

**BHARATHIAR UNIVERSITY (CBCS PATTERN)**

**B. Sc. CLINICAL LAB TECHNOLOGY DEGREE COURSE WITH COMPULSORY  
DIPLOMA IN CLINICAL NUTRITION  
SCHEME OF EXAMINATION - CBCS PATTERN**

**For the students admitted during the academic year 2008 – 2009 batch and onwards**

Part	Study Components	Course title	Ins. hrs/ week	Examinations				Credit
				Dur.Hrs	CIA	Marks	Total Marks	
	<b>Semester I</b>							
I	Language – I		6	3	25	75	100	3
II	English – I		6	3	25	75	100	3
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	4
	Allied Practical I		2	-	-	-	-	-
IV	Environmental Studies #		2	3	-	50	50	2
	<b>Semester II</b>							
I	Language – II		6	3	25	75	100	3
II	English – II		6	3	25	75	100	3
III	Core Paper III - Biochemistry II – Cell Biology		4	3	25	75	100	4
	Core Biochemistry Practical – I		4	3	40	60	100	3
	Allied A : Paper II - Computer Science II		4	3	20	55	75	4
	Allied Practical – I		4	3	20	30	50	2
IV	Value Education – Human Rights #		2	3	-	50	50	2
	<b>Semester III</b>							
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	4
	Allied Practical II		4	-	-	-	-	-
IV	Skill based Subject I (Diploma) Nutrition Through Life Cycle		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	2

<b>Semester IV</b>							
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	3
	Allied B : Paper II – Chemistry II	4	3	20	55	75	4
	Allied Practical II	4	3	20	30	50	2
IV	Skill based Subject 2 (Diploma) Diet therapy	3	3	25	75	100	3
	Tamil @ /Advanced Tamil # (OR) Non-major elective -II (General Awareness #)	2	3	75		75	2
<b>Semester V</b>							
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	5
IV	Skill based Subject 3 (Diploma) Clinical Nutrition	3	3	25	75	100	3
<b>Semester VI</b>							
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	20	30	50	3
	Core practical IV Pathology	4	6	20	30	50	3
	Elective – II	4	3	25	75	100	5
	Elective – III	4	3	25	75	100	5
IV	Skill Based Subject 4 (Diploma) Practical – I & II	6	6	40	60	100	3
V	Extension Activities @	-	-	50	-	50	1
	<b>Total</b>					3600	140

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

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<b>List of Elective papers (Colleges can choose any one of the paper as electives)</b>		
Elective – I	<b>A</b>	Drug Biochemistry
	<b>B</b>	*
	<b>C</b>	*
Elective – II	<b>A</b>	Bio instrumentation - Principles and applications
	<b>B</b>	*
	<b>C</b>	*
Elective - III	<b>A</b>	Clinical laboratory & its interpretations
	<b>B</b>	*
	<b>C</b>	*

\* - yet to be submitted.

**SEMESTER I**  
**SUBJECT TITLE : CORE PAPER I**  
**HUMAN ANATOMY AND PHYSIOLOGY**

**SUBJECT DESCRIPTION :**

This course presents an Introduction and provides a comprehensive, balanced introduction to this exciting, evolving and multi-disciplinary field of anatomy and physiology.

**GOALS:**To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various organs.

**OBJECTIVES:**

On successful completion of the course the students should have:

Understood clearly on various alimentary parts of human body.

Learnt more specific on the endocrinal activities

Learnt the mechanisms and actions of vital organs.

**HUMAN ANATOMY:**

**UNIT I:**

I. The Human body as a whole.

Definitions, Subdivision of Anatomy, Terms of location and positions, Fundamental planes, Vertebrate structure of man, Organization of the body cells, Tissues.

II. Anatomy of Nervous system.

Central Nervous system : Spinal cord, Anatomy, Functions, Reflex- Arc, Meninges.

III. Anatomy of Circulatory System

Heart: Size, Location, Coverings, Chambers, Blood supply, Nerve supply, and the blood vessel.

Names of arteries and veins

**UNIT II**

I. Anatomy of the Respiratory system Organs of the Respiratory system .

Respiratory portion - Pleurae and Lungs - Brief knowledge of parts and position.

II. Anatomy of the Digestive system

Components of digestive system, Mouth , Tongue, Tooth, Salivary glands, Liver, Biliary apparatus, Pancreas - position and their brief functions.

III. Anatomy of the excretory system and reproductive system

Kidneys - Ureters, Urinary Bladder, Urethra Male Reproductive System - testis, Duct system.

Female Reproductive System - Ovaries, Duct system and Accessory glands.

IV. Anatomy of the Endocrine system

Name of all the glands and their position, hormones and their functions - Pituitary, Thyroid, Parathyroid, Adrenal gland and Gonads, Islets of Pancreas.

## HUMAN PHYSIOLOGY

### UNIT III

I. Blood - Composition, properties and function of blood.

RBC - Size, Shape, functions, count, physiological variations of RBC count, Haemoglobin - Function, concentration, physiological variations, WBC - Functions, production, Life span, count, Differential count,

Platelet - Size, shapes, count, production.

ESR and PCV - definition, values, variation factors affecting, significance, Blood volume.

Lymph - Lymphoid tissue, formation, circulation, composition, and functions.

II. Cardiovascular system.

Cardiac output - Definitions, factors affecting, physiological variations, regulation of heart rate.

Pulse - Jugular pulse, radial pulse and triple response.

Heart sounds - Cause, characteristics and significances;

### UNIT IV

I. Digestive System

Functions of Digestive system -function of salivary glands, Saliva - properties, Functions of stomach - properties and functions of gastric juice. Regulation gastric digestion.

Functions of Pancreas - Composition, properties and function of pancreatic juice. Functions of Liver - Properties, composition and function of Bile, Regulation of bile secretion, gall bladder functions and its emptying. Functions of large intestine -Regulation of intestinal secretion, composition and functions of success entericus.

II. Respiratory system

Functions of respiratory system - Respiratory tract, Respiratory muscles and respiratory organs-lungs, stages of respiration.

Respiratory Physiology - Transportation of oxygen - Direction, pressure gradient, forms of transportation, oxygenation of Hb, Quantity of O<sub>2</sub> transported.

### UNIT V

I. Excretory System -

Kidney- vasa recta, cortical and juxta medullary nephrons - structure and functions.

Mechanism of urine formation - GFR, Plasma fraction, EFP, Factors affecting GFR, Determination of GFR, Selective reabsorption - sites for reabsorption, substances reabsorbed,

Mechanism of reabsorption, Glucose, Urea, HCl, aminoacids, etc.,TMG, Tubular load, Renal Thershold Percentage of reabsorption for different substances, Selective secretion.

Properties and composition of normal urine.

II. Reproductive systems

Function of reproductive system, puberty, male reproductive system, functions of testis, spermatogenesis site and stage factors influencing semen, Endocrine functions of testis - Androgens - Testosterone - structure and functions.

Female Reproductive system Ovulation, Menstrual cycle, physiological changes during pregnancy Actions of estrogen, progesterone, functions of placenta.

Lactation - Composition of milk and factors controlling lactation.

REFERENCES:

ANATOMY

Ester.M. Greishcimer. Physiology and anatomy with Practical Considerations. J.P. Lippin Cott, Philadelphia.

Willam Davis. Understanding Human Anatomy and Phsiology, MC Graw Hill.

Willam's ( Pter, L) Gray's Anatomy, 38lfl eds. Churchill Livingstone, 1995.

T.S. Ranganathan, A text book of Human Anatomy.

Fahana, Human Anatomy (Descriptive and Applied) Saunders & Co., Prism Publishers, Bangalore.

PHYSIOLOGY

Guyton, Textbook of Physiology. 8th Eds. Prism Publishers. Bangalore. 1991.

Chatterjee, Human Physiology, 10th Eds., Medical Allied agency.

Choudhari, Concise Medical Physiology, 1st, Eds, New Central Books, Calcutta, 1993.

Ganong (Willams), Review of Medical Phsiolog, 18th eds., Appliton and Lange, 1997.

Endocrinology by Williams.

**SEMESTER I**

**SUBJECT TITLE: CORE PAPER II. BIOCHEMISTRY -I -BIOMOLECULES**

SUBJECT DESCRIPTION:

This course emphasizes on various bio-molecules and its significance.

