Annexure - IV

SCHEME OF STUDIES

FOR

DOCTOR OF MEDICAL LAB SCIENCES

(DMLS-5 Years)

As per HEC Recommendation

DEPARTMENT OF ALLIED HEALTH SCIENCES

SARGODHA MEDICAL COLLEGE CAMPUS

FACULTY OF MEDICAL & HEALTH SCIENCES
UNIVERSITY OF SARGODHA, PAKISTAN

DOCTOR OF MEDICAL LAB SCIENCES
(DMLS-5 Years) Programme
PAPER PATTERNS & MARKS DISTRIBUTION OF UNIVERSITY EXAMINATIONS

I **TOTAL MARKS = 100** (having Theory Section only)
II **TOTAL MARKS = 200** (having Theory + Practical & G. Viva)

I- TOTAL MARKS = 100 *(having Theory only)*

THEORY (100 marks)	
Question	**Marks for each Questions**
Question 01: MCQs (20 stems with 04 possible options only 01 correct)	01x20 = 20
Question 02: SEQs (08 stems Requiring short answer of all)	08x05 = 40
Question 03-05: LEQs (Requiring detailed answer of any 02 Qs)	02x15 = 30
Total Marks	**90**
INTERNAL ASSESSMENT (10 MARKS)	
Internal assessment Theory part	10
Total Marks	10
Grand Total Marks	**100**

II- TOTAL MARKS = 200 *(having both Theory and Practical & General Viva)*

WRITTEN /THEORY (100 marks)	
Question	**Marks for each Questions**
Question 01: MCQs (20 stems with 04 possible options only 01 correct)	01x20 = 20
Question 02: SEQs (08 stems Requiring short answer of all)	08x05 = 40
Question 03-05: LEQs (Requiring detailed answer of any 02 Qs)	02x15 = 30
Total Marks	**90**
PRACTICAL (40 marks)	
Marks for Internal	20
Marks for External	20
Total Marks	**40**
G.VIVA (50 marks)	
Marks for Internal	25
Marks for External	25
Total Marks	**50**
INTERNAL ASSESSMENT (20 MARKS)	
Internal assessment Theory part	10
Internal assessment Practical part	10
Total Marks	**20**
Grand Total Marks	**200**

CREDIT ACCUMULATION AND TRANSFER SYSTEM (CAT)

A Credit accumulation and transfer system is a systematic way of describing an educational program based upon its components. Credit hour or credit unit is basically the academic currency of the academic activities. In DMLS under the CAT system is defined as

Title	Recommended	Actual		
		Teaching	Clinical	Total
1. Contact hours 1500-1800 hrs/year **2.** 25-30 Contact hours = 01 credit point **3.** Number of credit points in a year = 55-60	1500-1800 hours/year	1600+1600+1300+ 1400+1400=7300	400+500+500= 1400	8700/5=1740 hours/year

DMLS Syllabi / Course Outline

1st Year:

Anatomy I	200 Marks
Physiology I	200 Marks
Biochemistry I	200 Marks
English	100 Marks
Introduction to Computer	100 Marks
Introduction to Allied Health Sciences I	100 Marks
Total	**900 Marks**

2nd Year:

Anatomy II	200 Marks
Physiology II	200 Marks
Biochemistry II	200 Marks
Islamic studies	100 Marks
Pakistan Studies	100 Marks
Introduction to Allied Health Sciences II	100 Marks
Total	**900 Marks**

3rd Year:

Medical Instrumentation- I	100 Marks
General Technology I (General Pathology & Microbiology)	200 Marks
General Technology II (Haematology & Blood Banking)	200 Marks
Total	**500 Marks**

4th Year:

Medical Instrumentation- II	100 Marks
Special Technology I (Histopathology & Cytopathology)	200 Marks
Special Technology II (Immunology & Serology)	200 Marks
Community Medicine including Sociology, Biostatistics & Research Methodology	100 Marks
Total	**600 Marks**

5th (Final) Year:

Medical Labs Report Writing and Evaluation	200 Marks
Medical Lab Establishment	200 Marks
Supervised Clinical Labs Practices	200 Marks
Total	**600 Marks**
G. Total	**3500 Marks**

DIVISION OF STUDY HOURS

1st YEAR

Sr	Subject Title	Contact Hours
1	Anatomy I	500
2	Physiology I	400
3	Biochemistry I	400
5	English	100
6	Introduction to Computer	100
7	Introduction to Allied Health Sciences I	100
	TOTAL	1600

2nd YEAR

Sr	Subject Title	Contact Hours
1	Anatomy II	500
2	Physiology II	400
3	Biochemistry II	400
5	Islamic Studies	100
6	Pakistan Studies	100
7	Introduction to Allied Health Sciences II	100
	TOTAL	**1600**

3rd YEAR

Sr	Subject Title	Contact Hours
1	Medical Instrumentation- I	200
2	General Technology I (General Pathology & Microbiology)	600
3	General Technology II (Haematology & Blood Banking)	600
	TOTAL	**1400**

4th YEAR

Sr	Subject Title	Contact Hours
1	Medical Instrumentation- II	600
2	Special Technology I (Histopathology and Cytopathology)	600
3	Special Technology II (Immunology and Serology)	200
4	Community Medicine including Sociology, Biostatistics & Research Methodology	200
	TOTAL	**1600**

5th (FINAL)YEAR

Sr	Subject Title	Contact Hours
1	Medical Labs Report Writing and Evaluation	600
2	Medical Lab Establishment	400
3	Supervised Clinical Labs Practices	400
	TOTAL	**1400**

BREAK DOWN OF HOURS OF CLINICAL PRACTICE

Year	Ward/Clinic	Hours	Period
4th Year	Laboratory Rotation	500	04 Months
5th Year	Laboratory Rotation	500	06 Months
	G. TOTAL	**1000**	

Note:

* 2/3rd of the clinical training shall be provided in the morning whereas 1/3rd of the clinical training shall be provided in the evening. There shall be 2 months of summer vacations in an academic session.

Detailed Syllabi / Course Outlines
DMLS (Doctor of Medical Lab Sciences)

1st Year:

Anatomy I	200 Marks
Physiology I	200 Marks
Biochemistry I	200 Marks
English	100 Marks
Introduction to Computer	100 Marks
Introduction to Allied Health Sciences I	100 Marks
Total	**900 Marks**

1. ANATOMY I

CELL BIOLOGY

GENERAL ANATOMY

Terms related to position and movements, The skin and subcutaneous tissues, Layers of skin, Integuments of skin, Glands associated with hair follicle, Microscopic picture of skin

BONES AND CARTILAGES

Osteology, Functions of Bones, Classification of bones, Parts of developing long bones, Blood supply of bones, Lymphatic vessels & nerve supply, Rule of direction of nutrient foramen, Gross structure of long bone, Surface markings, Cartilage, Development of bone and cartilage and Microscopic picture of cartilage and bone

THE MUSCLE

Introduction, Histological Classification, Functions of muscles in general, Type of skeletal muscles, Parts of skeletal muscle and their action and Nomenclature and Microscopic picture of muscle

STRUCTURES RELATED TO MUSCLES & BONES

Tendons, Aponeurosis, Fasciae, Synovial bursae, Tendon Synovial sheaths, Raphaes, Ligaments, Condyle, Epicongyle, Ridge, Tuberosity, Tubercle, Foramen, Canal, Groove, Process and Spur

THE JOINTS

Introduction, Functional classifications, Structural classification, Structures comprising a Synovial joint, Movements of joints, Blood supply of Synovial joints, their nerve supply and lymphatic drainage and Factors responsible for joint stability and Development of joints

CARDIOVASCULAR SYSTEM

Definition, Division of circulatory system into pulmonary & systemic, Classification of blood vessels and their microscopic picture and Heart and its histology and Function of the Heart and Anastomosis

NERVOUS SYSTEM

Definition, Outline of cellular architecture, Classification of nervous system, Parts of the central nervous system, Microscopic picture of cerebrum, cerebellum, spinal cord, Functional components of a nerve, Typical spinal nerve and Microscopic picture of nerve and Introduction of autonomic nervous system and Anatomy of neuromuscular junction

UPPER LIMB

OSTEOLOGY:

Detailed description of all bones of upper limb and shoulder girdle along their musculature and ligamentous attachments

MYOLOGY

Muscles connecting upper limb to the axial skeletal, Muscles around shoulder joint, Walls and contents of axilla, Muscles in brachial region, Muscles of forearm, Muscles of hand, Retinacula and Palmar apouenrosis and Flexor tendon dorsal digital expansion

NEUROLOGY

Course, distribution and functions of all nerves of upper limb and Brachial plexus

ANGIOLOGY (CIRCULATION).

