PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 636011

DEGREE OF BACHELOR OF SCIENCE

CHOICE BASED CREDIT SYSTEM

Syllabus for

B.SC. BIOINFORMATICS

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to

Periyar University from 2017 - 2018 onwards)

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REGULATIONS

1. ELIGIBILITY

Refer this office circular No: PU/R/AD-1/UG/PG/Programmes Eligibility/2019 Dated: 16-04-2019.

2. DURATION OF THE COURSE

The course shall extend over a period of three years comprising of six semesters with two semesters in one academic year. There shall not be less than 90 working days for each semester. Examination shall be conducted at the end of every semester for the respective subjects.

3. COURSE OF STUDY

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time. The syllabus for various subjects shall be clearly demarcated into five viable units in each paper/subject. Part -I, Part-II, Part – III and Part – IV subjects are as prescribed in the scheme of examination.

4. EXAMINATIONS

The theory examination shall be three hours duration to each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination. The practical examinations for UG course should be conducted at the end of the even semester.

4.(a) Submission of record note books for practical examinations

Candidates appearing for practical examinations should submit bonafide Record Note Books prescribed for practical examinations, otherwise the candidates will not be permitted to appear for the practical examinations. However, in genuine cases where the students, who could not submit the record note books, they may be permitted to appear for the practical examinations, provided the concerned Head of the department from the institution of the candidate certified that the candidate has performed the experiments prescribed for the course. For such candidates who do not submit Record Books, zero (0) marks will be awarded for record note books.

5. Revision of Regulations and Curriculum

The University may revise /amend/ change the Regulations and Scheme of Examinations, if found necessary.

6(a). Passing Minimum – Theory

The candidate shall be declared to have passed the examination if the candidate secure not less than 40 marks out of 100 (**CIA – 10 marks out of 25 and EA – 30 marks out of 75**) in the University examination in each theory paper.

6(b). Passing Minimum – Practical

The candidate shall be declared to have passed the examination if the candidate secure not less than 40 marks put together out of 100 (**CIA – 16 marks out of 40 and EA – 24marks out of 60**) in the University examination in each practical paper.

7. Question Paper Pattern

7.1 (a). THEORY - Question Paper Pattern [EA] (Total Marks: 75)

PART – A (10 x 2 = 20 Marks)

(Answer ALL questions), (Two questions from each unit)

PART – B (5 x 5 = 25 Marks)

(Answer ALL questions) & (One question from each unit with Internal Choice)

PART – C (3 x 10 = 30 Marks)

(Answer ANY THREE questions) & (Open Choice – 3 out of 5 questions)

7.1 (b). THEORY - Internal Marks Distribution[CIA] (Total Marks: 25)

- Attendance : 5 Marks
- Assignment : 5 Marks
- Internal Examinations : 15 Marks

7.2 (a). **PRACTICAL –** *Marks Distribution & Question paper Pattern* (**Max. Marks: 100**)

[External [EA]: 60 Marks & Internal [CIA]: 40 Marks]

8. Commencement of this Regulation

These regulations shall take effect from the academic year 2017-2018, i.e, for students who are to be admitted to the first year of the course during the academic year 2017-2018 and thereafter.

Part	Sub Code	Subject	Credit	Marks		
				CIA	EA	Total
SEMESTER I						
I	Language	Tamil - I	3	25	75	100
II	Language	English - I	3	25	75	100
III	Core I	Cell Biology	4	25	75	100
	Core Practical I	Cell Biology & Biophysics	-	-	-	-
	Allied I	Basic Mathematics	4	25	75	100
		Value Education	2	25	75	100
		Total	**16**	**125**	**375**	**500**
SEMESTER II						
I	Language	Tamil - II	3	25	75	100
II	Language	English - II	3	25	75	100
III	Core II	Biophysics	4	25	75	100
	Core Practical I	Cell Biology & Biophysics	6	40	60	100
	Allied II	Fundamentals of computer and office automation	4	25	75	100
	Allied Practical - I	Computer lab	6	25	75	100
IV		Env. Studies	2	25	75	100
		Total	**28**	**190**	**510**	**700**

