

BHARATHIAR UNIVERSITY , COIMBATORE
B.Sc. BIOTECHNOLOGY DEGREE COURSE WITH COMPULSORY
DIPLOMA IN MEDICAL BIOTECHNOLOGY
SCHEME OF EXAMINATION - CBCS PATTERN

For the students admitted during the academic year 2008 – 2009 batch 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	3
II	English – I		6	3	25	75	100	3
III	Core Paper I - Cell biology		4	3	25	75	100	4
	Core Paper II - Biodiversity		4	3	25	75	100	4
	Core practical I		2	-	-	-	-	-
	Allied A : Chemistry I		4	3	20	55	75	4
	Allied Practical		2	-	-	-	-	-
IV	Environmental Studies #		2	3	-	50	50	2
	Semester II							
I	Language – II		6	3	25	75	100	3
II	English – II		6	3	25	75	100	3
III	Core Paper III - Biochemistry		5	3	25	75	100	4
	Core Practical I (cell Biology & biochemistry)		4	3	40	60	100	3
	Allied A : Chemistry II		4	3	20	55	75	4
	Allied Practical (Chemistry)		3	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	3
II	English – III		6	3	25	75	100	3
III	Core Paper IV - Microbiology		4	3	25	75	100	4
	Core Paper V Genetics		4	3	25	75	100	4
	Core Practical II		2	-	-	-	-	-
	Allied B: Paper I – Basic Mathematics		3	3	20	55	75	4
IV	Skill based Subject I – Diploma Paper I - Human Physiology		3	3	25	75	100	3
	Tamil @ / Advanced Tamil# (OR) Non-major elective - I (Yoga for Human Excellence)# / Women's Rights#		2	3	75	75	75	2

Semester IV							
I	Language – IV	6	3	25	75	100	3
II	English – IV	6	3	25	75	100	3
III	Core Paper VI Bioinformatics	4	3	25	75	100	4
	Core Practical – II (Microbiology & Genetics)	3	3	40	60	100	3
	Allied B : Paper II – Computer applications	4	3	20	55	75	4
	Allied Practical (Computer applications))	2	3	20	30	50	2
IV	Skill based Subject 2 - Diploma Paper II Human Pathology	3	3	25	75	100	3
	Tamil @ /Advanced Tamil # (OR) Non-major elective -II (General Awareness#)	2	3	75		75	2
Semester V							
III	Core paper VII Immunology	4	3	25	75	100	4
	Core Paper VIII Plant Biotechnology	4	3	25	75	100	4
	Core Paper IX Animal Biotechnology	4	3	25	75	100	4
	Core Paper X Molecular Genetics	4	3	25	75	100	4
	Practical III Applied Biotechnology	4	-	-	-	-	-
	Practical IV : Lab in immunology and rDNA technology	3	-	-	-	-	-
	Elective 1	4	3	25	75	100	5
IV	Skill based Subject 3 Diploma Paper III Diagnostic tools	3	3	25	75	100	3
Semester VI							
III	Core Paper XI – Microbial Biotechnology	5	3	25	75	100	4
	Core Paper XII – Environmental Biotechnology	5	3	25	75	100	4
	Practical III Applied Biotechnology	5	6	40	60	100	3
	Practical IV : Lab in immunology and rDNA technology	4	6	40	60	100	3
	Elective – II	4	3	25	75	100	5
	Elective – III	4	3	25	75	100	5
IV	Skill Based Subject 4 - Diploma Paper IV Pharmacology	3	3	25	75	100	3
V	Extension Activities @	-	-	50	-	50	1
Total						3800	140

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

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List of Elective papers (Colleges can choose any one of the paper as electives)		
Elective – I	A	Biology of cloning Vectors
	B	Bionanotechnology *
	C	Enzymology *
Elective – II	A	rDNA technology & Bioethics
	B	Tropical Diseases and Vaccines *
	C	Hybridpma Techniques *
Elective - III	A	Biophysics & Bioinstrumentation
	B	Aquaculture *
	C	Plant Tissue Culture *

* - yet to be submitted.

CORE PAPER: I

Subject Title: CELL BIOLOGY

Subject description: This course presents the types and structural details of the basic unit by which all the living things are made of (the cell).

Goals: To make the student to understand the concept of cell and their activities.

Objectives: On successful completion the subject student should have understand: Structural features, Organelles and the cellular mechanisms.

UNIT I

Cell as a basic unit: discovery of the cells, classification of cell types, development of cell theory, early chemical investigation in cell biology. Prokaryotic and Eukaryotic cell organization.

UNIT II

Cell transport phenomenon: membrane architecture. Active, Passive, diffusion and osmosis. Chemistry of carbohydrates, lipids, proteins and nucleic acids.

UNIT III

Structure and function of cytoplasmic compartments of the cell: ribosome and protein synthesis, energy flow through mitochondrion, chloroplast and photosynthesis, Golgi apparatus, lysozymes and micro bodies, endoplasmic reticulum, cytoskeleton, vacuoles, peroxysomes, lysosomes and Nuclear compartment. Heterochromatin and euchromatin, polytene chromosomes.

UNIT IV

Cell division in prokaryotes and eukaryotes: Cell cycle, mitosis, meiosis, crossing over and characteristics of cancer. Apoptosis, Stem cell. Prions.

UNIT V

Integrative and specialized cellular events, cell-cell signaling, specialized cells nerve cells, sperm cells, microfilaments, microtubules, muscle cells. Cells of vision, Nucleo-cytoplasmic interaction, cell cloning.

References

1. Cell and molecular biology, 3rd edition, Philip Sheeler, Donal E Bianchi, John Wiley
2. Molecular biology of cell, Alberts et al
3. Molecular cell biology, Lodish, Baltimore, Scientific American books, 1994
4. Molecular and cell biology, Stephen L Wolfe, Wordsworth Publishing company 1993
5. Cell biology. Sadava
6. Cell and Molecular Biology De Roberties

CORE PAPER: II

Subject Title: BIODIVERSITY

Subject description: This course presents the Divers nature of the organisms

Goals: To make the student to understand the diversity of the nature

Objectives: On successful completion the subject student should have understand:
Species and genius on the earth, conservation and development of biological resources.