Course and distribution of all arteries and veins of upper limb, Lymphatic drainage of the upper limb and Axillary lymph node and Cubital fossa

ARTHROLOGY

Acromioclavicular and sternoclavicular joints, Shoulder joint, Elbow joint, Wrist joint, Radioulnar joints, Inter carpal joints, Joints MCP and IP and Surface Anatomy of upper limb, and Surface marking of upper limb

DEMONSTARIONS:

Demonstration on Shoulder joint, attached muscles and articulating surfaces, Demonstration on Elbow joint, Demonstration on Wrist joint, Demonstration on Radioulnar joint, Demonstration on MCP and IP joints, Demonstration on acromioclavicular joint, Demonstration on sternoclavicular joint and Demonstration on Brachial plexus and Demonstration on Structure of bones

THORAX

STRUCTURES OF THE THORACIC WALL:

Dorsal spine (Vertebrae), Sternum, Costal Cartilages & Ribs, Intercostal Muscles, Intercostal Nerves, Diaphragm, Blood supply of thoracic wall and Lymphatic drainage of thoracic wall and Joints of thorax

THORACIC CAVITY:

Mediastinum, Pleura, Trachea, Lungs, Bronchopulmonary segments, Pericardium, Heart – Its blood supply, venous drainage & nerve supply, Large veins of thorax, superior and in-ferior vena cava., pulmonary veins brachiocephalic veins and Large Arteries – Aorta & its branches

LOWER LIMB

OSTEOLOGY

Detailed description of all bones of lower limb and pelvis along their musculature and ligamentous attachments.

MYOLOGY

Muscles of gluteal region, Muscles around hip joint, Muscles of thigh (anteriorly, posteriorly, laterally and medially) and Muscles of lower leg and foot

NEUROLOGY

Course, distribution, supply of all nerves of lower limb and gluteal region and Lumbosacral plexus.

ANGIOLOGY

Course and distribution of all arteries, veins and lymphatic drainage of lower limb

ARTHROLOGY

Pelvis, Hip joint, Knee joint, Ankle joint, Joints of the foot, Surface Anatomy of lower limb and Surface marking of lower limb

GENERAL HISTOLOGY

Cell, Epithelium, Connective tissue, Bone, Muscles tissue, Nervous tissues, Blood vessels, Skin and appendages and Lymphatic organs

GENERAL EMBRYOLOGY:

Male and female reproductive organs, Cell division and Gametogenesis, Fertilization, cleavage, blastocyst formation and implantation of the embryo. Stages of early embryonic development in second and third week of intrauterine life, Foetal membrane (amniotic cavity, yolk sac, allantois, umbilical cord and Placenta) and Developmental defects

PRACTICAL

During study of Gross Anatomy, emphasis should be given on applied aspect, radiological anatomy, surface anatomy and cross-sectional anatomy of the region covered in the respective year.

RECOMMENDED TEXT BOOKS:

1. *Gray's Anatomy* by Prof. Susan Standring 39th Ed.,
2. Elsevier, *Clinical Anatomy for Medical Students* by Richard S. Snell,
3. *Clinically Oriented Anatomy* by Keith Moore,
4. *Clinical Anatomy* by R.J. Last, Latest Ed,
5. *Cunningham's Manual of Practical Anatomy* by G.J. Romanes, 15th Ed., Vol-I, II and III,
6. *The Developing Human. Clinically Oriented Embryology* by Keith L. Moore, 6th Ed, *Wheater's Functional Histology* by Young and Heath,
7. Latest Ed, *Medical Histology* by Prof. Laiq Hussain, *Neuroanatomy*by Richard S.Snell.

2. PHYSIOLOGY I

BASIC AND CELL PHYSIOLOGY

Functional organization of human body, Homeostasis, Control systems in the body, Cell membrane and its functions, Cell organelles and their functions and Genes: control and function

NERVE AND MUSCLE

Structure and function of neuron, Physiological properties of nerve fibers, Physiology of action potential, Conduction of nerve impulse, Nerve degeneration and regeneration. Synapses, Physiological structure of muscle, Skeletal muscle contraction, Skeletal, smooth and cardiac muscle contraction, Neuromuscular junction and transmission, Excitation contraction coupling, Structure and function of motor unit

Clinical Module

Perform nerve conduction studies and explain their clinical importance. Myopathies and neuropathies. Peripheral nerve injuries

CARDIOVASCULAR SYSTEM

Heart and circulation, Function of cardiac muscle, Cardiac pacemaker and cardiac muscle contraction, Cardiac cycle, ECG: recording and interpretation. Common arrhythmias and its mechanism of development, Types of blood vessels and their function, Haemodynamics of blood flow (local control systemic circulation its regulation and control). Peripheral resistance its regulation and effect on circulation, Arterial pulse, Blood pressure and its regulation, Cardiac output and its control, Heart sounds and murmurs Importance in circulation and control of venous return., Coronary circulation, Splanchnic, pulmonary and cerebral circulation , Triple response and cutaneous circulation, Foetal circulation and circulatory changes at birth

Clinical Module

Clinical significance of cardiac cycle, correlation of ECG and heart sounds to cardiac cycle. Clinical significance of cardiac cycle, interpretation of ischemia and arrhythmias. Effects of hypertension. Clinical significance of heart sounds. Effects of ischemia. Shock

RESPIRATORY SYSTEM

Function of respiratory tract, Respiratory and non-respiratory function of the lungs, Mechanics of breathing, Production & function of surfactant and compliance of lungs, Protective reflexes, Lung volumes and capacities including dead space, Diffusion of gases across the alveolar membrane, Relationship between ventilation and perfusion. Mechanism of transport of oxygen and carbon dioxide in blood, Nervous and chemical regulation of respiration, Abnormal breathing, Hypoxia, its causes and effects, Cyanosis, its causes and effects

Clinical Module

Clinical importance of lung function tests. Causes of abnormal ventilation and perfusion. Effects on pneumothoax, pleural effusion, and pneumonia. Respiratory failure. Artificial respiration and uses & effects of O_2 therapy. Clinical significance of hypoxia, cyanosis, and dyspnoea

BLOOD

Composition and general functions of blood, Plasma proteins their production and function, Erythropoiesis and red blood cell function, Structure, function, production and different types of haemoglobin, Iron absorption storage and metabolism, Blood indices, Function, production and type of white blood cells, Function and production of platelets, Clotting mechanism of blood, Blood groups and their role in blood transfusion, Complications of blood transfusion with reference to ABO & RH incompatibility, Components of reticuloendothelial systems, gross and microscopic structure including tonsil, lymph node and spleen, Development and function of reticuloendothelial system

Clinical Module

Anemia and its different types. Blood indices in various disorders. Clotting disorders. Blood grouping and cross matching. Immunity

SKIN AND BODY TEMPERATURE REGULATION

PHYSIOLOGY PRACTICALS

HEMATOLOGY

Use of the microscope. Determination of haemoglobin. Determination of erythrocyte sedimentation rate. Determining packed cell volume. Measuring bleeding and clotting time. RBC count. Red cell indices. WBC count. Leukocyte count. Prothrombin and thrombin time

RESPIRATORY SYSTEM

Clinical examination of chest. Pulmonary volume, their capacities and clinical interpretation. Stethography

CARDIOVASCULAR SYSTEM

Cardiopulmonary resuscitation (to be coordinated with the department of medicine), Examination of arterial pulse, ECG recording and interpretation, Arterial blood pressure, Effects of exercise and posture on blood pressure, Apex beat and normal heart sounds

RECOMMENDED TEXT BOOKS

1. *Textbook of Physiology by Guyton and Hall, Latest Ed.*
2. *Review of Medical Physiology by William F. Ganong, Latest Ed.*
3. *Physiology by Berne and Levy, Latest Ed.*
4. *Human Physiology: The Basis of Medicine by Gillian Pocock, Christopher D. Richards*
5. *Physiological Basis of Medical Practice by John B. West and Taylor, 12th Ed.*

3. BIOCHEMISTRY I

CELL

Introduction to Biochemistry, Cell: (Biochemical Aspects), Cell Membrane Structure, Membrane Proteins, Receptors & Signal Molecules

BODY FLUIDS

Structure and properties of Water, Weak Acids & Bases, Concept of pH & pK, Buffers, their mechanism of action, Body buffers

BIOMOLECULES

Amino Acids, Peptides & Proteins

Amino acids: Classification, Acid-Base Properties, Functions & Significance, Protein Structure, Primary, Secondary & Super secondary. &, Structural Motifs, Tertiary & Quaternary Structures of Proteins, Protein Domains, Classification of Proteins, Fibrous proteins (collagens and elastins) & Globular proteins