Part	Sub Code	Subject	Credit	Marks		
				CIA	EA	Total
SEMESTER III						
I	Language	Tamil - III	3	25	75	100
II	Language	English - III	3	25	75	100
	Core III	Microbiology	4	25	75	100
III	NMEC - I	Fundamentals of Bioinformatics	2	25	75	100
	Allied III	Chemistry	4	25	75	100
		Total	**16**	**125**	**375**	**600**
SEMESTER IV						
I	Language	Tamil - IV	3	25	75	100
II	Language	English - IV	3	25	75	100
III	Core IV	Biostatistics	4	25	75	100
	Allied IV	Biochemistry	4	25	75	100
	NMEC II	Applications of Bioinformatics	2	25	75	100
	Core Practical -II	Microbiology	6	40	60	100
	Allied Practical - II	Biochemistry	6	40	60	100
		Total	**28**	**205**	**495**	**700**
SEMESTER V						
III	Core V	Molecular Biology	4	25	75	100
	Core VI	Biological Data banks and their analysis	4	25	75	100
	Core VII	Immunology	4	25	75	100
	Core VIII	Plant and Animal Biotechnology	4	25	75	100
	Core IX	Relational Data Bases Management Systems	4	25	75	100
		Total	**20**	**125**	**375**	**500**

Part	Sub Code	Subject	Credit	Marks		
				CIA	EA	Total
SEMESTER VI						
III	Core X	Systemic evolution and Environmental Biology	4	25	75	100
	Core XI	Drug and Molecular modelling	4	25	75	100
	Core XII	Proteomics and Genomics	4	25	75	100
	Core XIII	Data mining and Warehousing	4	25	75	100
	Core XIV	Object oriented programming and C++	4	25	75	100
	Core Practical III	Lab in Molecular Biology and Plant Biotechnology	6	40	60	100
	Core Practical IV	Lab in Data base analysis, programming in PERL, C++ and molecular modelling	6	40	60	100
		Total	**32**	**205**	**495**	**700**

B. Sc. BIOINFORMATICS

SEMESTER – I

CORE - I - CELL BIOLOGY

UNIT I

Cell as a basic unit, classification of cell types, cell theory, organization of plant and animal cells, comparison of microbial, plant and animal cell.

UNIT II

Ultrastructure of cells, Biochemical composition of cells (nucleic acid, carbohydrate, protein and lipids).

UNIT III

Subcellular organization- cytosol, endoplasmic reticulum, nucleus, cytoskeleton, ribosomes, mitochondria, chloroplast, vacuoles, peroxisomes, lysosomes and cell wall.

UNIT IV

Structure and functions of cell membranes, cell division (eukaryotic and prokaryotic), mitosis, meiosis and cell cycle.

UNIT V

Specialized cell-motile cells, nerve cells, muscle cells, cell death and apoptosis.

Recommended Books:

- De Robertis and De Robertis. 2005. 8th Eds. Cell and Molecular Biology. Lippincott Williams & Wilkins
- Lodish, Berk, Baltimore et al. 2000. 6th Eds Molecular Cell Biology. W.H. Freeman & Co.
- Gerald Karp, 2008. Cell and Molecular Biology: Concepts and Experiments, 5th Eds. Wiley
- Geoffrey Cooper, 2000. The Cell: A molecular approach. 2nd Eds. Sinauer Associates Inc.

B. Sc. BIOINFORMATICS

SEMESTER - II

CORE - II - BIOPHYSICS

UNIT I

Energetics of a living body, sources of heat limits to temperature (qualitative treatment), heat dissipation to conservation, laws of thermodynamics. Nature of chemical bonds, intra and intermolecular interaction in biological systems.

UNIT II

Chromatography- Principles behind chromatography techniques; Types-Paper, Thin Layer, Column, HPTLC, ion-exchange, affinity & Gas chromatography; Electrophoresis-PAGE & SDS.

UNIT III

Spectroscopic techniques- Beer-Lambert's law, colorimetry, spectrophotometry (UV-visible, Fluorescence, Atomic absorption, IR to Ramanspectra).

UNIT IV

Physical methods of imaging, intact biological structures (X-ray, CAT-Scan, ECG, EEG &NMR) and radioactive pollution- GM counter.

UNIT V

Structure of proteins-primary, secondary, tertiary and quaternary. X-ray crystallography. Physical methods for determining size and shape of macromolecules – diffusion to sedimentation, reverse osmosis, ultracentrifugation

Recommended Books:

- Volkones, HV, General Biophysics Vol I&II.

- Pullman, B and M.Voino. Molecular biophysics.