UNIT-I

General aspects of biodiversity-General introduction. Types of Biodiversity-Global biodiversity, biodiversity in India-Species biodiversity, Measures of biodiversity-Loss of biodiversity. Listing of threatened biodiversity-threatened animals, Plants, causes for the loss of biodiversity. Biodiversity-strategy and action plan.

UNIT II

Species concept; biological nomenclature. Theories of biological classification; structural, biochemical and molecular systematic. DNA fingerprinting, numerical taxonomy, magnitude and distribution of biodiversity, economic value, wild life biology,.

UNIT III

Broad outlines of classification and evolutionary trends among algae, fungi, bryophytes and terydophytes. Economic importance of algae, fungi and lichens. Biotic community-concept, structure, dominance, fluctuation and succession; N,P,C,S cycles in nature Principles of conservation, conservation strategy and sustainable development.

UNIT IV

Interaction between environment and biota; concept of habitat and ecological niches, limiting factor, energy flow, food chain, food web and tropic levels, ecological pyramids and recycling.. Ecosystem dynamics and management, stability and complexity of ecosystem, speciation and extinctions, environmental impact assessment.

UNIT V

Physiochemical properties of water, distribution and impact of experimental factors on the aquatic biota, productivity, mineral cycles and biodegradation in different ecosystem, biology and ecology of reservoirs.

References

1. Glimpses of Biodiversity- B.Blosetti.
2. Environmental biodiversity- P.R.Yadav
3. Biodiversity of microbial life- Stanely Reysenbach
4. Ecology & Env. Biology Sathyanarayana Books & Allied (P) Ltd

CORE PAPER: III

Subject title: BIOCHEMISTRY

Subject description: This course presents the chemical reactions or metabolic functions in the living system and their regulations.

Goals: To make the student to understand the concept of biochemical regulations

Objectives: On successful completion the subject student should have understand:

Basic metabolism

Enzymes and their kinetics

Applications of metabolites

UNIT I

Structure of atoms and biomolecules: atomic theory, valancy, atomic weight, molecular weight, Molarity.

Chemical Bonding, properties of Water ionization p^H and buffers

UNIT II

Introduction to Biochemistry: Fundamental Structures of proteins, nucleic acid, lipid and carbohydrates.

Thermodynamics in biology: Energy metabolism. Free energy, energy rich bonds, weak interactions, coupled reactions, kinetics, association dissociation concepts, biological energy transducers.

UNIT III

Enzymes and co-enzymes, IUB classification and nomenclature of enzymes, enzyme kinetics (positive and negative cooperativity), regulation of enzyme activity, active sites, activators and inhibitors; allosteric enzymes

UNIT IV

Classifications and reactions of sugars. structural features of polysaccharides. Glycolysis, TCA cycle, glycogen breakdown and synthesis, gluconeogenesis, bioconversion of pentoses and hexoses, ETC, Oxidative and photo phosphorylation

Classification and functions of lipids.

Metabolism of lipids; Fatty acid biosynthesis and oxidations,

UNIT V

Amino acids and peptides – classifications chemical reactions and physical properties, metabolisms of amino acids. Functions of proteins. Biosynthesis and degradation of nucleic acids (purines and pyrimidines) Integration of metabolism and regulations.

Secondary metabolites –applications,

isoprenoids and hetero cyclic compounds

REFERENCES:

1. Boyer.R., (2002) Concepts in Biochemistry 2nd ed. Brooks/cole publishing company New York.
2. David L. Nelson and M. Cox (2003) Lehninger's Principles of Biochemistry, 3rd Ed, Worth publication New York
3. Voet & Voet (1995) Fundamentals of Biochemistry, 2nd Ed, John Wiley and sons inc., New York.
4. Geoffery L Zubay (1995) Principles of Biochemistry, WCB publishers, London
5. Murrey RK., D.K. Granner, P.A. Mayers and V.W. Rodwell, (2003) Harper's Biochemistry, Prentice –Hall Int, Boston
6. Outlines of Biochemistry Conn & Stumph
7. Biochemistry 3rd ed Sathyanarayana Books & Allied (P) Ltd

CORE PRACTICAL I:

(CELL BIOLOGY AND BIOCHEMISTRY)

1. Microscopy
2. Cell Types --- Microbial, animal and Plant cells – simple staining and visualization through microscope
3. Fraction of Cellular components—Demonstration.
4. Mitotic Preparation – Onion Root Tip, Grasshopper *Hepatic coacae*
5. Meiotic Preparation from Grasshopper Testis and flower buds of *Rheo discolor*
6. Cell Staining – Cytochemical Methods for Demonstration of Cellular and sub-cellular components.
7. Estimation of Protein – Lowry's, Bradford's method.
8. Estimation of DNA--- DPA Method.
9. Estimation of RNA by Orcinol method
10. Estimation Of Sugars ---Anthrone and Benedict method
11. Estimation of total free amino acids --- Sulfovnicillin method.
12. Estimation of Lipids.
13. Analysis of Oils—Iodine Number---Saponification Value ---Acid Number.
14. Quantification of Vitamin C.
15. Thin Layer Chromatography.
16. Paper Chromatography.
17. Isolation of Enzymes.
18. Enzyme assay.
19. Determination of Km value.

CORE PAPER: IV

Subject Title: MICROBIOLOGY

Subject description: This course presents the study of Micro organisms.

Goals: To make the student to understand Micro organisms and their participation in day to day activities.

Objectives: On successful completion the subject student should have understand:
What are micro organisms?
Their studying methods and their positive and negative on our lives

UNIT I:

Definition and scope of microbiology-- A general account on microbial diversity. Basic principles in microscopy, Types of microscopes- light, dark, phase contrast, fluorescent and electron microscope- (Transmission and Scanning electron)

UNIT II:

A detailed account of General structure, growth and reproduction of the various Bacteria, fungi and Viruses. Economic and industrial importance of yeast and moulds

UNIT III:

Microbiological Media: Types, preparation, methods of sterilization; enumeration of microorganisms in soil, water and air; isolation of microorganisms from Environment and infected tissue; Techniques of pure culture, maintenance and Preservation; Staining: stains and types of staining;

UNIT IV:

Physiology and biochemistry of microbes--Nutrition (Photo-autotrophs, Chemo-autotrophs, Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, endozoic microbes) -- microbial pathogens of plants, animals and Humans.

