICATIONS IN PHYLOGENETICS**9 Hrs**

Genetic Polymorphism and Evolution - Evolutionary significance - analysis of allele frequency data - DNA polymorphism - Statistical tests - Population trees from genetic markers - Analysis of RAPD data - Software Tools - TreeView - MrBayes, PAUP, PHYLIP, Spectronet, HYPHY, Dendroscope, FigTree, ModelTest, Mesquite and MEGA.

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

- Joseph Felsenstein, Inferring Phylogenies, 1st edition Sinauer Associates Inc, 2004
- Baxevanis and Oulette, Bioinformatics Practical guide, Wiley, 2005
- Durbin, Biological sequence Analysis, 1st Edition, 1998
- David Mount, Bioinformatics: Sequence and Genome Analysis, 2nd Edition, CSHL press 2004
- Masatoshi Nei, Molecular Evolution and Phylogenetics, Oxford University press, 2000

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SIT1201	JAVA PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Understand the Classes and Objects
- Understand the Inheritance, Types of Inheritance and Packages
- Understand the Input/Output basics and Threading
- Understand the Applet basics and AWT

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction to Java - Classes and Objects - Class Fundamentals - Constructors - Operators - Control Statements - Arrays -String Handling - String class - String buffer class. Inheritance - Basics - Using Super - Method Overriding - Abstract Classes - Using final with inheritance

UNIT 2 PACKAGES AND INTERFACES**9 Hrs.**

Using Packages - Importing packages - Access protection - Interfaces - Exception Handling - Exception Types - Using try, catch, throw, throws and finally -Garbage Collection- Multithreading -JavaThread Model - Main thread - Creating multiple thread - Thread priorities -Synchronization - Enumeration - Autoboxing - Annotations - Lambda Expressions

UNIT 3 JAVA LIBRARY**9 Hrs.**

Exploring java.io package - String Handling - Primitive type wrappers - Runtime - System - Object - Class - Using clone() and the Cloneable Interface - Byte and Character Streams - Exploring java.util packages

UNIT 4 APPLETS**9 Hrs.**

Applet Class - Applet basics - Applet architecture - HTML APPLET tag -Passing parameters to applets- Graphics, Fonts - Delegation Event Model - Handling Mouse and Keyboard Events - Adapter Classes - AWT - AWT Controls -- Layout Managers - Menus - Dialog Boxes

UNIT 5 NETWORKING**9 Hrs.**

Basics - Inet address - TCP/ IP - URL - UDP - Java beans and swings - Bean concepts - Bean Properties- Developing a simple Bean using JDK - Swing components

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Bruce Eckel , "Thinking in Java", Pearson Education, 2000.
2. Clayton Walnum, "Java By Example", QUE Publications, 2000.
3. Herbert Schildt ,Java: The Complete Reference, 9th Edition, Tata McGraw Hill, 2014
4. <http://docs.oracle.com/javase/tutorial/java/>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam duration : 3 Hours****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1206	STATISTICS AND RANDOM PROCESSES	L	T	P	Credits	Total Marks
		3	1	0	3	100

COURSE OBJECTIVE

- To acquire skills in handling situations involving more than one random variable and functions of random variables. This gives exposure to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

UNIT 1 POINT ESTIMATION 12 Hrs.

Properties of estimators, Unbiasedness, Efficiency, Consistency, Sufficiency - Rao - Blackwell theorem, C.R. Rao Inequality - Methods of estimation: Method of Likelihood Estimation, Method of Minimum χ^2 , Modified χ^2 - Method of moments.

UNIT 2 THEORY OF SAMPLING AND TEST OF HYPOTHESIS 12 Hrs.

Test of Hypothesis - large sample - test of significance - Single mean, difference of means, single proportion, difference of proportions - Small sample - students 't' test - single mean - difference of means - Fisher's test or difference of variance - Chi square test - goodness of fit - independence of attributes.

UNIT 3 NON PARAMETRIC TESTS 12 Hrs.

Sign test, Wilcoxon Signed Rank Test, Median test, Mann-Whitney U test, Kruskal-Wallis H test.

UNIT 4 INTRODUCTION TO STOCHASTIC PROCESSES 12 Hrs.

Definition, Classification of Stochastic processes, Random walk, Markov chains, Transition Probability Matrix, Graphical representation of Markov chains, Classification of states and chains- Simple Problems- Chapman Kolmogorov Theorem.

UNIT 5 MARKOV PROCESS 12 Hrs.

Introduction to Markov Process- Poisson process-Postulates and properties-Birth and Death process-Hidden Markov Model - Introduction - Viterbi Algorithm, Forward and Backward Algorithm, Estimation algorithms.

Max. 60 Hours

TEXT / REFERENCE BOOKS

- Veerarajan T, Probability, Statistics and Random Process, 4th edition, Tata McGraw Hill, 2008.
- Medhi J, Stochastic Processes, Second Edition, New Age International Publishers. 2002.
- Stephen Bernstein Schaum's Outline of Elements of Statistics I: Descriptive Statistics and Probability, McGraw-Hill, 1998.
- Jerrold H zar, Biostatistical Analysis, 5th edition, Prentice Hall, 2010.
- Irvin Miller John E Freund, Probability and Statistics for Engineers, Prentice Hall, 1977.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

PART A : 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks

SBI1207	PERL PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the basics of PERL programming and its role and applications in Bioinformatics discipline.

UNIT 1 INTRODUCTION TO PERL PROGRAMMING**9 Hrs.**

Introduction to Perl for Bioinformatics- Comprehensive PERL Archive Network-Variables in Perl: Scalars, Arrays and Hashes. Basic structure of Perl language- a functional approach - constructing atgc.pl. tr/// function -text formatting - formatting numerical output with printf - trapping errors at run time - the s/// operator - the chop and chomp operators.

UNIT 2 INTRODUCTION TO ARRAYS AND HASHES**9 Hrs.**

Introduction to arrays and Hashes Variables - Printing hash data, accessing and removing elements. Special variable \$! Accessing elements in an array. Function list - reverse- sort- join- split- pop- push- shift- unshift-split function-advanced array operation - copying and creating arrays - populating arrays with sequential data - qw function - determination of the size of an array -counting arrays - accessing first element in an array, accessing last element in an array, accessing other elements in an array - adding elements to the end of an array - adding elements- removing elements - appending elements ,altering elements - array slices - splicing array - sorting arrays - reversing arrays - arrays from strings. Merging arrays, Transforming strings to arrays, transforming arrays to strings (Split and join functions).

UNIT 3 PERL REGULAR EXPRESSIONS AND CONTROL STRUCTURES.**9 Hrs.**

Perl regular expressions - special characters (+, *,?, []) - regex operator - pattern modifier operator - conditional matching operator - range operator - match quantifiers - matching boundaries, grouping matching. Perl control statements - control structures - if statements - if-else - if-elsif - if-elsif-else - while loop - until loop -unless for loop - foreach loop -scoping of variables.

UNIT 4 FILES AND DIRECTORY MANIPULATIONS**9 Hrs.**

Files- Operating modes: read, write, append function- File variable, Die function- terminating a program, Reading complete file, Reading a file line by line, Closing a file. File test operators (d, e, l, r, s, w, x, B, T)- Manipulation Functions -link, unlink, rename, truncate, removing files. Directory Manipulation functions - mkdir, chdir, opendir, readdir, closedir, rmdir, chmod.

UNIT 5 INTRODUCTION TO PERL MODULES**9 Hrs.**

Introduction to modules and Subroutines- BioPerl module, Getopt: Long module and LWP: Simple Module- Owd module - creating perl module tree, system function -Perl subroutines and functions. Introduction and applications of Common Gateway Interfaces (CGI).

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

1. Harshawardhan P Bal, Perl Programming for Bioinformatics, Tata McGraw Hill Publishing Company Limited, 2003.
2. Tim Bunce and Alligator Descartes, Programming the Perl DBI, O'Reilly Media, USA, 2000.
3. Michael Moorhouse and Paul Berry, Bioinformatics, Biocomputing and PERL, John Wiley and Sons Ltd., UK, 2004.
4. James Tisdall, Beginning Perl for Bioinformatics, O'Reilly & Associates, USA, 2001.
5. Steven Holzner, PERL, Black Book, Dreamtech Publications, 2nd Edition, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs****20 Marks****60 Marks**

SBI4054	PERL PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Program for Basic Arithmetic operations.
2. Program using Translation (~tr//), substitution (~s//), concatenation operations.
3. Program using chop, chomp, and reverse complement.
4. Program for calculating the GC content.
5. Basic array operations-I: Creating, counting and manipulating an array, push, pop, shift, unshift functions.
6. Basic array operations-II: Split, join, splice, sort, reverse, reverse sort.
7. Concatenation DNA fragments, Transcribing DNA into RNA
8. Calculating the Reverse complement of a DNA strand
9. Program for Looping and control statements.
10. Perl regular expression using +, *, ?, [] characters.
11. File Handling
12. Subroutine.
13. Installing Bioperl, Uses of Bioperl modules for sequence manipulation, accessing local database
14. Translate a DNA sequence in all six reading frames
15. Extract sequence chains from PDB file
16. Uses of CGI.pm Module and Passing Parameters via CGI, Debugging CGI programs
17. Uses of Hashes for the genetic code: translating codons into amino acids

SBI4055	MOLECULAR MODELING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

Molecular visualization Tools

1. Rasmol
2. SPDB viewer

Dimensional protein structure prediction using Homology Modeling techniques

1. Swiss model work space
2. Modeller9v7
3. Insight II

Protein structure Validation

1. Structure Analysis and Verification Server
2. Mol probity server

Energy Minimization techniques

1. First order derivation (Steepest Descent and Conjugate Gradient) methods.
2. Mutation Techniques.

Protein- Ligand Docking

1. Hex
2. Auto Dock

SCS4201	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Develop a C++ program to implement a class, object creation, member function invocation concept.
2. Develop a C++ program to implement the various constructors and destructor concept.
3. Develop a C++ program to implement a friend function, Inline function.
4. Develop a C++ program to implement an operator (Unary & Binary) overloading concept.
5. Develop a C++ program to implement a function overloading concept.
6. Develop a C++ program to implement a run time polymorphism.
7. Develop a C++ program to implement the following inheritance types.
 - a) Single
 - b) Multiple
 - c) Multilevel
 - d) Hierarchical
 - e) Hybrid
8. Develop a C++ program to implement an Abstract class concept.
9. Develop a C++ program to implement a Virtual function.
10. Develop a C++ program to find the number of characters in a file.
11. Develop a C++ program to handle the exceptions.

Case Study

1. Categorization of living beings as humans, animals, birds, insects, etc., using inheritance.
2. Develop user defined manipulator for the following named
 - a) Rupees for displaying Rs. and sets the precision to 2.
 - b) Dollar for displaying \$.

SIT4106	JAVA PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Write a java program to implement constructor overloading.
2. Write a java program to implement multilevel inheritance.
3. Write a java program to implement interfaces.
4. Write a java program to implement packages with all access specifiers.
5. Write a java program to implement runtime polymorphism.
6. Write a java program to demonstrate priority of threads.
7. Write a java program to demonstrate nested class.
8. Write a java program to demonstrate clonable interface.
9. Write a java program to implement mouse events.
10. Write a java program to calculate the simple interest by getting input from the user using Streams.
11. Create a student form in an applet window using AWT controls and update the database.
12. Write a java program to include controls using cardlayout manager.
13. Write a java program to include checkbox, radio button, tabbed panes in a window using swings.
14. Write a java program to print the address and name of local machines.
15. Develop a simple java bean using BDK.

SCS1313	DATA STRUCTURES AND ALGORITHMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To introduce mathematical aspects and analysis of algorithms
- To introduce the various data structures.
- To familiarize sorting and searching techniques

UNIT 1 LINEAR DATA STRUCTURES**9 Hrs.**

Algorithm Performance Analysis:- Notations - Case Study:- Insertion, Selection Sort - Abstract Data Types (ADTs):- List ADT - Array, Linked List implementation - Cursor Based Linked List - Doubly Linked List - Circular Linked List - Applications of Linked List:- Polynomial Manipulation, Radix Sort.

UNIT 2 STACK & QUEUE**9 Hrs.**

Stack ADT - Array, Linked List implementation - Applications of Stack:- Evaluation of Expression - Queue ADT - Array, Linked List Implementation - Applications of Queue:- Scheduling, Circular Queue.