GOALS:To enable the students to learn the basic functions, structures and biological importance of lifeless chemical compounds.

OBJECTIVES:

On successful completion of the course the students should have understood the significance of the complex bio-molecules, polysaccharides, lipids, proteins, nucleic acids, vitamins and minerals.

UNIT-I

Carbohydrates:Monosaccharides-cl,ssification, stereochemistry;cyclic stacture and anomeric forms: Haworth projection. Reactions of monosaccharides-characteristics of aldehyde and ketone groups. Action of acids and alkalies on sugars. Reactions of sugars due to hydroxyl groups.

Disaccharides-Classification ,structure,chemistry and functions.

Trisaccharides-Structure and functions of raffinose.

Polysaccharides: Storage polysaccharides-Starch, glycogen, dextrin and inulin.

Structural polysaccharides: Cellulose, chitin, glycosaminoglycans (Structures not required).

Artificial sweeteners – Saccharin Aspartame, Monellin, Neohesperidine dihydrochalcone.

## UNIT-II

Lipids: Definition; classification of lipids-simple, compound and derived lipids, Simple lipids: Physical and chemical properties of fats.

Compound lipids- Structure and function of phospholipids, glycolipids and lipoproteins. Derived lipids: Fatty acid-saturated and unsaturated.

Fatty acids: Essential fatty acids; Steroids-structure of cholesterol, ergosterol and stigmasterol. Value of lipids in cardiovascular diseases (Atherosclerosis).

## UNIT-III

Amino acid and proteins Amino acids: Definitions. Amino acids as ampholytes. Structure and classification of amino acids. Chemical reactions of amino acids to carbonyl groups and amino groups.

Peptides: Structure and properties. Identification of N and C terminal residues. Determination of primary structure of peptides.

Proteins: Classification; properties, structure of proteins: Strong and weak bonds; primary structure-insulin, secondary structure- collagen and keratin.

Determination of primary structure of peptides-Glutathione, Oxytocin and Vasopressin

## UNIT IV

Nucleic acids: Structure of purines and pyrimidines; nucleotides and nucleosides, DNA. Double helix; A, B & Z forms; DNA denaturation and renaturation. RNA: Types, unusual bases.

Enzymatic hydrolysis of nucleic acids. DNA as genetic material

Structure of chromatids, nucleosome and histones.

## UNIT V

Vitamins and Minerals:

Vitamins: Definition, classification, fat soluble vitamins- sources, structure and physiological functions; water soluble vitamins-sources, structure and physiological functions.

Minerals: Mineral requirement, essential macro minerals and essential micro minerals. Sources and functions.

## REFERENCES:

1. Ambika shanmugam, Fundamentals of Biochemistry for Medical students.
2. Deb, AC, Fundamentals of Biochemistry, New central Agency, Calcutta, 3rd edition, 1989.
3. Lehninger. A.L., Nelson .D.L., Cox. M M, Principles of Biochemistry, CBS Publishers, 2nd edition, 1993.
4. Lubert stiver, Biochemistry, Freeman and company, 4th edition, 1995.
5. Harpers text book of biochemistry- Revised edition, 2004.

**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 Electrolytes

Serum Globulin

Serum Iron

Serum Phosphorus

Plasma Fibrinogen

Serum Potassium

Total Serum Proteins

Serum A/G ratio

Triglycerides

Bicarbonate

Bilirubin

Serum Chloride

Cholesterol

Glycosylated Hb

HDL Cholesterol

LDL Cholesterol

Serum Uric acid

Serum Sodium

VLDL Cholesterol

The following Biochemical parameters in Urine:

Protein

Potassium

Calcium

Copper

Creatinine

Phosphorus

Urea

Spot Phosphorus

Spot Potassium

Spot Sodium

Spot Urea

Spot Uric acid

Bence Jones Protein

Spot Calcium

Porphyryns

**SEMESTER II**  
**SUBJECT TITLE: CORE PAPER 111 -BIOCHEMISTRY II - 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.

**UNIT-I**

An overview of cells:- origin and evolution of cells. Cell theory. Classification of cells:- prokaryotic and eukaryotic cells: comparison of prokaryotic and eukaryotic cells. Molecular composition of cells:- Water, carbohydrates, lipids, nucleic acid and proteins.

**UNIT-II**

Cell membrane:- Fluid mosaic model of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their role.

Transport across membrane:- Diffusion ,active and passive transport.

**UNIT-III**

Endoplasmic reticulum:- Types, structure and functions. Golgi apparatus:- structure and functions. Lysosomes:- structure and functions, morphology and functions of peroxisomes and glyoxysomes.

**UNIT-IV**

Mitochondria:- structure and functions. Biological oxidation- Electron transport chain, theories of oxidative phosphorylation, uncouplers and inhibitors of oxidative phosphorylation.

Cytoskeleton: Types of filaments and their functions. Microtubules:- chemistry and functions : cilia and flagella.

**UNIT-V**

Nucleus: - structure and functions. Chromosomes; chromatin structure.

The cell cycle:-Phases of cell cycle. Meiotic and mitotic cell divisions.

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

Oncogenes: Retro viral, proto, tumor suppressor gene.



**REFERENCES:**

1. Cell biology organelle structure and functions, 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. De Robertis. E.D.P.E.M.R. Robertis. 7th edition (1980) Cell and molecular biology, Saunders Company.
5. Harvey Lodish, Baltimore Arnold Berk, et al (1995) 3rd ed Molecular cell biology.

**SEMESTER III**

**SUBJECT TITLE : CORE PAPER IV.  
MICROBIOLOGY I - GENERAL MICROBIOLOGY**

**SUBJECT DESCRIPTION :**

This course presents the Morphological characteristics of Micro organisms, their cultivation methods, identification. Life cycle, economic importance and microbial diseases.

**GOALS:** To enable the students to learn the basic functions and components of microorganisms and their economic uses.

**OBJECTIVES:**

On successful completion of the course the student should have:

Understood the structure and types of microorganisms

Learnt the economical uses of microorganisms

Learnt about the pathogenesis of various microbes in the environment

**UNIT-I**

Historical introduction - with special reference to the contribution of Louis Pasteur, Joseph Lister, Robert Koch, Edward Jenner and Alexander Fleming; Importance of microbiology in laboratory medicine.

**UNIT-II**

Classification of microorganisms; Microscopy- Light microscope, Dark-ground microscope, Fluorescent microscope, Phase contrast microscope, and Electron microscope; Observation of micro-organism - Wet preparations, Staining preparations; Anatomy of Bacterial cell; Morphological Classification of bacteria with example.

**UNIT -III**

Morphology of viruses, classification and cultivation of viruses; plaque assay.

Phages: - T4 Phages stages - lifecycle; synthesis and assembly of protein

Lambda Phages - Life cycle; switch between lysogeny and lytic cycle.

RNA viruses: - Retroviruses and life cycle- HIV.

DNA viruses: - Oncogenic viruses.

Mechanism of oncogenesis.

#### UNIT- IV

Microbial diseases: - Normal human micro flora; host - parasitic interaction; epidemics; exo Endotoxins.

Air borne diseases: - Aetiology, symptoms and prevention of Tuberculosis, Diphtheria, Polio - myelitis and Influenza, Food and Waterborne diseases:- Aetiology, symptoms and pathogenesis of Typhoid, Cholera, Bacillary dysentery and Hepatitis.

Direct contact disease: - Aetiology and symptoms of Rabies

#### UNIT –V

Water microbiology: - Microbes in water, Bacteriological examination of water; sewage and its treatment; purification of drinking water.

Soil microbiology: - Symbiotic and Non- symbiotic Nitrogen fixing organisms: Rhizosphere

Food microbiology ; Microbiology of food borne diseases- Botulism, Salmonellas, Staphylococcal poisoning Perfringens poisoning and Mycotoxins.

#### REFERENCES:

- 1 .Mackie and McCartney - Practical Medical Microbiology by J.G.Collee/A.G. Frazer, B.P. Marimion/A.Simmon
2. Textbook of Microbiology by Ananthanarayan,R and Jayaram Panicker.K.
3. Pelczer J, R E. C .S John Noel R Krieg, Microbiology: MC Graw Hill Book Company, 1986.
4. Prescott L. M; J.H Harley and D. A Klein, Microbiology, C. Brown Publishers, 1993.
5. Ronald M. Atlas, Microbiology-Fundamentals and Applications, Macmillan Publishing Company, New York, 1993.