UNIT V:

Respiration and fermentation, Nitrogen metabolism including Nitrogen fixation (Symbiotic and asymbiotic), Lipid metabolism, Secondary metabolism, Production of enzymes and antibiotics--Role of microbes in biogeochemical cycles.

References:

1. Michael T. Madigan John M. Martin & Jack Parker, 1984, Biology of Microorganisms Prentice Hall International, Inc., London.
2. Edward A. Birge, 1992, Modern Microbiology – Principles and application. Wm.C. Brown Publishers, Inc. U.S.A.
3. Gerard J. Tortora, Berdell R. Funke, Christine & L. Case, 2001, Microbiology - An Introduction. Benjamin Cummings, U.S.A.
4. Danial Lim, 1998, Microbiology, McGraw-Hill Companies, New York.
5. Stephen A. Hill, 1984, Methods in Virology. Blackwell Scientific Publication, London.

CORE PAPER: V

Subject Title: GENETICS

Subject description: This course presents the way characters get transferred through generations and methods to analyze and modify them

Goals: To make the student to understand the concept of genes and their behaviour

Objectives: On successful completion the subject student should have understand:

Basic genetics

Gene expression and regulation

UNIT I

History of Genetics - Mendelian Principles, Segregation, Independent Assortment, Dominance relations, Multiple alleles, Incomplete dominance, Over dominance,

UNIT II

Gene interaction, Epistasis, lethality and lethal genes, Sex determination and sex linkage in diploids, linkage and crossing over, gene mapping. Chromosomal theory of inheritance, maternal effects.

UNIT III

Chromosomal variation in number, Changes in Chromosomal structure, Chromosomal aberrations, Genetics of Hemoglobin, Transposable elements in prokaryotes and eukaryotes.

UNIT IV

Fine structure of Gene, cistron, recon, Structure of Eukaryotic gene, Experimental evidence for DNA as the genetic material, cytoplasmic genetic systems- mitochondria and chloroplast DNA, Plasmids- F, R and Col plasmids. Relation between genes and polypeptides.

UNIT V

Population genetics, calculating gene frequency, factors affecting gene frequency. Genetic control of Development in Drosophila and Arabidopsis. Genetic drift, Shift, Pedigree analysis and genetic counseling.

Reference:

1. Basic genetics by D.L.Hartl,1991,Jones and Bartett public.
2. Friedfelder 1987, Microbial genetics ,Jones and Bartett public.
3. Molecular Biology of the genes 4th Ed. Watson et.,al, the Benjamin /cummings coins 1987
4. Molecular cell biology, 1994.Lodish, Baltimore scientific American books,Inc.
5. Genetics Strickberger.M
6. Genetics by Goodenough

Diploma Paper I:

Subject Title: HUMAN PHYSIOLOGY

Subject description: This course presents the various physiological activities in human being

Goals: To make the student to understand the human physiology

Objectives:

After the completion of the course the student should have understood various systems in human and their activities

UNIT I

MUSCLE- skeletal muscles – composition – functions and properties of plain (smooth) and cardiac muscles – electromyography

NERVOUS SYSTEM – organization – basic functions of synapses and transmitter substances – sensory receptors – sense of hearing – taste and smell. Special senses – optics of vision – function of retina –cortical and brain stem control of motor function . Cerebellum –limbic and hypothalamus – states of brain activity cerebral blood flow, cerebrospinal and brain metabolism

UNIT II

BLOOD & BODY FLUID – blood cell –Haematosi s – determination of coagulation – plasma proteins – platelets – leucocytes. Bone marrow – functions of tissue fluid – Lymph nodes

CADIO VASCULAR SYSTEM – Heart as pump – rhythmic excitation – electrocardiogram – cardiac arrhythmias. Circulation- functions of arterial and venous system – microcirculation and lymphatic system – rapid control of arterial pressure- hypertension – cardiac failure – heart sounds

RESPIRATORY SYSTEM- pulmonary ventilation – pulmonary circulation – gaseous exchange - O₂ and CO₂ transport in blood and body fluids – mechanism of breathing - ventilation

UNIT III

DIGESTIVE SYSTEM – digestive tract – gastrointestinal function – motility– secretory functions of alimentary tract – digestion and absorption.

EXCRETION – functions of kidney – renal associated mechanisms - extracellular and intracellular fluids – osmolality and sodium concentration – regulation of blood volume – excretion – regulation of urea, potassium – regulation of acid base balance. Micturition – skin – sweat

ENDOCRINES – pituitary hormones and their control by hypothalamus – thyroid metabolic hormones – adreno-cortical hormones – insulin, glucagons and Diabetes mellitus – parathyroid hormone, calcitonin. Gonadotrophic hormones –testosterone – estrogen – corpus leutem - progesterone – Endometrical and menstruation – puberty – menopause – pregnancy and lactation – fetal and neonatal physiology

References:

1. Text book of Medical physiology by Guyton . 8th edition . W B Saunders company. USA
2. Human physiology by Dr.C.Chatterjee I & II. Medical Allied Agency, Kolkatta.
3. Anthony's Text book of Anatomy and Physiology by Gary A. Thiodeare & Kevin T patton, 2nd edition . Moshi year book, New York
4. Anatomy and Physiology by Ross & Wilson 8th edition. Churchill livingstone
5. Human physiology by Sarada Subramaniam & K.MadhavanKutty. S.Chand and company, New Delhi
6. Human Physiology by Vander Sherman Luciano McGraw Hill NewYork.

CORE PAPER: VI

Subject Title: BIOINFORMATICS

Subject description: This course presents the fundamentals of Information processing

Goals: To make the student to understand the concept Informatics

Objectives: On successful completion the subject student should have understand:
Methods to retrieve and submit data
Genome data bases and other databases and their analysis

UNIT I

Introduction and history of bioinformatics – Internet, World Wide Web, Web browser, EMB net, NCBI. File transfer protocol. Search engines

UNIT II

Database- Definition, DBMS – Biological Databases – FASTA, Blast, Genbank, DNA sequence databases, Protein databases. Entry formats, carbohydrate databases, Enzyme databases, Pathway databases. Relational database model. Theory on RDBMS. SQL, introduction to access, making queries. Designing forms. Report design

UNIT III

Genomic resources, Gene structure and DNA sequences. EST searches, gene hunting, gene finders, Expression analysis- SAGE, cDNA library, EST, Microarray – DNA sequencing and sequence alignment – RFLP, SNP, RAPD, Human Genome Project, RNA analysis.