ENZYMES

Introduction, Classification & Properties of Enzymes, Coenzymes, Isozymes & Proenzymes, Regulation & Inhibition of Enzyme activity & enzymes inhibitors, Clinical Diagnostic Enzymology

CARBOHYDRATES

Definition, Classification, Biochemical Functions & Significance of Carbohydrates, Structure & Properties of Monosaccharides & Oligosaccharides, Structure & Properties of Polysaccharides, Bacterial cell Wall, Heteropolysaccharides, GAGS

LIPIDS

Classification of Lipids, Fatty Acids: Chemistry, Classification occurrence & Functions, Structure & Properties of Triacylglycerols and Complex Lipids, Classification & Functions of Eicosanoids, Cholesterol: Chemistry, Functions & Clinical Significance, Bile acids/salts

NUCLEIC ACIDS

Structure, Functions & Biochemical Role of Nucleotides. Structure & Functions of DNA, Structure & Functions of RNA

MINERALS & TRACE ELEMENTS

Sources, RDA, Biochemical Functions & Clinical Significance of Calcium & Phosphorus, Sources, RDA, Biochemical Functions & Clinical Significance of Ca, Na, K, Cl, Mg, S, &P, Biochemical Functions & Clinical Significance of Fe, Cu, Zn, Mn, Mb, Se, Co, I,F etc.

VITAMINS

Sources, RDA & Biochemical Functions & Clinical Significance of Fat Soluble Vitamins, Sources, RDA & Biochemical Functions & Clinical Significance of Water Soluble, Vitamins

NUTRITION

Dietary Importance of Carbohydrates, Lipids & Proteins and other dietary Ingredients. Balanced Diet. Diet in specialized conditions

MOLECULAR BIOLOGY

Nitrogenous basis, Nucleosides and Nucleotides, Structure & Role of Nucleotide.

TISSUE BIOCHEMISTRY

Extracellular Matrix, Collagen, Elastin and Extracellular Matrix Components, Biochemistry of Proteoglycans, Bone & Teeth, Muscle & Cytoskeleton

PRACTICAL TRAINING

Section 1: Introduction to Biochemistry

Working SOPs for a Biochemistry Practical Laboratory. Introduction to Laboratory Equipments and Techniques. Preparation of solution (Normal, Molar Equivalent solution etc).

Section 2: Physical Biochemistry

Surface Tension. Process of adsorption. Buffer Action. Practical application of Henderson-Hasselbalch's equation

Section 3: Carbohydrate

Molisch's Test & Iodine Test. Benedict's Test & Barfoed's Test. Selivanoff's Test & Phenylhydrazine Test. Sucrose Hydrolysis. Starch Hydrolysis. Schematic Identification of an unknown carbohydrate

Section 4: Proteins

Biuret Test, Heat Coagulation Test & Salt Saturation Test. Ninhydrin Test, Xanthoproteic Test & Millon-Nasse's Test. Aldehyde Test, Sakaguchi's Test & Lead Sulphide Test. Determination of Isoelectric pH of casein Protein. Schematic Identification of unknown protein

Section 5: Lipids

Emulsification of natural fat & Solubility of soap. Acrolein Test & Test for Cholesterol

19. Iodine & Peroxide value calculation. Saponification value calculation

Section 6: Biochemical analysis of different body fluid

Sample Collection & Physical Evaluation of Urine. Analysis of Normal Urine. Analysis of Abnormal Urine

RECOMMENDED BOOKS

1. ***Harper's Biochemistry*** *by Robbert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwel (Latest Edition).*
2. ***Lippincott's Illustrated Review of Biochemistry*** *by Pamela C. Champe and Richard A. Harvey (Latest Edition).*
3. ***Practical Clinical Biochemistry*** *by Varley (Latest Edition).*
4. ***Textbook of Biochemistry*** *by Devlin (Latest Edition).*
5. ***Textbook of Medical Biochemistry by*** *M.A. Hashmi (Latest Edition).*
6. ***Biochemistry*** *by Stryer (Latest Edition).*

4. ENGLISH

DETAILED COURSE OUT LINE

Comprehension; Answers to questions on a given text

Translation skills; Urdu to English

Paragraph writing; Topics to be chosen at the discretion of the teacher

Paragraph writing; Practice in writing a good, unified and coherent paragraph

Essay writing; Introduction

CV and job application; Translation skills, Urdu to English

Study skills; Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

Academic skills; Letter/memo writing, minutes of meetings, use of library and internet

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical report writing , Progress Report writing

RECOMMENDED TEXT BOOKS:

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
3. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41 45-53.

4. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
5. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
6. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
7. Reading and Study Skills by John Langan

5. INTRODUCTION TO COMPUTER

Basic Definitions & Concepts
Hardware: Computer Systems & Components
Storage Devices , Number Systems
Software: Operating Systems, Programming and Application Software
Introduction to Programming, Databases and Information Systems
Networks
Data Communication
The Internet, Browsers and Search Engines
The Internet: Email, Collaborative Computing and Social Networking
The Internet: E-Commerce
IT Security and other issues

RECOMMENDED TEXT BOOKS

1. Introduction to Computers by Peter Norton, 6th International Edition (McGraw HILL)
2. Using Information Technology: A Practical Introduction to Computer & Communications by Williams Sawyer, 6th Edition (McGraw HILL)
3. Computers, Communications & information: A user's introduction by Sarah E. Hutchinson, Stacey C. Swayer
4. Fundamentals of Information Technology by Alexis Leon, Mathewsleon Leon press

6. INTRODUCTION TO ALLIED HEALTH SCIENCES I

What is Allied Health Sciences? Introduction of various sub disciplines in Allied Health Sciences. Introduction of Equipments, Chemicals, Kits & Glassware etc. in various sub disciplines existing in Allied Health Sciences.

RECOMMENDED BOOKS

1. Basic Pathology by Robbins Latest Edition.
2. Essentials of Radiology by Fred A Mettler Latest Edition.
3. Short practice and surgery by Bailey and Love Latest Edition.
4. Text book of community medicine by Parke J. E. Latest Edition.
5. Text book of clinical chemistry by NW Tietz Latest Edition.
6. Practical Heamtology By Dacie And Lewis
7. Medical Bacteriology: A Practical Approach by Peter Hawky
8. Basic Medical Lab Technology by CJ Kirk and RN Peel

2nd YEAR

Anatomy II	200 Marks
Physiology II	200 Marks
Biochemistry II	200 Marks
Islamic Studies	100 Marks
Pakistan Studies	100 Marks
Introduction to Allied Health Sciences II	100 Marks
Total	**900 Marks**

1. ANATOMY II

EMBRYOLOGY:

SPECIAL; Musculoskeletal system, cardiovascular system, CNS

THE HEAD AND NECK

THE NECK:

Muscles around the neck, Triangles of the neck, Main arteries of the neck, Main veins of the neck, Cervical part of sympathetic trunk, cervical plexus, cervical spine (Vertebrae), Joint of neck

THE FACE:

Sensory nerves of the face, Bones of the face, Muscles of the face, Facial nerve, Muscles of mastication, Mandible, Hyoid bone, Temporomandibular joint, Brief description of orbit and nasal cavity

THE SKULL:

Bones of skull, Anterior cranial fossa, Middle cranial fossa, Posterior cranial fossa, Base of skull and Structures passing through foramina

NEURO ANATOMY

Central Nervous System: Disposition, Parts and Functions, Brain stem (Pons, Medulla, and Mid Brain), Cerebrum, Cerebellum, Thalamus, Hypothalamus, Internal Capsule, Blood Supply of Brain, Stroke and its types, Ventricles of Brain, CSF circulation and Hydrocephalus, Meninges of Brain, Neural pathways (Neural Tracts), Pyramidal and Extra pyramidal System (Ascending and Descending tracts), Functional significance of Spinal cord level, Cranial Nerves with special emphasis upon IV, V, VII, XI, XII (their course, distribution, and palsies), Autonomic nervous system, its components and Nerve receptors

SPINAL CORD

Gross appearance, Structure of spinal cord, Grey and white matter (brief description), Meninges of spinal cord, Blood supply of spinal cord and Autonomic Nervous system

ABDOMEN

ABDOMINAL WALL:

Structures of anterior abdominal wall: superficial and deep muscles, Structure of rectus sheath, Structures of Posterior abdominal wall, Lumbar spine (vertebrae), Brief description of viscera.

PELVIS

Brief description of anterior, posterior and lateral walls of the pelvis, Inferior pelvic wall or pelvic floor muscles, Sacrum, Brief description of perineum and Nerves of perineum.