B. Sc. BIOINFORMATICS

SEMESTER - I & II

CORE PRACTICAL - I   -   CELL BIOLOGY & BIOPHYSICS

1.   Cell types – Microbial, animal and plant morphometric measurements.

2.   Fractionation of cellular components.

3.   Cell membrane, separation and analysis of membrane components.

4.   Cell Staining : Cytochemical methods for demonstration of cellular and sub-cellular components (Protein, carbohydrate and lipids).

5.   Enzymes: Assay of urease, demonstration catalytic activity.

6.   Titration curve of amino acids.

7.   Selection of complementary filters.

8.   Beer- Lambert's law verification.

B. Sc. BIOINFORMATICS

SEMESTER – II

ALLIED - II

FUNDAMENTALS OF COMPUTER AND OFFICE AUTOMATION

(This paper is introduced instead of Allied paper - II :
Computer Fundamentals and Basic programming)

UNIT I

Introduction to Computers: – Characteristics of Computers. Classification of Computers – Programming Languages : Machine Language – Assembly Language – Input Devices- Keyboard – Mouse - Trackball – Output Devices – Dot Matrix Printer – Inkjet – Laser Printer – LCD & LED Printers: Hard Disk – CD –DVD – primary memory

UNIT – II

Getting Started: Starting a Program – Identifying Common Screen Elements – Choosing Commands – Finding Common Ways to Work – Getting Help with Office.

UNIT – III

MS-WORD: Learning Word Basics – Formatting a Word Document – Working with Longer Document.

UNIT – IV

MS-EXCEL: Creating a Simple Spreadsheet – Editing a Spreadsheet – Working with Functions and Formula – Formatting Worksheets – Completing Your Spreadsheet – Creating Charts

UNIT – V

MS-POWERPOINT: Creating and Viewing Presentations – Editing a Presentation – Working with Presentation Special Effects

Recommended Books

1. Fundamentals of computers science and Communication Engineering. **Alexis Leon & Mathews Leon**, Vikas Publishing House Pvt. Ltd., New Delhi (Unit-I)

2. Microsoft Office XP – fast & easy (UNIT II, III, IV & V),DIANE KOERS Prentice Hall of India Private Limited, New Delhi, 2001

B. Sc. BIOINFORMATICS

SEMESTER II

ALLIED PRACTICAL –I : COMPUTER LAB

(This practical lab is introduced instead of Allied Practical -I: Computer fundamentals and Basic programming)

LAB EXERCISE

MS Office

1. Create a document with tables, and do the following : Formatting, tab setting, page setting for printing, and Header & Footer setting

2. Drawing flow chart using drawing toolbar, inserting picture and setting frames

3. Mail Merge in word (Creating main document, data source, inserting merge fields and viewing merge data, viewing and printing merged letter, using main merge to print envelope creating mailing labels)

4. Create a document, Format the document and edit the document as follows:

    (i)   Find and Replace options

    (ii)   Cut, Copy and Paste options

    (iii)   Undo and Redo options

    (iv)   Using Bold, Underline and Italic.

    (v)   Chance Character size using the font dialog box.

    (vi)   Formatting paragraph: Center, Left aligns & Right aligns

    (vii)   Changing paragraph and line spacing Using Bullets and Numbering in paragraphs

    (viii) Creating Hanging paragraphs

MS – EXCEL

1. Create a work sheet, moving / copying / inserting / deleting rows and Columns. (Usage of cut, paste commands, copying a single cell, copying a range of data, filling up a cell. Undo command, inserting a row, column Deleting rows and columns).

2. Create a worksheet and perform to date, time ,Math functions, and Logical and financial functions

3. a.Data base concept: Data base, Record field and field name – creating and sorting a data base and maintaining a data base (date form)

   b. Using auto filter, advanced filter

   c. Creating subtotals and grand totals – Using database functions

4. Creating charts (Pie, Bar, Line)

   a. Using chart wizard (five steps)

   b. Changing the chart type (Pie, Bar, Line)

   c. Inserting titles for the Axes x, y

   d. Changing colors

   e. Printing charts

MS – POWER POINT

1. Creating a presentation using auto content wizard

2. Different views in power point presentation

3. Setting animation effects / grouping / ungrouping / cropping power/ point objects

4. Design to presentation to market the product using animation effects/ buttons/links

B. Sc. BIOINFORMATICS
SEMESTER – III
CORE - III - MICROBIOLOGY

UNIT 1

Microbial study: Types of Microscopes (Light, Phase-contrast and Electron microscopy) –classification of microorganisms- viruses, bacteria, fungi, algae and protozoans.