UNIT IV

Proteomics – proteome analysis – 2D gel electrophoresis, Mass spectrophotometry, protein – protein interaction, protein – DNA interaction. Enzyme – Substrate interaction, pathway analysis.

UNIT V

Application aspects – target searchings – drug designing – E- cell, phylogenetic analysis, PERL, Chemoinformatics

References:

1. Introduction to Bioinformatics T.K.Altwood, D.J.Parry-smith (2004) Pearson Education
2. Bioinformatics for the beginners K.Mani & N.vijayaraj
3. Proteomics- Pennigton & Dunn (2002) Viva books publishers, New Delhi
4. Bioinformatics- A practical guide to the analysis of genes & protein 2nd ED Andreas, Baxevanis and Francis Ouellette.
5. The internet (1999) Christian Crumlish. BPB publications.

**CORE PRACTICAL II:
(MICROBIOLOGY AND GENETICS)**

1. Laboratory rules and regulations of Microbiology
2. Media preparation and sterilization
3. Enumeration of microorganism from soil, water and spoiled food--- serial dilution technique.
4. Pure culture technique—Pour plate, spread plate and streak plate methods.
5. Isolation of single colonies of bacteria
6. Auxotrophic selection
7. Measurement of growth of bacteria.
8. Measurement of growth of Phage.
9. Staining of bacteria—Gram's; Spore, capsule, acid fast bacilli.
10. Fungal Staining --- Wet Mount technique.
11. Drosophila – Morphology, Section culture and maintenance.
12. Identification of Mutants—Physical and Chemical Methods.
13. Experiments to determine Mendel's law.
14. Monohybrid and dihybrid cross using plants.
15. Salivary Gland chromosome of
16. Human karyotype --- demonstration.
17. Sex chromatin (buccal smear).

DIPLOMA PAPER II:

Subject Title: HUMAN PATHOLOGY

Subject description: This course presents the diseases of human being

Goals: To make the student to understand the concept Pathology

Objectives: On successful completion the subject student should have understand:
Pathogen, disease and metabolic disorders.

UNIT I:

An introduction to Biotechniques in clinical medicine: sampling, analysis, reporting, and interpretation of results. Disorders of Kidney: acute renal failure, chronic renal failure, proteinuria and nephritic syndrome and urinary calculi. Disorders of Liver: Biochemical assessment of liver function. Liver diseases: Acute hepatitis, chronic hepatitis, acute liver failure, Cirrhosis, alcohol and liver. Inherited abnormalities of bilirubin metabolism: Gilbert's, Crigler-Najjar, Dubin-Johnson, Jaundice, and Rotor. Drugs and the Liver. Biotechnological approaches to liver diseases: Vaccine development and drug delivery.

UNIT II:

Disorders of Carbohydrate metabolism: Diabetes mellitus - Etiology and pathogenesis, diagnosis and management. Metabolic complications of diabetes: Ketoacidosis, pathogenesis, non - ketotic hyperglycaemia, Lactic acidosis, diabetic nephropathy, Lipoprotein metabolism in diabetes, Diabetes in pregnancy, glycosuria, hypoglycaemia - diagnosis and management. Disorders of Plasma proteins and enzymes: Hypoalbuminaemia, hypogammaglobulinaemia, hypergammaglobulinaemia. Alkaline phosphatase, Creatine kinase, Haemoproteins - Haemoglobinopathies, and abnormal haemoglobin derivatives-Methaemoglobin, Carboxyhaemoglobin. Secondary hyperlipidaemia, Types of Primary hyperlipidaemias. Lipoprotein deficiency-abetalipoproteinaemia. Diseases of Heart-Myocardial infarction, Heart failure and Hypertension. Inherited metabolic diseases: Glucose-6-phosphatase deficiency, Galactosaemia, Phenyl ketonuria, Cystic fibrosis

UNIT III:

Disorders of hypothalamus and pituitary: Disorders of anterior pituitary hormones: Hypopituitarism, Anorexia nervosa, Growth hormone deficiency, Growth hormone excess: acromegaly and gigantism, Hyperprolactinaemia and Cushing's disease.

Disorders of Adrenal Glands:

Disorders of Adrenal cortex: Adrenal hypofunction (Addison's disease). Adrenal hyper function: Cushing's syndrome, conn's syndrome, congenital adrenal hyperplasia (CAH). Disorders of adrenal medulla: catacholamines.

Disorders of Thyroid gland: Hyperthyroidism, hypothyroidism, thyroiditis, goiter and thyroid cancer.

Metabolic aspects of cancer: Metabolic complications of cancer. Tumour markers: α -Fetoprotein (AFP), Carcinoembryonic antigen (CEA), Para proteins, Human chorionic gonadotrophin (hCG), markers of prostatic cancer, enzymes as tumour markers and Carbohydrate antigen (CA) markers.

REFERENCES:

1. Clinical Chemistry by Willium J.Marshall (Fifth edition, Mosby Publications).
2. An Illustrated color text of Clinical Biochemistry by Allen Gaw, Robert A.Cowan, illustrated by Robert Britton (1999, second edition, Churchill Living stone press).
3. Harper's Illustrated Biochemistry (27th Edition) by Robert K. Murray, Daryl K. Granner, Victor W. Rodwell.
4. Lippincott's Illustrated reviews: Biochemistry (Lippincott press, Third Edition) by Richard Harvey and Pamela C.Champe.

5. Medical Microbiology by Panicker Medical Microbiology by Roitt Medical Parasitology by Panicker
6. Color Atlas of Biochemistry (second edition, Thieme Publications, revised and enlarged) by Jan Koolman and Klaus-Heinrich Roehm.
7. Marks' Basic Medical Biochemistry: A Clinical Approach (2nd Edition), by Colleen M. Smith, Allan D. Marks and Michael A. Lieberman.
8. Medical Microbiology by Jawetz.