PRACTICAL

During study, emphasis should be given on applied aspect, radiological anatomy, surface anatomy and cross-sectional anatomy of the region covered in the respective semester /year

RECOMMENDED TEXT BOOKS:

1. *Gray's Anatomy* by Prof. Susan Standring 39th Ed., Elsevier.
2. *Clinical Anatomy for Medical Students* by Richard S.Snell.
3. *Clinically Oriented Anatomy* by Keith Moore.
4. *Clinical Anatomy* by R.J. Last, Latest Ed.
5. *Cunningham's Manual of Practical Anatomy* by G.J. Romanes, 15th Ed., Vol-I, II and III.
6. *The Developing Human. Clinically Oriented Embryology* by Keith L. Moore, 6th Ed.
7. *Wheater's Functional Histology* by Young and Heath, Latest Ed.
8. *Medical Histology* by Prof. Laiq Hussain.
9. *Neuroanatomy*by Richard S.Snell

2. PHYSIOLOGY II

NERVOUS SYSTEM

General organization of the nervous system, Classification of nerve fibers, Properties of synaptic transmission, Function of neurotransmitters and neuropeptides, Type and function of sensory receptors, Function of the spinal cord and ascending tracts, Reflex action and reflexes, Muscle spindle and muscle tone, Mechanism of touch, temperature and pain., Functions of the cerebral cortex, Difference between the sensory and motor cortex and their functions, Motor pathways including pyramidal and extrapyramidal, Basal Ganglia and its functions, Cerebellum and its function, Control of posture and equilibrium, Physiology of sleep, Physiology of memory, Mechanism and control of speech, Function of the thalamus, Function of the hypothalamus and limbic system, Production of CSF, Mechanism of temperature regulation and Function of the autonomic nervous system and the physiological changes of aging.

Clinical Module

Significance of dermatomes. Injuries of the spinal cord. Hemiplegia and paraplegia. Parkinsonism. Effects of cerebellar dysfunction.

REPRODUCTION

Function of the male reproductive system, Spermatogenesis, Mechanism of erection and ejaculation, Production and function of testosterone and Physiological changes during male puberty, Function of the female reproductive system, Production and function of oestrogen, and progesterone, Menstrual cycle, Physiological changes during female puberty and menopause, Pregnancy and the physiological changes taking place in the mother, Function of the placenta, Parturition and lactation and Neonatal physiology.

Clinical Module

Male infertility. Female infertility. Contraception. Basis for pregnancy tests.

GASTROINTESTINAL TRACT

General function of gastrointestinal tract, Enteric nervous system, control of gastrointestinal motility and secretion, Mastication, Swallowing: mechanism and control, Function, motility and secretions of stomach, Function, motility and secretions of small intestine, Function, motility and secretions of large intestine, Function of GIT hormones, Mechanism of vomiting and its control pathway, Defecation and its control pathway, Functions of liver, Functions of, gallbladder and bile in digestion and Endocrine & exocrine pancreas and functions of pancreas in digestion

Clinical Module

Dysphagia. Physiological basis of acid peptic disease. Causes of vomiting. Diarrhea and constipation in clinical settings. Jaundice and liver function tests in clinical settings

ENDOCRINOLOGY

Classification of endocrine glands, Mechanism of action, feedback and control of hormonal secretion, Functions of the hypothalamus, Hormones secreted by the anterior and posterior pituitary and their mechanism of action and function.. Function of the thyroid gland, Function of the parathyroid gland, Calcium metabolism and its regulation, Secretion and function of calcitonin, Hormones secreted by the adrenal cortex and medulla, and their function and mechanism of action, Endocrine functions of the pancreas, Control of blood sugar. Hormones secreted by the gastrointestinal system and their function, Function of the thymus and The endocrine functions of the kidney and Physiology of growth.

Clinical Module

Acromegaly, gigantism and dwarfism. Effects of panhypopitutiarism. Diabetes insipidus. Thyrotoxicosis and myxoedema. Pheochromocytoma. Cushing's disease. Adrenogenital syndrome. Diabetes mellitus and hypoglycemia.

BODY FLUIDS AND KIDNEY

Components and quantitative measurements of body fluids, Fluid compartments, tissue and lymph fluid, Structure of the kidney and nephron, General function of the kidney, GFR and its regulation, Formation of urine including filtration, re-absorption and secretion, Plasma clearance., Mechanism of concentration and dilution of urine, Water and electrolyte balance with reference to the kidney, Role of the kidney in blood pressure regulation, Hormonal functions of the kidney, Acidification of urine and its importance, Acid base balance with reference to the kidney and Micturition and its control.

Clinical Module

Renal function tests and their clinical importance. Fluid excess and depletion. Renal failure and dialysis. Metabolic acidosis and alkalosis. Abnormalities of micturition.

PHYSIOLOGY PRACTICALS

Nervous System

Examination of superficial and deep reflexes. Brief examination of the motor and sensory system. Examination of the cranial nerves.

Special Senses

Measurement of the field of vision. Measurement of light reflex. Ophthalmoscopy. Colour vision. Hearing tests. Testing taste and smell. Pregnancy tests

RECOMMENDED TEXT BOOKS

1. *Textbook of Physiology by Guyton and Hall, Latest Ed.*
2. *Review of Medical Physiology by William F. Ganong, Latest Ed.*
3. *Physiology by Berne and Levy, Latest Ed.*
4. *Human Physiology: The Basis of Medicine by Gillian Pocock, Christopher D. Richards*
5. *Physiological Basis of Medical Practice by John B. West and Taylor,12th Ed*

3. BIOCHEMISTRY II

BIOENERGETICS

Introduction to Bioenergetics, Biological Oxidations and Electron Transport Chain and Oxidative Phosphorylation

METABOLISM OF CARBOHYDRATES

Digestion & Absorption of Carbohydrates, Glycolysis & its Regulation, Citric Acid Cycle, Metabolism of Glycogen, Gluconeogenesis and regulation of blood glucose and Pentose Phosphate Pathway & its Significance.

METABOLISM OF LIPIDS

Digestion & Absorption of Lipids, Metabolism & Clinical Significance of Lipoproteins, Fatty acid oxidation biosynthesis and metabolism of Triacylglycerols, Metabolism & clinical Significance of Cholesterol and Metabolism of Eicosanoids

METABOLISM OF PROTEINS & AMINO ACIDS

Digestion of Proteins & Absorption of Amino Acids, Transamination & Deamination of Amino Acids and urea cycle and Specialized products formed from Amino Acids

MOLECULAR BIOLOGY

Structural Organization of Chromosome and Genes. Replication, Transcription in Prokaryotes & Eukaryotes, Translation: (Genetic Code) in Prokaryotes & Eukaryotes, Translation Inhibition by Antibiotics, Regulation of Gene Expression and Recombinant DNA Technology & Polymerase Chain Reaction, Blotting Techniques.

HORMONES

Classification & Mechanism of Action of Hormones, Signal Transduction, Second Messengers and Receptors, Hypothalmic & Pituitary Hormones, Steroid Hormones: Glucocorticoids and Mineralocorticoids, Insulin & Glucagon and Disease related to hormones abnormalities

Practicals

Section 1:

Techniques of Instruments in Clinical Biochemistry with examples.

Visible Spectrophotometry. Flame photometry. UV & IR spectrophotometry. Atomic Absorption spectrophotometry. pH Metry. Chromatography and determination of Amino Acids in Urine by pape chromatography

Section 2: Clinical quantatives analysis in Biochemistry

Sample Collection Blood, Faces and body fluids. Serum Glucose Estimation. Glucose tolerance Test (GTT). Serum Cholesterol estimation (Total, HDL and HDL cholesterol). Serum Bilirubin Estimation (Total, Direct and Indirect bilirubins). Serum Amylase Estimation. Serum AST Estimation. Serum ALT Estimation. Serum ALP Estimation. Serum Creatine Kinase(CK) Estimation. Serum Ascorbic acid Estimation. Serum LDH Estimation. Serum Proteins Estimation (Total, Albumin & Globulin). Serum Total lipids Estimation. Serum calcium Estimation (total, ionized & unionized). Serum Uric acid Estimation. Serum Magnesium Estimation. Serum Urea Estimation. Serum Creatinine Estimation

RECOMMENDED TEXT BOOKS:

1. ***Harper's Biochemistry*** *by Robbert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwel (Latest Edition).*
2. ***Lippincott's Illustrated Review of Biochemistry*** *by Pamela C. Champe and Richard A. Harvey (Latest Edition).*
3. ***Practical Clinical Biochemistry*** *by Varley (Latest Edition).*
4. ***Textbook of Biochemistry*** *by Devlin (Latest Edition).*
5. ***Biochemistry*** *by Stryer (Latest Edition).*by Stryer, Lubert, Latest Ed

4. ISLAMIC STUDIES

FUNDAMENTAL BELIEFS AND PRACTICES OF ISLAM.

