BHARATHIAR UNIVERSITY (CBSC PATTERN)
B. Sc. BIOCHEMISTRY DEGREE COURSE
For the students admitted during the academic year 2014 – 2015 batch and onwards

SCHEME OF EXAMINATION - CBCS PATTERN

Part	Study Components	Course title	Ins. hrs/ week	Examinations				Credit
				Dur.Hrs	CIA	Marks	Total Marks	
	Semester I							
I	Language – I		6	3	25	75	100	4
II	English – I		6	3	25	75	100	4
III	Core Paper I - Biomolecules		3	3	25	75	100	4
	Core Paper II - Cell Biology		3	3	25	75	100	4
	Core Biochemistry Practical – I		2	-	-	-	-	-
	Allied A : Paper I – Chemistry		6	3	20	55	75	4
	Allied Chemistry Practicals		2	3	-	-	-	-
IV	Environmental Studies #		2	3	-	50	50	2
	Semester II							
I	Language – II		6	3	25	75	100	4
II	English – II		6	3	25	75	100	4
III	Core Paper III - Biomedical Instrumentations		5	3	25	75	100	4
	Core Biochemistry Practical – I		3	3	40	60	100	4
	Allied A : Paper II - Chemistry		6	3	20	55	75	3
	Allied Practical – Chemistry		2	3	20	30	50	2
IV	Value Education – Human Rights #		2	3	-	50	50	2
	Semester III							
I	Language – III		6	3	25	75	100	4
II	English – III		6	3	25	75	100	4
III	Core Paper IV - Enzyme and Enzyme Technology		3	3	25	75	100	4
	Core Paper V – Microbiology		3	3	25	75	100	4
	Core Biochemistry Practical - II		2	-	-	-	-	-
	Allied B: Paper I – Basic Mathematics		6	3	20	55	75	3
IV	Skill based Subject I - Bioinformatics		2	3	20	55	75	3
	Tamil @ / Advanced Tamil# (OR) Non-major elective - I (Yoga for Human Excellence)# / Women's Rights#		2	3	50		50	2
	Semester IV							
I	Language – IV		6	3	25	75	100	4
II	English – IV		6	3	25	75	100	4
III	Core Paper IV – Intermediary Metabolism		4	3	25	75	100	4

	Core Biochemistry Practical – II	3	6	30	45	75	3
	Allied B : Paper II – Computer	4	3	20	55	75	3
	Practical – Computer	2	3	20	30	50	2
IV	Skill based Subject 2 - Basics of Information Technology	3	3	20	55	75	3
	Tamil @ /Advanced Tamil # (OR) Non-major elective -II (General Awareness #)	2	3	50		50	2
	Semester V						
III	Core Paper VII – Human Physiology	4	3	25	75	100	4
	Core Paper VIII – Clinical Biochemistry	4	3	25	75	100	4
	Core Paper IX – Molecular Biology	4	3	25	75	100	4
	Core Paper X – Genetic Engineering and Bioprocess Technology	3	3	25	75	100	4
	Biochemistry Practical – III	4	-	-	-	-	-
	Biochemistry Practical - IV	4	-	-	-	-	-
	Elective – I	4	3	20	55	75	3
IV	Skill based Subject 3 - Genomics and Proteomics	3	3	20	55	75	3
	Semester VI						
III	Core Paper XI – Plant Biochemistry and Plant Therapeutics	4	3	25	75	100	4
	Core Paper XII – Medicinal Chemistry	4	3	25	75	100	4
	Biochemistry Practical – III	4	6	30	45	75	3
	Biochemistry Practical – IV	4	6	30	45	75	3
	Elective – II	4	3	20	55	75	3
	Elective – III	4	3	20	55	75	3
IV	Skill Based Subject 4 - Practical – Bioinformatics	6	6	30	45	75	3
V	Extension Activities @	-	-	50	-	50	2
	Total					3500	140

@ No University Examinations. Only Continuous Internal Assessment (CIA)

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List of Elective papers (Colleges can choose any one of the papers as electives)		
Elective - I	A	Immunology and Immunotechniques
	B	Introduction to Biomaterials
	C	Nutritional Biochemistry
Elective - II	A	Plant and Animal Biotechnology
	B	Nanomaterials and Nanomedicine
	C	Health and Hygiene
Elective - III	A	Diagnostic Biochemistry
	B	Sports Biochemistry
	C	Nanobiotechnology

Note :

The syllabus for the above papers (**except Core papers Cell Biology, Biomedical Instrumentations, Intermediary Metabolism, all Skill based subjects and Elective II-A Plant & Animal Biotechnology**) be the same as prescribed for the academic year 2010-11.

