

BHARATHIAR UNIVERSITY (CBCS PATTERN)

B. Sc. CLINICAL LAB TECHNOLOGY DEGREE COURSE
SCHEME OF EXAMINATION - CBCS PATTERN

For the students admitted during the academic year 2011 – 2012 batch and onwards

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 – Human Anatomy and Physiology		4	3	25	75	100	4
	Core Paper II - Biochemistry I - Biomolecules		4	3	25	75	100	4
	Core Biochemistry Practical – I		2	-	-	-	-	-
	Allied A : Paper I – Computer Science I		4	3	20	55	75	3
	Allied Practical I		2	-	-	-	-	-
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 - Biochemistry II – Cell Biology		4	3	25	75	100	4
	Core Biochemistry Practical – I		4	3	40	60	100	4
	Allied A : Paper II - Computer Science II		4	3	20	55	75	3
	Allied Practical – I		4	3	20	30	50	2
IV	Value Education – Human Rights #		2	3	-	50	50	2
Semester III								
III	Core Paper IV - Microbiology I- General Microbiology		5	3	25	75	100	4
	Core Paper V – Pathology I - Principles of Pathology and Clinical Pathology		4	3	25	75	100	4
	Core Paper VI - Biochemistry III - Enzymology & Intermediary Metabolism		4	3	25	75	100	4
	Core Biochemistry Practical - II		4	-	-	-	-	-
	Allied B: Paper I – Chemistry I		4	3	20	55	75	3
	Allied Practical II		4	-	-	-	-	-
IV	Skill based Subject I (Diploma) Nutrition Through Life Cycle		3	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								
III	Core Paper VII – Microbiology II		4	3	25	75	100	4
	Core Paper VIII - Pathology II - Histopathology		4	3	25	75	100	4

	Core Paper IX - Biochemistry IV - Clinical Biochemistry	4	3	25	75	100	4
	Core Biochemistry Practical - II	5	6	40	60	100	4
	Allied B : Paper II - Chemistry II	4	3	20	55	75	3
	Allied Practical II	4	3	20	30	50	2
IV	Skill based Subject 2 (Diploma) Diet therapy	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 X Microbiology III	4	3	25	75	100	4
	Core paper XI Pathology III - Haematology	4	3	25	75	100	4
	Core Paper XII Biochemistry V - Nutrition and Cancer Biology	4	3	25	75	100	4
	Core Paper X - Blood banking and immuno haematology	3	3	25	75	100	4
	Core Practical - III Microbiology	4	-	-	-	-	-
	Core Practical - IV Pathology- Clinical Pathology	4	-	-	-	-	-
	Elective - I	4	3	25	75	100	4
IV	Skill based Subject 3 (Diploma) Clinical Nutrition	3	3	20	55	75	3
	Semester VI		-				
III	Core Paper XIII Immunology & Immuno techniques	4	3	25	75	100	4
	Core paper XIV Pathology IV - Cytology	4	3	25	75	100	4
	Core practical III Microbiology	4	6	30	45	75	3
	Core practical IV Pathology	4	6	30	45	75	3
	Elective-II	4	3	25	75	100	4
	Elective - III	4	3	25	75	100	4
IV	Skill Based Subject 4 (Diploma) Practical - I & II	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	Drug Biochemsitry
	B	Introduction to Biomaterials
	C	Plant & Animal Biotechnology
Elective - II	A	Bioinstrumentation-Principles and applications
	B	Nanomaterials and Nanomedicine
	C	Genetic Engineering And Bioprocess Technology
Elective - III	A	Clinical laboratory & its interpretations
	B	Nanobiotechnology
	C	Plant Therapeutics

Note :

1. The syllabus for the above papers (**except Biochemistry Practical I, II and Elective Papers I - B, C; II - B, C; III - B, C**) be the same as prescribed for the academic year 2008-09.
2. The syllabus for the **Biochemistry Practical I, II and Elective Papers I - B, C; II - B, C; III - B, C** are furnished below:

SEMESTER I & II
BIOCHEMISTRY PRACTIAL I

Determination of the following Biochemical Constituents:

Blood Glucose – Fast, PP, Random.