CORE PAPER: VII

Subject Title: IMMUNOLOGY

Subject description: This course presents the basic defense mechanism of animals

Goals: To make the student to understand the concept immunology

Objectives: On successful completion the subject student should have understand: Immunity, Antigen, Antibody, Cells of immune system and their function and regulations

UNIT I:

Introduction- Historical Development in Immunology. Immunity-. Humoral and Cell mediated response, Primary and Secondary immune response. Cells involved in immune response. Innate and Acquired Immunity. Mechanisms of defense.

UNIT II:

Antigen- Types and classifications. Antibody – Structure, Types, properties and their biological functions, poly clonal sera, Monoclonal antibody. Primary and Secondary lymphoid organs – Thymus, Bone marrow, Lymph nodes and Spleen. Lymphocytes traffic and regulation, CD molecules

UNIT III:

Hematopoiesis and development of B and T lymphocytes. Immunoglobulin Gene expression B cell and T cell activation. MHC molecules Response of B cells to antigens. Plasma Cells, Memory Cells.

Unit IV

Complement – activation and regulation. Cytokines- structure and functions, Interferons and interleukins. Immuno regulation: Tolerance. Suppression, Autoimmunity and hypersensitivity reactions .Primary and secondary Immuno deficiency disorders.

UNIT V:

Transplantation, HLA Typing; Mechanism of Graft rejection. Tumor immunology.Immuno surveillance- mechanisms.

Antigen – Antibody Interactions. Immunodiffusion and Immunoelectrophoresis. Principle and Applications of RIA, ELISA, Fluorescent Antibody techniques. I

REFERENCES:

1. Immunology – Kuby., J - 5th Edition
2. Immunology – Tizard
3. Immunology – Ivan M. Roitt – Third Edition
4. Immunobiology – Janeway and Travers – 5th Edition

CORE PAPER: VIII

Subject Title: PLANT BIOTECHNOLOGY

Subject description: This course presents the application of Plants in Biotechnology

Goals: To make the student to understand usage of Plants and methods to improve their utility

Objectives: On successful completion the subject student should have understand:
Crop development, Callus culture, Biotechnological applications of plants

UNIT I

Conventional methods of crop improvement- Selection, mutation, polyploidy and clonal selection.

UNIT II

Plant genome organization, gene families in plant. Organization of chloroplast genome, nucleus- encoded and chloroplast encoded genes for chloroplast proteins. Organization of mitochondrial genome- nuclear and mitochondrial encoded genes for mitochondrial proteins, cytoplasmic male sterility. Seed storage proteins and heat shock proteins.

UNIT III

Plant tissue culture. Callus culture, organogenesis, meristem culture, anther, pollen, embryo culture and their applications .somatic hybridization Somatic embryogenesis, cybrids.

UNIT IV

Symbiotic nitrogen fixation in legumes -Biochemistry and molecular biology, gene rearrangement and nitrogen fixation in cyanophytes. Agrobacterium and Crown gall tumors. Ti plasmid vectors for plant transformation, agro-infection. Classification of plant viruses, molecular biology of plant stress response.

UNIT V

Direct transformation of plants by using physical methods Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors.. Genetic engineering of plants for virus resistance, pest resistance, herbicide tolerance, delay of fruit ripening, resistance to fungi and bacteria. Production of antibodies, viral antigens

and peptide hormones in plants. Importance of RFLP in plant breeding. Management aspect of plant genetic engineering, tagging and cloning of plant genes..

REFERENCE

1. An introduction to genetic engineering in plants, Mantel. S. H, Mathews. J. A, Mickee. R. A
2. Revolution on biotechnology, Marks. J.L.
3. Plant genetic engineering, Dodds J.H.
4. Plant molecule biology, Grierson and S.V. Convey
5. Molecular biotechnology, Principle and applications of recombinant DNA technology, Bernard R Glick.
6. Plant Biotechnology-Monica Hughes.

CORE PAPER: IX

Subject Title: ANIMAL BIOTECHNOLOGY

Subject description: This course presents the usage of Animals in biotechnology and their improvement

Goals: To make the student to understand the Animal products and exploitation of them in Biotechnology

Objectives: On successful completion the subject student should have understand: Animal tissue culture, Animal products, production & improvement of them.

UNIT I

Animal cell culture: Fundamentals. facilities and applications. Media for Animal cells. Biology of cultured cells, measurement of growth, cell synchronization, senescence and apoptosis

UNIT II

Types of cell culture: Primary cell culture, secondary culture, cell transformation, cell lines, stem cell cultures, cell viability and cytotoxicity. Organ culture. Cryopreservation
Insect cell lines

UNIT III

Genetic engineering in animals: methods of DNA transfer into animal cells- calcium-phosphate co precipitation, micro-injection, electroporation, Liposome encapsulation, Billogical vectors. Hybridoma technology, Vaccine production.

UNIT IV

Embyology: Collection and preservation of embryo, culture of embryos, culture of embryonic stem cells and its applications. Gametogenesis and fertilization in animals, Molecular events during fertilization, genetic regulations in embryonic development.

UNIT V

Transgenics: Transgenic animals. Production and recovery of products from animal tissue cultures: cytokines, Plasminogen activators, Blood clotting factors, Growth hormones.

REFERENCES:

1. Animal cell culture – a practical approach, 4th ED., Freshney. John Wiley Pub.,
2. Methods in Cell Biology. VOL 57 Animal methods, ED Mather & Barnes, Academic Press.
3. Mammalian Cell Biotechnology- A practical approach. ED Butler. Oxford UNI Press.
4. Exploring Genetic mechanisms. ED Singer & Berg.

CORE PAPER: X

Subject Title: MOLECULAR GENETICS

Subject description: This course presents the genetics at molecular level

Goals: To make the student to understand the molecular genetics

UNIT- I

DNA as genetic material; Organization of genome – Structure and function of DNA and RNA; DNA replication – conservative, semi conservative, unidirectional, bidirectional replication; Enzymology of replication; *in-vitro* DNA synthesis

UNIT – II

Gene as the unit of expression; Colinearity: Transcription and gene regulation in prokaryotes and eukaryotes; elucidation of genetic code.

