

BHARATHIAR UNIVERSITY, COIMBATORE.
M. Sc., BIOCHEMISTRY DEGREE COURSE WITH COMPULSORY DIPLOMA
(AFFILIATED COLLEGES)
(Effective from the academic Year 2009-2010)
SCHEME OF EXAMINATIONS – CBCS PATTERN

SEM	Subject and Paper	Inst. Hrs/ week	Examinations				Credit
			Dur.Hrs	CIA	Marks	Total Marks	
I	Paper-I Biopolymers	5	3	25	75	100	5
	Paper-II Analytical Biochemistry and Bioinformatics	5	3	25	75	100	5
	Paper-III Enzymes and Enzyme Technology	4	3	25	75	100	5
	Paper-IV Cellular Biochemistry	4	3	25	75	100	4
	Paper-V Plant Biochemistry and Biotechnology	4	3	25	75	100	4
	Practical-I Biochemistry Practical-I	3	-	-	-	-	-
	Practical-II Biochemistry Practical-II	3	-	-	-	-	-
	Diploma Course – Paper I	2	3	25	75	100	3
II	Paper-VI Microbial Biochemistry	5	3	25	75	100	5
	Paper-VII Immunology	5	3	25	75	100	5
	Paper-VIII Advanced Clinical Biochemistry	5	3	25	75	100	5
	Paper-IX Molecular Biology	4	3	25	75	100	4
	Practical-I Biochemistry Practical-I	4	96	40	60	100	4
	Practical-II Biochemistry Practical-II	4	6	40	60	100	4
	Diploma Course – Paper II	2	3	25	75	100	3
III	Paper-X Biostatistics	5	3	25	75	100	5
	Paper-XI Metabolism and Metabolic Regulation	5	3	25	75	100	5
	Paper-XII Genetic Engineering	5	3	25	75	100	4
	Paper-XIII Endocrinology	5	3	25	75	100	4
	Paper-XIV Pharmaceutical Chemistry and Neurochemistry	5	3	25	75	100	4
	Diploma Course – Paper III	5	3	25	75	100	3
IV	Project Work	-	-	-	-	200*	6
	Diploma Course – Paper IV	-	-	-	-	100*	3
	Total					2200	90

* Includes 25 / 40% continuous internal assessment marks for theory and practical papers respectively. For Project report - 80%; Viva-voce - 20%

List of Group Elective/Diploma papers (Colleges can choose any one of the Group/Diploma papers as electives)

Paper / Sem	GROUP A Diploma in Cell Culture and Molecular Techniques	GROUP B Diploma in Computational Molecular Biology	GROUP C Diploma in Nanoscience
I	Plant Tissue Culture	Computational Molecular Biology	Fundamentals of Nanoscale Science
II	Animal Tissue Culture	Genomics	Nanomaterials Synthesis
III	Methods in Molecular Biology	Proteomics	Characterization and Application of Nano Materials
IV	Practical I & II	Practical in Genomics and Proteomics	Project work

Note :

1. The Syllabus for the above papers (except Biochemistry Practical – II, Elective Diploma papers Group A – Paper IV, Group B & Group C) be the same as prescribed for the academic year 2007- 08.
2. The syllabus for the Biochemistry Practical – II, Elective Diploma papers Group B & Group C are furnished below :

**SEMESTER I AND II
BIOCHEMISTRY PRACTICALS – II**

Clinical biochemistry:

1. Determination of the activity of the following serum enzymes:
a) LDH b) Acid phosphatase c) Alkaline phosphatase d) Aspartate amino transferase e) Alanine amino transferase f) Creatine kinase g) Superoxide dismutase
h) glutathione peroxidase
2. Determination of the following from urine/serum:
a) Chloride b) Calcium c) Magnesium
3. Estimation of albumin
4. Estimation of thiobarbituric acid reactive substances (TBARS) in serum
5. Determination of Na⁺ and K⁺ using flame photometer
6. Estimation of glucose, protein and chloride in CSF

Genetic engineering and molecular biology:

7. Agarose gel electrophoresis of DNA
8. Preparation of competent *E. coli* – Transformation (demonstration)
9. Plasmid DNA isolation from *E. coli*
10. Genomic DNA isolation from *E. coli/Drosophila melanogaster*

Immunology:

11. Immunodiffusion – single radial and double diffusion
12. Immunoelectrophoresis
13. Rocket immunoelectrophoresis
14. Agglutination antibodies
15. Identifying blood group and Rh typing

Separation techniques:

16. Separation of amino acids by paper chromatography – circular, ascending and descending
17. Separation of amino acids/lipids/sugars by TLC
18. Separation of plant pigments by column chromatography

GROUP A
DIPLOMA IN COMPUTATIONAL BIOLOGY - PAPER IV
PRACTICAL-I

PLANT TISSUE CULTURE

- 1) PTC laboratory organization
- 2) Sterilization procedures
- 3) Preparation of PTC medium
- 4) Invitro germination of seeds and estimation of carbohydrate, proteins
- 5) Callus induction and estimation of phenol
- 6) Micro propagation
- 7) Artificial seed production

ANIMAL TISSUE CULTURE

- 1) Preparation of ATC medium and membrane filtration
- 2) Preparation of primary culture from chick embryo
- 3) Estimation of enzymes from liver cells any one of the following
a) Phosphatases b) LDH c) Transaminase
- 4) Isolation of DNA from animal cell

References

- 1) Molecular Cloning : a laboratory Manual, J. Sambrook, Fritsch and Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
- 2) Applied Molecular Genetics, Roger, L.Miesfield, John Wiley and Sons Inc Publications, 1999.
- 3) Recombinant DNA Principles and Methodologies, James .J. greene, Vengalla B.Rao, Marcel Dekker Publications, 1998.
- 4) DNA Cloning, a pratical approach, D.M. Glover and B.D. Hames, IPL press, Oxford, 1995
- 5) Molecular and Cellular methods in Biology and Medicine, P.B. Kaufman, W.Wu, D.Kim and L.J.Cseke, CEC press, Florida, 1995.

GROUP A
DIPLOMA IN COMPUTATIONAL BIOLOGY - PAPER IV
PRACTICAL-II

METHODS IN MOLECULAR BIOLOGY

- 1) Isolation of genomic DNA and RNA
- 2) Isolation of plasmid DNA and estimations by DNP mentods
- 3) Southern plotting
- 4) Northern plotting
- 5) Polymerase chain reaction
- 6) Isolation and purification mitochondrial DNA and assay by Marker enzymes

GROUP B
DIPLOMA IN COMPUTATIONAL BIOLOGY
PAPER I - COMPUTATIONAL MOLECULAR BIOLOGY

Preamble:

Scope: To provide molecular biologists the modern molecular databases and tools including literature, sequence, structure and expression databases.

Objective: To provide information an understanding of the major computational problems in the field of molecular biology.

Goal: To gain knowledge on molecular databases, comparative genomics, pattern search, classification of sequence and structure, alignment of sequences, rapid similarity searching, phylogenies, automated pattern learning, representing and searching protein structure, gene expression profiling, clustering expressed genes, discovering transcription factor binding sites, discovering common functions of co-expressed genes, metabolic pathways, signal transduction pathways.

Contents:

Unit – I

Computational Molecular Biology: Bioinformatics - Bibliographic and Full Text Journal Access - Genome Databases - Molecular Biology Databases on the Web - DNA and protein forensics analysis - Probability and statistics - Prior probability - Linkage analysis

Unit - II

Pattern Matching with Consensus Sequences - Quantitative & Probabilistic Pattern Matching - Sequence Alignment - Rapid Sequence Similarity Search - Near-Optimal Sequence Alignments - Multiple Sequence Alignment.

Unit III

Distance Based Phylogenies - Sequence Blocks & Profiles - Protein Sequence Motifs
Protein Structural Motifs.

Unit IV

Clustering and Functional Analysis of Coordinately Regulated Genes - Discovering Transcriptional Regulatory Signals - Ultra conservation in the Human Genome - Pathway Bioinformatics.