UNIT 3 NON LINEAR DATA STRUCTURES**9 Hrs.**

Binary Trees - Representation - Binary Search Trees - Traversal - Application of Trees - Graphs - Representation - Breadth First Search Traversal - Depth First Search Traversal - Spanning Trees - Minimum Spanning Tree - Kruskal's Algorithm - Application of Graphs:- Shortest Path Algorithm

UNIT 4 SORTING AND STRING PATTERN MATCHING**9 Hrs.**

Heap Sort - Disk Sort - K-Way Merge Sort - Tape Sort - Polyphase Sort, Oscillating Sort - String Pattern Matching Algorithms - Naïve String Search Algorithm - Rabin-Karp String Search Algorithm - Knuth-Morris-Pratt Algorithm

UNIT 5 ADVANCED SEARCH TECHNIQUES**9 Hrs.**

B Trees - Tries - AVL Trees - Red Black Trees - Splay Trees - Hash Table - Hash Functions - Collision Resolution Techniques.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Thomas H Corman, E Leiserson, Ron Rivest, Introduction to Algorithms, MIT Press, 2nd Edition, Jan 2001.
2. Alfred V Aho, J D Ullman, J E Hopcroft, Data Structures and Algorithms, Addison Wesley Longman, 1983.
3. Mark Allen Weiss, Data Structures in C++, Addison Wesley Longman, 2nd Edition, 1998.
4. Horowitz E and Sahni S, Fundamentals of Computer Algorithms, Computer Science Press, 1984.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1301	MOLECULAR BASIS OF DISEASES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand that diseases are phenotypic representation of proteins quality and quantity disorders, either at DNA, transcriptional, translational or post translational levels

UNIT 1 BIOCHEMISTRY AND MEDICINE**9 Hrs.**

Biochemistry and medicine - Metabolic basis of disease - Enzymes - A Role in defining disease - Cholera - an usurper of intestinal metabolism - Jaundice - A metabolic indicator of disease - Atherosclerosis - An aberration of lipid metabolism - Inborn errors of metabolism - Mechanism - Major categories - Neonatal Aminoacidopathies - Phenylketonuria - Management - Basic Principles of therapy. - Online Mendelian Inheritance in Man (OMIM).

UNIT 2 PATHOLOGENESIS**9 Hrs.**

Pathologic processes that occur in human body - Cellular Adaptations - Hyperplasia Physiologic Hyperplasia - Pathologic Hyperplasia - Hypertrophy - Atrophy - Metaplasia - Cell injury and cell death - Necrosis - Apoptosis - Causes of apoptosis - Mechanisms & examples of apoptosis - Inflammation - Autoimmune Disorders - SCID, SLE, Rheumatoid Arthritis.

UNIT 3 GENETIC BASIS OF DISEASE**9 Hrs.**

Genetic basis of disease - Brief history of Medical Genetics - 3 major classes of Genetic disorders - Chromosomal, Monogenic, Multifactorial - Genetic Variation - Types of mutation - Molecular Consequences of Mutation - Clinical Consequences of Mutation: The Hemoglobin Disorders - Molecular basis of Diabetes & Cystic Fibrosis.

UNIT 4 CANCER BIOLOGY**9 Hrs.**

Cancer Biology - Causes of Cancer - Genetic and molecular basis - Retroviruses and Oncogenes - Major Classes of SBI Cancer Genes - Tumor Suppressor Genes - p53 Pathways Inherited Cancer Genes - Neurodegenerative disorders - Parkinson's disease - Alzheimer's disease.

UNIT 5 MOLECULAR MEDICINE - GENE THERAPY**9 Hrs.**

Molecular medicine - Gene Therapy - Types of gene therapy - Broad methods - Vectors in gene therapy - Viruses - Non-viral methods - Hybrid methods - Dendrimers - Major developments in gene therapy - Antisense therapy. Steps involved in drug development - insilico drug design - Active site directed Drug Design - *In silico* ADME/T prediction.

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

1. Thomas M. Devlin, Clinical Biochemistry, John Wiley & Sons, 2010.
2. Eric C.R. Reeve, Routledge; Encyclopedia of genetics, III edition, 2001.
3. Robbins and Cotran Review of Pathology, Edward C. Klatz, Vinay Kumar, Saunders, 2009.
4. <http://themedicalbiochemistrypage.org/inborn.html>
5. www.biochemsoc.org/Portals/0/Education/Docs/BASC09_full.pdf

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs****20 Marks****60 Marks**

SBI1302	NANOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the biochemical principles used to understand the material properties of biological systems and to create new technologies. The most important objectives is to in to develop new tools, for medical and biological purposes

UNIT 1 SYNTHESIS OF NANOMATERIALS 9 Hrs.

Introduction to nanotechnology, Physical Methods- Inert gas condensation, Arc discharge, RF-plasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Ball Milling, Molecular beam epitaxy, Chemical vapour deposition method and other variants, Electrodeposition. Chemical Methods- Metal nanocrystals by reduction, Solvothermal synthesis, Photochemical synthesis, Electrochemical synthesis, Nanocrystals of semiconductors and other materials by arrested precipitation, Thermolysis routes, , Liquid-liquid interface, Hybrid methods, Langmuir Blodgett (L-B) method Solvated metal atom dispersion, Post-synthetic size-selective processing. Sol- gel, Micelles and microemulsions, Biological Methods of Synthesis- Use of bacteria, fungi, Actinomycetes for nanoparticle synthesis, Synthesis process and application, Role of plants in nanoparticle synthesis.

UNIT 2 NANOMATERIALS: CHARACTERIZATION 9 Hrs.

Lithographic Techniques- AFM based nanolithography and nanomanipulation, E beam lithography and SEM based nanolithography and nanomanipulation, Ion beam lithography, oxidation and metallization. Mask and its application. Deep UV lithography, X-ray based lithography.

UNIT 3 MICROBIAL NANOPARTICLE PRODUCTION 9 Hrs.

Poly hydroxyalkonate particles produced by microbes-synthesis and potential application, cyanophycin inclusions-biosynthesis and application, Magnetotactic bacteria for natural synthesis of magnetic nanoparticles; Mechanism of formation- Magnetosomes in bacteria biochemistry and application Viruses as components for the formation of nanostructured materials- bacteriophages; Synthesis process, self assembly and application

UNIT 4 DNA AND PEPTIDE BASED NANOMATERIALS 9 Hrs.

DNA Motifs and self-Assemblies, Peptide nanostructures, DNA-protein conjugates Cell-penetrating peptides, S-layer proteins potential application in nanotechnology, bacteriorhodopsin and its application, nanomotors - ATPsynthase Molecular biomimetics linking polypeptides to inorganic structures Polymer Nanomaterials-Basics of quantum dots, Energy-level structure, Quantum dot biomolecular tags, Conjugating quantum dots to biomolecules, Quantum Dots for drug discovery, Quantum Dots in Cancer Treatment.

UNIT 5 NANOBIOSSENSORS 9 Hrs.

Micro and nano-sensors, Fundamentals of sensors, biosensor, micro fluids, MEMS and NEMS, Packaging and characterization of sensors, Method of packaging at zero level, dye level and first level. Sensors, generation of biosensors, immobilization, characteristics, applications Sensor for bio-medical applications: Cardiology, Neurology and as diagnostic tool, DNA Biosensors, optical sensors. Biochips. Nanosensor probes for single living cells, Silicon nanowires for monitoring drug interaction, Carbon nanotubes for monitoring Antibody-Antigen Reaction Real-time detection of proteins and DNA using Si nanowires, DNA switch ,DNA biochips Cantilever nanosensors for identifying genetic sequences, Nanotoxicology.

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

- Hari Singh Nalwa - Encyclopedia of Nanotechnology, Journal of Nanoscience and Nanotechnology, 2011.
- Bharat Bhusan, Springer Handbook of Nanotechnology, Springer, 2006.
- CNR Rao et.al, Chemistry of nanomaterials : Synthesis, properties and applications, Wiley, 2006
- Hari Singh Nalwa, Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology, Amer Scientific Pub, 2005.
- C.M.Niemeyer, C.A. Mirkin, Nanobiotechnology, Wiley, 2003.
- Ed. Challa S., S. R. Kumar, J. H. Carola, Nanofabrication towards biomedical application: Techniques, tools, Application and impact -Wiley, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs****20 Marks****60 Marks**

SBI1303	MOLECULAR MODELING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- Enables the student to gain knowledge Classical & Statistical mechanics and Quantum mechanics and its applications.

UNIT 1 INTRODUCTION TO MOLECULAR MODELING 9 Hrs.
 Introduction to molecular modeling - Areas of application - simple molecule calculation - assemblies of molecules - Molecular geometry-2D, 3D, conformational parameters, bond length, bond angle, torsional angle, internal energy of molecule, transitional state, potential energy surface, molecular visualization and graphics.

UNIT 2 EMPIRICAL FORCE FIELDS 9 Hrs.
 Introduction to Molecular Mechanics- Molecular geometry - Conformational parameters - Potential energy Surface -Empirical force fields- Molecular mechanics-bond stretching, angle bending, torsional terms, solvent dielectric models - Vander waal's interaction, non-bonded and electrostatic interaction- electrostatic dipolar contribution, hydrogen bonding, types of force fields, geometry optimization - Force field models for simulation of liquid water - simple water models.

UNIT 3 ENERGY MINIMIZATION 9 Hrs.
 Energy minimization - introduction - maxima, minima and saddle points - Applications of energy minimization - Determination of transition structure and reaction pathways - first derivative method - steepest descent method and conjugate gradient. Second derivative method - Newton Raphson method, conformational analysis.

UNIT 4 MOLECULAR DYNAMICS 9 Hrs.
 Introduction to Molecular dynamics- Molecular dynamics simulation of biomolecules, Setting up MD - energy conservation in MD Simulation, continuous potential, constrained dynamics, MD at constant temperature and pressure, solvent effects, Monte-Carlo simulation.

UNIT 5 HOMOLGY MODELING 9 Hrs.
 Protein structure modeling - Homology modeling - steps in homology modeling - loop modeling- side chain modeling- Case Study for Protein Modeling: the Nuclear Hormone Receptor - Comparative Modeling - Analysis of Protein-Ligand Complexes - conformational analysis.- threading - folding- Ab initio modeling.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Andrew R. Leach, Molecular modeling, Principles and applications, Prentice Hall, 2001.
- Vinter J.G. and Mark Gardener, Molecular modeling and drug design, Mac Millan, 1994.
- Hans – dietes, Molecular Modeling, Wiley,2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs****20 Marks****60 Marks**

SBI1304	SIGNAL TRANSDUCTION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To study communication between cells- production of chemical signals, recognition, interpretation and response to signals in its cellular environment.

UNIT 1 INTRODUCTION TO CELLULAR SIGNALING 9 Hrs.

Introduction to cellular signaling - Signaling Molecules Basic characteristics of cell signaling systems - Paracrine, endocrine, autocrine signaling, Tight junctions and Gap junctions - Types of extra cellular signaling - Types of receptors - General Mechanism of signaling. Second messengers and their role in signal transduction, Second messengers Camp, lipid derived second messengers (phosphatidyl inositol derived second messenger) & IP3, Role of ion channels in signal transduction, calcium as second messenger.

UNIT 2 RECEPTOR SIGNALING 9 Hrs.

General Introduction and Introduction to G-Protein-Coupled Receptor (GPCR) Signaling, Structure of GPCRs, G proteins, and GTPases, GPCRs and Their Modulation, G-Protein Effectors, Bacterial toxins and G-protein functions, G-proteins and disease - Cholera and Whooping cough Protein Kinases, Protein Phosphatases Protein Kinases, Growth Factor/ Receptor Tyrosine Kinases (RTKs)-Insulin signaling and Wnt Receptors, Nuclear receptor signalling, Toll-like receptor signaling Ras to Mitogen-Activated Protein Kinase (MAPK) Pathways

UNIT 3 SIGNAL TRANSDUCTION THROUGH ION CHANNELS 9 Hrs.

Signal transduction cascades, Signal Transduction through ion channels, Ligand-Gated Channels, Voltage-gated, Regulation of Ion Channels by G Proteins, Transient Receptor Protein (TRP) Channels.

UNIT 4 CELLULAR LEVELS 9 Hrs.

Control of cellular Ca^{2+} levels, Ca^{2+} transport, Ca^{2+} cycling, Calcium homeostasis, Calcium signaling, Serine/Threonine phosphate/ kinases. Troponin-C, Calmodulin interaction Ca^{2+} -calmodulin complexes with target proteins.