UNIT – III

Translation of protein – post translational modifications and folding of newly assembled polypeptides; transit peptide and signal sequences – protein export

UNIT - IV

Gene mutation – Biochemical basis of mutations – types of mutations- spontaneous and induced mutations; Ames test for mutation; DNA damage – types of DNA repair and mechanisms – photo reactivation excision repair, post replication recombinant repair, SOS repair

UNIT - V

Genetic exchange – bacterial transformation, transduction, conjugation and their mapping, linkage and chromosome mapping, crossing over, gene targeting.

REFERENCES

1. Basic Genetics by D.L. Hartl 1991, Jones & Bartett publications.
2. Microbail Genetics, Friefelder 1987 – Jones & Bartnett publications
3. Molecular Biology of the gene 4th edition by Watson et al, The Benjamin / Cummings co
4. Molecular Cell Biology by Lodish 1994, Baltimore Scientific American Brocks

DIPLOMA PAPER III **Subject Title: DIAGNOSTIC TOOLS**

UNIT I Subject description: This course presents the Diagnostic methods of diseases
Goals: To make the student to understand the concept of Diagnostic methods

Objectives: On successful completion the subject student should have understand:
Examination of Blood, Urine and CSF.

UNIT I

Blood examination – anticoagulant, hemoglobin, RBC, Packed cell volume, ESR, WBC total, differential normal and abnormal hematopathies – anemia, bone marrow smear, leukemia and myelodysplastic syndromes, diagnostic significance of PB smear, hemorrhagic disorder, L.E. cell phenomenon.

UNIT II

Urine analysis – collection – physical, chemical and microscopic examination of urine – CSF
Parasite analysis

UNIT III

Histopathology Biochemical analysis of Blood, Blood banking, Transplantation, AIDS, Lab safety, ELISA, RIA, FACS, PCR, Computers in lab. Quality control.

REFERENCE:

1. Handbook of medical lab technology – Ed; V.H.Talib, CBS publication
2. Clinical Chemistry by Willium J.Marshall (Fifth edition, Mosby Publications).
3. An Illustrated color text of Clinical Biochemistry by Allen Gaw, Robert A.Cowan, illustrated by Robert Britton (1999, second edition, Churchill Living stone press).
4. Marks' Basic Medical Biochemistry: A Clinical Approach (2nd Edition), by Colleen M. Smith, Allan D. Marks and Michael A. Lieberman.
5. Medical Microbiology by Jawetz.

CORE PAPER: XI

Subject Title: MICROBIAL BIOTECHNOLOGY

Subject description: This course presents the utility of Microbes

Goals: To make the student to understand the applications of Microbes

Objectives: On successful completion the subject student should have understand:
Fermentation, Microbial products, Vaccine and antibiotics.

UNIT I:

Microbial Biotechnology: Scope and application-horizons of microbial Technology, public concern about the microbial biotechnology and Economics of microbial biotechnology.

UNIT II:

Microbes: Living factories for macromolecules-Production of proteins in Bacteria and yeast; recombinant and synthetic vaccines; microbial insecticides (*Bacillus.thuringiensis*, *B.spaerinus*, *B.papilliae* and Baculo-Viruses); microbial enzymes application in starch processing , textile designing, detergents, cheese making;polysaccharides and polyesters.

UNIT III:

Microorganisms in fermentation-Ethanol from feed stocks to fermentable Sugars, from sugars to alcholos, clostridial fermentation, lactic acid fermentation, acetic acid production and industrial production of various milk products.

UNIT IV:

Metabolites from microorganisms-amino acids; antibiotics-antibacterial agents (□-lactams, tetracyclines, peptides, amino glycosides), antifungal agents, anti-tumor antibodies.

UNIT V:

Application of microbial biotechnology in sewage and wastewater treatment, degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents, production of biofertilizers (nitrogen fixing Bacteria, single cell protein, mycorrizha and phosphate solubilizing Bacteria).

REFERENCES :

1. Glazer, A.N. and Nikaido, H. 1995. Microbial biotechnology. W.H.Freeman & Co.,New York
2. Encyclopedia of Microbiology. 1992. Vols.1-4. Academic Press.
3. Preve et al. 1987. Fundamentals of Biotechnology. VCH Publ.
4. Stanbury, P.F. Whittaker, A, Hall, S.J. 1995. Principles of fermentation technology.Butterworth Heinemann.
5. Prescott, L.M. Harley, J.P. and Klein, D.A. 1999. Microbiology. McGraw Hill Co.
6. Glick, B.R. and Pasternak, J.J. 1998. Molecular Biotechnology. Washington D.C. ASM Press.

7. Stainer, R.Y. Ingraham, J.L., Wheelis, M.L. and Painter, P.R. 1987. General Microbiology. Macmillan Co.
8. Lancini, G. Parenti, F. and Gallo, G.G. 1995. Antibiotics-A multidisciplinary Approach. Plenum Press, New York.
9. Gunasekaran.P. 1995. Laboratory manual in microbiology. New Age International Limited. New Delhi.

CORE PAPER: XII

Subject Title: ENVIRONMENTAL BIOTECHNOLOGY

Subject description: This course presents the Study and the Management of the Environment

Goals: To make the student to understand Ecology and Conservation of the Environment

Objectives: On successful completion the subject student should have understand: Ecosystem, Natural cycles. Diversity.

UNIT I:

Scope – Branches of ecology – Abiotic factors – water – soil – temperature – light. Biotic factors – Animal relationship – symbiosis – commensalisms – mutualism –Antagonism – Antibiosis – Parasitism – Predation – competition.

UNIT II:

Ecosystem –Definition –structure – pond ecosystem – primary production –secondary production – food chain – food web – trophic levels – energy flow – pyramid of biomass– pyramid of energy. Biogeochemical cycle: Nitrogen and Phosphorous.

UNIT III:

Pollution – types – sources – effects – Air-water – land – Noise – Thermal – Pesticide – Radioactive – green house effect, ozone and its importance – global warming – Acid rain– Bio accumulation – Bio magnification. Biological control. Principles of environment Impact. Assessment and environmental monitoring.

