# PERIYAR UNIVERSITY, SALEM – 11

## REGULATIONS FOR B.Sc., (BIOINFORMATICS) DEGREE COURSE with Semester System

(Effective from the academic year 2008-2009)

# REGULATIONS

### 1. ELIGIBILITY FOR ADMISSION

A candidate who has passed in Higher Secondary Examination with Biology or Pure Science (Academic stream or Vocational stream) as one of the subject under Higher Secondary Board of Examination, Tamilnadu as per norms set by the Government of Tamilnadu or an Examination accepted as equivalent thereto by the syndicate, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **Bachelor of Bioinformatics degree examination** of this university after a course of study of three academic years.

### 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 – 24 marks 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 2008-09, i.e, for students who are to be admitted to the first year of the course during the academic year 2008-09 and thereafter.

# PERIYAR UNIVERSITY, SALEM -636 011.

## B.Sc., Bioinformatics

### Scheme of Examination (CBCS PATTERN) for the Academic Year 2008-09

### SEMESTER – I

| Sem | Part | Sub Code | Subject | Credit | Marks | | |
|---|---|---|---|---|---|---|---|
| | | | | | CIA | EA | Total |
| I | I | | Tamil - I | 3 | 25 | 75 | 100 |
| | II | | English – I | 3 | 25 | 75 | 100 |
| | III | | Cell Biology | 4 | 25 | 75 | 100 |
| | | | 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

| Sem | Part | Sub Code | Subject | Credit | Marks | | |
|---|---|---|---|---|---|---|---|
| | | | | | CIA | EA | Total |
| II | I | | Tamil - II | 3 | 25 | 75 | 100 |
| | II | | English – II | 3 | 25 | 75 | 100 |
| | III | | Biophysics | 4 | 25 | 75 | 100 |
| | | | Major 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 |
| | | | NME-1 Fundamentals of Bioinformatics | 2 | 25 | 75 | 100 |
| | | | **Total** | **30** | **215** | **585** | **800** |

## SEMESTER – III

| Sem | Part | Sub Code | Subject | Credit | Marks | | |
|---|---|---|---|---|---|---|---|
| | | | | | CIA | EA | Total |
| III | I | | Tamil - III | 3 | 25 | 75 | 100 |
| | II | | English – III | 3 | 25 | 75 | 100 |
| | III | | Microbiology | 4 | 25 | 75 | 100 |
| | | | Allied III: Chemistry | 4 | 25 | 75 | 100 |
| | | | NME –2 Applications of Bioinformatics | 2 | 25 | 75 | 100 |
| | | | **Total** | **16** | **125** | **375** | **500** |

## SEMESTER – IV

| Sem | Part | Sub Code | Subject | Credit | Marks | | |
|---|---|---|---|---|---|---|---|
| | | | | | CIA | EA | Total |
| IV | I | | Tamil - IV | 3 | 25 | 75 | 100 |
| | II | | English – IV | 3 | 25 | 75 | 100 |
| | III | | Biostatics | 4 | 25 | 75 | 100 |
| | | | Allied IV : Biochemistry | 4 | 25 | 75 | 100 |
| | | | Major Practical - II (Microbiology) | 6 | 40 | 60 | 100 |
| | | | Allied Practical – II Biochemistry | 6 | 40 | 60 | 100 |
| | | | **Total** | **26** | **180** | **420** | **600** |

## SEMESTER – V

| Sem | Part | Sub Code | Subject | Credit | Marks | | |
|---|---|---|---|---|---|---|---|
| | | | | | CIA | EA | Total |
| V | III | | Molecular Biology | 4 | 25 | 75 | 100 |
| | | | Biological Data bank and their analysis | 4 | 25 | 75 | 100 |
| | | | Immunology | 4 | 25 | 75 | 100 |
| | | | Plant & Animal Biotechnology | 4 | 25 | 75 | 100 |
| | | | Relational Data Bases Management Systems (RDBMS) | 4 | 25 | 75 | 100 |
| | | | **Total** | **20** | **125** | **375** | **500** |

## SEMESTER – VI

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

**Total Credits: 140**
**Total Marks: 3600**

**SEMESTER – I**

**UBI 111- MAJOR PAPER- 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**

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

**UNIT III**

Ultrastructure of cells, subcellular organization, structure and function of cell membranes, cytosol, endoplasmic reticulum, nucleus, cytoskeleton, ribosomes, mitochondria, chloroplast, vacuoles, peroxisomes, lysosomes and cell wall.