UNIT 5 SIGNAL TRANSDUCTION IN APOPTOSIS 9 Hrs.

Introduction to Necrosis, Senescence, Apoptosis - Programmed cell death, Mechanisms of apoptosis, Apoptosis triggered by internal signals, Apoptosis triggered by external signals, Apoptosis inducing factor, Apoptosis in cancer, immune system, organ transplants. Regulation of apoptotic signaling pathway.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Gerhard Krauss, Biochemistry of Signal Transduction and Regulation, Wiley-VCH, 2008.
- Stryer, Biochemistry, Wiley, 2002.
- Voet & Voet, Biochemistry, John Wiley & Sons, 2006.
- Morgan, Signal Transduction, Wiley-Blackwell, 2007.
- Baltimore, Cell & Molecular Biology, Thomson Learning, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI1305	GENOMICS AND PROTEOMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- This paper helps the students to understand the role of non coding stretches in genomic DNA.

UNIT 1 GENOME STRUCTURE 9 Hrs.

Overview- Structure and organization of Prokaryotic and eukaryotic genome - concept of central dogma, variations in the general structure and organization in genomes expression profiles. Brief outlook of various genome projects and their outcome - overview and importance.

UNIT 2 GENOME SEQUENCING & MAPPING 9 Hrs.

Various techniques of genome sequencing - short gun, direct short gun, clone contig approach, chromosome walking, primer walking, chromosome jumping, contig assembled, genome marking and mapping techniques- genomic DNA library, cDNA library- Mapping and Sequence assembly- genetic marker - RFLP, STR, SSLP, VNTR. Physical marker, EST, STS, FISH, Radiation hybrid, Sequence marker, SNP's.

UNIT 3 HUMAN GENOME PROJECT AND GENOMIC DATABASES 9 Hrs.

Human Genome Project - Goals - Brief outlook of various genome projects and their outcome. Human Genome Project: Ethical, Legal, Social Issues of HGP - IPR & Patents, Expression analysis, micro array approach.

UNIT 4 PROTEOME STRUCTURE 9 Hrs.

Introduction to Proteomics - Proteomics Vs Genomics - Completed Proteome projects and their significance. Proteomic Technologies - Protein separation technologies: 2D-PAGE for proteome analysis, Liquid chromatography. Protein affinity chromatography, Protein detection - Protein identification and characterization: Mass spectrometry - EMI - MS, Tandem MS, TOF - MS, MALDI MS, Proteome databases: EBI, ExPasy, swiss2DPAGE, SWISS-PROT, TrEMBL, PROSITE, BLOCKS, PDB, Metabolic databases.

UNIT 5 PROTEOMIC ANALYSIS 9 Hrs.

Protein expression profiling - Protein-Protein interactions: Yeast Two Hybrid System application of proteomics to medicine, toxicology and Pharmaceuticals- Application of Proteome analysis -Protein biochip technology - Drug Development and Toxicology. Pharmacokinetics, Legal aspects of Genomics & proteomics

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Brown T.A, Genome, 2nd Edition, BIOS Scientific Publishers Ltd, 2002.
- Cantor, Genomics - The Science and Technology behind HGP, John Wiley & Sons, 1999.
- Pennington SR, Dunn MJ, Proteomics from Protein Sequence to Function, 2nd Edition, Viva Books Ltd, 2002
- Daniel C. Liebler, Introduction to Proteomics, Humana Press, 2001.
- David W Mount, Bioinformatics: Sequence and Genome Analysis, 2nd Edition, CBS Publishers, 2004.
- S.Sahai, Genomics and Proteomics, Functional an Computational Aspects, Plenum Publications, 1999

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI4054	PERL PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Program for Basic Arithmetic operations.
2. Program using Translation (~tr//), substitution (~s//), concatenation operations.
3. Program using chop, chomp, and reverse complement.
4. Program for calculating the GC content.
5. Basic array operations-I: Creating, counting and manipulating an array, push, pop, shift, unshift functions.
6. Basic array operations-II: Split, join, splice, sort, reverse, reverse sort.
7. Concatenation DNA fragments, Transcribing DNA into RNA
8. Calculating the Reverse complement of a DNA strand
9. Program for Looping and control statements.
10. Perl regular expression using +, *, ?, [] characters.
11. File Handling
12. Subroutine.
13. Installing Bioperl, Uses of Bioperl modules for sequence manipulation, accessing local database
14. Translate a DNA sequence in all six reading frames
15. Extract sequence chains from PDB file
16. Uses of CGI.pm Module and Passing Parameters via CGI, Debugging CGI programs
17. Uses of Hashes for the genetic code: translating codons into amino acids

SBI4055	MOLECULAR MODELING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

Molecular visualization Tools

1. RasMol
2. SPDB viewer

Dimensional protein structure prediction using Homology Modeling techniques

1. Swiss model work space
2. Modeller9v7
3. Insight II

Protein structure Validation

1. Structure Analysis and Verification Server
2. Mol probity server

Energy Minimization techniques

1. First order derivation (Steepest Descent and Conjugate Gradient) methods.
2. Mutation Techniques.

Protein- Ligand Docking

1. Hex
2. Auto Dock

SBI4056	MOLECULAR BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Isolation of DNA from onion.
2. Isolation of Genomic DNA from Bacteria.
3. Isolation of Genomic DNA from leaves.
4. Isolation of Genomic DNA from Whole Blood.
5. Nucleic Acid Electrophoresis in Agarose Gel.
6. Isolation Plasmid by Alkali Lysis Method.
7. SDS-Polyacrylamide Gel Electrophoresis.
8. Staining of the PAGE Gel with Coomassie Brilliant Blue.
9. Silver staining of SDS-PAGE Gels.
10. Chromatography techniques:
 - i. paper chromatography
 - ii. Thin layer chromatography
 - iii. column chromatography
11. ELISA technique (demo only)
12. Southern and Northern blotting (demo only)

SBI4057	QSAR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. KEGG Ligand Database.
2. Pubchem
3. Zinc
4. Comia
5. QSAR
6. Deriving 3D pharmacophore Generation
7. Database screening
8. Pocket Detection
9. Properties
10. Drug likeliness
11. *Insilico* ADME / T Screening
12. COMFA Analysis

SBI4058	COMPUTATIONAL CHEMISTRY & BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Modeling of Polysaccharide Using Chems sketch.
2. Modeling of Polypeptide Using Chems sketch.
3. Calculation of Molecular Orbitals for small molecules.
4. Calculation of Conformational parameters – ARGUS Lab.
5. Cloning and Working with gel electrophoresis.
6. Open Reading frame.
7. RFLP.
8. PCR Analysis.
9. DNA Analysis - Complementary sequence and GC content.
10. Identification of restriction sites in a DNA sequence.
11. Translation of DNA sequence into 6 frames.

SIT1301	DATAMINING AND WAREHOUSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the principles of Data warehousing and Data Mining.
- To know the Architecture of a Data Mining system and Data preprocessing Methods.
- To perform classification and prediction of data.

UNIT 1 DATA WAREHOUSING**9 Hrs.**

Data warehousing components - Building a data warehouse - Multi Dimensional Data Model-OLAP Operation in the Multi-Dimensional Model-Three Tier Data Warehouse Architecture-Schemas for Multi dimensional data Model-Online Analytical Processing (OLAP) - OLAP Vs OLTP Integrated OLAM and OLAP Architecture.

UNIT 2 DATA MINING**9 Hrs.**

Introduction - Data - Types of data - Steps in KDD-SystemArchitecture-Data mining functionalities - Classification of data Mining systems - Data mining task primitives - Integration of a data mining system with a data warehouse - Issues -Data preprocessing-Data Mining Application

UNIT 3 ASSOCIATION RULE MINING**9 Hrs.**

Mining frequent patterns - Associations and correlations - Mining methods - Finding Frquent itemset using Candidate Generation-Generating Association Rules from Frequent Itemsets- Mining Frquent itemset without Candidate Generation -Mining various kinds of association rules - Mining Multi-Level Association Rule-Mining Multi-Dimensional Association Rule-Mining Correlation analysis - Constraint based association mining.

UNIT 4 CLASSIFICATION AND PREDICTION**9 Hrs.**

Classification and prediction - Issues Regarding Classification and Prediction-Classification by Decision Tree Induction- Bayesian classification - Baye's Theorem-Naïve Bayesian Classification-Bayesian Belief Network-Rule based classification - Classification by Backpropagation - Support vector machines -Prediction-Linear Regression-Non Linear Regression

UNIT 5 CLUSTERING, APPLICATIONS AND TRENDS IN DATA MINING**9 Hrs.**

Cluster analysis - Types of data in Cluster Analysis- Categorization of major clustering methods -- Partitioning methods-K Means-K Medoids - Hierarchical methods -Density-based methods -Grid-based methods - Model based clustering methods -- Constraint Based cluster analysis - Outlier analysis - Data mining applications.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, 2nd Edition, Elsevier, 2007
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw Hill, 2007.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction To Data Mining, Person Education, 2007.
4. K.P. Soman, Shyam Diwaker and V. Ajay, Insight into Data mining Theory and Practice, Easter Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta, Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.
6. Daniel T.Larose, Data Mining Methods and Models, Wile-Interscience, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hours****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SCS1609	ORACLE & SQL	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To gain knowledge on data and its management.
- To understand the basics of querying in database transaction.
- To provide knowledge of incorporating SQL with programming languages.
- To understand cursors and triggers.

UNIT 1 INTRODUCTION TO RDBMS & ORACLE 9 Hrs.

Overview of RDBMS - DBMS - Database Models - RDBMS - Codd's rule - Introduction to Oracle - Tools - Oracle data types - DDL, DML, TCL - Introduction to Integrity Constraints - Domain Integrity - Entity Integrity - Referential Integrity.

UNIT 2 QUERIES AND TABLES 9 Hrs.

Different Select Statements - Operations in SQL * Plus - SQL * Plus functions - Set Operators - Simple Join - Table aliases - Self Join - Outer Join - Usage of Subqueries - Multiple Sub Queries - Correlated sub queries - Locks and Table Partitions - Row level - Table level lock - Table partitions.

UNIT 3 DATA BASE OBJECTS 9 Hrs.

Synonym - Sequences - View- Index - OODBMS Vs DBMS - Concepts of Object oriented programming - Features of OOPS - Advantages of Object orientation - Abstract data types - Object views - Varying arrays - Nested tables - Object tables - Object views with REFS.

UNIT 4 INTRODUCTION TO PL/SQL 9 Hrs.

Advantages - Architecture - PL/SQL Block - Data types and Usage - User - defined data types - Control Structures - Concept of Error Handling.

UNIT 5 CURSOR MANAGEMENT AND DATABASE TRIGGERS 9 Hrs.

Static Cursors - REF Cursors Subprograms: Procedures - Functions - Packages Database Triggers - Creating Triggers - Types - Built-in-packages.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Scott Urman, Oracle & PL/SQL, Tata Mgraw Hill, 2002
2. Steven Feuerstein with Bill Pribyl, Oracle PL/SQL Programming, O'Reill 4th Edition, 2005

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1306	BIOINFORMATICS ALGORITHMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- This paper enables the students to have knowledge on the different algorithms employed in bioinformatics applications.

UNIT 1 INTRODUCTION 9 Hrs.

Introduction to algorithms and complexity- Genetic Algorithms: An Overview-Simple genetic algorithms- genetic algorithms & traditional search methods. Brief examples of working principles of genetic algorithms. Applications of Bioinformatics algorithms.

UNIT 2 ALGORITHM DESIGN TECHNIQUES AND TYPES 9 Hrs.

Algorithm design techniques and Types: Dynamic Programming-Exhaustive search-Greedy algorithms -Divide and Conquer algorithms. Combinatorial Pattern Matching Genetic Algorithms in Problem Solving & Scientific Models- Measuring evolutionary activity.

UNIT 3 ALGORITHMS FOR PROTEINS AND NUCLEIC ACIDS 9 Hrs.

Algorithms for proteins and nucleic acids: Graph Algorithms-Graphs and genetics-Shortest problem-Feng - Doolittle algorithm. Needleman Wunsch algorithm, Smith and waterman algorithm.

UNIT 4 COMBINATORIAL PATTERN MATCHING AND CLUSTERING 9 Hrs.

Combinatorial Pattern matching and clustering: Repeat finding - Hash Tables- Exact pattern matching- suffix trees- Types of clustering approaches-Hierarchical clustering - k - Means Clustering .