The syllabus for the **Core papers Cell Biology, Biomedical Instrumentations, Intermediary Metabolism, all Skill based subjects and Elective II-A Plant & Animal Biotechnology** are furnished below.

SEMESTER – I CORE PAPER II

SUBJECT TITLE: CELL BIOLOGY

SUBJECT DESCRIPTION:

This course presents to identify the range of the cellular activities that are very much specific to the multicellular activities and also the basic ways that cells associate to form the tissue.

GOALS:

To enable the students to get themselves aware on how different tissue types are combined to form organs and how the organs function which follows from the structure and function of the constituent tissue.

OBJECTIVES:

On successful completion of the course the students should have:

- Understood the relationship between cellular organization and biological function of normal cell, pro and eukaryotic cells.
- Learnt on the various cell organelles with their functions and actions.
- Learnt the application of cell biology in research.

CONTENTS:

UNIT – I

An Overview of cells – Origin and evolution of cells. Cell theory, Classification of cells – Prokaryotic cells and Eukaryotic cells. Comparison of prokaryotic and eukaryotic cells.

Cell Cycle: Phases, Meiotic and Mitotic division.

UNIT – II

Cell Membrane – Fluid mosaic model of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their role. Transport across membranes – Diffusion - active and passive diffusion.

UNIT – III

Endoplasmic reticulum – Types, structure and function. Golgi apparatus – Structure and function. Lysosome – Structure and functions. Morphology and functions of peroxisomes and glyoxisomes. Ribosomes – Types structure and function.

UNIT – IV

Nucleus: Structure and function. Chromosomes, chromatin structure. Mitochondria – Structure and functions. Cytoskeleton: Types of filaments and their functions. Microtubules – Chemistry and functions – Cilia and flagella.

UNIT – V

Oncogenesis: Development and causes of cancer, Types of cancer, Properties, early detection, Treatment.

REFERENCES:

1. Cell Biology. Organelle structure and function, David E Sadava, Jones Bartlett Publishers.
2. Cooper M 1995. The cell molecular approach, ASM Press.
3. Principle of cell and molecular biology 2nd edition – Lewis J Kleinsmith, Valerie M Kish.
4. DeRobertis, EDP, E.M.F Robertis, 7th edition 1980. Cell and molecular biology, Saunders Company.
5. Harvey Lodish, Baltimore. Arnold Berk et al 1995. 3rd edition. Molecular cell biology.

SEMESTER II CORE PAPER III

SUBJECT TITLE: BIO - MEDICAL INSTRUMENTATION

SUBJECT DESCRIPTION:

This course presents the principles, instrumentation, working and application of the instruments commonly used in the laboratories.

GOALS:To enable the students to learn about the functioning components of the various instruments.

OBJECTIVES: On successful completion of the course the students would have learnt the principles and applications of the instruments.

CONTENTS:

UNIT-I

PH meter- pH scale, Henderson- Hassalbalch equation, Buffer solutions,
Various ways of expressing and conversion of concentration of solutions-molality, molarity, normality, mole fraction. Simple problems to be worked out.

UNIT-II

Chromatography-principle, materials, methods & applications of paper chromatography, TLC, GLC, Adsorption, Ion-exchange, Affinity chromatography and Molecular sieve.
HPLC, FPLC and GC-MS [principles only].

UNIT-III

Electrophoresis-principles, instrumentation and applications of paper electrophoresis, agar gel, starch gel, SDS-PAGE, isoelectric focusing.
Centrifuges-Bench top, high speed, Ultra centrifuge.
Principle and description of Analytical Centrifuge.
Determination of Molecular weight by Sedimentation velocity method.
Separation of Cell Organelles.

UNIT-IV

Principle, Instrumentation and application of Colorimetry, Spectrophotometry, Fluorimetry and Flame photometry.

ECG, EEG, CT-Scan, Doppler, MRI scan- Principle and application only.