Tauheed (Unity of Allah), Risalat (Finality of the Prophet-hood). Akhirat (Day of Judgement).,Salat, Soum, Zakat, Hajj and Jehad

NEED OF RELIGION AND ITS ROLE IN HUMAN LIFE.

MORALITY IN ISLAM.

Concept of morality, Concept of morality and Faith., Islamic principles and methods of character building., Moral values in Islam.

RIGHTS OF THE INDIVIDUAL IN ISLAM.

QURAN AS A GUIDE FOR THE MODERN SOCIETY AND SCIENTIFIC DEVELOPMENT.

HOLY PROPHET (PEACE BE UPON HIM) AND HIS LIFE.

ISLAMIC CONCEPT OF STATE.

ISLAM AND SOCIETY.

Role of man and women in society, Rights of women children in Islam. Concept of woman's freedom in Islam., Hukook-ul-Ibad.

IMPORTANCE OF RIZK-E-HILAL.

CONTRIBUTION OF ISLAMIC SCHOLARS IN SCIENCE AND MEDICINE.

RECOMMENDED BOOKS

1. Introduction to Islam by Dr. Hamidullah.
2. Islam: Its meaning and message by Khurshid Ahmad
3. اسلام ایک نظر میں مولانا صدرالدین اصلاحی
4. قرآن اور تعمیر سیرت ڈاکٹر میر ولی الدین

5. PAKISTAN STUDIES

IDEOLOGY OF PAKISTAN.

Definition and elucidation. Historical aspect. Ideology of Pakistan in the light of speeches and sayings of Allama Iqbal and Quaide-Azam.

PAKISTAN MOVEMENT

Basis for the creation of Pakistan. Historical developments: 1857-1947

POLITICAL DEVELOPMENTS IN PAKISTAN SINCE 1947

LAND AND PEOPLE OF PAKISTAN

Geography, Society., Culture., Natural resources., Health and education with reference to characteristics trends and problems.

RECOMMENDED BOOKS

1. Ideological Orientations of Pakistan by Sharif Al Mujahid.
2. Struggle for Pakistan by I.H. Qureshi.
3. The Making of Pakistan by Richard Symond

6. INTRODUCTION TO ALLIED HEALTH SCIENCES II

Existing status and scope of various sub-disciplines existing in Allied Health Sciences. Working and trouble shooting of Equipments available in different sub-disciplines of Allied Health Sciences. Recent advances and future trends in various sub disciplines of Allied Health Sciences.

RECOMMENDED BOOKS

1. Basic Pathology by Robbins Latest Edition.
2. Essentials of Radiology by Fred A Mettler Latest Edition.
3. Short practice and surgery by Bailey and Love Latest Edition.
4. Text book of community medicine by Parke J. E. Latest Edition.
5. Text book of clinical chemistry by NW Tietz Latest Edition.
6. Practical Heamtology By Dacie And Lewis Latest Edition.
7. Medical Bacteriology: A Practical Approach by Peter Hawky Latest Edition.
8. Basic Medical Lab Technology by CJ Kirk and RN Peel Latest Edition.

3rd Year

Medical Instrumentation -I	100 Marks
General Technology I (General Pathology & Microbiology)	200 Marks
General Technology II (Haematology & Blood Banking)	200 Marks
Total	**500 Marks**

PAPER I: MEDICAL INSTRUMENTATION I

Different relevant Techniques used in Medical fields. The names of instruments used, based upon different Techniques for working and evaluation of different parameters in Medical fields. Normal functioning of these instrument, parts of these instruments & individual functions of these parts. Their trouble shootings and routine manipulations to obtain correct results. Maintenance of Sensitivity & Specificity of these instruments. The general study of following Medical Instruments available in Medical fields.

Microscopes; Types, functions, uses, limitations etc. Advanced Microscopy techniques. Water Bath. Water Distillation unit. Incubators. Colorimeters & Photometers, advanced UV visible & IR Spectrophotometers including different types of Chemistry Analysis. Amino Acid Analyzer. Flame Photometers. Chromatography; including Paper, Thin layer, Gel and other types of chromatographics & advanced chromatographic techniques e.g. Gas Chromatography, GLC, HPLC etc. Electrophoresis Apparatus; its types, functioning the Papers Gel electrophoresis and Iso-electric Focusing etc. Elisa Apparatus; its parts, scope, working, limitations and uses. Haematology Analyzers; its parts, scope, working, limitations & uses etc. Centrifuge Machines; types, functions, use, limitations. Micro Wave Ovens. Refrigerators. Freezers. Glucometers. B.P Apparatus. Pulse Meters. Weighing Machines. Scientific Calculators etc.

PAPER II: GENERAL TECHNOLOGY I (GEN. PATHOLOGY & MICROBIOLOGY)

i. GEN. PATHOLOGY

Cell Injury and Death: Causes of cell injury, Necrosis, Apoptosis and Sub cellular responses. Cell Adaptations: Hyperplasia, Hypertrophy, Atrophy, Metaplasia and Intracellular accumulation. Inflammation: Acute inflammation. Vascular events, Cellular events and Chemical mediators. Chronic Inflammation. General, Granulomatous and Morphologic patterns of acute and chronic inflammation. Healing and Repair: Normal controls, Repair by connective tissue and Wound healing. Haemodynamic Disorders. Edema, Hyperemia / congestion, Hemorrhage, Thrombosis, Embolism, Infarction and Shock. Diseases of Immunity General features, Hypersensitivity reactions, Immune deficiencies, Autoimmunity and Amyloidosis Neoplasia**:** Nomenclature, Molecular basis, Carcinogenic agents and Clinical aspects

ii. MICROBIOLOGY

Interaction between host and infectious agent. Purpose of infectious agent in nature. What is the virulence role of environment in infection? Gram positive cocci. Taxonomy. General characteristics. Clinical significance of bacteria. Isolation and identification of bacteria. Staphlococci and related gram positive cocci. Strepto cocci. Entero cocci. Enterobacteriaceae: Escherichieae. Edwardsielleae. Salmonelleae. Citrobacteriaceae. Klebsielleae. Proteacae. Yersinieae, Erwinieae. The Non-fermentative gram negative bacilli. Curved gram-negative bacilli. Vibrionaceae and campylo- bactericaeae. Fastidious gram negative bacilli. Hemophilus. sp. Actino bacillus sp. Pasteurella. Dysgonomonas species. Streptobacillus

Moniliformis brucella species. Bartonella. sp. Bordetella sp.Legionella. Neisseria species and moraxella catarrhalis. Aeobic and gram positive bacilli. Listeria monocytogenes. Erysipelothrix. Corynebacterium. sp. Gardnerella vaginalis. Lactobacillus sp. Aerobic actinomycetes. Nocardioform group the maduromycetes. Streptomycetes. Thermophilic actinomycetes. The Anaerobic bacteria, Anaerobic. non. Spore forming gram-positive bacilli. Acinomycetes.sp, Lactobacillius. Clostridum species. Mycoplasmas and Ureaplasmas. Mycobacteria. Spirochetal infections: Treponema. Borrelia, Leptospira, Spirillum minus(rat bite fever)

Mycology:

Clinical categorization of fungal infections. Laboratory approach to diagnosis of fungal infection. Identification of dermatophytes. Laboratory identification of yeast.

Parasitology:

Clinical manifestations of parasitic disease. Life cycle. Prevention. Collection. Transport of specimen and its identification in laboratory. Intestinal (1) Protozoa. Amoeba. Flagellates. Ciliates.(2) Nematodes. (3)Cestodes (4) Trematodes(5) Blood and tissues parasites.

Virology:

Introduction. Clinical manifestation of viral infection. Diagnosis of viral infection. Infections with Chlamydia species. Infections with Rickettsia. Coxiella. Ehrlichia and anaplasma.

Sterilization

Laboratory Exercises:

- Each lecture will be followed by two hour practical class where the student will apply their theoretical knowledge in the understanding of related microbiological investigations, which have been proved useful for the diagnosis of human diseases.
- During the other laboratory sessions, the students will be engaged in the preparation of media, the sterilization of glass ware, Antigens, Antibodies, Vaccines – haemolysin, permanent slides, laboratory reagents and also to assisting postgraduate students in the isolation of micro – organisms from clinical materials.