UNIT 5 APPLICATIONS OF GENETIC ALGORITHMS 9 Hrs.

Applications of genetic Algorithms - motif finding - Hidden markov models- CpG Islands -Decoding Algorithms- similarity search tools -Fragment Assembly-Gene finding.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Melanie Mitchell, An Introduction to Genetic Algorithms, MIT Press, 1998.
- Neil C.Jones and Pavel A. Pevzner. An Introduction to Bioinformatics Algorithms 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI1307	GENE EXPRESSION AND MICROARRAYS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To gain knowledge of gene expression profiling, the measurement of the activity of thousands of genes at once, to create a global picture of cellular function. And to measure changes in expression levels, to detect single nucleotide polymorphisms (SNPs), or genotype or targeted resequencing.

UNIT 1 INTRODUCTION 9 Hrs.

Introduction - The Central Dogma - Basic Genetic Mechanisms - Nucleic acid structure; transcription of protein encoding gene; Decoding mRNA by tRNAs - Stepwise synthesis of proteins on ribosomes; DNA replication; DNA repair - Transcription Control of Gene Expression - Post-transcriptional Control - Signal Transduction Leading to Gene Expression.

UNIT 2 CONCEPT OF MICROARRAY 9 Hrs

Introduction and Overview of Microarray analysis – DNA MicroArray - The Technical Foundations-Why are MicroArrays Important- What is a DNA MicroArray- Types of MicroArray - NCBI and MicroArray Data Management, GEO (Gene Expression Omnibus) - MAML - The benefits of GEO and MAML - The Promise of MicroArray Technology in Treating Disease.

UNIT 3 MICROARRAY DATA ANALYSIS 9 Hrs.

Microarray Data analysis - Statistical analysis of array data: Dimensionality reduction, clustering, and regulatory regions - Problems and approaches - Visualization, dimensionality reduction, and principal component analysis - Clustering overview - Hierarchical clustering - K-means, mixture models, and EM algorithms - DNA arrays and regulatory regions.

UNIT 4 MICROARRAY EXPERIMENTAL DESIGN 9 Hrs.

The design, analysis, and interpretation of gene expression profiling experiments - Experimental design - Identification of differentially expressed genes - Determination of the source of errors in DNA array experiments - Estimation of the global false positive level for a DNA array experiment - Improved statistical inference from DNA array data using a Bayesian statistical framework - Application of clustering and visualization methods.

UNIT 5 MODERN TECHNIQUES 9 Hrs.

New Trends in Mining Gene Expression Microarray Data - Meta-Analysis of Microarray Data - Meta-Analysis of Differential Genes - Meta-Analysis of Co-Expressed Genes - Semi-Supervised Clustering - General Semi-Supervised Clustering Algorithms - A Seed-Generation Approach - Integration of Gene Expression Data with Other Data - A Probabilistic Model for Joint Mining - A Graph-Based Model

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Pierre Baldi and G. Wesley Hatfield, DNA Microarrays and Gene Expression: From Experiments to Data Analysis and Modeling Cambridge University Press 2002
- Aidong Zhang, Advanced Analysis of Gene Expression Microarray Data. World Scientific Company Ptre. Ltd. ISBN: 2006
- Helen Causton, Microarray Gene Expression Data Analysis: A Beginner's Guide. 2003
- Michael J. Korenberg, Microarray Data Analysis: Methods and Applications (Methods in Molecular Biology) 2007.
- David B. Allison, Grier P. Page, T. Mark Beasley, Jode W. Edwards,
- DNA Microarrays and Related Genomics Techniques: Design, Analysis, and Interpretation of Experiments (Chapman & Hall/CRC Biostatistics Series) 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam duration : 3 Hrs.****20 Marks****60 Marks**

SBI1308	RATIONAL DRUG DESIGN & QSAR	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- This paper enables the students to learn the correlation between the structure and activity of different molecules, thereby enabling them to design a drug.

UNIT 1 INTRODUCTION TO QSAR 9 Hrs.

Introduction to QSAR -purpose of QSAR-application of QSAR- lead molecules - linear and non linear modeled equations - biological activities -physicochemical parameters and molecular descriptors - molecular modeling in drug discovery -

UNIT 2 DESCRIPTORS USED IN QSAR 9 Hrs.

Descriptors used in QSAR with reference to electronic, hydrophobic, steric parameters. Selection of descriptors.Chemo metric methods of QSAR. Hansch analysis,free Wilson analysis and relationship between them and their application.

UNIT 3 3D QSAR 9 Hrs.

3D QSAR and pharmacophore mapping - pharmacophore mapping and pharmacophore based drug design,introduction to CoMFA, CoMSIA, and other methods on 3D QSAR. Validating 3D QSAR models.

UNIT 4 STRUCTURE BASED DESIGN 9 Hrs.

Structure based design- Various algorithm and software used in protein-ligand docking, protein-protein docking,overview of a energy function, scoring function used in docking.

UNIT 5 LEAD DISCOVERY 9 Hrs.

Identification of lead compound from database searching, Insilico ADME/T screening.Pro drug concept in new drug discovery.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Donald J Abraham, Burger's Medicinal Chemistry, Wiley Interscience, 1994.
- J.G. Vinter and Mark Gardener, Molecular modeling and drug design, MacMillan, 1994.
- Graham L. Patrick, Introduction to Medicinal Chemistry, Oxford University Press, 2001

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI4056	MOLECULAR BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Isolation of DNA from onion.
2. Isolation of Genomic DNA from Bacteria.
3. Isolation of Genomic DNA from leaves.
4. Isolation of Genomic DNA from Whole Blood.
5. Nucleic Acid Electrophoresis in Agarose Gel.
6. Isolation Plasmid by Alkali Lysis Method.
7. SDS-Polyacrylamide Gel Electrophoresis.
8. Staining of the PAGE Gel with Coomassie Brilliant Blue.
9. Silver staining of SDS-PAGE Gels.
10. Chromatography techniques:
 - i. paper chromatography
 - ii. Thin layer chromatography
 - iii. column chromatography
11. ELISA technique (demo only)
12. Southern and Northern blotting (demo only)

SBI4057	QSAR LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. KEGG Ligand Database.
2. Pubchem
3. Zinc
4. Comia
5. QSAR
6. Deriving 3D pharmacophore Generation
7. Database screening
8. Pocket Detection
9. Properties
10. Drug likeliness
11. *Insilico* ADME / T Screening
12. COMFA Analysis

SBI4058	COMPUTATIONAL CHEMISTRY & BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Modeling of Polysaccharide Using Chems sketch.
2. Modeling of Polypeptide Using Chems sketch.
3. Calculation of Molecular Orbitals for small molecules.
4. Calculation of Conformational parameters – ARGUS Lab.
5. Cloning and Working with gel electrophoresis.
6. Open Reading frame.
7. RFLP.
8. PCR Analysis.
9. DNA Analysis - Complementary sequence and GC content.
10. Identification of restriction sites in a DNA sequence.
11. Translation of DNA sequence into 6 frames.

SBI1401	INTRODUCTION TO SYSTEMS BIOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

- To understand complex biological systems which require the integration of experimental and computational research.

UNIT 1 GENERAL INTRODUCTION 12 Hrs.

Introductory Concepts - Modeling in biology - Properties of models - Transcription networks : Basic Concepts - The Cognitive problem of the cell - Elements of transcription networks - Dynamics and response time in simple gene regulation - The human interactome - On mathematical modeling of biological phenomena

UNIT 2 REGULATION 12 Hrs.

Patterns, Randomized networks and Network motifs - Autoregulation - Negative and positive autoregulation - Feed forward loop network motif - Structure and dynamics - Convergent evolution of FFLs - Temporal Expression programs - Global structure of transcription networks

UNIT 3 SYSTEMS BIOLOGY OF DEVELOPMENT, SIGNAL TRANSDUCTION & NEURONS 12 Hrs.

Developmental transcription networks - Positive feedback, Regulated feedback, Long transcription cascades and developmental timing - Robust patterning in development - Network motifs in Signal transduction networks - Information processing using multi layered perceptron - Composite Network motifs - Neuronal network of *C. elegans*.

UNIT 4 PROTEIN AND GENE CIRCUITS 12 Hrs.

Robustness principle in protein circuits -Bacterial chemotaxis - Chemotaxis protein circuit of *E. Coli* - Models explaining exact adaptation - Fine tuned and Barkai - Leibler model - Robust adaptation and integral feedback - Individuality and robustness in bacterial chemotaxis - Optimal expression level of a protein under constant conditions - Optimal regulation in variable environments.

UNIT 5 KINETICS AND GENE REGULATION 12 Hrs.

Kinetic proof reading of the genetic code - Recognition of self and non - self by the immune system - Proof reading of diverse recognition processes in the cell - Demand rules for gene regulation - Savageau demand rule - Rules based on minimal error load- Demand rules for multi regulator systems - Simplicity in biology

Max. 60 Hours**TEXT / REFERENCE BOOKS**

- Chapman and Hall CRC, An introduction to systems biology. Design Principles of biological circuits, Uri Alon. 2007
- Choi, Sangdun, Introduction to Systems Biology, Humana Press, 2007.
- Alberghina, L. and Westerhoff, H, Systems Biology : Definitions and Perspectives, Springer, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI1402	QUANTITATIVE MODELS IN BIOLOGICAL SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study and develop a model and discover, properties of cells, tissues and organisms functioning as a system.
- To study, particularly, the study of the interactions between the components of biological systems, and how these interactions give rise to the function and behavior of that system.
- To study the, strategy of pursuing integration of complex data about the interactions in biological systems.

UNIT 1 BASIC PRINCIPLES 9 Hrs.

Introduction to Systems biology - Modeling in biology - System states, Steady state, Variables, parameters and constants - Model behaviour, advantages of computational modeling, model development - Typical aspects of biological systems and corresponding models -Bottom-up and top-down approaches of complex system, Mathematical representation of cell -biological system Time and space, Future of systems biology - Experimental Planning in the Systems Biology Phase of Biological Research

UNIT 2 BASIC MATHEMATICAL CONCEPTS 9 Hrs.

Linear Algebra - Linear Equations, Systematic Solution of Linear Systems - Matrices - Basic Notions - Linear Dependency, Basic Matrix Operations - Ordinary Differential Equations - Notions, Solution of Linear ODE Systems, Malthus law, Stability of Steady States - Difference Equations - Graph and Network Theory - Regulatory Networks - Linear, Boolean, Bayesian Networks.

UNIT 3 STANDARD MODELS AND APPROACHES 9 Hrs.

Metabolism - Enzyme Kinetics and Thermodynamics - The Law of Mass Action, Reaction Kinetics and Thermodynamics, Review of network concepts -properties and modelling of feedback/feedforward system. Reaction kinetics, competitive inhibition, co-operativity, Hyperbolic and sigmoidal responses, Michaelis-Menten Kinetics - Metabolic Networks - Systems Equations, Information Contained in the Stoichiometric Matrix N, Flux Balance Analysis - Signal Transduction - Function and Structure of Intra- and Intercellular Communication, Structural Components of Signaling Pathways - G Proteins, Ras Proteins, MAP Kinase Cascades, Apoptotic pathway, Two component signalling pathways of bacterial chemotaxis.

UNIT 4 SELECTED BIOLOGICAL PROCESSES 9 Hrs.

Biological Oscillations - Glycolytic Oscillations: The Higgins-Sel'kov Oscillator - Cell Cycle - Steps in the Cycle, Models of Budding Yeast Cell Cycle - Modeling of Gene Expression - Modules of Gene Expression, Modeling the Elongation of a Peptide Chain, The Model According to Griffith. Noise and oscillation in biological system. Circadian rhythm-how to build an oscillator. Gene circuit design,

UNIT 5 COMPUTER-BASED INFORMATION RETRIEVAL AND EXAMINATION 9 Hrs.