UNIT II

Microbial physiology: Microbial growth- medium, Environmental factors affecting growth-nutritional classification of microbes. Microbial metabolism: glycolysis, Aerobic process-Photosynthesis- cyclic and non-cyclic Phosphorylation.

UNIT III

Viruses (Lytic and Lysogenic), Bacterial genetics: Plasmids and conjugation, transduction and transformation. Mutations, mutagenesis and recombination.

UNIT IV

Environmental & Agricultural microbiology: Biogeochemical cycle: Biodegradation and bioremediation. Bio-fertilizers.

UNIT V

Microbiology of human diseases- Bacteria –*Staphylococcus*sp*., Vibriocholerae*, Virus-Pox-virus, Adeno virus, Fungus-*Aspergillus*and*Candida*sp*.* Medicine: Penicillin and Streptomycin.

Recommended Books

- Michael T. Madigan John M. Martin & Jack Parker, 1984. Biology of Microorganisms Prentice Hall International, Inc., London.

- Edward A. Birge, 1992. Modern Microbiology. Principles and application. W.M.C. Brown Publishers, Inc. U.S.A.

- Gerard J. Tortora, Berdell R. Funke, Christine & L. Case, 2001. Microbiology –An Introduction. Benjamin Cummings, U.S.A.

- Danial Lim, 1998. Microbiology, McGraw-Hill Company, New York.

B. Sc. BIOINFORMATICS
SEMESTER – III
NON MAJOR ELECTIVE COURSES
NMEC I - FUNDAMENTALS OF BIOINFORMATICS

Unit –I

Bioinformatics-Definition, History, Scope and Applications. Opportunities in Bioinformatics. Emerging areas of Bioinformatics

Unit II

Computers and Programming Languages. Internet, World Wide Web, Browsers, Search Engines – Google, Yahoo

Unit III

Cell Structures and Cell Organelles. Introduction to Macromolecules like DNA, RNA and Proteins

Unit IV

Introduction to Molecular Biology and genetics. Central dogma of life: DNA – RNA - Protein. Role of Bioinformatics in Human Genome Project

Unit –V

Biological databases, Importance of databases, Nucleic acid sequence databases, Protein databases and Structure databases

Recommended Books

1.   Basic Bioinformatics – S.Ignacimuthu (2005). Narosa Publishing House

2.   Bioinformatics for Beginners – K.Mani and Vijayaraj (2002). KalaikathirAchagam

3.   Fundamentals of Bioinformatics – Irfan Ali Khan, AtiyaKhanum (2003). Ukaaz publications.

B. Sc. BIOINFORMATICS

SEMESTER – IV

CORE - IV - BIO STATISTICS

UNIT 1

Biostatistics- definition- statistical methods- basic principles. Variables- Measurements and functions. Limitations and uses of statistics.

UNIT II

Data : primary and secondary. Methods of data collection. Merits and limitations. Classification, tabulation and presentation of data.

UNIT III

Measures of Central tendency- Mean, Median and Mode, – merits and limitations. Measures of dispersion – range, standard deviation and mean deviation.

UNIT IV

Correlation and regression, similarities and dissimilarities of correlation and regression methods.

UNIT V

Statistical interference – hypothesis: simple hypothesis, Hypothesis testing. Student's t-test, Chi-Square test, ANOVA.

Recommended Books

Daniel, W.W. 1987. Biostatistics, John Wiley Sons, New York.

Sundarrao, P.S.S. and Richards, J.2003. An Introduction to Biostatistics, 3rd Edition, CMC, Vellore.

Selvin, S. 1991. Statistical analysis of epidemiological data, University press, NY.

Bishop, O.N, 1983. Statistics for biology, Hougtan, Boston.

Freedman, P, 1950.The principles of scientific research, Pergamonpress,NY.

B. Sc. BIOINFORMATICS

SEMESTER - IV

NON MAJOR ELECTIVE COURSE

NMEC - II - APPLICATIONS OF BIOINFORMATICS

Unit –I

Protein Structure prediction, Gene and Protein expression data. Protein interaction data, Similarity and database searching tools – FASTA, BLAST

Unit II

Protein sequence data banks, NBRF, PIR, SWISSPROT, Nucleic Acid Sequence Data Bank, EMBL & NCBI

Unit III

Sequence analysis and Phylogeny – sequence search alignment- pair wise and multiple sequence. Scoring matrices. Introduction to Phylogenetic Trees.