**UNIT IV**

Cell division ( eukaryotic and prokaryotic), mitosis, meiosis and cell cycle.

**UNIT V**

Specialized cell, motile cells, nerve cells, muscle cells.

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.

**SEMESTER II**

**UBI121-MAJOR PAPER-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 chemicsl bonds, intra and intermolecular interaction in biological systems.

**UNIT II**

Absorption spectroscopy- Beer-Lambert's law, Colorimetry to Spectrophotometry( single and double beam spectrophotometer), primary biophysical events in photosynthesis. Physical methods for determining size and shape of macromolecules – diffusion to sedimentation, reverse osmosis, ultracentrifugation.

**UNIT III**

Spectroscopic techniques to find out molecular structure (quantitative techniques), general spectroscopy (UV, Visible, Fluorescence, Atomic absorption, IR to Raman spectra).

**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

**Recommended Books:**

Volkones, HV, General biophysics Vol I&II.

Pullman, B and M.Voino. Molecular biophysics.

**SEMESTER –II**

**UBIP121- MAJOR 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: Cyto chemical 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**.**

## Allied paper - II (Semester – 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: Introduction – Types of Computers – Characteristics of Computers. Generations of Computers - Classification of Computers – Programming Languages : Machine Language – Assembly Language – High level languages. Input Devices- Keyboard – Mouse - Types of mice – Connections – Mouse Pad - Trackball – Joystick -Out put Devices – Dot Matrix Printer – Inkjet – Laser Printer – LCD & LED Printers– Line Printer Auxiliary Storage Devices : 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

**TEXT 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

# Allied Practical –I: Computer lab

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

## Semester II: 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

## SEMESTER – II

## Non Major Elective Courses

## NME –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, Internet Search Engines – Google, Yahoo

**Unit III**

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

**Unit IV**

Introduction to Molecular Biology and genetics. DNA replication. Enzymes and accessory proteins involved in DNA replication- Recombination . Role of Bioinformatics in Human Genome Project

**Unit –V**

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

References


1. Basic Bioinformatics – S.Ignacimuthu (2005). Narosa Publishing House
2. Bioinformatics for Beginners – K.Mani and Vijayaraj (2002). Kalaikathir Achagam
3. Fundamentals of Bioinformatics – Irfan Ali Khan, Atiya Khanum (2003). Ukaaz publications.

## SEMESTER – III

## UBI211 MAJOR PAPER - III

## MICROBIOLOGY

**UNIT 1**

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

**UNIT II**

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

**UNIT III**

Life cycle pattern of microbes: Viruses (Lytic and Lysogenic), bacteria, fungi-yeast and *Neurospora*. Bacterial genetics: Mutations, mutagenesis, recombination and transposition, Plasmids, F plasmids and conjugation, transduction and transformation.

**UNIT IV**

Environmental microbiology: Microbial population of air, water and soil. Biogeochemical cycle: Nitrogen, carbon, sulphur cycles, Biodegradation and bioremediation. Microbial enzymes.

**UNIT V**

Microbiology of human diseases- Epidemiology, pathogenesis, diagnosis, prevention and control. Bacteria - *Staphylococcus, Streptococcus, Vibriocholerae*, *Salmonella*, Virus-Pox-virus, Adeno virus, Fungus-*Aspergillus, Candida.* Protozoa-Amoeba, Plasmodia. Medicine: Antibiotics-Penicillin and Streptomycin. Agriculture: biofertilizers- Bacteria and Cyanobacteria (BGA). Food - Preservation, spoilage of food products and food borne diseases.