### **SEMESTER III**

#### **SUBJECT TITLE : CORE PAPER V. PATHOLOGY - I PRINCIPLES OF PATHOLOGY AND CLINICAL PATHOLOGY**

#### **SUBJECT DESCRIPTION :**

This course provides precise information of techniques for pathological and clinical analysis.

**GOALS:**To students will have the knowledge about the histopathology, clinical pathology and methods of analysis of various specimens.

#### **OBJECTIVES:**

After completion of this course the student would have understood:

- Techniques in histopathology.
- Examination of urine and stool.
- Serum analysis.
- Calculi analysis.

## UNIT-I

### Histopathology:

#### Introduction to histopathology.

- Receiving Specimens in Laboratory
- Grossing techniques

Various fixatives - Mode of action, Indications, Preparation  
Decalcification of calcified tissue before sectioning

- Processing of tissues for routine paraffin sections and other methods of embedding.

## UNIT II

### Laboratory organization

Reception of organization, dispatch of reports, "Records keeping" coding the lesions of cases

Follow up programme, quality control of techniques etc.,

## UNIT-III

### Clinical pathology.

#### 1. Urine examination

Physical .

Chemical

Microscopic

#### 2. Stool examination.

## UNIT - IV

Examination of body fluids, cell counts

Ascitic fluid, pleural fluid, synovial fluid, pericardial fluid, urinary calculi.

## UNIT-V

Semen analysis

CSF ( Cerebro Spinal Fluid )

## REFERENCES:

1. Todd and Sanford, Clinical diagnosis by laboratory method.
2. Culling -Histopathology techniques.
3. Dycie and Lewis -Practical haematology.
4. Ramani Sood, Laboratory technology (Methods and interpretations) 4th Ed. J.P. Bros, New Delhi, 1996.
- 5 Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi.

**SEMESTER III**  
**SUBJECT TITLE: CORE PAPER VI. BIOCHEMISTRY-III**  
**ENZYMOLGY & INTERMEDIARY METABOLISM**

**SUBJECT DESCRIPTION:**

Enzymes are protein catalyst that regulates the rates at which physiological process takes place. Consequently defects in enzyme function frequently cause diseases. Hence, sound knowledge about enzymes is essential for life science students.

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, different types of enzymes and its isolation and purification which will pave the ways in which the students can enter in research field..

**OBJECTIVES:**

Provides much information related to carbohydrate, fat and protein metabolism that takes place in our body. On successful completion of the course the students will acquire knowledge about

Interrelationship between carbohydrate, fat and protein metabolism.

Role of purine and pyrimidines in nucleic acid metabolism.

Various disorders related to each metabolism.

Techniques of isolation & purification of the enzymes.

Kinetics of the enzymes

Enzymes that are used in medicine and industry

**UNIT-I**

Enzymes: Introduction, International classification of enzymes, six main classes of enzymes. Extraction, purification and characterization of enzymes.

Factors affecting enzyme activity, Enzyme kinetics- Michaelis menten equation(M.M Equation), Lineweaver burk plot. Mechanism of chymotrypsin and lysozyme.

**UNIT-II**

Enzyme Inhibition: Competitive, Non-competitive and uncompetitive enzyme inhibition . Co-enzymes: Definition, structure and functions of thiamine pyrophosphate, nicotinamide, flavin nucleotides, coenzyme A, biotin and folate coenzymes. Metal cofactors (Mechanism of action of coenzymes are not required). Use of enzymes in analysis, enzyme electrodes, Biosensors.

**UNIT-III**

Metabolism of carbohydrates:

Glycolysis: Introduction, overview, pathway and energetics.

Oxidation of pyruvate to acetyl Co A.

TCA Cycle. Introduction, overview, pathway and energetics. Amphibolic nature of TCA Cycle.

Glycogenesis and glycogenolysis: Introduction, overview pathway and energetics.

Pentose phosphate pathway (HMP Shunt).

#### UNIT-IV

Metabolism of proteins.

Fate of dietary proteins , metabolic nitrogen pool.

Catabolism of amino acid- oxidative deamination, non-oxidative deamination, transamination, decarboxylation.Catabolism of glycine, phenylalanine, and tyrosine.

Lipids:

Fate of dietary lipids, Biosynthesis of saturated Fattyacids. Extra mitochondrial and microsomal system for synthesis of fatty acids.

Oxidation of fatty acids, alpha oxidation, beta oxidation and omega oxidation.

Biosynthesis of phospholipids.

#### UNIT-V

Metabolism of Nucleic acids:

Metabolism of purines. Introduction, biosynthesis , de novo synthesis , salvage pathway and catabolism of purines.Regulation of purine metabolism.

Metabolism of pyrimidines Introduction, biosynthesis , de novo synthesis , salvage pathway and catabolism of pyrimidines,Regulation of pyrimidine metabolism.

#### REFERENCES:

Lehninger L.S., et.al. Principles of Biochemistry.CBS Publishers. 2nd edition, 1993.

Murray.K.Robert.et.al., Harpers Biochemistry, 2 Isl edition, 1988.

Voet and Voet. Biochemistry.John Wiley & Sons, 2<sup>nd</sup> edition, 1995.

Trevor palmer,Understanding enzymes, F.lis Horwood Ltd, 3rd edition,

Enzyme technology -Chapline & Bucke.

### **SEMESTER III & IV. BIOCHEMISTRY PRACTICAL II**

Determination of the following Enzymes

Acid phoshatases

Alkaline phoshatases

Alpha- Amylase

CPK

CPK MB

I. DM

Cholinesterase

SGOT

SGPT

Gamma GT

Determination of the Hormones:

Beta HCG  
CEA  
Free T3  
Free T4  
FSH  
Progesterone  
Prolactin  
PSA  
T3  
T4  
Testosterone  
TSH  
Alpha feto protein

Determination of Immunoglobulins

IgA  
IgE  
IgG  
IgM  
Serum Immunoglobulins

Determination of the following in CSF

Cellcount  
Chloride  
Glucose  
Protein  
CSF analysis (Comp)  
Globulin

Determination of the following

Arterial Blood gas analysis  
Glucose Tolerance Test  
Electrophoresis of plasma proteins.  
Inborn Errors of Metabolism  
Iron Binding capacity  
Lipid Profile  
Liver Function Test  
Paper Chromatography – Urine  
Partial Thromboplastin  
Pertioneal Fkuid Analysis  
Pleural fluid Analysis  
Prothrombin Time  
Renal Calculi analysis  
Renal Function Test  
Urea Clearance Test

## **SEMESTER III (DIPLOMA) NUTRITION THROUGH LIFE CYCLE**

### **UNIT I**

Concept of different food groups, recommended dietary allowances for Indian's, basis for requirement, computation of allowance.

Nutrition in pregnancy - nutritional requirements, storage of nutrients, physiological cost of pregnancy, complications of pregnancy, implications of public health and prophylaxis programme for pregnant women.

### **UNIT II**

Nutrition in Lactation – special foods during lactation, nutritional requirements during lactation, implications of public health programmes.

Nutrition in infants – Rate of growth, weight as the indicator, premature infant, feeding premature infants, low birth weight, nutritional allowances, supplementary feeding, weaning foods.

### **UNIT III**

Nutrition in Preschool Children – Growth and development of preschool children, prevalence of malnutrition (Vitamin A, infection, anaemic, IDD) in preschool age, nutritional requirements, supplemental foods, feeding programmes for preschool children.

Nutrition in School Age – Early and middle childhood, physiological development, food habits, nutritional needs and feeding, RDA, Foods habits and intervention programmes and its implications.

### **UNIT IV**

Nutrition During Adolescence – Physical growth, physiological and psychological problems associated with pubertal changes, nutritional needs, eating disorders – anorexia bulimia, nutrition and medical problems in adolescent pregnancy and its requirements and complications.

Nutrition During Adulthood – Nutrition and work efficiency, basis for requirements, RDA.

### **UNIT V**

Nutrition for Old Age – socio economic and psychological factors – nutritional requirements, factors affecting food intake, clinical needs and malnutrition, institutionalized changes in old age. Advances in geriatric nutrition.