Unit IV

Introduction to drug discovery : Structure based drug design. Docking. Classical SAR / QSAR.

Unit V

Structure of commonly used drugs in medical field. New drug design for cancer. Identification of novel drug design with least side effect.

Recommended Books

1. Introdcution to Bioinformatics - S.Sundararajan and Balaji

2. Instant notes - Bioinformatics - Westhead, Howard parish and Twyman. Viva books Pvt. Limited. Chennai

3. Bioinformatics basic skills and applications - Rastogi

B. Sc. BIOINFORMATICS

SEMESTER – IV

CORE PRACTICAL   II - MICROBIOLOGY

1.   Staining techniques - gram staining, negative staining, flagellar staining and spore staining.

2.   Microscopic slide preparation- bacterial and fungal strains.

3.   Various sterilization techniques – surface, glassware, media, dry heat, wet heat, radiation, chemicals and filtration.

4.   Preparation of solid and liquid media.

5.   Isolation of microorganisms from soil, air, plants and water by streak plate, pour plate and spread plate methods

6.   Maintenance of cultures – soil stock, glycerol stock and lyophilisation

7.   Biochemical test- starch hydrolysis, catalase production, milk curdling, fluorescence, acid and gas production by Durham tube, IMVIC.

B. Sc. BIOINFORMATICS

SEMESTER V

CORE - V - MOLECULAR BIOLOGY

Unit I

Cell structure and function: Membrane architecture, membrane associated process, ATP synthesis and photosynthesis, Subcellular organelles : Mitochondria and chloroplast.

Unit II

Chromosomal structure: prokaryotes and eukaryotes. Gene transfer in bacteria- genetic mapping and its uses.

Unit III

Prokaryotic and eukaryotic replication: Gene expression-transcriptional and translational regulation in prokaryotes. Post translational modification in eukaryotes.

Unit IV

Mutations and mutant, Biochemical basis of mutation, types of mutation – spontaneous and conditional. Chemical and physical mutagens- point mutation.

Unit V

Transposons and insertion sequences: Types of transposons – prokaryotes and eukaryotes. DNA rearrangement mediated by transposons.

Recommended Books

- Lodish, Berk, Baltimore et al. 2000. Molecular Cell Biology. 6th Edition. W.H. Freeman & Co

- Twyman, R.M.2000. Advanced Molecular Biology. Garland/bios Scientific Publishers.

- Sandy B Primrose, 1991. Molecular Biotechnology. 2nd Edition. Blackwell Scientific Publishers.

- Brown, T.A, 2002.Genomes. 2nd Edition. Wiley-Liss (New York).

- Larry Snyder, Wendy Champness, 2002.Molecular Genetics of Bacteria. 2nd Edition. American Society for Microbiology.

B. Sc. BIOINFORMATICS

SEMESTER V

CORE - VI - BIOLOGICAL DATA BANKS AND THEIR ANALYSIS

Unit I

DNA and protein sequence data banks, NCBI, EMBL, DDBJ, NBRF-PIR, SWISSPROT, signal peptide databank.

Unit II

Analytical tools for sequences databanks: BLAST, FASTA, Pairwise alignment- Multiple alignment-ClustalW, PRAS.

Unit III

Structural databanks: Protein databank (PDB), the Cambridge structural database, Genome databank, metabolic pathway databanks- KEGG and Meta Cyc.

Unit IV

Introduction to microbial strain data network, numerical coding system of microbes, hybridoma data bank structure, virus and cell line information system.

Unit V

Protein structure classification databases: SCOP and CATH, Human genome and diseases database – OMIM.

Recommended Books

- Adams, M. D., C. Fields, J. C. Venter. 1994. Automated DNA sequencing and analysis. Academic press, London.

- Bishop, M. J., C.J. Rawings. 1997. Nucleic acid and protein sequencing, A practical approach, IRI press, Oxford.

- Sushai, S, 1997. Theoretical and computational methods in genome research. Plenum press, NY.

- Hepsyba, S.G.H. and C.R. Hemalatha, 2009. Basic Bioinformatics, MJP Publishers, Chennai.

B. Sc. BIOINFORMATICS
SEMESTER V
CORE - VII - IMMUNOLOGY

UNIT I

Historical perspectives and overview of immune system: Innate and acquired immunity. Cells and organs of immune system. Inflammation.