- Practicals in Gernal Pathology:

- Acute Inflammation
- Chronic Inflammation
- Necrosis
- Gangrene
- Pigmentation
- Calcification

2- Microbiology:

- Urine Examination
- Sterilization
- Culture Media
- Sensitivity
- Blood Culture
- Anaerobic Culture/Jar
- Gram Staining
- ZN Staining

3- Mycology:

- KOH preparation for scraping

4- Parasitology:

- Stool Examination

5- Virology:

ELISA

PAPER III: GENERAL TECHNOLOGY II (HAEMATOLOGY & BLOOD BANKING)

i. HAEMATOLOGY

Orientation and introduction to study of Haematology. Origin and Development of Blood Cells. Maturation of Erythrocytes and erythrocyte count. Haemoglobin. Haematocrit, Erythrocyte sedimentation rate. Maturation of Leukocytes, Leukocyte Count. Maturation of Thromobocytes. Preparation of Blood Smears and Differential Blood Count. Total Eosinophil Count and Cerebrospinal fluid count. Pathology of Erythrocytic series, Including abnormal Haemoglobin syndromes and Indices. Reticulocytes, Haemostasis and Blood Coagulation. Laboratory Diagnosis of Coagulation defects. Special Stains in Haematology. L.E Phenomenon and Continuation of Bone Marrow study.

Introduction to Haematology

Review of vascular system and Blood Constituents. Methods for Securing Blood. Method for securing Bone Marrow. Origin and Development of Blood cells, Maturation of Erythrocytes and erythrocyte count. Blood formation; Intrauterine & Extrauterine. Factors which govern Haematopoiesis. Principles of Normal cell Maturation. Erythrocytes; Definition, Maturation and Erythropoesis. Enumeration of Erythrocytes. Haemoglobin; Definitions of terms. Chemistry of Haemoglobin. Metabolism. Compounds of Haemoglobin. Haemoglobinometery. Correlation of Haemoglobin, Haematocrit, and Erythrocyte Count. Erythrocyte Sedimentation Rate. Maturation of Leukocytes, Leukocyte Count. Introduction: Definition, Origion & Functions and biological Properties. Maturation of Granulocytic Series. Maturation of Lymphocytic Series. Maturation of Monocytic Series. Enumeration of Leukocytes:- Maturation of Thrombocytes. Preparation of Blood Smears. Fixation & Staining. Examination of stained smears: Normal Values for the method used. Cerebrospinal fluid: Definition. Sources. Functions. Collection:- The Lumbar puncture. Laboratory studies. Necessity of maintaining sterlity. Necessity of imidiate examination. Gross Observation. Cytologic studies. Principle of the cell count. Normal values and significance abnormal findings. Pathology of Erythrocytic series, Including abnormal Haemoglobin syndromes and Indices. Brief review of maturation of erythrocytes and haemoglobin metabolism. The Indices & Abnormal Forms:

Reticulocyte Count, Fragility of Erythrocytes, Sickle cell studies: Reticulocyte Counts: Fragility of Erythrocytes: Sickle Cell studies: Principle of tests for sickle cell studies, Laboratory Diagnosis. Thrombocytes, Homeostasis, and Blood Coagulation: Thrombocytes: Haemostasis: Special stains in Haematology: Peroxidase stain. Sudan Black B. Periodic Acid Schiff (PAS) Stain. Feulgan reaction Histochemical techniques for alkaline phosphatase. Miscellaneous stains used in Haematology:

Giemsa. Prussian blue reaction. L. E phenomenon and techniques of L.E cells preparation. Bone Marrow Examination. Bone marrow aspiration and trephine biopsy. Bone marrow differential count.

ii. BLOOD BANKING

History of Blood Transfusion. Antigen – Antibody theory. Classification of antibodies. Blood Groups A.B.O systems. Rh – Hr typing, Agglutinogen-Agglutinin theory. Cross matching procedure. Other Blood group system. Transfusion Reactions. Antiglobulin tests. Rh antibody tests. Erythroblastosis foetalis (Review of clinical and Laboratory findings). Donors. History of Blood Transfusion. Antigen Antibody theory: Antigen, Antibody, Immunization. Classification of Antibodies: Preciptin, Lysin, Agglutinoid, Complete/Bivalent Antiglobulin test. Blood groups ABO systems: Agglutinogen, Agglutinin, Landsteiner's Postulates, Sub groups of "A" and "B". Techniques for blood grouping-slide test. Techniques for reverse blood grouping-tube test. Sources of error, controls in blood bank, general. Low titered groups "O" blood. Rh – Hr Typing: Agglutinogen Agglutinin theory: Agglutinogen definition, Agglutinin definition, Cause of sensitization to the Rh – Hr factor, Techniques for Rh typing, Sources of error Controls. Cross Matching prcocedures: Purpose of ccrossmatch. Methods of crossmatching. Crossmatching problems; Rouleaux. Cold Agglutinins. Hyperproteinemia and hyperglobulinemia. Other Blood Group Systems. Transfusion reactions. Antiglobulin tests: Direct Coomb's. Indirect Coomb's. Sources of error, controls. Rh Antibody tests: Screening tests using a cell panel; Slide test. Tube test. Titrations. Erythroblastosis Foetalis: Causes: Due to Rh incompatibility. Methods of testing. Due to ABO incompatibility. Methods of testing.

PRACTICALS

1- Hematology:

- Malarial Parasites
- TLC, DLC

- Hb, ESR

2- Blood Banking:

- Blood Grouping and Cross Matching

4th Year

Medical Instrumentation II	100 Marks
Special Technology I (Histopathology & Cytopathology)	200 Marks
Special Technology II (Immunology & Serology)	200 Marks
Community Medicine including Sociology, Biostatistics & Research Methodology	100 Marks
Total	**600 Marks**

PAPER I: MEDICAL INSTRUMENTATION II

Different relevant Techniques used in Medical fields. The names of instruments used, based upon different Techniques for working and evaluation of different parameters in Medical fields. Normal functioning of these instrument, parts of these instruments & individual functions of these parts. Their trouble shootings and routine manipulations to obtain correct results. Maintenance of Sensitivity & Specificity of these instruments. The general study of following Medical Instruments available in Medical fields

Microtomes; parts, working, limitations & uses. Power Labs. ECG Machines. EEG Machines. Echo-Cardiography. Endoscopy Machine. X-Ray, MRI & Mammography Machines. Ultra Sound Machine. Anesthesia Machine. Dental Chair. Other specialised Machines used in fields of Surgery, Medicine, Gynae & Obstetrics, Eye, ENT, Paediatrics, Cardiology, Radiology, Orthopaedics, Neurosurgery, Urology and Dermatology etc.

PAPER II: SPECIAL TECHNOLOGY I (HISTOPATHOLOGY & CYTOPATHOLOGY)

i. HISTOPATHOLOGY

Brief history of microscopy. Parts of a microscope. Types of microscope. Classification and their uses. Nature of light, Concepts of amplitude, Wavelength and Phase. Perception of color and brightness. Refraction, formation of images. Merits and Demerits of achromatic and apochromatic objectives. Immersion objectives. Specification of objective magnification, focal length, tube length, resolution, numerical aperture etc. Calculation of the resolution and magnification. Care and Cleaning of the Microscope. Introduction to common Histological Techniques: Examination of fresh material. Supravital staining. Examination of fixed material. Fixation: The purpose of fixation, common fixative used for the histological techniques. The Paraffin method of sectioning tissue: Advantages and disadvantages of the paraffin method. Dehydration of tissues. Clearing of tissues Infiltration with paraffin. Paraffin block making. Section cutting with a rotary microtome. Fixing paraffin section to slides. Microtome and Microtome Knives: Grinding and stooping of microtome knives & Cleaning and lubrication of the microtome.

The Freezing Method of Sectioning: Advantages and disadvantages of freezing method, Common techniques of freezing tissues & Cutting sections with a freezing microtome.