Exercise and thermogenesis, role of carbohydrate, fat and protein as a fuel for exercise, fluid and electrolyte balance during prolonged exercise, nutritional requirements in sports, dietary intake before, during and after exercise.

### **REFERNCES**

Vinodhni Reddy, Prahlad Rao, Govinth Sastry and Kashinath, “Nutrition Trends in India”, NIN, Hyderabad, 1993.

Sahills, E.M. Olson, A.J. and Shike, Lea and Febiger, "Modern Nutrition in Health and Diseases".

Frances, J.Zeman, Nutrition and Dietetics, 1983.

B. Srilakshmi, "dietetics", New Age International Pvt.Ltd., 2003.

B. Srilakshmi, "Nutrition Science", New Age International Pvt. Ltd., 2003.

## **SEMESTER IV**

### **SUBJECT TITLE: CORE PAPER VII. MICROBIOLOGY II**

#### **SUBJECT DESCRIPTION:**

This course provides the precise information of systemic bacteriology.

**GOALS:**To enable the students to learn the basic sterilization procedures and thorough knowledge about bacteriology.

#### **OBJECTIVES:**

On successful completion of the course the students should have understood:

Clostridium group of organisms.

Mycobacterium tuberculosis.

Rickettsials.

Borrelia.

#### **UNIT-I**

Sterilisation -Definition,Physical agents employed with example, Sterilization controls;Disinfection-Definition,Classification of Chemical methods of disinfection, its mechanism; Testing of disinfectants;

#### **UNIT II**

Bacterial growth and nutrition; Bacterial metabolism; Bacterial genetics and variation; Artificial culture media; Identification of bacteria-Morphology, Culture, Biochemical reactions, antigenic character, typing of bacteria, animal pathogen city and toxicogenicity tests.

#### **UNIT-III**

Brief morphological Feature, Colonial morphology, identification characters,laboratory diagnosis and porpylaxin of the following microorganisms a) cocci- Staphylococci,Streptococci,Pneumococci.Neisseria b) Bacilli- Cornybactrium, Diptheriae,Bacillus anthraciae,Clostridium tetani.

#### **UNIT-IV**

Clostridium group of organisms,Enterobacteriaceae.Pseudomonas , Vibrio Cholerae, Brucella,Yersenia;Heamophilus and Bordetella.

#### **UNIT-V**

Borrelia; Treponema; Leptospira; Rickettsiales; Chlamydiae. Mycobacterium tuberculosis.Mycobacterium leprae. Antibiotics- Definition, Classification, Modes of action, Antibiotic susceptibility testing.



REFERENCES:

1. Bailey and Scott, Diagnostic microbiology by Sydney M. Finegold and Ellen Jo Barbara
2. Medical Microbiology by Satish Gupta
3. Mackie and McCartney - Practical Medical Microbiology by J.G. Collee/A.G. Frazer, B.P. Marimion/A. Simmon
4. Textbook of Microbiology by Ananthanarayan, R and Jayaram Panicker. K.

**SEMESTER IV**  
**SUBJECT TITLE: CORE PAPER VIII. PATHOLOGY II**  
**HISTOPATHOLOGY**

**SUBJECT DESCRIPTION** This course provides the information about instruments and techniques used in histopathology.

**GOALS** To enable the students the basic procedures of histopathology.

**OBJECTIVES**

On successful completion of this course the students would have understood:

Instruments used in Histopathology.

Techniques.

Maintenance of slides.

Microphotography.

**UNIT-1**

1. Instrumentation:

a) Tissue Processor b) Knife sharpener c) Automatic slide stainer d) Microtome, knives e) Freezing microtome; Cryostat f) Instruments for grossing g) Electric saw.

**UNIT-II**

Frozen section techniques: Co<sub>2</sub> Freezing, Cryostat and freezing microtome.

Techniques and principles of sections cuttings and routine staining, and special stains.

Mounting Techniques, various mounting lining.

**UNIT-III**

Use of microscope, polarisers.

Introduction to Electron Microscopy and technique of preparing slides

**UNIT-IV**

Maintenance of records and filing slides, Familiarisation with computer.

Microphotography - technique.

**UNIT-V**

Museum technology- preservation,

Coding-. ICDS - Classification.

#### REFERENCES:

1. Todd and Sanford, clinical diagnosis by laboratory method.
2. Culling -Histopathology techniques.
3. Dycie and Lewis -Practical haematology.
4. Ramani Sood, Laboratory technology (Methods and interpretations) 4th Ed. J.P. Bros, New Delhi, 1996.
5. Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi.

### **SEMESTER IV** **SUBJECT TITLE: CORE PAPER IX. BIOCHEMISTRY-IV** **CLINICAL BIOCHEMISTRY**

#### SUBJECT DESCRIPTION

This course emphasizes the students to realize the diagnostic importance of various metabolic disorders.

**GOALS** This course enables the students to know the clinical aspects of various metabolic disorders.

#### OBJECTIVES

This course would have made the students understand the significance of diagnostic biochemistry.

#### UNIT I

Disorders of carbohydrate metabolism : Normal sugar level in blood, renal threshold and regulation of blood glucose concentration.

Hypoglycemia - Definition and causes.

Hyperglycemia - Definition and causes.

Diabetes mellitus: Introduction, aetiology, types of diabetes mellitus, clinical pathology and diagnosis. Urine testing, random blood sugar and GTT.

Glycosuria, differential diagnosis of glycosuria, complication of diabetes mellitus-

Diabetic ketoacidosis, Diabetic coma, Fructosuria, pentosuria, Galactosemia, and

Glycogen storage diseases.

#### UNIT II

Disorders of Lipid Metabolism: Plasma lipids and lipoproteins - Introduction.

Hyperlipoproteinemia - Type I, II, III, IV, V and alpha- lipoproteinemia. Hypolipoproteinemia -

A - beta lipoproteinemia, Hypo- beta - lipoproteinemia, Tangiers disease and LCAT ( Lecithin Cholesterol Acyl Transferase) deficiency; Artherosclerosis. Fatty liver and hyper lipidemia,

Hypercholesterolemia, and Hypocholesterolemia, Lipidosis and Xanthomatosis. Taysch's diseases, Niemann - Pick disease.

#### UNIT III

Disease of Aminoacid Metabolism; Plasma proteins.

Abnormalities: Total plasma ( serum ) proteins, Fibrinogen, Albumin, Pre-albumin, and Globulins. Abnormal Non- protein Nitrogen: Urea, Uric acid, Creatinine, and Ammonia, Prophyria.

Aminoacid Metabolism: Cystinuria, Phenylketonuria, Maple Syrup Disease, Alkalptonuria, Albinism, and Hartnup disease.

Disorders of Purine and Pyrimidine metabolism:

Disorders of purine metabolism: Normal level of uric acid in blood and urine, miscible uric acid pool. Hyperuricemia and Gout; Hypouricemia - Xanthinuria and Xanthinolithiasis.

Disorders of Pyrimidine metabolism: Orotic aciduria

#### UNIT IV

Gastric, Pancreatic and Intestinal Functions

Gastric function: Introduction, Tests for gastric function- The Insulin Stimulation test, determination of Gastrin in serum and Tubeless gastric analysis.

Pancreatic function: Introduction, pancreatic function tests, serum amylase and lipase; direct stimulation test, indirect stimulation test,

Intestinal function: Introduction, Test used in the diagnosis of malabsorption- determination of total faecal fat ( fat balance test), test of monosaccharide absorption (xylose excretion test) and determination of total protein ( Lowry's method).

#### UNIT V

Liver disease and liver function tests: Introduction, bilirubin metabolism and jaundice, Liver function tests, Estimation of conjugated and total bilirubin in serum ( Diazo method), detection of bilirubin and bile salts in urine ( Fouchet's test and Hay's sulphur test), Thymol turbidity test, Prothrombin time. Serum enzymes in liver disease- serum Transaminases- SGPT, SGOT and Lactate dehydrogenases (LDH).

Kidney Function test: Introduction, physical examination of urine, elimination tests, Clearance tests- Inulin clearance test, Creatinine clearance and Urea clearance tests, Renal blood flow and filtration fraction.