UNIT II

Antigens, antigenicity. Immunogenicity. Complement system. Antigen-antibody interaction. Monoclonal antibodies.

UNIT III

Organization and expression of immunoglobulin genes. Major Histocompatibility Complex (MHC) and antigen.

UNIT IV

Cytokines: Structure, function and receptors, Cell mediated immunity. T- Cell maturation and activation. B-Cell activation and proliferation. Hypersensitive reactions – Types I, II, III and IV.

UNIT V

Immune regulation, Vaccines, autoimmunity, immune response to infectious and immuno-deficiency diseases.

Recommended Books

- Thomas J. Kindt, Barbara A. Osborne, **Janis Kuby**, **Richard A. Goldsby**, 2006. Immunology, **Janis Kuby**. W H Freeman & Co.

- Charles Janeway, Paul Travers, Mark Walport, Mark Shlomchik, Mark J. Shlomchik, 2004.**Immunobiology: The Immune System in Health and Disease** . Garland Pub.

- Abul K Abbas, Andrew K. Lichtman& Jordan S. Pober (Eds.), 1997. Cellular and Molecular Immunology, 3rd Edn. W.B.Saunders Company.

B. Sc. BIOINFORMATICS

SEMESTER V

CORE - VIII - PLANT AND ANIMAL BIOTECHNOLOGY

UNIT I

Application of plant tissue culture, organogenesis and somatic embryogenesis.Protoplast culture and fusion. *Agrobacterium* mediated transformation in plants, production of secondary metabolites by cell culture.

UNIT II

In-vitro conservation of germplasm. Synthetic seeds. Transgenic plant –*Bt*, herbicides, resistance pests and pathogens .Biotic & Abiotic stresses.

UNIT III

Animal cell culture: historical perspectives and applications, manipulation of animal cells (microinjection, electroporation, liposome mediated transformation). Production of native and recombinant proteins- animal viral vectors.

UNIT IV

Embryo transfer technology and animal breeding. Micromanipulation and embryo splitting, *In vitro* fertilization- chromosome engineering. Stem cells and its applications.

UNIT V

Transgenic animals: gene targeting, types of vaccines recombinant and DNA vaccines, production and its applications.

Recommended Books

- Kalyan Kumar De, 1992. Plant Tissue Culture , New Central Book Agency ,Calcutta

- Robert N. Trigiano, Dennis J. Gray, 1996. Plant Tissue Culture Concept and Laboratory Exercises, CRC Press, London.

- P.S. Srivasta, 1998. Plant Tissue Culture and Molecular Biology, Narosa Publishing House,New Delhi.

- R.Spier and J.Griffiths, 1994. Animal Cell Biotechnology. Academic Press.

- M .M. Ranga, 2000. Animal Biotechnology, Agrobios (India)

B. Sc. BIOINFORMATICS

SEMESTER VI

CORE – X - SYSTEMIC EVOLUTION AND ENVIRONMENTAL BIOLOGY

UNIT-I

Morphological classification of plants: Various systems, Binomial nomenclature; Cyto and chemotaxonomy.

UNIT-II

Morphology and Whittaker's five kingdom classification of animals, animal diversity, classification of chordates and non-chordates up to classes.

UNIT-III

Evolution: Origin of life, fossils, Carbon dating in fossils, Geological time scale. Palaeozoic, Mesozoic, Cenozoic life, Lamarkism, Neolamarkism, living fossils, modern concepts of evolution and speciation, variations, natural selection, isolation, mechanisms in evolution and speciation.

UNIT-IV

Environmental biology: Autoecology, synecology, ecosystem and its components, energy flow, primary productivity, food chain. Wild life preservation and management, water, air and noise pollution. Global warming and Marine pollution (Oil spills).

UNIT-V

Function of ecosystems. Vegetation pattern in South India. Pollution and soil conservation. Afforestation and social forestry. A general account of renewable and non-renewable resources.

Recommended Books

- G.L.Chopra, 1976. Angiosperms. S.Nagin& Co, Delhi.

- C.L.Porter, 1969. Taxonomy of flowering plants. Eurasia Pub. house, Delhi.

- Hans-Joachim Jördening, Josef Winter, 2005. Environmental Biotechnology: Concepts and Applications. Wiley.

- S.K. Dwivedi, M.C. Kalita, Padmanabh Dwivedi. 2007. Biodiversity and Environmental Biotechnology. (1st edition) Scientific Publishers.

- P.D.Sharma, 1994. Environmental Biology. Rastogi Publishers.