UNIT IV:

Uses and values of Biodiversity -A very general account on uses of Bioresources-plant uses: food, timber, medicinal ornamental and other uses- animal uses: food animals (terrestrial and aquatic), non food uses of animals, Domestic livestock-uses of microbes. Valuing Biodiversity-Instrumental (Goods, Services, and Information and Psychospiritual values) and Inherent or Intrinsic values, ethical and aesthetic values-An outline account on methods of valuing biodiversity. A general account on multilateral treaties- the role of CBD, IUCN, GEF, IBPGR, NBPGR, WWF, FAO, UNESCO and CITES-Bioresources, Biotechnology and Intellectual property rights:

UNIT V:

Conservation of Biodiversity - Current Practices in conservation - Habitat or ecosystem approaches – Speciesbased approaches - Social approaches -Chipko movement - *In situ*

(Afforestation, Social Forestry, Agro forestry, Botanical Gardens, Zoos, Biosphere Reserves, National Parks, Sanctuaries, Sacred Groves and Sthalavrikshas) and *Ex situ* (Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperms Banks, DNA Banks, Tissue Culture and Biotechnological Strategies), eco restoration, environmental education.

REFERENCES:

1. Groombridge, B (Ed.) 1992. Global Biodiversity – Status of the Earth’s Living Resources. Chapman & Hall, London.
2. UNEP, 1995, Global Biodiversity Assessment , Cambridge Univ. Press, Cambridge.
3. Virchow, D. 1998. Conservation & Genetic Resources , Springer – Verlag, Berlin.
4. Gary K.Meffe & .Ronald Carroll ,C.1994. Principles of Conservation Biology, Sinauer Associates, Inc., Massachusetts.
5. Clarke, G.L. 1954, Elements of ecology, John Wiley & sons. N.Y.
6. Kendeigh, S.c. 1961. Animal Ecology. Prentice Hall.
7. Odum, E.P. 1971. Fundamentals of Ecology. W.B.Saunders company, Philadelphia.
8. Rastogi, V.B. and M.S. Jayaraj, 1989. Animal ecology and distribution of animals, Kedamath Ramnath.
9. Sharma, P.D. 1990. Ecology and environment. Rsatogi publications, Meerut.
10. Southwick, C.H. 1976. Ecology and the quality of environment D.Van.Nostrand Co.,
11. Verma P.S. and V.K. Agarwal. 1996.Principles of Ecology S.Chand. & co., New Delhi.

PRACTICAL III APPLIED BIOTECHNOLOGY

1. Fermentor Design and Working Principle
2. Organic acid Production -- Citric acid (solid state or submerged).
3. Production and assay of extra cellular enzyme – Protease—submerged.
4. Wine Production.
5. Antibacterial sensitivity test.
6. Production of an Antibiotic
7. Preservation and maintenance of cells.
8. Identification of fungal spoilers. (Aspergillums, Mucor).
9. Plant tissue culture media preparations.
10. *In-vitro* germination of seeds.
11. Callus induction and differentiation.
12. Embryo culture.
13. Somatic embryogenesis.
14. Isolation and fusion of protoplast.
15. Artificial seed production.
16. Meristem culture.
17. Micro propagation.
18. *Agrobacterium* mediated gene transfer --- Demonstration.

PRACTICAL IV: LAB IN IMMUNOLOGY AND rDNA TECHNOLOGY.

1. Preparation of Antibodies.
2. Antigen- Antibody Reactions.
3. Immuno diffusion. (Single radial, double and rocket)
4. Blood grouping.
5. Preparation of serum from blood.
6. Method of immunization and bleeding.
7. ELISA- Demonstration.
8. Immuno assay and Typhoid antibodies.
9. Salt precipitation of Immunoglobulin.
10. Agarose gel Electrophoresis.
11. Isolation of Genomic DNA—Bacteria, Plant and Animal.
12. Isolation of Plasmid DNA.
13. Isolation of RNA.
14. Restriction Digestion.
15. Isolation of Phage DNA.
16. Transformation.
17. Southern blotting --- Demonstration.
18. Northern blotting --- Demonstration.
19. Western blotting --- Demonstration.
20. PCR-. Demonstration.
21. Construction of restriction Map of plasmid DNA --- Demonstration.

DIPLOMA PAPER IV

Subject Title: PHARMACOLOGY

Subject description: This course presents Medicines for different disease

Goals: To make the student to understand the concept therapy.

Objectives: On successful completion the subject student should have understand:
Drug administration, drug metabolism and allergy.

UNIT I

Pharmacology – origins and antecedents – Pharmacology in the 20th century – Drugs – Sources, dosage forms and routes of administration. Absorption, factors modifying drug absorption, distribution, metabolism – Phase I, II reactions, action of cytochrome P450

UNIT II

Targets for drug action, receptor proteins, ion channel and drug targets, control of receptor expression, assay of drug potency: Chemical, bioassay and immunoassay-Drug tolerance and drug dependence. Principles of basic Pharmacokinetics, Adverse response

to drugs, drug intolerance, drug allergy, tachyphylaxis, drug abuse, vaccination against infection, factors modifying drug action and effect.

UNIT III

Mechanism of action of drugs used in therapy of

- a) Respiratory systems – cough, bronchial asthma, pulmonary tuberculosis
- b) Cancer chemotherapy
- c) Antimicrobial drugs – sulfonamide, trimethoprim, penicillins, aminoglycosides and bacterial resistance.
- d) Thyroid and anti thyroid drugs, insulin and anti diabetic drugs, anti fertility and ovulation inducing drugs.

References:

1. Pharmacology – 5th edition – H.P.Rang, M.M.Dale, J.M.Ritter, P.K.Moore
2. The Pharmacology, Volume I and II – Goodman and Gillman
3. Basic Pharmacology – Foxtor Cox. Butterworth's 1980
4. Pharmacology and Pharmacotherapeutics – R.S.Satoskar, S.D. Bhandhakam and S.S. Alinapure
5. Principles of Medicinal Chemistry – William O.Foye – B.I. Waverks. Pvt. Ltd, New Delhi

ELECTIVE I - A

Subject Title: BIOLOGY OF CLONING VECTORS

Subject description: This course presents the types of cloning vehicle

Goals: To make the student to understand the concept of vector preparation, gene manipulation and gene transfer technologies

Objectives: On successful completion the subject student should have understand:
Biology of plasmid, usability of plasmid and viral particles as vectors

UNIT-I

Introduction to cloning vectors: Plasmid Biology. *E.coli* vector; properties of plasmid (plasmids in gene transfer) plasmid compatibility, copy number control, PBR³²², BAC and expression vectors in prokaryotes. Site - directed mutagenesis, m RNA isolation, cDNA synthesis.Genomic and cDNA liobraries.