#### REFERENCES:

1. Burtis A. Carl and Edward R. Ashwood. Tietz Text book of Clinical Chemistry. W.B. Saunders Company, 2nd edition. 1994.
2. Philip D. Maync. Clinical Chemistry in Diagnosis and Treatment. ELBS Publications, 6th edition, 1994.
3. Varley . Text book of Clinical Biochemistry.
4. Montgomery, Conway, Spector. Biochemistry- A case oriented approach. C.V Moshby Company,  
5 edition, 1990.

**SEMESTER IV (DIPLOMA)**  
**DIET THERAPY**

**UNIT-I**

Diet therapy – Definition, Principles, classification of therapeutic diets. Routine Hospital diet – Regular diet, Light diet, soft diet, clear diet, full fluid diet. Professional code and ethics for dietetician, Indian dietetic Association.

**UNIT – II**

Modification of Diet for fever, Infection, Diarrhea, constipation, Gastritis and peptic ulcer.

**UNIT – III**

Dietary Management in Diabetes Mellitus, Acute and Chronic Cardiac disease, Hypertension, Atherosclerosis, Congestive heart failure, Sodium restricted diet.

**UNIT- IV**

Dietary management in kidney disease – nephrosis, acute renal failure, acute and chronic glomerulonephritis, kidney transplant and dialysis.

**UNIT – V**

Diet in relation to deficiency disease – Protein Calorie deficiency, Vitamin A deficiency, Anaemia.

Obesity, Underweight, Importance of Maintenance diets.

**REFERENCES**

Townsend, C.E and Roth, R.A (1999) Nutrition and Diet Therapy, 7th edition, Delman Publishers.  
Gopalan,C. and et al (1996), Nutritive value of Indian foods.  
Mohar,L.K and Stump,S.E.(2000) Food, Nutrition and Diet Therapy, 10th edition, W.B.Saunders Company.

**SEMESTER V**  
**SUBJECT TITLE: CORE PAPER X. MICROBIOLOGY III**

**SUBJECT DESCRIPTION**

This course provides the information regarding serological tests, skin tests, hospital infection and diagnostic methods for viral diseases.

**GOALS**

To enable the students to have precise knowledge in endemic, epidemic and pandemic disease, viral infection, malaria etc.

**OBJECTIVES**

On successful completion of the course students should have understood:

Microbial pathogenicity.  
Viral diseases.  
Dermatophytes and mycetoma.  
Malaria and different types of worms.

#### UNIT -I

Factors pre disposing to microbial pathogenicity- Sources of infection-Susceptible host - Mean of transmission- Definition and example of endemic , epidemic.and paradigmic.

#### UNIT-II

Normal Flora- Collection and transport of Clinical species, Infective syndromes and their diagnostic procedures (Respiratory tract infections, Intestinal infections, Urinary tract infections,Meningeal infections, Wound infections; Reproductive system infections :Pyroxia;

#### UNIT- III

Serological tests - widal; Brucella agglutination tests; Aso test; Cold agglutination tests,Paul Bunner Tests, Weil relic test.  
Skin Tests (Tuberculin;Lepromin; Fries test and Colonies test)  
Hospital infection-Definition,aetiology, Laboratory diagnosis

#### UNIT-IV

General properties of Viruses- Viral diagnostic methods of Poliomyelitis,Hepatitis,Rabies and HIV

#### UNIT-V

Brief outline on Caudidiasie,Cryptocococolin,Dermatophytes and Mycetoma  
Brief outline on Giardian , Malaria, Round worm, Hook Worm, Pin Worm. Tape, worm and Fluke worm.

#### REFERENCES:

- 1.. Textbook of Microbiology by Ananthanarayan,R and Jayaram Panicker.K.
2. Parasitology (Protozoology and Helminthology) By K.D.Chatterjee. 3. Clinical diagnosis and Management By Laboratory methods - ToDD Stauford Davidson.
4. Mackie and McCartney - Practical Medical Microbiology by J.G.Collee/A.G. 1 ra/.ei, B.P. Marimion/A.Simmon

### **SEMESTER V**

#### **SUBJECT TITLE: CORE PAPER XI. PATHOLOGY III - HAEMATOLOGY**

#### **SUBJECT DESCRIPTION:**

The paper encompasses the basic concepts of hematology and the diseases related to it.

#### **GOALS:**

To enable the students to acquire knowledge about the composition of blood and the laboratory methods to identify the various disorders related to it.

#### **OBJECTIVES:**

On successful completion of the course the students should have understood:

Composition of blood.  
Methods for the determination of blood cells and staining techniques.  
Techniques of bone marrow aspiration  
Various diseases related to it.

## UNIT I

Introduction

Blood collection

Anticoagulants used in Haematology

Normal values in Haematology

Basic Haematological techniques

- a. RBC Count
- b. Haemoglobin estimation
- c. Packed cell volume
- d. WBC counts - Total and differential
- e. Absolute eosinophil count
- f. Platelet count
- g. Erythrocyte sedimentation rate
- h. Reticulocyte count

Preparation of blood films

Stains used in Haematology

Morphology of red cells

Morphology of Leukocytes and platelets

Bone marrow

- a. Techniques of aspiration, preparation and staining of films
- b. Bone marrow biopsy
10. Preparation of buffy coat smears.

## UNIT II

Laboratory methods used in the investigation of anemia:

- a. B 12 and folate assay
- b. Schilling test
- c. Serum iron and iron bonding capacity

Laboratory methods used in the investigation of haemolytic anaemias:

- a. Osmotic fragility
- b. Investigation of G-6 PD deficiency
- c. Test for sickling
- d. Estimation on of Hb-F, Hb-A2
- e. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
- f. Haemoglobin electrophoresis
- g. Test for auto immune hemolytic anaemias
- h. Measurements of abnormal Hb pigments.

## UNIT- III

Investigation of Haemorrhagic disorders

- a. Mechanism of coagulation

- b. Collection and anticoagulants used in coagulation studies
- c. Bleeding time and clotting time
- d. Other coagulation studies PT, KPTT, TGT, etc.,
- e. Assay of clotting factors

#### UNIT-IV

Test for blood fibrinolytic activity and detection of FDP Platelet function tests Demonstration of LE cells Cytochemistry

#### UNIT-V

Automation in haematology

Organisation and quality control in haematology laboratory

Preparation of glassware and disposal of the waste in the laboratory

#### REFERENCES:

1. Todd and Sanford, clinical diagnosis by laboratory method.
2. Culling -Histopathology techniques.
3. Dacie and Lewis -Practical haematology.
4. Ramani Sood.Laboratory technology\*Methods and interpretations 4 th Ed. J.P. Bros, New Delhi, 1996.
5. Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi.

### **SEMESTER V**

### **SUBJECT TITLE: CORE PAPER XII. BIOCHEMISTRY V NUTRITION AND CANCER BIOLOGY :**

#### SUBJECT DESCRIPTION:

This course provides the basic concept of nutrition, therapeutic diets and cancer biology.

#### GOALS:

To enable the students to acquire knowledge in the field of principles of nutrition, diets, cancer biology, endocrinology and free radical biology

#### OBJECTIVES:

On successful completion of the course the students should have understood:

Basics of nutrition.

Diets for different diseased conditions.

Different types of cancer and its treatment

Enzymic and non-enzymic antioxidants.

#### UNIT-I

Objectives of diet therapy. Principles of diet preparation and counseling.

Dietary treatment of kidney diseases.

Diet in allergy-definition,classification and common food allergy tests of allergy,dietetic treatment

## UNIT-II

Therapeutic diets for the following disorders.

- a. Underweight - definition, etiology, treatment.
- b. Obesity-definition, etiology treatment, diseases of the gastro intestinal tract.
- C. Peptic ulcer and duodenal ulcer.
- d. Dumping syndrome, constipation.
- e. Acute and chronic diarrhea- dehydration, therapy.
- f. Diabetes, anaemia, hypertension.

## UNIT III

Cancer Biology

Classification, characteristics of the cancer cells, factors causing cancer, chemical Carcinogenesis, and role of radiation in Carcinogenesis.

Classification and characteristics of tumor antigen, detection of myeloma protein , alpha feto protein and prostate specific antigens.

## UNIT IV

Endocrinology

Hormones - Definition, local and general hormones, properties of hormones, mechanism of action - AMP, major endocrine glands and their location.

General characteristics, biosynthesis and action of peptide hormones, adrenal hormones, thyroid hormones and pancreatic hormones.

Vasoactive peptide hormones and sex hormones.