Computer-based Information Retrieval and Examination - Databases and Tools on the Internet - Gene Ontology, KEGG, BRENDA - Modeling and Visualization tools - Gepasi, Copasi, MEGA, Netpath, Biotapestry. E-Cell, PyBioS, Systems Biology Workbench - Jdesigner, CellDesigner, Petri Nets, Model Exchange Languages, Data Formats - Introduction to XML, Systems Biology Markup Language, MathML. Cytoscape. SBML tool box for MATLAB.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Edda Klipp, Ralf Herwig, Axel Kowald, Christoph Wierling, Hans Lehrach, Systems Biology in Practice: Concepts, Implementation and Application. Wiley-VCH; 1 Edition (May 6, 2005) ISBN-10: 3527310789, ISBN-13: 978-3527310784.
2. Darren James Wilkinson, Stochastic Modelling for Systems Biology.. April 2006, Chapman & Hall/CRC Press. ISBN:1-58488-540-8
3. Zoltan Szallasi, Joerg Stelling, Vipul Periwal, Systems Modeling in Cellular Biology. MIT Press. ISBN 0-262-19548-8. March 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI4059	BIOINFORMATICS LAB	L	T	P	Credits	Total Marks
		0	0	0	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Search and Retrieval of Nucleic Acid Sequence from NCBI and EMBL
2. Search and Retrieval of Protein Sequence from SWISSPROT.
3. Structure Database-PDB.
4. Pairwise Global Alignment-NEEDLE
5. Pairwise Local Alignment-WATER
6. Homology Search using BLAST and FASTA.
7. Multiple Sequence Alignment using CLUSTALW.
8. Secondary Structure Prediction.
9. Molecular Visualization-RASMOL

SBI4060	SYSTEMS BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Modeling and Visualization
2. E cell
3. Gepasi
4. Copasi
5. Construction and Analysis of gene expression networks
6. Mat lab I
7. Mat Lab II
8. Cell Designer
9. Cytoscape

SBI4061	MOLECULAR DYNAMICS & SIMULATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Protein simulation using different force fields
2. Dynamic simulation of Peptide / Protein.
3. Solvation of Peptide / Protein / Biomolecule.
4. Local and Global Minimization of peptide / Protein
5. Simulation of peptide using Quantum Mechanics & Molecular Mechanics.
6. Optimisation of Protein using various ensembles.
7. Simulations of Complex molecules (Protein – Ligand, protein – protein, protein – metal and protein – Nucleic Acids)
8. Membrane Protein dynamics

SBI1403	STRUCTURAL BIOINFORMATICS	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

- The structural bioinformatics course, aimed for life-scientists and chemists alike, will present the latest tools available in the field and their usage for derivation of Biological insight.

UNIT 1 INTRODUCTION TO STRUCTURAL BIOINFORMATICS 12 Hrs.

Overview of Structural bioinformatics- understanding structural basis for biological phenomena - challenges in structural bioinformatics - integration of structural data- Structure Databases - PDB, NDB. Organization of structural bioinformatics-Primary resources-Data format-Data growth-Data processing-Integration. SP - Structural genomics.

UNIT 2 STRUCTURAL DATABASES AND DATA REPRESENTATIONS 12 Hrs.

Proteins: Primary Structure, Secondary Structures, Super Secondary Structures, Tertiary and Quaternary structures. Three dimensional structural databases: PDB, MMDB, CCSD- structural Classification databases-SCOP, CATH, FSSP. The PDB format-mmCIF formats & other data formats. Introduction to structural alignments and superimposition.

UNIT 3 MACROMOLECULES STRUCTURE PREDICTION AND VALIDATION 12 Hrs.

Introduction to secondary structure prediction methods, Algorithms of Chou Fasman, GOR, PHD, PSI-PRED. Crystallographic macromolecular structure determination-NMR spectroscopy- Electron microscopy- Docking of comparative models into low-resolution Cryo-EM Maps-Theoretical protein modeling- Homology modeling, *ab initio* prediction, Threading. Introduction to protein structure validation and server- Measuring accuracy of predictions using Ramachandran Map, SAVS, Molprobiy server. RMSD analysis, Energy plot based on potentials of mean force.

UNIT 4 MODELING PROTEIN FOLDING PATHWAYS AND INTERACTOMES 12 Hrs.

Introduction: Protein folding pathway history-Knowledge based models for folding pathways-HMMSTR-ROSETTA-motif interactions- Fold recognition using potential maps-Consensus and composite contact map predictions. Introduction to interactomes-protein-protein interactions- Protein-DNA interactions - Protein-Ligand interactions. Introduction to interactions databases- ProNIT and BIND.

UNIT 5 STRUCTURE COMPARISON 12 Hrs.

Protein structure comparison - Automated comparative protein structure modeling-Accuracy of comparative models - DALI - principle and applications - protein structure evolution- Distance geometry - Non linear optimization- Sampling conformational space - case study of common folds - TIM barrel, Rossmann folds - applications. Applications of Structural bioinformatics in pharmaceutical industry

Max. 60 Hours**TEXT / REFERENCE BOOKS**

- C.R.Cantor & P.R.Schimmel, Biophysical Chemistry Part - I, W.H. Freeman & Co., in San Fransisco, 1980.
- C. Branden and J. Tooze, Introduction to Protein Structure, Garland Publishing Inc., New York, 1999.
- P.E. Bourne and H. Weissig (Eds.) Structural Bioinformatics, John-Wiley and Sons, 2003.
- Introduction to Protein Structure, Branden, Carl and Tooze, John Garland Publ. Inc., 1991
- Protein Structure, stability and folding Ed. K.P. Murphy, Humana Press, 2001
- Introduction to Protein Science Arthur M. Lesk, Oxford University Press, 2004
- Introduction to Protein Architecture Arthur M. Lesk, Oxford University Press, 2001

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBT1403	CONCEPTS IN STEM CELL RESEARCH	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To advance knowledge about organism develops from a single cell and how healthy cells replace damaged cells in adult organisms.

UNIT 1 STEM CELL BASICS**9 Hrs.**

Introduction to Stem cells, Unique properties of stem cells - embryonic stem cells - adult stem cells - umbilical cord stem cells - similarities and differences between embryonic and adult stem cells. Properties of stem cells - pluripotency - totipotency

UNIT 2 EMBRYONIC STEM CELLS AND ETHICAL ISSUES**9 Hrs.**

Embryogenesis, *In vitro* fertilization -culturing of embryos-isolation of human embryonic stem cells - blastocyst - inner cell mass - Growing ES cells in lab - laboratory tests to identify ES cells - properties of ES cells and Embryonic stem cell markers. Governance of hESC research, Ethical issues at stake, regulation in European member states regarding human ESC research, Regulation in some Non European countries regarding hESC research.

UNIT 3 ADULT STEM CELLS**9 Hrs.**

Somatic stem cells, Test for identification of adult stem cells, Adult stem cell differentiation - Trans differentiation -Plasticity - Different types of adult stem cells- Isolation of haemopoietic stem cell, Muscle and Cardiac stem cell and their applications.

UNIT 4 ADVANCEMENT OF STEM CELL IN TISSUE ENGINEERING**9 Hrs.**

Tissue engineering triad, ECM components and their role in tissue development, Tissue engineering application - Production of complete organ - Kidney - Eyes - Heart - Brain.

UNIT 5 THERAPEUTIC APPLICATION OF STEM CELLS**9 Hrs.**

Gene therapy - genetically engineered stem cells - stem cells and Animal cloning - transgenic animals and stem cells - Therapeutic applications – Parkinson's disease - Neurological disorder - limb amputation - heart disease - spinal cord injuries - diabetes -burns - HLA typing- Alzheimer's disease.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Kursad and Turksen, Embryonic Stem cells, Humana Press, 2002
- Stem cell and future of regenerative medicine. By committee on the Biological and Biomedical applications of Stem cell Research, 12 National Academic press, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBI1601	CANCER BIOLOGY & THERAPEUTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To explain mechanisms that enhance cancer development and progression and translate the discoveries for better diagnostics and interventions.

UNIT 1 FUNDAMENTALS OF CANCER BIOLOGY**9 Hrs.**

Definition, Benign Tumors Vs. Malignant Tumors, Types of Cancer, Common Symptoms. Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, Tumor Suppression genes, modulation of cell cycle in cancer. Different forms of cancers.

UNIT 2 PRINCIPLES OF CARCINOGENESIS**9 Hrs.**

Principles of Carcinogenesis I - Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis. Principles of Carcinogenesis II Principles of Physical Carcinogenesis, X - Ray radiation - mechanism of radiation Carcinogenesis.

UNIT 3 MOLECULAR CELL BIOLOGY OF CANCER**9 Hrs.**

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth Factor and Growth Factor receptors that are Oncogenes. Oncogenes / Proto Oncogene activity. Growth factors related to transformations. Cancer pathways.

UNIT 4 PRINCIPLES OF CANCER METASTASIS**9 Hrs.**

Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane disruption, Three-step theory of Invasion, Proteinases and tumour cell invasion.

UNIT 5 DETECTION OF CANCER AND CANCER THERAPY**9 Hrs.**

Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection. Different forms of therapy, Chemotherapy, radiation therapy, and Immuno therapy: advantages and limitations. Challenges in cancer treatment. Case study of cancer Survivors.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- An Introduction to Cellular and Molecular Biology of Cancer, Oxford Medical publications, 1991.
- Maly B.W.J. Virology a practical approach, IRL Press, Oxford, 1987.
- Dunmock N.J and Primrose.S.B., Introduction to modern Virology, Blackwel Scientific Publications.Oxford, 1988.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1602	FORENSIC SEROLOGY AND DNA PROFILING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To understand and appreciate the scope of forensic biology and techniques used in Forensic DNA analysis

UNIT 1 IMMUNOLOGY 9 Hrs.

Immune system, immune response, innate and acquired immunity, antigens, antibodies, haptens and adjuvants, immunoglobulin-types, physical - chemical properties and function, raising of anti -sera, Lectins -their forensic significance. Buffers and serological reagents, methods of sterilization employed for serological work.

UNIT 2 SEROLOGY 9 Hrs.

Structure and function of Carbohydrates, fats and proteins, serum proteins, cellular proteins, Haemoglobin and its variants, Haptoglobins – Various types, HLA, Polymorphic enzymes and their forensic significance. Basic concepts of Genetics- Mendelian genetics, Genotypes, Phenotypes, mutation, multiple alleles, genetic variants, biochemical genetics, Gene structure, its frequency determination, Gene mapping and Gene Expression, Genetic markers and their forensic significance.

UNIT 3 SEROGENETIC MARKERS 9 Hrs.

Blood groups – history, biochemistry and genetics of ABO, Rh, Mh and other systems, Methods of ABO blood grouping (absorption-inhibition, mixed agglutination and absorption elution) from blood stains and other body fluids/stains viz. menstrual blood, semen, saliva, sweat, tear, pus, vomit, hair, bone, nail etc., blood group specific ABH substances, determination of secretor/non secretor status, Lewis antigen, Bombay Blood group, Polymorphic enzymes typing- PGM, GLO-I, ESD, EAP, AK, ADA.

UNIT 4 DNA PROFILING STRUCTURE, FUNCTIONS & ANALYSIS 9 Hrs.

History of DNA fingerprinting, Human genetics – Heredity, Alleles, Mutations & Population Genetics, Molecular Biology of DNA, Variations, Polymorphism DNA typing systems – RFLP analysis, PCR amplifications, sequence polymorphism .Analysis of SNP, Y-STR, Mitochondrial DNA, Evaluation of results, Frequency estimate calculations, Interpretation, Allele frequency determination, Match probability – Database, Quality control, Certification and Accreditation.

UNIT 5 FORENSIC SIGNIFICANCE OF DNA PROFILING 9 Hrs.

Applications in disputed paternity cases, child swapping, Missing person's identity – civil immigration, veterinary & wild life and Agriculture cases, legal perspectives – legal standards for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad. New & Future technologies – DNA chips, SNPS, DNA cloning, limitations of DNA profiling.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. George V. Burns; The Science of Genetics - An Introduction to heredity, Macmillan 1980
2. Eldon J Gardner; Human Heredity- John Wiley & sons, USA 1983
3. D.L. Hartl, D.Friedfelder and L.A.Snyder; Basic Genetics, Jones and Bartlet, USA 1988
4. M.Krawczak and J. Schmidtke; DNA Finger Printing, Bios Scientific Oxford UK 1994

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBI1603	COMPARATIVE GENOMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To understand the common features of two organisms which will often be encoded within the DNA that is evolutionary conserved between them.

UNIT 1 BASICS OF GENOME SEQUENCING 9 Hrs.

Approaches and techniques used to sequence and analyze genomes-Human Genome Landscape- Examination of comparing genomes within and between species- Genomic information and resources-Introduction to Gene Annotation, Phylogenomic comparison.

UNIT 2 INTRODUCTION TO COMPARATIVE GENOMICS 9 Hrs.

Definition and Explanation of comparative genomics-Timeline of developments in genomics- History of Human Genome Project along with Ethical and societal issues: Iceland's Genomic Database as a case study

UNIT 3 ASSEMBLING GENOME SEQUENCES 9 Hrs.