**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.

**SEMESTER – III**

**UBIP221 MAJOR 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 micro organisms 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.

**SEMESTER – III**

**NME –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, Gen Bank, EMBL

Unit III
Sequence analysis and Phylogeny – sequence and similarity, sequence alignment – local, global, pair wise and multible sequence. Scoring matrices. Introduction to Phylogenetic Trees.

Unit IV
Introduction to drug discovery. Structure based drug design. Docking. Clasical SAR / QSAR.

Unit V
Structure of commonly used drugs in medical field. Finding new drug targets to treat diseases like cancer. Identification of novel drug design with least side effect from 3D database.

**References**


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

## SEMESTER – IV

## UBI221 MAJOR PAPER - IV

## BIO STATISTICS

**UNIT 1**

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

**UNIT II**

Data - primary, secondary. Methods of data collection. Merits and limitations. Classification, tabulation and presentation of data. Sampling methods.

**UNIT III**

Measures of Central tendency- Mean, Median, Mode, Quartiles, Deciles and Percentiles – merits and limitations. Measures of dispersion – range, standard deviation, mean deviation. Coefficient of variations.

**UNIT IV**

Correlation – Types and methods, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression.

**UNIT V**

Statistical interference – hypothesis: simple hypothesis, Hypothesis testing. Student's t test, Chi-Square goodness of fit 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, Pergamon press,NY.

## SEMESTER V

## UBI311 MAJOR PAPER - V

## MOLECULAR BIOLOGY

**Unit I**

Cell structure and function: Membrane architecture, membrane associated process, ATP synthesis and photosynthesis, subcellular organelles- mitochondria, chloroplast.

**Unit II**

Chromosomal architecture: Modern concept of gene- prokaryotes and eukaryotes. Gene transfer in bacteria- transformation, transduction and conjugation. Mechanisms and their uses in genetic mapping. Bacteriophage –transfection.

**Unit III**

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

Unit IV

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

Unit V

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

## SEMESTER V

## UBI312 MAJOR PAPER - VI

## BIOLOGICAL DATABANKS AND THEIR ANALYSIS

**Unit I**

Data warehousing: Capture and analysis. Sequence data banks- Introduction, DNA and protein sequence data banks, GENBANK, EMBL, DDBJ, NBRF-PIR, SWISSPROT, signal peptide databank.

**Unit II**

Analytical tools for sequences databanks: BLAST, FASTA, Pairwise alignment- Needleman, Wunsch algorithm, Smith Waterman algorithm. 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**

Microbial and cellular databank: 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.

**SEMESTER V**

**UBI313 MAJOR PAPER- 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. Immunoglobulins- Types, structure, and characteristics. Complement system. Antigen-antibody interaction. Monoclonal antibodies.

**UNIT III**

Organization and expression of immunoglobulin genes. Major Histocompatibility Complex (MHC) and antigen. T-cell receptor.

**UNIT IV**

Cytokines: structure and function. Cytokine receptors, biological function of cytokines-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.

**SEMESTER V**

**UBI314- MAJOR-PAPER-VIII**

**PLANT AND ANIMAL BIOTECHNOLOGY**

**UNIT I**

Scope and 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**

Conservation of germplasm using biotechnological tools. Production of synthetic seeds. Engineering resistance to herbicides, insect pests and pathogens. Molecular basis of plant adaptation to abiotic stresses (e.g. salinity, drought and flood).

**UNIT III**

Tissue culture techniques and applications in plant breeding, role of plant cell culture in food biotechnology. Quality control in commercial plant tissue culture.

**UNIT IV**

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. Embryo transfer technology and animal breeding. Micromanipulation and embryo splitting, *In vitro* fertilization- chromosome engineering and pest management.