Blood Urea

Blood Urea Nitrogen

Serum Albumin

Serum Creatinine

Serum Calcium

Serum Iron

Serum Phosphorus

Total Serum Proteins

Triglycerides

Bilirubin

Cholesterol

HDL Cholesterol

LDL Cholesterol

Serum Uric acid

VLDL Cholesterol

The following Biochemical parameters in Urine:

Protein

Calcium

Creatinine

Phosphorus

Urea

Bence Jones Protein

SEMESTER III & IV. BIOCHEMISTRY PRACTICAL II

Determination of the following Enzymes

Acid phosphatases
Alkaline phosphatases
Alpha- Amylase
CPK
CPK MB
I. DM
Cholinesterase
SGOT
SGPT
Gamma GT

Determination of Immunoglobulins

IgA
IgE
IgG
IgM
Serum Immunoglobulins

Determination of the following

Glucose Tolerance Test
Electrophoresis of plasma proteins.
Liver Function Test
Paper Chromatography – Urine
Prothrombin Time
Renal Calculi analysis
Renal Function Test
Urea Clearance Test

SEMESTER – V ELECTIVE I - B

INTRODUCTION TO BIOMATERIALS

Unit – I

9

Biomaterials and biological materials – examples and uses: first generation biomaterials – general characteristics – naturally occurring biomaterials – pure metals – alloys – ceramics – polymers – composites.

Unit – II

9

Second generation biomaterials and their properties – bioactive and biodegradable ceramics – biodegradable polymers – hydrogels.

Unit – III **9**

Third generation biomaterials – characteristics – biomaterials in tissue engineering – enzyme conjugates, DNA conjugates – DNA- protein Conjugates – microarray technologies – micronanotechnology – microfabrication – nanofabrication – interaction between biological materials, molecular – biomolecules and nanomaterials.

Unit – IV **9**

Nanobotechnology – introduction – DNA nanotechnology – structural DNA assembly – nanopore and nanoparticles – biological arrays – nanopores for analytical applications – nanosensors – nanoscale organization – characterization – quantum size effects – nanobiosensors – sensors of the future.

Unit – V **9**

Microscopies – SEM – TEM – modern advances – microanalysis – optical detection of single molecules – applications in single molecule spectroscopy – single molecule DNA detection, sorting, sequencing – DNA nanoparticles studies by AFM – DNA computer – PCR amplification of DNA fragments – molecular surgery of DNA.

Total number of periods 45

TEXT / REFERENCE BOOKS

1. Nano: The essentials: Pradeep .T, 2007, Tata McGraw-Hill Publishing Company Ltd.
2. Nanoparticles assemblies and Superstructures: Nicholas A.Kotov, 2006, CRC Press.
3. Nanoscale Technology in Biological Systems: Editors: Ralph et al, 2005, CRC Press.
4. Micromachines as Tools for Nanotechnology: H.Fujitha, 2003, Springer Verlag.
5. Nanobiotechnology: Concepts, Applications and Perspectives, C.M.Niemeyer & C.A. Mirkin, 2004, Willey VCH Verlag GMBH &co.
6. Biomaterials: An introduction. 1992. By Park JB, Lakes RS.
7. Advances in Biomaterials, Drug delivery – AICHE. J 2003, 49(12): 2990 – 3006.

SEMESTER – VI ELECTIVE II - B

NANOMATERIALS AND NANOMEDICINE

Unit I

Structure property relationship of Biological materials: tissues, bones and teeth, collagen rich tissues, elastic tissues, nanostructured collagen mimics in tissue Engineering.