- Gary K.Meffe & Ronald Carroll, C, 1994. Principles of Conservation Biology,Sinauer Associates, Inc., Massachusetts.

B. Sc. BIOINFORMATICS

SEMESTER V

CORE - IX - RELATIONAL DATABASES MANAGEMENT SYSTEMS

Unit I

Purpose of database systems-Entity relationship model: mapping constraints-primary keys-ER diagram.

Unit II

Relational model: Structure-formal query languages-relational Algebra-relational calculus-commercial query language.

Unit III

Relational database design: Pitfalls-Normalization using functional dependencies-Decomposition-Third and fourth normal form-normalization. .

Unit IV

Hierarchical data model: Tree structure diagram-data retrieval, Networks data model: Data structure diagram-DBTG CODASYL model, updating and set processing.

Unit V

Interpretation-equivalence of expressions-Query processing cost- query optimizer. Basic concepts of data base recovery-currency control, database security and integrity-distributed database.

Recommended Books

- Jeffery D. Ulman, 1998. Principles of database system, Galgotia Publishers.

- Jdate C.J., 1995. An Introduction to Database System, Third Ed. Narosa Publishing Company.

- Henry F. Korth and Abraham Silberschatz, 2000. Database system concepts, McGraw Hill International Publication.

B. Sc. BIOINFORMATICS

SEMESTER VI

CORE – XI - DRUG AND MOLECULAR MODELLING

UNIT I

Classification of drugs, routes of drug administration. Absorption & Distribution of drugs. Importance of liver and kidney in drug interaction with biomolecules. Binding of drugs to plasma proteins. Effect of drug dosage on rate of metabolism.

UNIT II

Importance of Phase I and Phase II biotransformation. Role of cytochrome p-450, enzyme inhibition strategies, enzyme induction and pharmacological activity, detoxification enzyme system, LD_{50} and IC_{50}.

UNIT III

Drug receptors : Drug-receptor interaction, Drug action not mediated by receptors. Structural based drug design, mechanism of their action. Lipinski's rule of 5, Clinical trials 1-4 phases.

UNIT IV

Target sites & mode of action of cancer, neuro and HIV chemotherapy agents. Antimetabolites, antibodies, plantibodies, radiation therapy and alkylating agents. PUBCHEM database.

UNIT V

Molecular modelling- Homology modelling, Abinito methods and modelling, structure validation, Prochem, Ramachandran plot, stability- Molecular dynamics stimulation

Recommended Books

- Singh.H and Kapoor. V.K, 2002. Organic pharmaceutical chemistry. Vallabhprakashan publishers. New Delhi

- Andrew, R., 1998. Molecular modeling: principles and application. Leach. Harlow.

- Andrew, R., 1997. Molecular modeling: Basic principles and applications. Hans- X.

B. Sc. BIOINFORMATICS

SEMESTER VI

CORE - XII   - PROTEOMICS AND GENOMICS

UNIT I

Algorithms and applications of proteomics: proteome mining, protein expression profiling, protein-protein interaction, protein modification and automation.

UNIT II

Protein digestion techniques, SDS-PAGE, 2D-Electrophoresis, Isoelectric focusing(IEF), High Performance Liquid Chromatography- Mass Spectroscopy (HPLC-MS).

UNIT III

Overview of genome, genome sequence acquisition and analysis, comparative homologies, evolutionary changes, Single Nucleotide Polymorphism (SNPs). Genetic analysis: linkage mapping and analysis; physical mapping, Microarrays; sequence specific tags, sequence tagged sites, ISH, FISH.

UNIT IV

DNA sequencing: Maxam and Gilbert method, Sanger method, Ladder, Fluorescent, Shotgun, Automation DNA sequencing. Implications of DNA sequencing. Basics about Next Generation Sequencing.

UNIT V

Construction of cDNA and genomic DNA libraries; Polymerase Chain Reaction (PCR), Yeast two-hybrid system, SAGE Adaptation for Downsized Extract (SADE), ESTs,

Recommended Books

- Leibler DC. 2002. Introduction to proteomics, tools for the new biology. Humana press.

- Hunt SP, Livesey FJ, 2000. Functional genomics, Oxford University press.

- Cantor CR, 1999. Genomics. John Wiley, NY.

- Westermier R, Naven T, 2002. Proteomics in practice: A laboratory manual of proteome analysis. John Wiley- VCH.