Unit V

Intro to the GCG SeqWeb Interface - Sequence Comparision - GCG SeqWeb - BestFit and Gap - Description of Progressive Pairwise Algorithm - Phylogenetic Analysis.

References:

1. Bioinformatics-A beginner's guide by Jean – Michel Claverie and Cedric Notredame, Wiley- Dream Tech India Pvt. Ltd.
2. Developing bioinformatics computer skills by Cynthia Gibas and Per Jambeck, O' Reilly publications.

3. Introduction to bioinformatics by T.K. Attwood and D.J. Parry –smith, Pearson Education Asia.
4. Bioinformatics by David.W.Mount, CBS publishers and distributors.
5. Instant notes in bioinformatics by D.R. Westhead, J.H.Parish and R.M.Twyman.
6. Biostatistical analysis. Zar.J.H
7. Peuzner, P.A., Computational molecular Biology, An algorithmic approach.

GROUP B
DIPLOMA IN COMPUTATIONAL BIOLOGY
PAPER II - GENOMICS

Preamble:

Scope: To provide students a detailed through background various wet lab techniques and data generation tools related to DNA sequences.

Objective: To handle the data in analyzing and interpretation including annotation.

Goal: To educate students on stand alone and online software for genetic studies.

Contents:

Unit I

Genome structure: Genome sizes and the C-value paradox, introns and exons, microbial and organelle genomes - Centromeres and telomeres, tandem repeats- dispersed repeats (transposons), gene density, intergenic DNA.

Unit II

Genome physical mapping and sequencing: Fragmenting the genome, the need for markers - marker sequences (RFLPs, AFLPs, SNPs, etc) - hybridization mapping - mapping without cloning - Basic Sanger sequencing - automated sequencing- sequencing simple genomes - Sequencing large genomes - finalizing sequences – resequencing.

Unit III

Genome project and bioinformatics - www databases for genomes - DNA dynamics - Recombination – Evolution - Gene diversity - Consensus and pattern recognition - Sequence diversity – Polymorphism.

Unit IV

Phylogenetic Genome mapping - DNA sequence database analysis - Random-shearing GenBank - Web-based ORF finding, sequence alignment and 3-D matrix tools – Genotator - DNA modeling.

Unit V

Orthologues and paralogues, RNA transactions, comparative genomics of viruses, bacteria, organelles and eukaryotes, lateral gene transfer.

Reference:

1. The Human Genome Project; Deciphering the blueprint of heredity ; Edited by Necia Grant Cooper; University Science books, CA, USA, 1994.
2. Bioinformatics-A beginner's guide by Jean – Michel Claverie and Cedric Notredame, Wiley- Dream Tech India Pvt. Ltd.
3. Developing bioinformatics computer skills by Cynthia Gibas and Per Jambeck, O' Reilly publications.

GROUP B
DIPLOMA IN COMPUTATIONAL BIOLOGY
PAPER III - PROTEOMICS

Scope: To provide students a detailed through background various wet lab techniques and data generation tools related to protein sequences.

Objective: To enable students to know various wet lab and insilico tools for handling proteomic studies.

Goal: To educate students on stand alone and online software for proteomic studies.

Contents:

Unit I

Introduction to 2D gel electrophoresis, multidimensional chromatography, mass spectrometry, and analytical protein chips. Identifying proteins in complex mixtures. Protein profiling, quantitative 2DGE, quantitative mass spectrometry,

Unit II

The analysis of phosphoproteins and glycoproteins. Protein interaction analysis, Y2H, mass spec complex analysis, functional protein chips, protein localization, high throughput functional annotation.

Unit III

Protein domains and folds, using sequences and structures to predict gene function, high throughput structural analysis of protein, structural proteomics and what it can achieve.

Unit III

Pharmacogenomics and new drug design. Need for developing new drugs: Procedure followed in drug design; Molecular modification of lead compounds; Prodrug and soft drugs; Physico-chemical parameters in drug design; QSAR; Active site determination of enzymes; Design of enzyme inhibitors.