UNIT-V

Tracer and other Techniques-Radioactive decay, units of Radioactivity, detection and measurement of Radioactivity, GM counter, Scintillation counter, Auto radiography.

Applications of Radio isotopes in biological and medical sciences.

REFERENCES:

1. Sharma B.K. (1981) 11th Edition. Instrumental method of chemical analysis.
2. Kudesia V.P. Sawhaney H., (1989) Instrumental method of chemical analysis.
3. David T. Plummer, 3rd Edition (1998), An Introduction to Practical Biochemistry.
4. Keith Wilson, Kenneth H. Goulding, 3rd Edition 1992.A Biologists guide to Principles and Techniques of practical Biochemistry. Cambridge University Press.
5. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurement- 2nd Edition.

SEMESTER IV CORE PAPER IV

SUBJECT TITLE : INTERMEDIARY METABOLISM

SUBJECT DESCRIPTION :

The nature of the diet sets the basic pattern of metabolism in the tissues. Mammals such as humans need to process the absorbed products of digestion of dietary carbohydrates, lipids and protein. These are mainly glucose, fatty acids, glycerol and amino acids respectively. The fate of dietary components after digestion and absorption constitutes intermediary metabolism. Knowledge of metabolism in the normal human being is a pre requisite to a sound understanding of abnormal metabolism underlying many diseases.

GOALS: To enable the students to learn the basic functions, principles and concepts of metabolism.

OBJECTIVES: Provides much information related to carbohydrate, fat and protein metabolism that takes place in our body.

- Interrelationship between carbohydrate, fat and protein metabolism.
- Role of purine and pyrimidines in nucleic acid metabolism.
- Various disorders related to each metabolism.

CONTENTS:

UNIT I:

Bioenergetics: - Free energy and the laws of thermodynamics; Role of high energy compounds as energy currency of the cell; free energy of hydrolysis of ATP and other organophosphates. The basic metabolic pathways, anabolic, catabolic and amphibolic pathways.

Electron transport chain: - Role of respiratory chain in mitochondria; in energy capture; respiratory control.Oxidative phosphorylation: - Mechanism of oxidative phosphorylation; Chemiosmotic theory; uncouplers of oxidative phosphorylation.

UNIT II:

Fate of absorbed carbohydrates.Glycolysis: - Pathways and energetics; Oxidation of pyruvate to acetyl CoA. TCA Cycle: - Pathway and energetics; anaplerotic reaction.Gluconeogenesis; Pasteureffect .Glycogenesis and glycogenolysis.Pentose Phosphate Pathway (HMP shunt).
GlucuronicAcidCycle andglyoxylate cycle (Entner- Duodorfi pathway)
Metabolism of other hexoses: - Fructose and galactose.

UNIT III:

Blood lipids and phase of dietary lipids. Oxidation of fatty acids: - Carnitine cycle; beta oxidation.Alpha oxidation and omega oxidation.Biosynthesis of propionyl CoA. Biosynthesis of saturated fatty acids: - Extra – mitochondrial in a microsomal system for synthesis of fatty acids. Biosynthesis of unsaturated fatty acids: - Monounsaturated and polyunsaturated fatty acids. Biosynthesis and degradation: - Lecithin, cephalin, inositol, phosphatidyl serine, cholesterol.

UNIT IV:

Fate of dietary proteins, metabolic nitrogen pool. Catabolism of amino acid: Oxidative deamination, non – oxidative deamination, transamination, amino – acid decarboxylation, catabolism of carbon skeleton of amino acids. Catabolism of glycine, phenylalanine and tyrosine.

UNIT V:

Interrelation between carbohydrates, fat and protein metabolism.Metabolism of purines: - de novo synthesis, salvage pathways; catabolism. Metabolism of pyramidines: - de novo synthesis, salvage pathways; catabolism.

REFERENCE:

1. Lehninger, L.S., *et al*., - *Principles of Biochemistry*. 2nd edition. CBS Publishers, 1993.
2. Murray, K. Robert, *et al*., - *Harper's Biochemistry*. 21st edition, 1998.
3. Voet and Voet - *Biochemistry*. 2nd edition. John Wiley and Sons, 1995.
4. Mathews, Freeland and Miesfeld - *Biochemistry – a short course.*Wiley & sons. 1996.
5. Garrett and Grisham – *Biochemistry*. Saunders College Publishers, 1995.