## UNIT V

Free Radical Biology

Process of Lipid peroxidation, measurement of lipid peroxidation, pathological consequences of lipid Peroxidation.

Formation of free radical. Free radical in tissue injury and cancer Enzymic antioxidants - chemistry, mechanism, antioxidant effect of SOD, Catalase, Glutathione peroxidase

Non- Enzymic antioxidants - chemistry, mechanism, antioxidant effect of vit A, vit C, vit E, Glutathione and selenium.

## REFERENCES:

Food, Nutrition and Diet Therapy. 6th Edition. Kraure and Mohan. WB Saundaers Company, London.

Clinical Dietetics and Nitrition. Anitha . F.P. Oxford University press, NewDelhi.

Fundamentals of Clinical Chemistry. TeitzN.W. ( 1994). W.B. Saunder's Company

Molecular biology of Cell. Alber ts & Bray ( 1994). Garlind Publishers.

Biochemistry of oxygen toxicity. Annual Review of Bioc lemistry. Enrique Cadinar, Vol 58, 1989, pp 78- 110.

Free radicals in biology. William A. Pryor, Academic Press, 1980, pp 96 - 150.

Vitamins- Annual research review. Horrobin, Eden Press Pub., Vol. 1980.



**SEMESTER V      SUBJECT TITLE: CORE PAPER XIII**  
**BLOOD BANKING AND IMMUNO HEMATOLOGY**

**SUBJECT DESCRIPTION:**

This course provides the information about blood transfusion, hurdles and diseases related to it.

**GOALS:**

To enable the students to acquire knowledge about the blood grouping, methods of blood transfusion and cytogenesis.

**OBJECTIVES:**

On successful completion of the course the students should have understood:

Blood group systems.

Investigation of transfusion reactions.

Care and selection of blood donors

Cytogenetics.

**UNIT-I**

ABO Blood group system, Rh typing and weaker variants in Rh system, Subgroup and weaker variants of A and B and Bombay phenotype.

**UNIT-II**

Preparation and standardization of anti human globulin reagent, Coomb's test. Blood grouping and cross- matching in blood bank, investigation of transfusion reaction.

**UNIT-III**

Care and selection of donors, Role of Australia antigen and hepatitis C virus (HCV) in Blood transfusion, Screening for Australia antigen and HCV HAL antigens and their significance in blood transfusion.

**UNIT-IV**

Preparation o blood, principles and its application in Blood banking, Component therapy in clinical practice, Blood Bank administration, Screening the blood for infective material.

**UNIT-V**

Cytogenetics:

Human genetics, an introduction to the subjects.

Terminology classifications and nomenclature of human chromosomes.

Methods for karyotypic analysis

a. Culture of bond marrow, peripheral blood lymphocytes, solid tumors, skin fibroblast, etc.

b. Direct preparations from tumor material.

4.Characterisation of human chromosomes by various banding techniques

5. Sex chromatin identification.
6. Karyotyping and analysis of chromosomal abnormalities.
7. Common chromosomal observations in cancer, mechanisms of their production and of oncogenes.

#### REFERENCES:

1. Guyton, Textbook of Physiology. 8th Eds. Prism Publishers. Bangalore. 1991.
2. Chatterjee, Human Physiology, 10th F.ds., Medical Allied agency.
3. Choudhari, Concise Medical Physiology, 1st, Eds, New Central Books, Calcutta, 1993.
4. Ganong (Willams), Review of Medical Physiology, 18th eds., Appliton and Lange, 1997.,

### **SEMESTER V & VI CORE PRACTICALS III – MICROBIOLOGY**

#### Unit I

1. Safety in the microbiology Laboratory; Instruments in Microbiology laboratory- Use and Care. ( Centrifuge, Balance, Refrigerator, Hot air oven. Autoclave, Incubator, Anaerobic Jar, Incubator loop, Magnifying lens, suction pump, Elisa Reader, VDRL Western blot, shaker) ..
2. Microscopy
  1. Hanging drop preparation
  2. Staining reactions
  3. Preparation of sterile container
  4. Preparation of Culture media
  5. Inoculation of Culture media
  6. Study of Colonial morphology
  7. Tests for the identification of Bacteria- Media Preparation; Method of inoculation; Observation of results
  8. Antibiotic susceptibility tests

#### Unit II

9. Cultural, Biochemical and identification tests of  
10. Staphylococci  
Streptococci  
Neisseria  
13. Corynebacterium diphtheriae  
14. Salmonella  
15. Shigella  
16. Pseudomonas  
17. E. Coli 18. Klebsiella

#### Unit III

19. Culture characteristics of Candida, Aspergillus, Mucor, Rhizopus, Penicillium - Block culture technic, Wet Ash staining procedure for fungal observation.

#### Unit IV

Serological tests ; Widal, Brucella, Aggulation tests, Weil Felix test, Cole Aggulation test, Pregnancy test, Latex Test ( RF, ASO, CRP ), ELISA test ( HIV, HbsAg, TORCH), Western blot test ( HIV ).

#### Unit V

Demonstration of bacteriological analysis of water milk and air.

### **SEMESTER V& VI PRACTICALS IV - PATHOLOGY CLINICAL PATHOLOGY**

(i) Examination of urine sample.

a. Physical examination: Volume, colour, odour, appearance, specific gravity and pH.

b. Chemical examination:

Protein - Heat and acetic acid test, sulphosalicylic acid method.

Reducing sugar - Benedicts test:

Ketone Bodies - Rotheras test.

Bile pigment - Fouchets method.

Bile salts - Hay's test.

Blood - Benzidine test.

Urobilinogen and porphobilinogen- Orhlich's aldehyde and schwarta test.

Bence Jone's protein.

c. Microscopic examination.

(ii) Stool examination.

a. Physical examination.

b. Chemical examination - Occult blood

-Reducing sugar.

c. Microscopic examination for ova, cysts, crystals and fat globules.

(iii) Semen analysis.

(iv) C.S.F Examination.

(v) Examination of body fluids - pleural , pericardial and peritoneal fluid, (vi) Synovial fluid analysis.

#### **HISTOPATHOLOGY:**

##### **Part I:**

Grossing techniques.

Preparation of various fixatives

Decalcification of calcified tissue before sectioning.

Processing of tissue for routine paraffin sections and other methods of embedding.

##### **Part II:**

Rotary microtome, microtome knives.

Techniques and principles of honing and sharpening, section, cutting.

Mounting techniques and various mounting medias.

4 Routine haematoxylin and Eosin staining.

5. Special stains.
  - a. Periodic acid schiff stain.
  - b. Alcian blue pH 1 and pH 2.5.
  - c. Mucicarmine- southgateds method.
  - d. Reticulin-Gordon and vmeets method.
  - e. Van-gieson stain.
  - f. Masson's trichrome- methods.
  - g. PTAH.
  - h. VerhoefFs Vangieson stain for elastic fibres.
  - i Perks-Purssian blue stain
  - j. Masson- Fontana method of stain melanin pigment and melanin bleach
  - k. Frozen section- Demonstration- freezing microtome, crystat.
  - l. Museum technique- Demonstration.

#### HAEMATOLOGY

Haemoglobin estimation by cyanmethaemoglobin method.

R.B.C total count.

W.B.C total count-Micropipette method and bulk dilution.

Platelet count-Direct and indirect method.

Absolute eosinophil count.

Reticulocyte count.

Preparation of blood smears and staining with Leishman stain.

Differential W.B.C Count.

Packed cell volume- Wintrobe's method.

Calculation of erythrocyte indices.

Erythrocytes sedimentation rate- wetergrens methods.

Osmotic fragility test.

Sickling test

Bleeding time and clotting time.

Preparation of buffy coat smears and demonstration of L.E cells.

Bone marrow smear preparation and staining procedure.

Demonstration of malarial parasites and microfilaria by smear and fluorescent method.

### **SEMESTER V (DIPLOMA PAPER III) CLINICAL NUTRITION**

#### UNIT – I

Diseases of GI tract: Effect on digestion, absorption and nutritional status.

Clinical manifestations in – Diarrhea, constipation, Gastritis, Colitis, Ulcer.

Malabsorption syndrome.

#### UNIT – II

Diseases of Liver, Gall bladder and Pancreas: Etiology, Symptoms, Metabolic and Clinical implications of Hepatitis, Cirrhosis and Hepatic coma.