Introduction to hierarchical shotgun sequencing- Large-scale sequencing methods: cloning and BAC library creation- Comparative Genome Analysis: Algorithms for aligning large-scale data (BLASTZ, LAGAN, AVID), Generating genomic alignments, viewing genomic alignments. Sequence quality scoring and vector screening- Sequence assembly into contigs and skeleton frameworks- Introduction to Phylogenetic Analysis and Homology.

UNIT 4 GENE IDENTIFICATION AND ANNOTATION 9 Hrs.

Introduction to CLUSTALX- Sequence alignment based on predicted secondary and tertiary structures- tRNA folding introduction (tRNAscan)-Mapping to known regions and other finding methods.

UNIT 5 EXISTING COMPRESSIONS AND FUTURE PROSPECTIVE 9 Hrs.

Summaries of bacterial genomes- Microbial genes in the human genome- Vertebrate evolution based on genome comparisons- Comparison of Human and chimpanzee genome-Assembly of Mitochondrial Genomes- Future of genomics in the aspect of Genome-scale approaches to phylogenies.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Pennisi, E. The Human Genome. Science 291:1177-1180, 2001
2. Roberts, L. Controversial from the start. Science 291:1182-1188, 2001
3. Baltimore, D. Our genome unveiled. Nature 409:814-816, 2001.
4. Wade, N. Scientists say human genome is complete. The New York Times, 2003.
5. H. G. S. Consortium. Initial sequencing and analysis of the human genome. Nature 409:860-921, 2001.
6. Wolfsberg, T. G., J. McEntyre, and G. D. Schuler. Guide to the draft human genome. Nature 409:824-826, 2001.
7. Birney, E., A. Bateman, M. E. Clamp, and T. J. Hubbard. Mining the draft human genome. Nature 409:827-828, 2001.
8. Saccone et al. Evolutionary genomics in Metazoa: the mitochondrial DNA as a model system. Gene 238:195-209, 1999.
9. Salzberg et al, Microbial genes in the human genome: lateral transfer or gene loss? Science 292: 1903-1906, 2001.
10. Rokas, A., B. L. Williams, N. King, and S. B. Carroll. Genome-scale approaches to resolving incongruence in molecular phylogenies. Nature 425:798-804, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SIT1305	MACHINE LEARNING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To focus on the construction and study of algorithms.
- To emphasize on the logical, knowledge-based approach
- To introduce the various local models of learning.

UNIT 1 INTRODUCTION TO MACHINE LEARNING**9 Hrs.**

Machine learning - examples of machine learning applications - Learning associations – Classification – Regression - Unsupervised learning - Supervised Learning - Learning class from examples - PAC learning - Noise, model selection and generalization - Dimension of supervised machine learning algorithm.

UNIT 2 DECISION THEORY**9 Hrs.**

Bayesian Decision Theory – Introduction – Classification – Discriminant function - Bayesian networks – Association rule - Parametric Methods – Introduction – Estimation – Classification – Regression - Multivariate Methods – Data - Parameter estimation – Classification – Complexity – Features - Dimensionality Reduction – Analysis – Multidimensional scaling - Linear discriminant analysis.

UNIT 3 CLUSTERING & REGRESSION**9 Hrs.**

Clustering - Mixture densities - k-means clustering - Supervised Learning after clustering - Hierarchical clustering - Nonparametric Methods - Density estimation - Generalization of multivariate data – Classification – Regression - Smoothing models - Decision Trees - Univariate trees - Multivariate trees - Learning rules from data – Linear Discrimination.

UNIT 4 MULTILAYER PERCEPTRONS**9 Hrs.**

Structure of brain - Neural networks as a parallel processing – Perceptron - Multilayer perceptron – Backpropagation – Training procedures - Tuning the network size - Learning time.

UNIT 5 LOCAL MODELS**9 Hrs.**

Competitive learning - Adaptive resonance theory - Self organizing map - Basis functions - Learning vector quantization - Assessing and Comparing Classification Algorithms - Combining Multiple Learners – Reinforcement Learning.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 2004
2. Tom Mitchell, Machine Learning, McGraw Hill, 1997
3. <http://mitpress.mit.edu/catalog/item/default.asp? type=2&tid=10341&mode=toc>.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A : 10** questions of 2 marks each - No choice**20 Marks****PART B : 2** questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SIT1614	J2EE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To explore the J2EE platform and architecture.
- To understand concepts like servlets, JSP and EJB.
- To design and implement enterprise applications.

UNIT 1 INTRODUCTION & DATABASE PROGRAMMING**9 Hrs.**

J2EE Platform – Enterprise architecture styles – J2EE run times – J2EE API – J2EE architecture – Containers – Introduction to J2EE technologies – Naming and directory services.
Database programming with JDBC – JDBC/ODBC bridge – Establishing a connection – Creating and executing SQL statements – Querying – Report statements – Scrollable and updatable result sets – Java.sql packages – JDBC data sources – Connection pooling.

UNIT 2 SERVLET PROGRAMMING**9 Hrs.**

Introduction to Servlet Programming - Servlet Implementations - Servlet configuration - Servlet exceptions – Servlet Life Cycle - Servlet Programming - Servlet Security- Servlet communication
Advanced Servlets : Approach to Session Tracking - Demonstrating Session - Lifecycle with Cookies - A simple shopping cart using Sessions - Servlet Context Interface - Servlet Collaboration

UNIT 3 JSP & JAVA MAIL**9 Hrs.**

Java Server Pages : Intro to JSP - JSP Directives - Scripting elements - Standard Auctions - Implicit objects - Scope - JSP pages as XML documents - JSP Sample Program - Design Strategies - JSP tag Extensions-A simple TAG- Writing TAG Extensions.
Java Mail API: Introduction to Java Mail - Mail Protocols- Java Mail Overview- Quick, Send me a Email (An example program)

UNIT 4 ENTERPRISE JAVA BEANS**9 Hrs.**

Overview of EJB-EJB Middleware Architecture - EJB Architecture- EJB Containers and its services - Design of EJB Tier - Session java Beans- Stateless and Stateful Beans, Entity Beans and Persistence - Container Vs Bean Managed Persistence, Message Driven Bean - Relationships, EJB Container Services.

UNIT 5 STRUTS & WEB SERVICE TECHNOLOGIES**9 Hrs.**

Struts: Development Models-Basic Components of Struts –Building simple struts Application.
Introduction to Web Service Technologies: Java Message Service - J2EE and Web Services – SOAP – WSDL - UDDI - JAXP - JAXB

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Subrahmanyam Allamaraju and Cedric Buest ,Professional Java Server Programming, A press,J2EE 1.3 Edition, 2007
2. Jim Keogh ,Completer Reference, J2EE,Tata McGraw Hill, 2004
3. James Holmes-Struts,The complete Reference, 2nd Edition, Tata McGraw Hill, 2007.
4. <http://www.java.sun.com/tutorial>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1604	INTRACELLULAR NETWORK AND ANALYSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To acquire an adequate knowledge about intracellular network which unfolds the mystery of complexity and modularity and functional aspects of biochemical interactions in transmitting signals in cell. At the end the student will be able to appreciate and understand the basics to analyze the intracellular networks.

UNIT 1 INTRODUCTION TO BIOLOGICAL NETWORKS AND MODELING 9 Hrs.

General Introduction to – Intracellular processes, Cell states, Cell fates – Cell compartments and organelles – Molecular machinery of gene expression - Molecular Pathways and networks – On mathematical modeling of biological phenomena – Gene Regulatory networks

UNIT 2 RECONSTRUCTION OF METABOLIC NETWORKS 9 Hrs.

Construction of Gene Networks – Gene expression profiling – Metabolites measurements - Characterization of Network topology - Hub genes in network – Computational analysis of signal specificity in yeast – Reconstruction of a Functional Human Gene Network.

UNIT 3 GENOME SCALE ANALYSIS AND METABOLIC CONTROL ANALYSIS 9 Hrs.

Genome Scale Analysis of metabolic networks – Flux analysis theory – Model development - Steps of a reconstruction – Resources – KEGG - BioCyc, EcoCyc, and MetaCyc - Pathway Tools - ERGO – metaTIGER - Metabolic network simulation - Extreme Pathways – Metabolic Control Analysis

UNIT 4 MODELING AND DYNAMICS 9 Hrs.

Modeling the dynamics of cellular networks – Methods – Network reconstruction – Network reduction – Kinetic modeling – Data acquisition, Results and interpretation – Model network – Applications – Transcriptome analysis of regulatory networks.

UNIT 5 REVERSE ENGINEERING IN BIOLOGICAL NETWORKS 9 Hrs.

Reverse engineering of Biological networks – Biological networks, Network representation, design principles – Approaches for inference of biological networks – Boolean networks, Bayesian networks - Network Biology – Graph theory, stoichiometric analysis, Sensitivity analysis.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Arul Jayaraman, Juergen Hahn Methods in Bioengineering: Systems Analysis of Biological Networks, Artec House, 2009
2. Bernard Palsson Systems Biology : Properties of Reconstructed Networks. published by Cambridge Univ. Press. ISBN: 0521859034, January 2006,
3. Uri Alon An introduction to Systems Biology: Design Principles of Biological Circuits., Chapman and Hall/CRC, Taylor and Francis Group. ISBN:1584886420, June 2006

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1605	PYTHON	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To learn to appreciate the programming language that can be used for a wide variety of programming tasks and to expose the student to the standard scripting language. At the end of the course, the student will be developing adequate skills in programming and will be known to understand the implementation of various applications using powerful assortment of built-in types in python.

UNIT 1 INTRODUCTION TO PYTHON 9 Hrs.

Introduction to PYTHON- History -Features –installation - Setting up path -Working with Python -Basic Syntax –Operator

UNIT 2 VARIABLE AND DATA TYPES 9 Hrs.

Native datatypes – Booleans –Numbers – Strings - Bytes and byte arrays-Lists- Tuples – Sets - Dictionaries

UNIT 3 REGULAR EXPRESSIONS 9 Hrs.

Python regular expressions – Match function -Search function -Matching Vs Searching -Modifiers -Patterns.

UNIT 4 CONTROL STATEMENTS 9 Hrs.

Conditional Statements -If , If- else , Nested if-else , - Looping- For , While , Nested loops,- Control Statements- Break , Continue , Pass

UNIT 5 FUNCTIONS AND MODULES 9 Hrs.

Functions - Defining a function -Calling a function -Types of functions -Function Arguments -Anonymous functions -Global and local variables, Modules- Importing module -Math module -Random module -Packages – Composition

Max. 45 Hours

TEXT / REFERENCE BOOKS

- Hetland., Beginning Python , Apress, 2008
- Mark Pilgrim, Dive Into Python, Apress, 2004
- Martin C. Brown, Python: The Complete Reference (English) ,McGraw-Hill/Osborne Media, 2001.
- Mark Summerfield, Programming in Python 3 2nd ed (PIP3) - Addison Wesley ISBN: 0-321-68056-1,2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBI1606	NEXT GENERATION SEQUENCING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The paper gives introductory knowledge on genome sequencing, genome resequencing, (RNA-Seq), DNA-protein interactions ChIP-sequencing.

UNIT 1 INTRODUCTION 9 Hrs.

NGS - Platform overview - Biological applications - Basic concepts - Recent scientific breakthroughs using NGS technology – Data processing - Analysis workflow - Sequence quality evaluation - Alignment theories - Data formats - Data visualization - DNA sequencing - genetic variations - NGS and genetics of complex disease (etiology) - NGS and personal genome sequencing

UNIT 2 DNA SEQUENCING 9 Hrs.

Experimental considerations - Whole genome sequencing - Target sequencing - Pool sequencing - Sequencing mappability - Refined alignment - Base quality recalibration - Variants identification for Diploid genome, Pooled DNA sequencing, Prioritizing genetic variants - Non-synonymous variants (SIFT, PolyPhen) - Synonymous variants - Regulatory variants - Statistical methods on rare variants. Next generation sequencing technologies (Illumina, Ion Torrent / Ion Proton, SOLiD and Pac Bio) Short read assembly, alignment and applications - denovo sequencing, resequencing, gene expression.

UNIT 3 RNA SEQUENCING 9 Hrs.

Biological theories on RNA-seq experiments - Experimental considerations - Published examples - Major scientific advance using RNA-seq – Alignment - Gene expression analysis - Differential expression analysis - Alternative splicing - Transcript variation - Allele-specific expression - RNA editing – smRNA

UNIT 4 CHIP – SEQ 9 Hrs.