SEMESTER – III (Skill Based Subject-1)

BIOINFORMATICS

UNIT I

BioInformatics:
Introduction, definition, objectives and scope.
BioInformatics and Internet.
Useful BioInformatics sites on www.
Application of BioInformatics.

UNIT II

Biological databases:
Primary protein database – SWISS PROT, TrEMBL, PIR, PDB.
Primary nucleic acid database – EMBL, GEN BANK, DDBJ.
Data mining of biological databases.

UNIT III

Tools for database search:
FASTA- Histogram, Sequence listing, Search and Programs.
BLAST – Algorithm, Services, MEGABLAST, PHI BLAST, PROTEIN BLAST, GRAPPED BLAST, PSI BLAST

UNIT IV

Protein Primary structure analyses and prediction:
Identification and characterization.
Gene Identification and prediction – pattern recognition, prediction method – laboratory based approaches – southern blotting, northern blotting, zoo blot, *In situ* hybridization.

UNIT V

BioInformatics and drug design:
Introduction, approaches – ligand based, target based.
Methods of drug designing – CAMD, docking program

REFERENCES

1. Westhead D.R, Parish J.H and Twyman R.M. (2003) Instant notes in BioInformatics, Ist Edition
2. Attwood.T.K. Parry D.J. and Smith (2001). Introduction to BioInformatics, Ist Indian Report.
3. Rastogi.S.C, Namita – Mendiratta and Parag Rastogi, (2004) BioInformatics – Concepts, Skills and applications.
4. Mani.K and Vijayraja (2005), BioInformatics – A practical approach

SEMESTER IV (Skill Based Subject-2)

BASICS OF INFORMATION TECHNOLOGY

UNIT-I

General format of representing a number-Classification of number system: Positional and Non-positional number system. Decimal, Binary, Octal and Hexadecimal. Conversion from one system to another.

UNIT-II

Fundamentals of Information technology: History and Generations of computers-classification of programming languages- Operating systems and their types.
Definitions of Compilers, Linker, Loaders, Assembler and Interpreter.
Algorithms Flowchart and its components.

UNIT-III

Internet: Evolution of Internet-Internet terminologies: WWW, FTP, HTML, HTTP, Gopher, E-mail browsers, protocol Archie Telnet, Search engines.
Application of Computers in education, business, entertainment, science, engineering and medicine

UNIT IV

Database systems; Definitions: Data abstraction, Instances, Schemes, Entity, Entity set: Strong and weak entity sets, Primary key, Foreign key, Super key.
Database models: Basic concepts of E-R model, Hierarchical model.

UNIT-V

Networking: Network architectures, Topologies, LAN, WAN, MAN AND Components of a network: Hubs, Routers, Repeaters, Bridges, Modems and cables.
Linux: Installation-Basic commands.

REFERENCES

1. Leon A and Leon M **Fundamentals of Information technology**.
2. Date C.J. **Introduction to Database systems**.
3. Andrew S. Tanenbaum **Computer networks**.

SEMESTER V Skill Based Subject - 3

GENOMICS AND PROTEOMICS

UNIT – I:

Genomes- Introduction
Genome anatomies-Anatomy of prokaryotes,Anatomy of eukaryotes.
The repetitive DNA content of genomes.
Tandemly repeated DNA – Minisatellites and microsatellites.
Interspersed genome-wide repeats – Transposons.

UNIT –II:

Genome sequencing-Chain termination DNA sequencing
Genome sequence assembly - shotgun approach,clone contig approach
Genome annotation
Genomics-Structural genomics,functional genomics,comparative genomics
Gene prediction in prokaryotes and Eukaryotes

UNIT –III:

Human Genome: Size, features, composition and characteristics of human genome – Sequence repeats, transposable elements, gene structure and pseudogenes.
Human Genome Projects – sequencing,mapping and future of Human Genome Projects.

UNIT –IV:

Proteomics: - Structural elements and terminology – phi and psi bonds, letter code for amino acids, helix, sheet strand, loop and coil.
Active site, Architecture, blocks, class and domains, fold, motif, PSSM, profile.
Protein structure prediction: Use of sequence pattern – Leucine zipper, coiled coil, transmembrane, signal peptide and cleavage site.