Stains: Object of staining, Classification of stains, Acids and basic dyes & Basophilic and acidophilic tissue components. Routine Haematoxyline-Eosin Staining of Paraffin Sections. The procedure of haematoxyline-eosin staining and mounting sections & The relation of various steps in this procedure. Special Staining Techniques. GMS, Mucicarmine and Alcian Blue. Stains for Connective Tissue Elements. Mallory's connective tissue stain, Aldehyde fuchsin and Verhoff's stain for elastic fibers, Gordon + Sweet stain for reticular fibres, Toluidine blue staining of mast cells & Von- Geison, Masson's Trichome. Stains for Nervous Tissues: Nissel Stain. Stains for myelin. Histochemical demonstration of lipids: Choice of fixative, Choice of sectioning Technique, Sudan Black B Stain & Staining for frozen section. Histochemical demonstration of glycogen: Choice of fixative and sectioning & best's Carmine staining for paraffin sections. Demonstration of: Calcium, Iron, Melanin, Muscle Tissue PTAH, Amyloid Material, Mucinous Material The PAS Technique: The Schiff reaction, Significance of the Schiff reaction & Procedure of the PAS staining. Special Gross Anatomical Techniques. Preserving and mounting gross anatomical specimen: Preservative fluids: Kaiserling Solution I & II, Mounting specimens in fluid media & Mountings specimens in plastics. Immunohistochemistry. Introduction and significance, Methods of Immunohistochemistry: Direct and Indirect, PAP / Avidin Biotin method, Steps involved in Immunohistochemistry (starting from dewaxing to the final chromogen application), Significance of interpretation of the results: scoring/ staining intensity,

Antigen retrieval methods, Types of fixatives, buffering media, enzyme labels and chromogens used in Immunohistochemistry & List of commonly used tumor markers in different diseases and their clinical utility. Biopsy and types of biopsies. Merits and demerits of different types of biopsies, Fixation methods with salient gross and microscopic morphological changes in common diseases of: Gastrointestinal Tract, Genitourinary System (Male and Female), Respiratory tract, Brain and spinal cord, Skin and subcutaneous tissues. Heart and blood vessels, Lymphatic system including tonsils, lymph nodes, the spleen and thymus

ii. CYTOLOGY

Cell and its structure, classification of cells and tissues, Basic principles of exfoliative cytology, Exfoliation, sites from which exfoliated cells can be obtained and methods for obtaining them. Pathologic processes affecting cell morphologies. Inflammation, Repair and regeneration, benign and malignant tumors. Female genital tract, Methods for obtaining smears and their fixation. Pap's and Giemsa's staining, Normal cells of female genital tract, Abnormal cells other than malignant cells & Diagnosis of carcinoma of male genital tract. Respiratory tract: Method for obtaining smears and their fixation. Cytologic techniques for Urinary tract, G.I. tract & Circulating blood and aspirating smears. Immunocytochemistry. Introduction and significance, Methods of Immunocytochemistry: Direct and Indirect, PAP / Avidin Biotin method, Steps involved in Immunocytochemistry (starting from fixation to the final chromogen application). Antigen retrieval methods, Types of buffering media, enzyme labels and chromogens used in Immunocytochemistry.

PRACTICALS

Histopathology:

- Squamous Cell Carcinoma and Papilloma
- Characteristics of Malignancy
- Haemangioma
- Fibroadenoma
- Colloid Goiter
- Leiomyoma and Leiomyosarcoma
- Hyperplasia
- Lipoma
- Osteogenic Sarcoma
- Papillary Carcinoma Thyroid
- Fibroadenoma and carcinoma breast
- Endometrial Hyperplasia
- BPH
- Carcinoma Prostate
- Renal cell carcinoma
- Acute Appendicitis
- Tuberculosis of intestine
- Chronic Cholecystits
- Meningioma

2- Cytology:

- FNA
- Pap Smear

PAPER III: SPECIAL TECHNOLOGY II (IMMUNOLOGY & SEROLOGY)

i. IMMUNOLOGY

General Immunology

Innate and adaptive immunity. Antigen and antigenecity. Antibodies and immunoglobulins. Cell mediated and humoral immunity. Immune system. Hypersensitivity. Autoimmunity. Immune mediated diseases. Immunization. Immune deficiency

Immunological Techniques

General considerations. Agglutination reactions. Precipitation reactions. Immunodiffusion techniques. Double diffusion. Single radial immunodiffusion. Immunoelectrophoresis. Complement Fixation test. Immunoflourescence. Direct & Indirect Enzyme Immunoassay (EIA).

Immunochemical Techniques:

Quantitation of IgG, IgA, IgM, IgD, and IgE in serum and other body fluids. Immunoelectrophoretic analysis of serum immunoglobulin abnormalities Detection/quantitation of Bence-Jones protein in the urine. Cryoglobulin determination and analysis. Tests for circulating immune complexes by immunochemical methods. Immunochemical and electrophoretic analysis of CSF. Measurement of overall complement function. Total haemolytic and alternative pathway titrations of complement components (especially C3, C4, Factor Band C1 esterase inhibitor). Electrophoretic examination for altered complement components**.** Other serum protein determinations including acute phase proteins (CRP etc.), Carcinoembryonic antigen, a-fetoprotein and protein clearance ratios. Pregnancy tests on urine.

Immuno histological Tests:

Detection of antigens, antibodies, Immunoglobulins and complement components deposited in pathological lesions, particularly in the kidney and skin; Characterization of plasma cells and lymphocyte types in relevant tissue biopsies, using immunofluorescent and enzyme-labelled techniques.

ii. SEROLOGY

Introduction of immune system. Antigens, definition types examples. Anti-bodies definition, types functions, structures. Antigen anti-body reactions

Serological Techniques

Tests for circulating antibodies to autoantigens in tissue sections by indirect immunofluorescence and enzyme-labelled techniques. Tests for antibodies to other autoantigens by agglutination, precipitation, complement fixation and radioimmunoassay. Tests for antibodies to non-microbial environment and fool allergens. Tests for antibodies to selected microbiological antigens. Tissue Typing For HLA-Antigens: Serological and DNA based. Principles of Quality Control and the use of reference preparations as laboratory standards. Antigen-Antibody reaction techniques. ELISA Technique. Widal test. Typhidot test. Brucella Agglutination test. Anti-streptolysin O titre. Bacterial Haemagglutination test. Paul Bunnel reaction. RA Factor Test. CRP test. RPR test. VDRL test. Complement fixation test. PCR.

PRACTICALS

- Immunology:

- ELISA
- Latex Agglutination

Serology:

- Widal Test

PAPER IV: COMMUNITY MEDICINE INCLUDING SOCIOLOGY, BIOSTATISTICS & RESEARCH METHODOLOGY

A. COMMUNITY MEDICINE

INTRODUCTION

History of Community Medicine, Definition, concept of Health & illness of diseases and Natural History of diseases, levels & prevention

ENVIRONMENTAL SANITATION & MEDICAL ENTOMOLOGY

Water, waste disposal and Environmental problems & pollution

GENETICS

Prevention of genetic diseases and Genetic counseling

GENERAL EPIDEMIOLOGY

DESCRIPTIVE EPIDEMIOLOGY

Time, Place and Person

ANALYTICAL EPIDEMIOLOGY

Case control and Cohort studies

EXPERIMENTAL EPIDEMIOLOGY RANDOMIZED CONTROL TRIAL

SYSTEMIC EPIDEMIOLOGY

Vector borne diseases, Water borne diseases, Air born diseases, Contact diseases and Diseases of major public health and its importance along with national health programs wherever Applicable.

NON-COMMUNICABLE DISEASES:

Diabetes, Hypertension, Heart diseases, Blindness, Accidents, Geriatric problems

OCCUPATIONAL HEALTH PROBLEMS:M.C.H. and family welfare Programs, Health care delivery in the community, National Health Policy, National Health programs including, Rehabilitation, Evaluation of Health, Programs, Health Planning Organization,

STRUCTURE OF HEALTH CARE SYSTEM IN THE COUNTRY

P.H.C. district level, State level and central level. P.H.C. Organization and Function and Role of Non Governmental Organization

HEALTH EDUCATION

Principles of Health Promotion, Methods, approaches and media for, I.E.C (Information, Education & Communication), Medical and Health/Information system, Mental Health and Nutrition.

TEACHING METHODOLOGY

Types of health services, public, private, scientific, traditional health system, Organization of public services in health, central, provincial and local levels, Burden of disease, concept of health needs for care, Levels of health care, primary, secondary and tertiary, Planning of health services, Organization of health services, Implementation and evaluation of health services, Management of resources in health services, Financial management, Health education and social cultural concept in health, Ethics in Health Services, Theories of learning facilitations Cognitive, Psychomotor domain & effective domain and Bloom taxonomy.

B. SOCIOLOGY

INTRODUCTION TO SOCIOLOGY

Definition, Subject matter, Sociology and The science of society

SOCIAL ACTION AND INTERACTION

Social processes, Co-operation, Competition and Conflict and Accommodation.

SOCIAL GROUPS

Primary-Secondary, In and Out Group and Reference group

CULTURE

Meanings, Materials, Non-material aspects of culture, Values, Beliefs, Sanctions, Cultural relativism and Ethnocentrism, Norms, Folk ways, Mores and Laws, Role and Status, Conflict, Deviancy and Social control.

SOCIALIZATION AND PERSONALITY

Socialization and personality formation

SOCIAL INSTITUTION

Meanings, Social stratification and Meanings and Forms (Classes and Castes)

SOCIAL AND CULTURAL CHANGE

Factors of promoting and resisting social change

THE FIELD OF MEDICAL SOCIOLOGY

Contribution of sociology to medicine, Social causes of diseases, Aging and its socio-medical implication, Environmental pollution and health, Patient perspective of Illness, Patient, Physiotherapist relationship and Role of Physiotherapists and attendants in the managements of patient.