Biopolymers: Preparation of nanobiomaterials – Polymeric scaffolds collagen, Elastins: Mucopolysaccharides, proteoglycans, cellulose and derivatives; Dextrans; Alginates; Pectins; Chitin.

Unit II

Cardiovascular implants: Role of nanoparticles and nanodevices in blood clotting; Blood rheology; Blood vessels; Geometry of blood circulation; Vascular implants; Cardiac pacemakers; blood substitutes; Biomembranes.

Unit III

Polymeric implant materials: Polyolefin; polyamides (nylon); Acrylic polymers (bone cement) and hydrogels; Fluorocarbon polymers; Natural and synthetic rubbers, silicone rubbers; High strength thermoplastics; deterioration of polymers.

Biomaterials for Ophthalmology: Contact lenses; Optical implants for glaucoma; adhesives; artificial tears; Protection gears.

Unit IV

Metallic and ceramic implant materials: Bone regeneration, Nano crystalline structures of Bone and Calcium phosphate cements. Cobalt-based alloys; Titanium and its alloys, Nanoparticles relating to Aluminium oxides: Hydroxyapatite; Glass ceramics; ceramic implants; carbon implants. Nano dental materials.

Unit V

Synthesis of nanodrugs – metal nanoparticles and drug delivery vehicles – Nanoshells – Tectodentrimers Nanoparticle drug systems – Diagnostic applications of nanotechnology.

Total number of Periods 45

Reference:

1. SV Bhat, Biomaterials (2nd Edition), Narosa Publishing House, New Delhi – 2005.
2. JB Park, Biomaterials Science and Engineering, Plenum Press, New York, 1984 Challa S.S.R.Kumar, Joseph Hormes, Carola Leuschmal.
3. Nanofabrication towards biomedical applications Willey – VCHVerlag GmbH &Co, KGaA.

SEMESTER – VI ELECTIVE III - B

NANOBIOTECHNOLOGY

Unit I

Interdisciplinary areas of Biotech and Nanoscience. It is a field that concerns the utilization of biological systems.

Cells, Cellular components. Nucleic acids and proteins refinement and application of instruments – to generate and manipulate nanostructured materials to basic and applied studies.

Unit II

Interphase systems pertaining to biocompatible inorganic devices for medical implants – microfluidic systems – microelectronic silicon substrates.

Unit III

Protein based nanostructures building blocks and templates – Proteins as transducers and amplifiers of biomolecular recognition events – nanibioelectronic devices and polymer nanocontainers – microbial production of inorganic nanoparticles – magnetosomes.

Unit IV

DNA based nanostructures - Topographic and Electrostatic properties of DNA and proteins – Hybrid conjugates of gold nanoparticles – DNA oligomers – use of DNA molecules in nanomechanics and computing.

Unit V

Semiconductor (metal) nanoparticles and nucleic acid and protein based recognition groups – application in optical detection methods – Nanoparticles as carrier for genetic material.

Total number of periods 45

References:

1. Nanobiotechnology – Concepts, Applications and Perspectives – 2004. Edited by CM, Niemeyer, C.A. Mirkin. Wiley – VCH.
2. Nano: The essentials: T. Pradeep. McGraw – Hill education – 2007.
3. Nanofabrication Towards Biomedical Applications, Techniques, Tools, Applications and Impact. 2005 – By Challa, S.S.R. Kumar, Josef Hormes, Carola Leuschner. Wiley – VCH.
4. Nanoparticle Assemblies and Superstructures. By Nicholas A. Kotov. 2006 – CRC.

SEMESTER – V ELECTIVE I - C

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 & B₅ 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:

Mammalian cell culture:- Establishment of cell in culture: Requirements for invitro growth; importance of serum.

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 ρ 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; the Human Genome Project.

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.

SEMESTER – VI ELECTIVE II - C GENETIC ENGINEERING AND BIOPROCESS TECHNOLOGY

UNIT I

Basis of gene cloning; Restriction endonucleases – types, features; ligations; linkers and adaptors.