Unit V

Significance of metabolomics, methodologies, technical problems, data handling, data Interpretation. Computational protein-protein interactions RasMol – Swiss PDB viewer

References

1. Branden, C and J. Troze, 1999. Introduction to protein structure. Second edition.
2. Baxevanis, A.D and Ouellette, B.F.F (Eds), 2001. Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley interscience. New York.

3. Higgins, D and Taylor, W (Eds), 2000. Bioinformatics: Sequence, structure and databnks.Oxford University Press, Oxford.
4. Misener, S and Krawetz, S.A (Eds), 2001.Bioinformatics: methods and protocols. Replica press private limited, New Delhi.

GROUP B
DIPLOMA IN COMPUTATIONAL BIOLOGY
PAPER IV - PRACTICALS IN GENOMICS AND PROTEOMICS

Preamble:

Scope: To become familiar with the bioinformatic tools and resources accessible via the World Wide Web for database storage, retrieval, integration and interpretation.

Objective: Bioinformatics tools will be used for aligning DNA sequences for pairwise and multiple sequence comparisons, structural and functional predictions, phylogenetic construction and polymorphic characteristics that contribute to distinct metabolic responses to pharmaceuticals

Goal: To gain hands on experience on molecular databases, comparative genomics, pattern search, classification of sequence and structure, alignment of sequences, rapid similarity searching, phylogenies, automated pattern learning, representing and searching protein structure, gene expression profiling, clustering expressed genes, discovering transcription factor binding sites, discovering common functions of co-expressed genes, metabolic pathways, signal transduction pathways.

Contents

1. Error! Not a valid link.
2. Molecular Modeling and drug design
3. Other data bases Small molecules, Fatty acids etc.

GROUP C - DIPLOMA IN NANOSCIENCE
Paper I FUNDAMENTALS OF NANOSCALE SCIENCE

Unit I: Basics of Nanotechnology I

Background to Nanotechnology – scientific revolutions – types of nanotechnology and nanomachines – atomic structure molecules & phases – molecular and atomic size – surfaces and dimensional space – top down and bottom up Nanoscale formation

Unit II: Forces between atoms and molecules

Strong intermolecular forces – covalent and coulomb interactions – interactions involving polar molecules and polarization – weak intermolecular forces and total intermolecular pair potentials – Van der Waals forces – repulsive forces; special interactions such as hydrogen –bonding, hydrophobic and hydrophilic interactions

Unit III: Nanostructures and their properties

Definition of nano systems – dimensionality and size dependent phenomena in Quantum dots, and Quantum wires – size dependent variation in magnetic, electronic transport properties

Unit IV: High vacuum technology

Evaporation theory – different sources for evaporation – working principles of rotary and diffusion pumps – cryogenic pumps – cryo sorption and getter pumps – vacuum materials

References:

1. Nanotechnology: basic science and emerging technologies – Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press (2005)
2. Amorphous and Nanocrystalline Materials: Preparation, Properties, and Applications, A.Inoue, K.Hashimoto (Eds.,) (2000)
3. Understanding Nanotechnology, Scientific American, editors at Scientific American, Warner Books (2002)
4. Introduction to Nanotechnology, Charles P. Poole, Frank J. Owens, Wiley-Interscience (2003)
5. Nanotechnology: A Gentle introduction to the Next Big Idea, Mark A. Ratner, Daniel Ratner, Mark Ratne, Prentice Hall PTR; 1st edition (2002)
6. Fundamentals of Surface and Thin Film Analysis, Leonard C.Feldman and James W. Mayer
7. Hand book of thin film technology, L.I. Maissel and R. Glang (McGraw – Hill Book Company)

GROUP C - DIPLOMA IN NANOSCIENCE

Paper II NANOMATERIALS SYNTHESIS

Unit I: Sol-gel processing

Fundamentals of sol-gel process – sol-gel synthetic methods for oxides – other inorganics and nano composites – the Pecheni method – silica gel – Zirconia and Yttrium gel – aluminosilicate gel – polymer nano composites

Unit II: Film deposition methods

Introduction – fundamentals of film deposition – thermal evaporation – molecular beam epitaxy – pulsed laser deposition – sputter deposition – chemical vapour deposition – layer by layer growth and ultra thin films – chemical solution deposition – Langmuir Blodgett films.