Pancreatitis, Cholecystitis, Cholelithiasis.

### UNIT –III

Carbohydrate Metabolism disorder & Renal disorder:

Diabetes, Inborn errors of metabolism, Gout.

Renal disorders – Aetiology, symptoms, Metabolic and Clinical implications of nephritis, Renal failure, Renal Calculi.

### UNIT –IV

Cardiovascular Disorder: Aetiology, symptoms, Metabolic and Clinical implications of hypertension, Atherosclerosis, Cardiac failure.

### UNIT –V

Nutritional therapy: Nutritional therapy and conditions like burns, Trauma Sepsis, HIV infection, Anaemia, Pulmonary disease, neurological disease, Food allergy and food intolerance.

### REFERENCES

Shils, E.M. Olson, A.J Aand Shike (1994) – Modern nutrition in health and diseases, Vol –II.

Anderson,L,(1982),Nutrition in health and diseases,17th edition.

Davidson Passmore,P.and Break,J.P.(1986),Human nutrition and Dietetics.

## **SEMESTER VI**

### **SUBJECT TITLE: CORE PAPER XIV**

### **IMMUNOLOGY AND IMMUNO TECHNIQUES**

#### **SUBJECT DESCRIPTION:**

This course will provide the basic concepts of immunology which follows the course of immune response. The course will introduce the various mechanisms by which microbial pathogens cause disease and the interaction with the host.

**GOALS:**To enable the students to acquire a knowledge in the field of infectious diseases and interaction with the host's immune system.

#### **OBJECTIVES:**

On successful completion of the course the students should have:

Understood the foundation for the future subjects in microbiology and immunology.

Learnt the basic terminology and techniques in microbiology and immunology.

Learnt on how much immune system is important to the humans.

#### **CONTENTS:**

### UNIT – I

Historical development of the science of the immunology. Innate and acquired immunity, Antibody mediated and cell mediated response tolerance.

Primary and secondary lymphoid organs. Structure of T, B and NK cells. Receptors on the surface of lymphocytes. Structure and functions of neutrophils, Macrophages – phagocytosis and inflammation, eosinophils and basophils.

#### UNIT – II

Antigen: Properties, Specificity and Cross reactivity, antigenicity, immunogenicity, antigen determinants, Haptens, adjuvants, Self antigens (MHC) an outline only.

Antibodies: Properties, classes and subclasses of immunoglobulins: Structure, specificity and distribution, Clonal selection theory of antibody formation.

Antigen-antibody interaction – Precipitation and agglutination – Definition and mechanism of formation. Complement component. Cytokines and their junctions.

#### UNIT – III

Precipitation in gel. Oudin procedure, oahley – Fulthope procedure, immune diffusion, Ouchterlony procedure, Immuno electrophoresis and electro immuno diffusion.

Agglutination: Slide agglutination, Table agglutination, Widal test.

Principle and application: RIA, ELISA, Flouresent antibody technique, monoclonal antibodies and their application.

#### UNIT – IV

Allergy and Hypersensitivity – Type I, II, III and IV, their clinical manifestations.

Immuno Disease: Rheumatoid arthritis, Myasthenia gravis.

Immunity to bacteria and viruses.

Skin Test: Montex and Penicillin test.

#### UNIT – V

Transplantation: Allograft rejection: Graft Vs Host Diseases: Immuno suppressors: mechanism of graft rejection.

Resistant to tumors: NK Cells: Tumor immuno therapy: Lymphoid tumors.

Vaccination: Passive and active immunization: Recombinant vaccines: DNA vaccines. Benefits and adverse effects of vaccination.

CD4 Cell count in HIV infection.

#### REFERENCES:

Immunology – An introduction, Tizzard R Jan, 1995.

Immunology – Roitt Ivann, Jonathan Brastoff, David Male, 1993.

Text book of microbiology – Ananthanarayanan. R. and Yayaraman Panikar, 1996.

Immunology – Janis Kuby, 3rd edition.

**SEMESTER VI**  
**SUBJECT TITLE: CORE PAPER XV. PATHOLOGY - IV - CYTOLOGY**

**SUBJECT DESCRIPTION:**

This course provides information about hormone cytology, tissue culture and immunochemistry.

**GOALS:**

To enable the students to have a sound knowledge on the methods of staining, characterization of culture cell lines and immunocytochemistry.

**OBJECTIVES:**

On successful completion of the course the students should have understood:

Hormone cytology.

Malignant cytology.

Characterization of cell lines

Basic concepts of immunochemistry.

**UNIT-I**

I 1 Normal cell structure and function

2. Normal Histology and cytology of epithelial and connective tissue.

II 1. Collection and preparation of samples

Fixation, fixatives

Staining - Principles, Preparations of reagents, techniques

a. Papanicolaou's stain

b. May - Grunwald Giemsa stain

**UNIT-II**

Hormone Cytology.

a. Various Cytological indices

i. Maturation Index

ii. Karyopyknotic Index

iii. Maturation value

Malignant Cytology:

Female genital tract, techniques of collection of specimen

Cervical Malignancy

Classification of cervical smear and characteristics of normal inflammatory, and dysplasia (mild, moderate, severe), Ca-in-situ, sq Cell carcinoma and adenocarcinoma of endocervix.

(c). Characterization and radiation changes in cells.

(d). Endometrial Malignancy, cytology of normal hyperplasia and adenocarcinoma. (e).

Miscellaneous - Ovarian carcinoma etc.,

(f) Cytological screening of cervical cancer (organ screening) programme, evaluation and follow up.

Respiratory tract.

(a). Collection, selection of material and making smear.

(b). Cytology of various types of bronchogenic carcinomas.

### Urinary Tract.

- (a). Collection and preparation of samples.
- (b). Cytology of normal, non-malignant and malignant tissues of urinary tract.

### VII. Gastrointestinal tract:

- a. Classification and preparation of samples.
- b. Characteristics of normal and malignant cytology.

### VIII Effusion & CSF

2. Collection and preparation of fluid for cytological examination. 3 Cytological features of non-inflammatory and malignant effusions.

### IX. Glands

- a. Cytological features of fine needle (FNAC) aspiration and discharge.

### UNIT III

#### Automation cytology

1. Flow cytometry.
2. Image analysis
3. Principles, equipments, procedure and evaluation.

### UNIT-IV

#### 1. Tissue culture and immuno-histochemistry

- a. Equipments necessary for carrying out tissue culture studies
- b. Laminar Flow equipment
- c. Carbon dioxide incubator.
- d. Inverted microscope.
2. Basic procedure for preparation of glassware, media etc for sterilization.
  - b. Dry heat sterilization.
  - c. Autoclaving in an atmosphere of steam.
  - d. Chemical sterilization.
  - e. Filter sterilization of liquid media etc.
3. Derivation of culture from the tissue
  - a. Enzymatic digestion of the tissue using collagens, protease etc.
  - b. Plating of cells in tissue culture media.
  - c. Observation of cells in inverted microscope.
  - d. Sub culturing and derivation of cell lines

#### 4. Characterization of cell lines

- a. Determination of biochemical markers in cells
- b. Chromosomal and DNA content of cells.
- c. Immunological properties of cells.
5. Preservation of immortalized cell lines
  - a. Storage in glycerol in liquid nitrogen
  - b. Storage in dimethyl sulfoxide in liquid nitrogen.

### UNIT-V

#### Immuno-cytochemistry.

1. Introduction



2 Basic concepts of immunochemistry.  
Monoclonal antibodies and their preparations.  
Fluorescence reactions.  
PAP techniques- principle, preparation of reagents and procedure.

**REFERENCES:**

1. Todd and Sanford, Clinical diagnosis by laboratory method
2. Culling -Histopathology techniques.
- 3 Dycie and Lewis -Practical haematology.
4. Ramani Sood. Laboratory technology (Methods and interpretations) 4th Ed. J.P. Bros, New Delhi, 1996.
- 5 Satish Gupta, -Short text book of medical laboratory for technicians, J.P. Bros, New Delhi

**SEMESTER VI (DIPLOMA)  
PRACTICAL I**

Menu Planning for the following Nutritional Status

Pregnant Women  
Lactating Women  
Infants  
Pre School Children  
School going Children  
Adolescent  
Old Age.