Vectors: Plasmid vectors – basic features – pBR 322; Bacterio phage vectors; cosmids; Artificial chromosomes.

Cloning hosts.

Preparation of plasmid DNA from bacteria.

UNIT II

Introduction of DNA into bacterial cells:- Transformation of E. coli – selection of transformed cells – identification of recombinants. Introduction of phage DNA into bacterial cell – identification of recombinant phage.

Genomic library and cDNA library.

Hybridization probes; Southern, Northern and Western blotting techniques.

UNIT III

DNA sequencing:- Outline of Sanger's method.

Genetic finger printing – applications.

In vitro mutagenesis:- Oligonucleotide directed mutagenesis. Protein Engineering.

PCR – Technique and application; Antisense RNA, RNAi.

UNIT IV

Expression vectors of E. coli:- Constituents; examples of promoters – expression cassettes – problems caused in expression of eukaryotic genes; fusion proteins – Application of gene technology. Recombinant insulin; Recombinant growth hormones.

Cloning HBV surface antigen in yeast. Insect cells as host system.

Safety aspects and hazards of genetic engineering.

UNIT V

Gene transfer in plants: Ti plasmid vectors; mechanism of T-DNA transfer, virulence genes.

Electroporation, biolistics and protoplast fusion.

Application : Transgenic plants – herbicide resistance, male infertility, virus resistance, pest resistance.

References:

1. T.A. Brown, 1995. (3rd ed.) Gene cloning – an introduction Chapman and Hall.
2. Balasubramaniam D., C.F.A. Bryce, K.Dharmalingam, J Green, Kunthala Jayaraman (Eds) 1996, concepts in Biotechnology COSTED-IBN University press.
3. R.W. Old & S.B. Primrose (1994) 5th (ed.) Principles of Gene manipulation. Blackwell scientific publications.
4. Glick, R. Bernard and Pasternak J. Jack 1994. Molecular Biotechnology. ASM Press, Washington, D.C.
5. Glazier, N. Alexander, Hiroshinkaido, 1995. Microbial biotechnology, W.H. Freeman & Co., New York.

SEMESTER – VI ELECTIVE III- C PLANT THERAPEUTICS

UNIT I

Medicinal plants-bioactive principles in medicinal plants: methods of extraction, isolation, separation and screening, pharmacologically active plants – CNS, CVS, Hypoglycemic.

UNIT II

Hepatoprotective, nephroprotective, anti allergic, anticancer, antibacterial, antiviral and antimalarial, anti-inflammatory, immunoactive properties of the medicinal plants, plants protecting against oxidative stress, chemotherapeutic products.

UNIT III

Free radicals –types, sources, importance, production, free radicals induced damages, lipid peroxidation , measurement of free radicals, disease caused by radicals, reactive oxygen species, antioxidant defence system, enzymic and non-enzymic antioxidants, role of antioxidants in prevention of diseases ,phytochemicals as antioxidants.

UNIT IV

Primary metabolites, Alkaloids, flavanoids, terpenoids, phenolics, steroids, Vitamins, minerals – Occurrence, distribution & functions.

UNIT V

Production of secondary metabolite in plants, stages of secondary metabolite production, uses of tissue culture techniques, elicitation, biotransformation- production of pharmaceutical compounds

REFERENCES:

1. Khan,I.A and Khanum.A 2004. Role of Biotechnology in medicinal & aromatic plants,Vol 1 and Vol 10, Ukkaz Publications ,Hyderabad.
2. Purohit.S.S. 2005 Agricultural Biotechnology, Dr.Updesh Purohit Publishers, Jodhpur.
3. Slater.A. Scott.N.W and Fowler.M.R 2004.Plant Biotechnology-The genetic manipulation of plants,Oxford University Press, Oxford.
4. Singh.M.P and Panda .H 2005.Medicinal Herbs with their formulations, Daya Publishing House,Delhi