Biological theories on ChIP-seq analysis - Published studies - Experimental considerations - DNA fragment evaluation - Peak identification - Two condition comparison - Saturation analysis - Motif finding and related theories - DNA methylation - Experimental considerations - Statistical considerations - Bioinformatics tools - Histone modification - Experimental approaches - Statistical considerations - Hidden Markov model annotating histone marks.

UNIT 5 ANALYSIS 9 Hrs.

Using RNA-seq Data to Detect Differentially Expressed Genes.- Differential Expression Analysis of Complex RNA-seq Experiments Using edgeR. Design of RNA Sequencing Experiments.- Measurement, Summary, and Methodological Variation in RNA- small RNA sequencing.- Functional PCA for differential expression testing with RNA-seq data. Data Statistical Considerations in the Analysis of Rare Variants. Epigenetics Next generation sequencing applications in Agri-Biotech, health care, metagenomics, GWAS and basic sciences.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

- Somnath Datta, Nettleton Dan (Eds.) Statistical Analysis of Next Generation Sequencing Data, 2014.
- Stuart M. Brown. Next-Generation DNA Sequencing Informatics, 2013.
- Ali Masoudi-Nejad, Zahra Narimani, Nazarin Hosseinkhan. Next Generation Sequencing and Sequence Assembly: Methodologies and Algorithms (SpringerBriefs in Systems Biology), ISBN-10: 1461477255, Springer; 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SCS1307	COMPUTATIONAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain knowledge of the concepts, paradigms, algorithms, and implementation of computational Intelligence and its constituent methodologies
- To provide a strong foundation of fundamental concepts in Artificial Intelligence, ANN, Fuzzy systems, Genetic Algorithms and Swarm Intelligence

UNIT 1 ARTIFICIAL INTELLIGENCE 10Hrs.

Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed and informed search strategies.

UNIT 2 ARTIFICIAL NEURAL NETWORKS 8 Hrs.

Basic concepts – Single layer Perceptron – Multilayer Perceptron – Supervised and Unsupervised learning – Back Propagation Networks-Performance Issues.

UNIT 3 FUZZY SYSTEMS 8 Hrs.

Introduction to fuzzy- Fuzzy sets and Fuzzy reasoning – Fuzzy matrices -Fuzzy Functions – Decomposition – Fuzzy rules and inferences – Fuzzy decision making.

UNIT 4 GENETIC ALGORITHMS 9 Hrs.

Survival of the fittest – Fitness Computations – Cross over- Mutation – Reproduction – Rank method – Rank Space method.

UNIT 5 SWARM INTELLIGENCE 10 Hrs.

Particle swarm optimization- Global PSO- Local PSO-Ant colony Optimization- -Simple Ant Colony –Ant System- Max, Min Ant System.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Stuart J. Russel, Peter Norvig, Artificial Intelligence A Modern Approach, 2nd Edition, Pearson Education, 2003.
2. Jang J.S.R., Sun C.T. And Mizutani E, Neuro-Fuzzy and Soft computing, Prentice Hall 1998.
3. Timothy J. Ross, Fuzzy logic with Engineering Applications, McGraw Hill, 1997.
4. Goldberg, D.E, Genetic Algorithm: Search, Optimization and Machine Learning, Addison Wesley, N.Y, 1989.
5. Andries . P. Engelbrecht , Computational Intelligence, Wiley Publications, Second Edition.2007.
6. Yagnanarayana.B., Artificial Neural Networks, Prentice Hall of India, 2006
7. Nilsson N.J., Artificial Intelligence - A New Synthesis, Harcourt Asia Pvt. Ltd.2000.
8. Elain Rich & Kevin Knight, Artificial Intelligence, Tata McGraw Hill 1991.
9. Laurene Fausett, Fundamentals of Neural Networks, Prentice Hall, 1994.
10. George Klir, Bo Yuan, Bo Yuan Fuzzy Sets And Fuzzy Logic, Prentice hall of India pvt ltd 1997
11. Kosko, B., Neural Network and Fuzzy Systems, Prentice Hall of India Pvt., Ltd., 1994.
12. Zimmerman H.J., Fuzzy set theory – and its applications, Kluwer Academic Publishers., 1996

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SCS1604	SOFTWARE ARCHITECTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of software architecture and styles.
- To understand the difference between software architecture and software design
- To develop the ability to understand design patterns and their application
- To understand utilization of formal models to build software projects
- To understand the use of various Architecture Description Languages and their applications

UNIT 1 SOFTWARE PROCESS AND THE ROLE OF MODELING AND ANALYSIS 9 Hrs.

Analysis modeling and best practices, process, process modeling; process notations – traditional best practice diagrams such as DFDs and ERDs.

UNIT 2 ARCHITECTURAL MODELING 9 Hrs.

UML diagrams, Structural static modeling, behavioural modeling – interactions – use cases – use case, interaction & Activity diagrams. Component and deployment diagrams – analysis case studies, analysis patterns.

UNIT 3 SOFTWARE ARCHITECTURE DESIGN 9 Hrs.

Design best practices, Design patterns – Creational patterns – structural patterns – behavioural patterns, Component technology, object oriented frameworks, distributed objects, interoperability standards, case studies.

UNIT 4 SOFTWARE ARCHITECTURE 9 Hrs.

Architectural styles, architectural patterns, patterns and software architecture, analysis of architectures, formal descriptions of software architectures.

UNIT 5 ARCHITECTURAL DESCRIPTION LANGUAGES ADL AND TOOLS 9 Hrs.

Requirements of Architecture – Description languages, Tools for Architectural design, scalability and interoperability issues, Web application architectures, case studies.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, 1999.
2. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Design Patterns, Elements of reusable Object Oriented Software, Addison Wesley 1995.
3. Frank Buschmann et al, Pattern Oriented Software Architecture, Volume 1: A system of patterns, John Wiley and Sons, 1996.
4. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice second edition, Addison Wesley, 1998.
5. Mary Shaw and David Garlan, Software Architecture Perspectives on an emerging Discipline, Prentice Hall, 1996.
6. Eric Braude, Software Design: From Programming to Architecture, John Wiley & Sons, February 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SCS1610	C# .Net	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To get a brief idea of the .Net framework.
- To understand concepts of assemblies, interfaces and collections.
- To develop an ability to write ADO.Net and ASP.Net applications.

UNIT 1 INTRODUCTION**9 Hrs.**

Overview of .NET – Advantages of .NET over the other languages – Overview of .NET binaries – Intermediate Language – Metadata – .NET Namespaces – Common language runtime – Common type system – Common language specification – C# fundamentals – C# class – object – string formatting – Types – scope – Constants – C# iteration – Control flow – Operators – Array – String – Enumerations – Structures – Custom namespaces – Object oriented programming concepts – Class – Encapsulation – Inheritance – Polymorphic – Casting.

UNIT 2 ASSEMBLIES**9 Hrs.**

Assemblies – Versioning – Attributes – Reflection – Viewing metadata – Type discovery – Reflecting on a type – Marshaling – Remoting – Understanding server object types – Specifying a server with an interface – Building a server – Building the client – Exception handling – Garbage collector.

UNIT 3 INTERFACES AND COLLECTIONS**9 Hrs.**

Interfaces and collections – Enumerator – Cloneable objects – Comparable objects – Collections – Indexes – Delegates – Events – Multithreaded programming.
Programming with windows form controls – Windows form control hierarchy – Adding controls – TextBox – CheckBoxes – RadioButtons – GroupBoxes – ListBoxes – ComboBoxes – TrackBar – Calendar – Spin Control – Panel – ToolTips – ErrorProvider – Dialog Boxes.

UNIT 4 IO NAMESPACE AND ADO .NET**9 Hrs.**

Input and output – Introduction to System. IO .namespace – File and folder operations – Stream class – Introduction to ADO .NET – Building data table – Data view – Data set – Data relations – ADO.NET managed providers – OleDb managed provider – SQL.

UNIT 5 ASP .NET AND WEB SERVICES**9 Hrs.**

Web development and ASP.NET – Web applications and web servers – HTML form development – Client side scripting – GET and POST – ASP.NET application – ASP.NET namespaces – Creating sample C# Web Applications. Understanding Web Security – Windows authentication – Forms authentication – Web services – Web service clients.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Andrew Troelsen, C# and the .NET Platform, AI Press, 2005.
2. Herbert Schildt, The Complete Reference: C#, Tata McGraw-Hill, 2004.
3. <http://www.Csharpcorner.com/tutorial.asp>.
4. <http://www.programmingtutorials.com/csharp.aspxal.as>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SIT1615	WEB SCRIPTING LANGUAGES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To introduce the various web scripting languages.
- To familiarize with the different tools, web servers and IDEs.
- To gain knowledge on the basics of version control systems and Web APIs.

UNIT 1 WEB SCRIPTING LANGUAGES**9 Hrs.**

Overview of Web Scripting Languages – Basics and introduction of PHP [Hyper Text Preprocessor], Perl, Python, Ruby on Rails – Web Database Connectivity with Scripting Language – PHP and MySQL

UNIT 2 WEB DEVELOPMENT TOOLS**9 Hrs.**

Basics of Web development tools – Support Mechanism - Google Chrome -Web Developer Tools – IE Web Developer Tools - Safari Web Development Tools - Firefox - Web Developer Toolbar and Opera Dragonfly – Features - Profiling and Auditing - Javascript Debugging – HTML and DOM Editor - Extensions and Plugins Development.

UNIT 3 WEBSERVERS AND IDES**9 Hrs.**

Introduction to web servers – architecture – Apache – LAMP – WAMP – XAMPP, IIS, nginx, GWS (Google Web Server) – Web development IDEs (Integrated Development Environments) – Aptana Studio, dreamweaver, Sublime Text, Net Beans, Eclipse.

UNIT 4 VERSION CONTROL SYSTEMS**9 Hrs.**

Basics of version controls system – Types - Local data model - Revision Control System (RCS) - Client-server model - Concurrent Versions System (CVS) - Distributed model – GIT and GIT HUB.

UNIT 5 WEB APIS**9 Hrs.**

Basics of Web APIs – Types of APIs – Serverside APIs – JSON XML SOAP and HTTP – Mashups architecture – Clientside APIs – JQUERY - YUI Library – AJAX – HTML5 - API Modeling Languages - RESTful API Modeling Language, Swagger, API Blueprint.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites ISBN-10: 1491949465 ISBN-13: 978-1491949467 Publisher: O'Reilly Media; 3 edition (June 16, 2014)
2. Apache Cookbook: Solutions and Examples for Apache Administrators ISBN-10: 0596529945 ISBN-13: 978-0596529949 Publisher: O'Reilly Media; Second Edition edition (January 11, 2008)
3. http://en.wikipedia.org/wiki/Web_API
4. <https://yuilibrary.com/yui/docs/>
5. http://en.wikipedia.org/wiki/YUI_Library
6. http://www.w3schools.com/html/html5_intro.asp
7. http://en.wikipedia.org/wiki/HTML5#New_APIs
8. <https://github.com/>
9. <http://git-scm.com/>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SHS1601	LIFE AND EMPLOYABILITY SKILLS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

The course aims at equipping students to be competent in facing the challenges in today's globalized context, by providing an insight to soft skills for success and life skills for survival at the workplace.

UNIT 1 ACHIEVEMENT MOTIVATION 9 Hrs.

Time Management - Positive and negative aspects of time log - Formula for successful time management.

UNIT 2 SELF-AWARENESS AND EMPATHY 9 Hrs.

Work-Life Balance – Project completion Techniques – Effective Planning and Organisation - Strategies to improve team communication.

UNIT 3 DECISION MAKING 9 Hrs.

Decision making techniques- types of decisions- Setting Goals and Plans - Problem Solving Techniques.

UNIT 4 EFFECTIVE COMMUNICATION 9 Hrs.

Non-verbal communication - means of communication – Personality development – Language and body language for interviews- Self Empowerment.

UNIT 5 NEGOTIATION SKILLS 9 Hrs.

Negotiation skills – skill acquisition strategies – effective persuading skills.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Gravells, Ann. "Delivering Employability Skills in the Lifelong Learning Sector Further Education and Skills", United Kingdom: SAGE Publications Ltd, 2010.
2. Hind, David W.G., Stuart Moss, "Employability Skills," Business Education Publishers Ltd., United Kingdom :Tyne & Wear, 2005.
3. Rao M.S., "Enhancing Employability: Connecting Campus with Corporate", New Delhi: I K International Publishing House Pvt. Ltd, 2010

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each – No choice

20 Marks

PART B : 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SHS1602	TECHNICAL WRITING FOR SCIENTISTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To provide with an introduction to professional writing as a disciplinary field.