**REFERENCES**

- Kaushik, V.B (1999). Problem of food nutrition and dietetics.  
Gopalan C and et al. (1996). Nutritive value of Indian foods.

**PRACTICAL II**

Preparation of routine hospital diet:

Regular  
Light  
Soft  
Clear  
Full liquid diet

Planning and preparation of diet:

Fever,  
Diarrhea,  
Constipation  
Peptic ulcer,  
Protein calorie,  
Malnutrition,  
Vitamin A deficiency

## REFERENCES

Kaushik, V.B (1999). Problem of food nutrition and dietetics.  
Gopalan C and et al. (1996). Nutritive value of Indian foods.

## SEMESTER V ELECTIVE I - A DRUG BIOCHEMISTRY

**SUBJECT DESCRIPTION:**This course presents to focus on the chemical principles used for drug discovery and it also covers human biology where ever relevant.

**GOALS:**Course provides for the specific needs and interests of students wishing to obtain experience in a modern research program

### OBJECTIVES:

On successful completion of the course the students should have:

Understood the development of the traditional and modern methods used for drug discovery; of how molecules interact.

Learnt the fact that the pharmaceutical industry is by far the largest employer of medicine

Learnt and developed skills in the use of reaction mechanisms and how a knowledge of reaction mechanisms can aid in understanding the mode of action of a drug, and the method by which it can be synthesized, and developed.

### UNIT I

Introduction and receptor concept; Introduction to drugs, classification of drugs, passage of drugs across biological membrane, absorption and distribution of drugs, binding of drugs to plasma proteins.

Drug receptor interaction, binding forces in drug - receptor interactions, types of receptors. Receptor theories, consequences of drug receptor interaction.

### UNIT II

Drug metabolism and elimination: Drug metabolism, methods to study drug metabolism, microsomal metabolism, Metabolism via hydroxylation, conjugation, deamination, N-oxidation, azo and nitro reduction, non-microsomal oxidation, oxidative deamination, purine oxidation, dehalogenation, hydrolysis, action of choline esterase, Elimination of drugs from the body with reference to renal system.

### UNIT III

Chemotherapy : Mode of action of sulfonamides, antimetabolites of folate, purines and pyrimidines, Antibacterials - mode of action and resistance to penicillin, streptomycin, tetracycline. chloramphenicol.

Antiviral, antimalarials, and anti TB drugs.

#### UNIT IV

Drugs acting on CNS and cardiovascular system. CNS structure and action of barbiturates, salicylates, MAO inhibitors and drugs for Parkinson disease. Cardiovascular disease: Structure and mode of action of cardiac glycosides, Heparin and Coumarin.

#### UNITV

Drugs of plant origin; Drug dependence and abuse - Management of self poisoning, cancer. Chemotherapy - Cytotoxic drugs, immunosuppressive drug therapy.

#### REFERENCES:

Satoskar, R.S., Bhandakar, S.D and S.S. Ainapure. Pharmacology and Pharmacotherapeutics, 141<sup>st</sup> Eds. ( 1995), Popular Prakashan , Bombay.  
Willam Foye . Principles of Medicinal Chemistry. #rd eds. 1986.  
Patrik.L.Grahm. An Introduction to Medicinal Chemistry. Oxford University Press.

### **SEMESTER VI** **SUBJECT TITLE: ELECTIVE II – A** **BIOINSTRUMENTATION- PRINCIPLES AND APPLICATIONS**

#### 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

#### UNIT I

Microscopy - Principles and application- Bright Field, Dark field, Phase contrast, Fluorescence, SEM & TEM's.

#### UNIT II

Autoclave, Hot air oven, Incubator, Water bath, Laminar air flow, BOD incubator, Centrifuges - Bench top, High speed, Ultracentrifuge.  
pH meter, Lyophilizer, Anaerobic jar, metabolic shaker, ELISA reader and washer.

#### UNIT III

Tissue processor - Microtome - Knife sharpener, Tissue Floatation bottle.

#### UNIT IV

Chromatography - Paper, Thin layer, Column, Ion exchange, Gas and HPLC, Electrophoresis - SDS - PAGE, and Agarose gel electrophoresis.  
Colorimetry, Turbidometry, Spectrophotometry - UV, Visible Spectrophotometer, Flame photometer.

#### UNIT V

Biochemical Waste Management; Safety regulations, Biosafety, Biohazard levels, Types of biochemical waste, Collection methods of biochemical waste, Handling of waste - blood, urine and tissues

Disposal of waste - Waste disposal issues, Disposal of pathological samples - blood, urine, tissue samples, Hazards of disposal, safety measures during disposal.

#### REFERENCE:

Gedder .A. and L.E. Balser, John Wiley and Sons. Principles of applied Biomedical Instrumentation.

Dean, Willard and Merrit, Instrumental Methods of analysis. Asian Ed.,

Fritschen.L.J and L.W Gay. Springer varlag. Environmental Instrumentation. 1979. Newyork.

Boyer, Rodney, I. Benjamin and Cummins. Modern Experimental Biochemistry. 2nd Edition.

### SEMESTER VI

#### SUBJECT TITLE: ELECTIVE III – A

#### CLINICAL LABORATORY TESTS AND ITS INTERPRETATION

**SUBJECT DESCRIPTION:**This course presents the various clinical laboratory tests and its interpretation.

**GOALS:**To enable the students to have a sound knowledge in clinical chemistry tests, microbiology and blood bank.

#### OBJECTIVES:

On successful completion of the course the students should have understood:

Biochemical constituents and enzymes that are used as marker for various diseases.

Serodiagnostic procedures.

Skin tests.

Haemogram and blood bank.

#### UNIT I

##### CLINICAL CHEMISTRY TESTS

Blood glucose, Glycoslyated Hb, Fructosmaine, Glucose tolerance test, Uric acid, Calcium, Phosphorous, Iron, Ferritin, Copper, CSF analysis, Electrolytes - Sodium, Potassium, Chloride and Bicarbonate, Serum protein electrophoresis.

#### UNIT II

Enzymes : Acid phosphatases, LDH, Gamma GT, CPK, CPK-MB, Alpha amylase.

Profile - Liver function test, Renal function tests,, Lipid profile.

Hormones - T3, T4,TSH, FSH, LH, Prolactin, Estradiol, Insulin.

Imrriunoglobulins - IgA, IgM, Ig G, Ig E.

### UNIT III ( MICROBIOLOGY)

Infective syndrome and their diagnostic, procedures - Respiratory tract infection, Intestinal infection, Urinary tract infection, Meningeal infection, Wound infections, Reproductive system infection and pyrexia.

Serodiagnostic procedures - Precipitation tests, VDRL test, Kahn test, Immunodiffusion test, Agglutination test - Widal test ( Slide and tube method), Brucella agglutination test, Weil Felix test. Cold agglutination test, ASO test, RA test, CRP test, Complement fixation test- Wasserman test, Immunofluorescence test, FT A test, Enzyme linked immunosorbent assay HIV test, Hepatitis markers, Antinuclear antibodies ( ANA), - 6 Profiles, Lepospiral Ig G and IgM, TORCH test, Immunoelectroblot technique - Western blot test,

Skin tests - Mantoux test, Casoni test, I. epramin test, Fries test.

### UNIT IV

Complete haemogram, Complete Urine analysis, Complete Motion analysis and Semen analysis.

### UNIT V

Blood bank - Blood group & Rh factor, Coomb's test - Direct/ Indirect. Coagulation studies - Prothrombin time (PT), Partial Thromboplastin (PTT). D - Dimer, Plasma Fibrinogen, Inborn errors of metabolism - 1. Benedict's test for reducing substances, 2. Test for Phenyl ketonuria, 3. DNPH test for presence of ketoacids, 4. Cyanonitroprusside test for Cystinuria and Homocysteine, 5. Cetrinide V for mucopolysaccharides. Paper chromatography.

### REFERENCES:

Practical Clinical Biochemistry - Harold Varley

Clinical Biochemistry - Teitz.

Metabolic Disease and Control - Bonde

Interpretation of Diagnostic Tests - A Synopsis of Laboratory Medicine - Jacques Wallach, 5th Eds. Little Brown & Co., London, 1992.

Clinical Chemistry in Diagnosis & Treatment. Joan Zilva & PR. Pannall. P.G Publishing Pvt Ltd., New Delhi.