UNIT –V:

Proteome-analysis:
2D Electrophoresis – Immobilized pH gradient, Sample preparation, first dimension criteria, second dimension criteria, stabilization.
Database for 2D gel.

REFERENCES

1. David W.Mount, (2001), **Bio-informatics sequence and genome analysis,** Cold Spring Harbor Laboratory press
2. Ed. Andreas D.Baxewanis and Francis quellette, **Bio-informatics a practical guide to the analysis of genes and proteins,** John willey & sons publications
3. Pennigtons S.R and Dunn M.J (2002), **Proteomics,** Viva books pvt ltd

SEMESTER VI (Skill Based Subject -4)

BIOINFORMATICS PRACTICAL

Working with MS-Office Packages One exercise each in Word, Excel, Power point and Access.

- Working with HTML Tags and HTML Forms. Creating HTML Pages.
- Basic commands in MS-DOS and command line execution in LINUX.
- Biological Databanks Sequence Databases, Structure Databases, Specialised Databases.
- Data retrieval tools and methods.
- Database file formats.
- Molecular visualization.
- Gene structure and function prediction (using Gen Scan, GeneMark).
- Sequence similarity searching (NCBI BLAST).
- Protein sequence analysis (ExPASy proteomics tools).
- Multiple sequence alignment (Clustal).
- Molecular phylogeny (PHYLIP).
- Analysis of protein and nucleic acids sequences
- Sequence analysis using EMBOSS or GCG Wisconsin Package

REFERENCE:

1. **Bio-informatics a practical approach** by K.Mani and N.Vijayaraj, *Aparna publications, Coimbatore*.

SEMESTER – VI ELECTIVE II - A

SUBJECT TITLE : PLANT & ANIMAL BIOTECHNOLOGY

SUBJECT DESCRIPTION :

This course presents the plant and animal tissue culture methods, explains the mechanism of gene transfer, Methods of selection, Production of novel proteins and their applications.

GOALS:

To enable the students to have a sound knowledge on the methods of tissue culture and large scale production of recombinant proteins.

OBJECTIVES:

On successful completion of the course the students should have:

- Understood the components of culture media and various tissue culture techniques.
- Learnt about the technique of genetic engineering in plants and animals.
- Learnt about the synthesis and applications of recombinant proteins from cell cultures.

CONTENTS:

UNIT – I:

Plant tissue culture: - Media composition, nutrients & growth regulators, MS medium & B_5 medium. Callus & suspension culture. Initiation & differentiation of PTC.
Micropropagation:- Methods, Production of haploid plants, phytochemicals from plant tissue culture.

UNIT – II:

Protoplast technology:- Isolation, fusion of protoplasts, Electroporation, Biolistics, Regeneration of plants from protoplasts.
Gene Transfer in plants:- Ti plasmid vectors, mechanism of T- DNA transfer, Vir genes.
Transgenic plants:- Herbicide, Virus, Pest resistance plants, Male infertility, Genetic engineering of plant oils.

UNIT - III:

Animal cell culture:- Culture media –composition and preparation,balanced salt solution and simple growth medium,serum and protein free defined media and their applications.
Cell-lines; cell transformation – properties of transformed cells, cell separation, Mass cultivation of cells: suspension culture; immobilized cultivation.

UNIT - IV:

Genetic Engineering of Animal cells: - Mammalian cell culture in protein production.
Gene transfer into mammalian cells, Selectable markers $_p$SV plasmids; retroviral vectors; Expression vectors; reporter genes.

UNIT – V:

Animal Biotechnology:- Artificial insemination and embryo transfer, Invitro fertilization (IVF): embryo cloning. Human embryo research, transgenic mice, Gene therapy.
Recombinant proteins from cell cultures: - Interferons, Viral vaccines, Hybridoma technology- Monoclonal antibodies- production and applications.

REFERENCES:

1. D. Balasubramanian and others, Concepts in Biotechnology, Universal press India 1996.
2. BIOTOL series, Invitro cultivation of animal cells- Butler worth Heineman, 1993
3. Walsh Gary and Headon R. Denis, Protein Biotechnology. John Wiley publishers, 1994.
4. Plant tissue culture; Razdan; Oxford IBH publishers, 1994.
5. Freshney; Animal cell culture; IRL press.