UNIT 1 INTRODUCTION TO TECHNICAL WRITING 9 Hrs.

Technical Writing – Principles and procedure of technical writing; Role of a Technical writer, Various forms of Technical Writing

UNIT 2 ONLINE TOOLS 9 Hrs.

Printed documentation and Online Help Systems, Working with images and illustrations, designing graphic aids.

UNIT 3 PROCESS OF WRITING 9 Hrs.

Collecting and Organizing information, Drafting information verbally and visually, Producing Information, Documentation Process.

UNIT 4 REACHING THE AUDIENCE 9 Hrs.

Technical Writing Process Templates and Page design, Audience Profiling.

UNIT 5 PRESENTATION 9 Hrs.

Writing specialized forms as abstracts, instructions, proposals and project and lab reports

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Mike Markel's "Technical Communication", New York: Bedford/St. Martin's, 2009
2. Joseph M. Williams book Style: "Toward Clarity and Grace", Chicago, University of Chicago Press, 1995

END SEMESTER EXAM QUESTION PAPER PATTERN:

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each – No choice

20 Marks

PART B : 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SCI1619	DISASTER MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To create an awareness towards natural and man-made disasters, disaster preparedness and disaster management

UNIT 1 INTRODUCTION TO DISASTERS**12 Hrs.**

Natural resources and its importance - understanding on fragile eco-system - characteristics and types of Disasters, Geological and Mountain Area Disasters: Earthquakes, Volcanic eruption, landslides - Wind and Water Related Natural Disaster: Floods, Droughts, Cyclones, Tsunamis - Man Made Disasters: Forest fires, Nuclear, Biological and Chemical disaster - Causes and effects - Disaster Profile of India - Disaster Management cycle.

UNIT 2 DISASTER PREPAREDNESS**8 Hrs.**

Disaster management, mitigation and preparedness: Disaster Preparedness for People and Infrastructure, CommUNITY based Disaster Preparedness Plan - Roles & Responsibilities of Different Agencies and Government: Education, Communication & Training, Central, State, District and local administration, Armed Forces, Police, Para Military Forces, International Agencies, and NGO's - Disaster Mitigation: Strategies, Emerging Trends, Mitigation management and Role of Team and Coordination.

UNIT 3 REHABILITATION, RECONSTRUCTION & RECOVERY**10 Hrs.**

Damage assessment – Development of Physical and Economic Infrastructure - Nature of Damage to Houses and Infrastructure due to Disasters - Funding Arrangements for Reconstruction - Monitoring and Evaluation of Rehabilitation Work: Training, Rescue and planning the rescue activities and rehabilitations - Role of Government and NGO's - Participative Rehabilitation Process: Case Studies

UNIT 4 DISASTER RESPONSE AND DISASTER MANAGEMENT**8 Hrs.**

Disaster Response Plan: Communication, Participation and Activation of Emergency Preparedness Plans, Search, Rescue, Evacuation and other logistic management - Human Behaviour and Response Management: Psychological Response and Psychological Rehabilitation, Trauma and Stress Management, rumour and Panic Management, Medical and Health Response to Different Disasters - Relief Measures: Minimum Standard of Relief, essential components of Relief Management, and funding.

UNIT 5 RISK ASSESSMENT AND VULNERABILITY ANALYSIS**7 Hrs.**

Hazard, Risk and Vulnerability: Concept and Relationship: Disaster Risk Reduction, People Participation in Risk Assessment - Vulnerability Analysis, Vulnerability Identification - Vulnerability profile of India - Strategies for Survival - Social Infrastructure for Vulnerability Reduction.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Bryant Edwards, "Natural Hazards", Cambridge University Press, U.K, 2005
2. Carter, W. Nick, "Disaster Management, Asian Development Bank", Manila, 1991.
3. Government of India, "Vulnerability Atlas of India", New Delhi, 1997.
4. Sahni, Pardeep et.al. (eds.), "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi, 2002
5. Sahni, Pardeep and Ariyabandu, Madhavi Malalgoda, 2012: "Disaster risk reduction in South Asia", Phi learning pvt. Ltd.- publisher, New Delhi, 2012.
6. Sharma, R.K & Sharma, G.,(ed), "Natural Disaster", APH Publishing Corporation, New Delhi, 2005.
7. Taori, K, "Disaster Management through Panchayati Raj", Concept Publishing Company, New Delhi, 2005.

Websites:

8. NOAA Coastal Services Center, "Linking People Information and Technology",
9. "Risk and Vulnerability Assessment Tool", at, <http://www.csc.noaa.gov/rvat/criticalEdd.html>

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each – No choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

SBI1207	PERL PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the basics of PERL programming and its role and applications in Bioinformatics discipline.

UNIT 1 INTRODUCTION TO PERL PROGRAMMING 9 Hrs.

Introduction to Perl for Bioinformatics- Comprehensive PERL Archive Network-Variables in Perl: Scalars, Arrays and Hashes. Basic structure of Perl language- a functional approach - constructing atgc.pl. tr/// function -text formatting - formatting numerical output with printf - trapping errors at run time - the s/// operator - the chop and chomp operators.

UNIT 2 INTRODUCTION TO ARRAYS AND HASHES 9 Hrs.

Introduction to arrays and Hashes Variables - Printing hash data, accessing and removing elements. Special variable \$! Accessing elements in an array. Function list - reverse- sort- join- split- pop- push- shift- unshift-split function-advanced array operation - copying and creating arrays - populating arrays with sequential data - qw function - determination of the size of an array -counting arrays - accessing first element in an array, accessing last element in an array, accessing other elements in an array - adding elements to the end of an array - adding elements- removing elements - appending elements ,altering elements - array slices - splicing array - sorting arrays - reversing arrays - arrays from strings. Merging arrays, Transforming strings to arrays, transforming arrays to strings (Split and join functions).

UNIT 3 PERL REGULAR EXPRESSIONS AND CONTROL STRUCTURES. 9 Hrs.

Perl regular expressions - special characters (+, *,?, []) - regex operator - pattern modifier operator - conditional matching operator - range operator - match quantifiers - matching boundaries, grouping matching. Perl control statements - control structures - if statements - if-else - if-elsif - if-elsif-else - while loop - until loop -unless for loop - foreach loop -scoping of variables.

UNIT 4 FILES AND DIRECTORY MANIPULATIONS 9 Hrs.

Files- Operating modes: read, write, append function- File variable, Die function- terminating a program, Reading complete file, Reading a file line by line, Closing a file. File test operators (d, e, l, r, s, w, x, B, T)- Manipulation Functions -link, unlink, rename, truncate, removing files. Directory Manipulation functions - mkdir, chdir, opendir, readdir, closedir, rmdir, chmod.

UNIT 5 INTRODUCTION TO PERL MODULES 9 Hrs.

Introduction to modules and Subroutines- BioPerl module, Getopt: Long module and LWP: Simple Module- Owd module - creating perl module tree, system function -Perl subroutines and functions. Introduction and applications of Common Gateway Interfaces (CGI).

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

1. Harshawardhan P Bal, Perl Programming for Bioinformatics, Tata McGraw Hill Publishing Company Limited, 2003.
2. Tim Bunce and Alligator Descartes, Programming the Perl DBI, O'Reilly Media, USA, 2000.
3. Michael Moorhouse and Paul Berry, Bioinformatics, Biocomputing and PERL, John Wiley and Sons Ltd., UK, 2004.
4. James Tisdall, Beginning Perl for Bioinformatics, O'Reilly & Associates, USA, 2001.
5. Steven Holzner, PERL, Black Book, Dreamtech Publications, 2nd Edition, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs****20 Marks****60 Marks**

SBM1304	BIOMATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The course provides an intriguing insight in chemistry, engineering, biology and medicine that has a significant impact on biomaterials.
- It highlights the way in which modern biology and medicine is inextricably linked to scientific discipline and helping us to understand the complex world of biomaterials.

UNIT 1 INTRODUCTION AND METALS**9 Hrs**

Biomaterials - Overview, Classification of biomaterials, Interfacial Phenomena and tissue response to biomaterials, Metals and alloys for orthopedic implants-Stainless steel, Cobalt chromium alloy, Titanium and its alloys, Precious metal alloys, Other metal alloys. Dental implants - materials, types and designs

UNIT 2 REPLACEMENT AND FIXATION DEVICES**9 Hrs**

Bioelectric effect, Wolff's Law, Types of orthopedic fixation devices-pins, screws and plates, Intra Medullary and spinal nails. Interface Problems with artificial joints and various fixation methods, Hard tissue replacements - total hip and knee joint replacements. Soft Tissue replacements- Sutures -Tapes, Staples, Adhesives. Maxillofacial Implants

UNIT 3 POLYMERS AND APPLICATIONS**9 Hrs.**

Polymers in biomedical use, Hydrogels, silicone rubber, biodegradable polymers, Polymer Sterilization, Deterioration of polymers

UNIT 4 BIOCERAMICS AND COMPOSITES**9 Hrs**

Bioceramics, types and - bioactive resorbable, non - resorbable, bioceramic coatings on metallic and implants and bone bonding reactions on implantation. Hydroxyapatite - properties and applications. Composites - Types and Applications, Bioglass

UNIT 5 OPHTHALMOLOGY, CORROSION AND TESTS**9 Hrs**

Ophthalmology- Introduction, Contact lenses, Eye shields, Viscoelastic solutions, Vitreous implants, Acrylate adhesives, Scleral buckling materials for retinal detachment, artificial tears. Corrosion, Biocompatibility and Hemocompatibility, Biological Tests. Material surface characterization

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Sujata V Bhat, Biomaterials, Narosa Publishing House, New Delhi, 2002.
2. Rolando Barbucci, Integrated Biomaterials Science, Plenum Publishers, New York, 2002.
3. A.F. Von Recum, Handbook of Biomaterials Evaluation - Scientific, Technical and Clinical Testing of Implant Materials, 1998.
4. 2nd Edition, Taylor & Francis, Philadelphia, 1999.
5. 4. J.B Park and R.S Lakes, Biomaterials: An Introduction, Second Edition, Plenum press, New York, 1992.
6. 5. Joseph D Bronzino, The Biomedical Engineering Hand Book, Vol - 11, CRC press, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each - No choice**PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

SBM1404	HOSPITAL MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The paper provides opportunities for training and research in all aspects of hospital / health administration. It helps to promote scientific management of hospital and advancement of health care systems so as to make it rational, responsive and cost efficient.
- The student is thus educated in the development of high quality of hospital care in the community and the country so as to provide a satisfactory environment to the patient and clinical research

UNIT 1 STANDARD OF HOSPITAL 9 Hrs

Concept of Hospital Management - Role of Administrator - Responsibilities of Administrator - Hospital Design - Outlines for establishing Departmental Zones - Hospital Engineering

UNIT 2 HOSPITAL ORGANIZATION 9-Hrs.

Organization of Out-Patient Services - Problems encountered in functioning of O.P Department - Organization of In- Patient Services - Casualty & Emergency Services - Organization and management of Operation theatres

UNIT 3 SERVICES IN HOSPITAL 9 Hrs

Organization of Ancillary Services: Lab Services - Department of Physiotherapy & Occupational Therapy - Organization of Blood Transfusion Services - Department of Radio - diagnosis - Hospital Pharmacy

UNIT 4 STERILIZATION AND HOSPITAL SAFETY 9 Hrs

Disease transmission, Sterilization and disinfection methods, Hospital safety - Radiation Safety, hazardous safety, safety disposal of biological waste - Maintenance of Equipments & Instruments.

UNIT 5 SUPPORTIVE SERVICES IN HOSPITAL 9 Hrs

Organization and management of Nursing services and Dietary Services in hospital - House-keeping and maintenance -Medical Records -Staffing the hospital - Human resources management in hospital - Management Assisted by Computers: Reservation, Admission, Registration & Discharge Module

Max.45 Hours.

TEXT / REFERENCE BOOKS

1. Dr. L.L. Rao, Hospital Management. Annamalai University Press
2. R. D. Lele, Computers in Medicine, Tata McGraw Hill, 2008
3. Mohan Bansal, Medical informatics, Tata McGraw Hill, 2005

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

PART A : 10 questions of 2 marks each - No choice

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

Exam Duration : 3 Hrs.

20 Marks

60 Marks