B. Sc. BIOINFORMATICS

SEMESTER VI

CORE – XIII   - DATA MINING AND WAREHOUSING

(This paper is introduced instead of Major Paper - XIII :
Parallel Computing and programming in PERL)

UNIT – I

Introduction: Data mining application – data mining techniques – data mining case studies- the future of data mining – data mining software - **Association rules mining: Introduction**- basics- task and a naïve algorithm- apriori algorithm – improve the efficient of the apriori algorithm – mining frequent pattern without candidate generation

UNIT – II

Classification : Introduction – decision tree – over fitting and pruning - DT rules- estimation predictive accuracy of classification methods - other evaluation criteria for classification method – classification software

UNIT – III

Cluster analysis: cluster analysis – types of data – computing distances-types of cluster analysis methods - partitioned methods – hierarchical methods – density based methods – dealing with large databases – quality and validity of cluster analysis methods - cluster analysis software.

UNIT – IV

Web data mining: Introduction- web terminology and characteristics- locality and hierarchy in the web-web content mining-web usage mining- web structure mining – web mining software - **Search engines:** Search engines functionality- search engines architecture – ranking of web pages.

UNIT – V

Data warehousing: Introduction – Operational data sources- data warehousing - Data warehousing design – Guidelines for data warehousing implementation - Data warehousing metadata - **Online analytical processing (OLAP):** Introduction – OLAP characteristics of OLAP system – Multidimensional view and data cube - Data cube implementation - Data cube operations OLAP implementation guidelines

Recommended Books

1.   "Introduction to Data mining with case studies", G.K. Gupta, PHI Private limited, New Delhi, 2008.

B. Sc. BIOINFORMATICS

SEMESTER - VI

CORE – XIV   -   OBJECT ORIENTED PROGRAMMING AND C++

Unit I

Principles of object oriented programming (OOP): Software evolution-OOP paradigm-basic concepts of OOP-object oriented languages-applications of OOP.

Unit II

Introduction to C++, Tokens, keywords, Identifiers, Variables, Operators, Manipulators, Expressions and control structures in C++. Functions in C++-main function-function typing-call by reference-return by reference-function overloading-friend and virtual function.

Unit III

Classes and objects: constructors and destructors and operating overloading and type conversions.

Unit IV

Inheritance: Types – single, multilevel, hierarchical and hybrid inheritance. Pointers, virtual functions and polymorphism. Managing console I/O operations.

Unit V

Working with files: Classes for file stream operations-opening and closing a file-end of file (EOF), file detection-file pointers-updating a file-error handling during file operations-command line arguments.

Recommended Books

- Balagurusamy, E. 1995.Object oriented programming with C++, TMH.

- Herbert Schidt, 1995. C++ The complete Reference, 2nd Edition, Osborne, MGH.

B. Sc. BIOINFORMATICS
SEMESTER - VI
CORE PRACTICAL - III
LAB IN MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY

1. Isolation of plasmid and genomic DNA and furtherconfirmation by Agarose gel electrophoresis
2. SDS-PAGE
3. Preparation of culture medium and basic sterilization techniques
4. Cell suspension
5. Callus induction
6. Extraction of secondary metabolites using cold percolation technique
7. Thin Layer chromatography.

B. Sc. BIOINFORMATICS

SEMESTER-VI

CORE PRACTICAL - IV

LAB IN DATABASE ANALYSIS, PROGRAMMING IN PERL, C++ AND MOLECULAR MODELLING

1.   PDB analysis of protein structure by RASMOL
2.   NCBI, EMBL and DDBJ (accession of information)
3.   BLAST and FASTA search
4.   Alignments – pair wise and multiple sequence alignment-ClustalW and X
5.   Program for function , operation overloading
6.   program for multiple constructors in a class
7.   program for multiple handling
8.   program for error handling
9.   program for friend and virtual functions
10. Molecular mechanics and dynamics of nucleotides and proteins
11. Molecular modelling using HEX

B. Sc. BIOINFORMATICS

SKILL BASED ELECTIVE COURSES

1. Microbial diversity
2. Medical Laboratory techniques
3. Recombinant DNA technology I
4. Recombinant DNA technology II
5. Microbial Biotechnology I
6. Microbial Biotechnology II

NON MAJOR ELECTIVE COURSES

1. Bioinstrumentation I
2. Bioinstrumentation II

PART IV

1. Environmental Studies
2. Value Education - Yoga

PART V

1. Extension Activities