Unit III: Synthesis of nanostructures

Surface Chemistry and its role to prepare quantum dots – Polymer as quantum dot size stabilizer – One-dimensional (1D) by Spontaneous Growth – 1D structure by VLS and SLS Growth – Template Assisted Growth – Electrochemical growth of 1D structures

Unit IV: New forms of carbon

Types of nanotubes – formation of nanotubes – methods and reactants – arcing in the presence of cobalt – laser methods – ball milling – chemical vapour deposition methods – properties of nano tubes – plasma arcing – electro deposition – pyrolytic synthesis – Zeolites and templated powders layered silicates.

References:

1. Nanoelectronics and Information technology: Advanced electronic materials and novel devices (2nd edition), Rainer Waser (Ed.), Wiley – VCH Verlag, Weiheim (2005)
2. Nanocomposite science and technology, Pulickel M. Ajayan, Linda S. Schadler, Paul V. Braun, Wiley – VCH Verlag, Weiheim (2003)
3. Amorphous and Nanocrystalline Materials: Preparation, Properties, and Applications, A.Inoue, K.Hashimoto (Eds.) (2000)
4. Quantum Heterostructures: Microelectronics and Optoelectronics, Vladimir Mitin
5. Theory of Modern electronic semiconductor devices, K.F. Brennan and A.S. Brown
6. Semiconductor Nanostructures for Optoelectronic applications, Todd D. Steiner
7. Smart Electronic Materials (Fundamentals and applications), Jasprit Singh
8. The Physics of Low dimensional semiconductors, John H. Davies

GROUP C - DIPLOMA IN NANOSCIENCE

Paper III

CHARACTERIZATION AND APPLICATION OF NANO MATERIALS

Unit I: Nano characterizing tool 1

Working of Atomic Force Microscopy – Mode of operations (qualitative) and its application – X-Ray diffraction basics and its application to Size Analysis of nanomaterials – NMR Basics and application to Nanomaterials

Unit II: Nano characterizing tool 2

Scanning Electron Microscope: Theory- Instrumental setup and its application – Low KV SEM and its application – Low temperature SEM and its application – working of electron probe micro analysis and its application in elemental analysis – EDX spectra

Important material systems – optical process in semiconductors – optical process in quantum wells – semiconducting optoelectronic devices – organic optoelectronic devices (qualitative)

Unit III: Applications of nanomaterials

Quantum dot IR photo detectors- Quantum dot lasers – Synthesis of Zinc oxide nanomaterials and its application – Synthesis of group three nitride nanostructures and their applications - SK growth of germanium dots on silicon and its application.

Unit IV: Cell Biology (quantitatively)

Amino acids, Protein structure: Primary, Secondary, tertiary, structure of Nucleic acids – Nucleosides and Nucleotides – physical properties of nucleosides & nucleotides – base pair – mismatch base pair – stacking – Backbone of Nucleic acids

Antibodies and their use in nano based drug delivery and imaging – Tumor targeted drug delivery.

References:

1. Nanoscale calibration and Standards and Methods Edited by C.Wilkening and Koenders
2. Fundamentals of Surface and Thin Film Analysis, Leonard C.Feldman and James W. Mayer
3. Scanning Electron Microscopy for Nanotechnology Edited by W.Zhou and Z. Lin Wang
4. Nanosystem characterization tools in the life sciences Edited by Challa Kumar
5. Nanostructures and Nanomaterials (Synthesis, Properties and Applications), Guozhong Cao
6. Nanoelectronics and Information technology Edited by Rainer Waser
7. Cell and Molecular Biology, Gerald Karp
8. Nucleic Acids in Chemistry and Biology, G. Michael Blackburn and Michal J. Gait
9. Principles of Nucleic Acid structure, Worfram Saenger
- 10.