UNIT II

Molecular biology of lambda, Lambda vectors; cosmid, phagemid. *in-vitro* packaging, M13 and other viral vectors of prokaryotes.

UNIT-III

Cloning in Yeast: genetics of *S.cerevisiae*, identification of Yeast genes, Yeast vectors, YAC.

Cloning in *Bacillus*. Plasmids and vectors, inducible promoters.

Cloning in *Streptomyces*.

UNIT-IV

Animal vectors; Selectable markers, SV40 Vectors, papilloma virus, Retero virus, Vaccinia virus. Bacculo virus

Ti plasmid as gene vector, Caulimo viruses, Gemini viruses, Transposable elements, RNA viruses, viroids

UNIT-V

Manipulation of genes for the Safety r DNA research. Laboratory and industrial applications. Reproductive engineering, Human genetic diseases, gene therapy, genetic manipulation of germ cells

REFERENCES:

1. Ernst.L.Winnacker, (2003) from genes to clones, 2nd edition, Panima publishing corporation, NewDelhi.
2. Benjamin Lewin (2004) Genes VIII, Pearson Education corporation, New Jersey
3. Alberts B, (1994) molecular biology of the cell, Garland publishing Inc New York
4. Friedfielder.D, (1987), Molecular biology II Ed., Narosa publishing house, New Delhi.
5. J.d.Watson (2001) Recombinant DNA technology, 2nd Ed WH Freeman and Company, New York
6. Brown T.A (1998) Introduction to gene cloning 3rd ED Stanley Thomas Pub ltd, Germany
7. Primrose S.B (2003) Principles of gene manipulation 6th Ed Black well Sci ltd, Germany.

ELECTIVE II - A

Subject Title: RECOMBINANT DNA TECHNOLOGY AND BIOETHICS

Subject description: This course presents the mechanism of gene manipulation

Goals: To make the student to understand the concept of gene manipulation and gene transfer technologies

Objectives: On successful completion the subject student should have understand:
Manipulation of genes
Transfer techniques
Expression systems and methods of selection

UNIT I:

Restriction and Modification systems of Bacteria. Restriction enzyme: DNA Polymerases, DNALigase, methylase, Taq polymerase, polynucleotide kinase, alkaline phosphatase, reverse transcriptase, DNaseI, S1nuclease, RnaseH, terminal deoxynucleotidyl transferase, RNA polymerase.

UNIT II:

Types and methods in probe construction, methods of labeling gene probes, identification of recombinant DNA. Construction of DNA libraries and genomic libraries, protein engineering.

UNIT III:

Introduction of cloned genes into the host cells: Transformation, transduction, Particle gun, electroporation, liposome mediated and co-cultivation.

UNIT IV:

Recombinant DNA techniques: Anti sense technology, terminator gene technology, site directed mutagenesis, Human genome project, hybridization techniques-southern, Western and Northern blotting, Chromosome walking. PCR, RFLP, RAPD, DNA finger printing, Micro array and sequencing, gene therapy, DNA sequencing.

UNIT V:

Public acceptance issues for biotechnology: Case studies/experiences from developing and developed countries. Biotechnology and hunger: Challenges for the Indian Biotechnological research and industries. The Cartagena protocol on biosafety. Biosafety management: Key to the environmentally responsible use of biotechnology. Ethical implications of biotechnological products and techniques. Social and ethical implications of biological weapons.

REFERENCES:

1. Ernst.L.Winnacker, (2003) from genes to clones, 2nd edition, Panima publishing corporation, NewDelhi.
2. James.D.Watson(2001) Recombinant DNA technology, 2nd edition, WH Freeman and company, New York.
3. Glick and Pasternak,(1996),Molecular biotechnology, Panima publishing corporation.NewDelhi.
4. BrownT.A., (1998) Introduction to gene cloning, 3rd edition, Stanley Thomas Publishing Ltd, London.
5. PrimroseS.B., (2003) Principles of gene manipulation, 6th edition, Blackwell Science Ltd, Germany.
6. Cartagena Protocol on Biosafety, January 2000.
7. Biological Warfare in the 21st century, by M.R. Dano, Brassies London, 1994.
8. Safety Considerations for Biotechnology, Paris, OECD, 1992 and latest publications.

ELECTIVE III - A

Subject Title: BIOPHYSICS AND BIOINSTRUMENTATION

Subject description: This course presents study of Biophysics and Instrument of Biological Importance.

Goals: To make the student to understand the methods to analyze Biomolecules.

Objectives: On successful completion the subject student should have understand: Analytical methods and Molecular structures.

UNIT I:

Conformation of Biological Macromolecules – Structure of Proteins – Primary, Secondary, Tertiary and Quaternary – Composition of proteins – Amino acids – Properties – Structure of Nucleic Acids – Primary, Secondary, Tertiary and Quaternary – Composition of nucleic acids – Nucleoside and Nucleotides – Properties of nucleic acids – Polysaccharides – Lipids.

UNIT II:

Forces that stabilizes the Macromolecules – Proteins and Nucleic acids – Hydrogen Bonding – Hydrophobic interactions – Ionic interactions – Disulfide Bonds – Glycosidic Bonds.

UNIT III:

Techniques for the study of biological structure – Spectroscopy – Principles and applications of UV, Visible, NMR, Infra red and Raman Spectroscopy. X – Ray Scattering and Diffraction.

UNIT IV:

Separation Methods – Chromatography – Affinity, Column, Paper, Thin Layer, Ion Exchange, HPLC, Gel Filtration and GC.

UNIT V:

Separation Methods – Sedimentation – Centrifugation – Ultracentrifugation – Diffusion – Macromolecular Diffusion - Electrophoresis – Agarose gel, Native PAGE and SDS – PAGE.

REFERENCES:

1. Biophysical Chemistry – Cantor and Schimmel – W.H. Freeman and Company, 2001
2. Practical Biochemistry – Keith Wilson and John Walker – Cambridge University Press – 5th edition, 2003
3. Basic Biophysics for Biologist – M.Daniel – Agrobios (India), 2005.