**UNIT V**

Transgenic animals: Improving important genes, gene targeting, vaccine production, DNA Vaccines etc. in animal cells, Sheep cloning.

**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)

## SEMESTER V

## UBI315 MAJOR PAPER – IX

## RELATIONAL DATABASES MANAGEMENT SYSTEMS

**Unit I**

Introduction: Purpose of database systems-overall system structure-Entity relationship model: Entitles and entity sets, relationships- mapping constraints-primary keys-ER diagram.

**Unit II**

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

**Unit III**

Relational database design: Pitfalls-Normalization using functional dependencies-Decomposition-Third normal form-normalization using multi valued dependencies-Fourth Normal form- normalization using join dependencies.

**Unit IV**

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

**Unit V**

Query processing: 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, Mc Graw Hill International Publication.

**SEMESTER VI**

**UBI321- MAJOR PAPER – 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.

## SEMESTER VI

## UBI322-MAJOR PAPER – XI

## DRUG AND MOLECULAR MODELLING

### UNIT I

Introduction: Classification of drugs, routes of drug administration. Absorption of drugs. Drug distribution. Role of kidney in drug interaction with biomolecules. Binding of drugs to plasma proteins.

### UNIT II

Drug receptors: Drug-receptor interaction, involvement of binding forces in drug interaction. Drug action not mediated by receptors. Structural based drug design, mechanism of their action. Design of ligands for known macromolecular target sites and drug receptor interactions. Lipinski's rule of 5, Clinical trials 1-4 phases.

### UNIT III

Effect of drug doses on the rate of metabolism- mechanisms and importance of Phase I and Phase II biotransformation. Role of cytochrome p450. Enzyme inhibition strategies, enzyme induction and pharmacological activity, $LD_{50}$ and $IC_{50}$.

### UNIT IV

Principles of cancer and HIV chemotherapy and target sites for cancer and HIV chemotherapeutic agents. Mode of action of anticancer and antiHIV drugs: antimetabolites, antibodies, plantibodies, radiation therapy and alkylating agents. Effects of chemotherapeutic agents on the cell cycle. PUBCHEM database.

### UNIT V

Quantitative Structure Activity Relationship (QSAR). Types of descriptors-constitutional, topological, charge, quantum chemical, walk and path counts, geometric descriptors. Types of QSAR methods-In static contour plot, in electro static contour plots, 3D-QSAR.

**Recommended Books**


- Singh.H and Kapoor. V.K, 2002. Organic pharmaceutical chemistry. Vallabh prakashan publishers. New Delhi
- Andrew, R., 1998. Molecular modeling: principles and application. Leach. Harlow.
- Andrew, R., 1997. Molecular modeling: Basic principles and applications. Hans- X.

**SEMESTER VI**

**UBI323-MAJOR PAPER-XII**

**PROTEOMICS AND GENOMICS**

**UNIT I**

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

**UNIT II**

Protein digestion techniques, 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.

**UNIT V**

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

**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

**SEMESTER VI**

**UBI324 MAJOR PAPER – 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

**TEXT BOOK:**

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

## BI324 MAJOR PAPER – 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.

**SEMESTER-VI**

**UBIP321 – PRACTICAL III**

**LAB IN MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY**

1. Isolation of plasmid and analysis by Agarose gel electrophoresis
2. SDS-PAGE
3. Mutagenesis
4. Determination of molecular size of DNA
5. Restriction analysis of DNA
6. Ligation of DNA into vectors
7. Transformation
8. Preparation of culture medium and basic sterilization techniques
9. Organ culture
10. Callus induction
11. Shoot tip culture
12. Isolation of Plant DNA and analysis by Agarose gel electrophoresis
13. Biochemical test for identification of bacteria.

**SEMESTER-VI**

**UBIP322 – 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 informations)
3. BLAST and FASTA search
4. Alignments – pair wise and multiple sequence alignment – Clustal W 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.

## 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