RECOMMENDED TEXT BOOKS:

1. *Text book of Community Medicine* by: Park J E. Latest Edition
2. *David, Tucket (ed), 1976, An Introduction to Medical Sociology, Lahore, Tavistock Publication.*
3. *Horton, Paul B. and Chester L. Hunt, 1984 Sociology, Singapore: Megraw Hill Book Co.*
4. *Moon, Graham, 1995. Society and Health; An introduction to Social Science for Processionals, London: Routledge.*
5. *Smelter Heil J. 1993. Sociology, New Delhi, Prentice Hall of India:*

C. BIOSTATISTICS

WHAT IS STATISTICS?

Definition of Statistics, Population, sample Descriptive and inferential Statistics, Observations, Data, Discrete and continuous variables, Errors of measurement, Significant digits, Rounding of a Number, Collection of primary and secondary data, Sources, Editing of Data.

PRESENTATION OF DATA

Introduction, basic principles of classification and Tabulation, Constructing of a frequency distribution, Relative and Cumulative frequency distribution, Diagrams, Graphs and their Construction, Bar charts, Pie chart, Histogram, Frequency polygon and Frequency curve, Cumulative Frequency Polygon or Ogive, Historigram, Ogive for Discrete Variable. Types of frequency curves.

MEASURES OF CENTRAL TENDENCY

Introduction, Different types of Averages, Quantiles, The Mode, Empirical Relation between Mean, Median and mode, Relative Merits and Demerits of various Averages. Properties of Good Average, Box and Whisker Plot, Stem and Leaf Display, definition of outliers and their detection

MEASURES OF DISPERSION

Introduction, Absolute and relative measures, Range, The semi-Inter-quartile Range, The Mean Deviation, The Variance and standard deviation, Change of origin and scale, Interpretation of the standard Deviation, Coefficient of variation, Properties of variance and standard Deviation, Standardized variables, Moments and Moments ratios. .

PROBABILITY AND PROBABILITY DISTRIBUTIONS.

Discrete and continuous distributions: Binomial, Poisson and Normal Distribution.

SAMPLING AND SAMPLING DISTRIBUTIONS

Introduction, sample design and sampling frame, bias, sampling and non sampling errors, sampling with and without replacement, probability and non-probability sampling, Sampling distributions for single mean and proportion, Difference of means and proportions.

HYPOTHESIS TESTING

Introduction, Statistical problem, null and alternative hypothesis, Type-I and Type-II errors, level of significance, Test statistics, acceptance and rejection regions, general procedure for testing of hypothesis.

TESTING OF HYPOTHESIS- SINGLE POPULATION

Introduction, testing of hypothesis and confidence interval about the population mean and proportion for small and large samples

TESTING OF HYPOTHESES-TWO OR MORE POPULATIONS

Introduction, Testing of hypothesis and confidence intervals about the difference of population means and proportions for small and large samples, Analysis of Variance and ANOVA Table.

TESTING OF HYPOTHESIS-INDEPENDENCE OF ATTRIBUTES

Introduction, Contingency Tables, Testing of hypothesis about the Independence of attributes.

REGRESSION AND CORRELATION

Introduction, cause and effect relationships, examples, simple linear regression, estimation of parameters and their interpretation and R^2. Correlation. Coefficient of linear correlation, its estimation and interpretation. Multiple regression and interpretation of its parameters.

RECOMMENDED BOOKS

- Walpole, R. E. 1982. "Introduction to Statistics", 3rd Ed., Macmillan Publishing Co., Inc. New York. Muhammad, F. 2005.
- "Statistical Methods and Data Analysis", Kitab Markaz, Bhawana Bazar Faisalabad

D. RESEARCH METHODOLOGY

RESEARCH FUNDAMENTALS:

Rehabilitation Research, Theory in Rehabilitation Research, Research Ethics

RESEARCH DESIGN:

Research Problems, Questions, and Hypotheses, Research Paradigms, Design Overview and Research Validity

EXPERIMENTAL DESIGNS:

Group Designs and Single-System Design

NON EXPERIMENTAL RESEARCH:

Overview of Non experimental Research, Clinical Case Reports, Qualitative Research, Epidemiology, Outcomes Research and Survey Research.

MEASUREMENT:

Measurement Theory and Methodological Research.

DATA ANALYSIS:

Statistical Reasoning, Statistical Analysis of Differences; The basics, Statistical Analysis of Differences; Advanced and special Techniques, Statistical Analysis of Relationships; The basics and Statistical Analysis of Relationships; Advanced and special Techniques

BEING A CONSUMER

Locating the Literature, Evaluating Evidence One Article at a time and Synthesizing Bodies of Evidence

IMPLEMENTING RESEARCH:

Implementing a Research Project and Publishing and Presenting Research

RECOMMENDED TEXT BOOK:

1. *Essentials of clinical research* By Stephan P. Glasser
2. Rehabilitation Research (Principles and Applications) 3rd Edition By Elizabeth Domholdt
3. Textbooks of Community Medicine, by Prof. H. A. Siddique (2nd Edition).
4. Parks text book of preventive & social medicine –K Park

5th (Final) Year

Medical Labs Report Writing and Evaluation	200 Marks
Medical Lab Establishment	200 Marks
Supervised Clinical Labs Practices	200 Marks
Total	**600 Marks**

PAPER I: MEDICAL LABS REPORT WRITING AND EVALUATION

INTERPRETING AND CORRELATING ABNORMALLABORATORY VALUES

General Considerations
Fundamental Principles in Interpretation of Values

REPORTING OF ABNORMALITIES IN THE HEMATOLOGY PROFILE

Anemias,
Microcytic Anemia
Normocytic Anemia
Macrocytic Anemia
Quantitative White Blood CellAbnormalities
Infection: The Most Common Cause of Elevated WBCCount
Elevated WBC Count Due to Leukemoid Reaction
Elevated WBC Count Due to CML
Elevated WBC Count Due to Chronic Lymphocytic Leukemia
Leukocytosis Due to Acute Leukemias
Low White Cell Counts
Coagulation Disorders
Bleeding Time Measures Platelet Function
Major Causes of Increased PT or APTT
The Other Cause of Isolated PT or APTT is Coagulation Factor Deficiency
The Major Cause of Elevated PT and APTT is DIC

REPORTING OF ABNORMALITIES IN CLINICAL CHEMISTRY

Electrolyte Abnormalities
Hyponatremia
Pseudohyponatremia
Hypernatremia
Hypokalemia
Hyperkalemia
Renal Disease
BUN
Creatinine
Calcium and Phosphate
Calcium and Albumin
Blood Gas Abnormalities
Anion Gap
Oxygenation
Glucose Abnormalities
Other Abnormal Laboratory
Findings in Diabetes Mellitus
Liver Function Tests
Correlations of Liver Function Test Results With Other Laboratory Findings
Cardiac Function Tests
Diagnosis of Myocardial Infarction and Acute Coronary Syndrome
Diagnosis of Congestive Heart Failure
Pancreatic Function Tests
Markers for Inflammatory Conditions
Endocrine Function Testing Principle
Thyroid Function
Adrenal Function
Parathyroid Hormone and Vitamin D

REPORTING OF INFECTIONS (MICROBIOLOGY REPORTING)

General consideration
Antibiotic sensitivity
Urine Complete examination

Faecal examination
Direct Microscopy
Staining
Reporting of bacterial culture
Reporting of fungal culture
Reporting of viral culture
Reporting of bacterial infection
Reporting of fungal infection
Reporting of viral infection
Reporting of PCR

REPORTING OF ABNORMALITIES IN THE IMMUNE SYSTEM

Reporting of Allergy
Reporting of Hypersensitivity reactions
Reporting of Immune deficiency
Reporting of Autoimmune diseases

Reporting Of Immunological Diseases;

Acetylcholine receptor
Graves' disease
Insulin-resistant diabetes
Lambert-Eaton myasthenia
Systemic lupus erythematosus
Rheumatoid arthritis
Rheumatic fever
Hemolytic anemia
Idiopathic thrombocytopenic purpura
Goodpasture's syndrome
Pernicious anemia
Hashimoto's thyroiditis
Insulin-dependent diabetes mellitus
Addison's disease
Acute glomerulonephritis
Periarteritis nodosa
Guillain-Barré syndrome
Wegener's granulomatosis
Pemphigus
IgA nephropathy
Allergic encephalomyelitis and multiple sclerosis

REPORT WRITING OF OTHER RELEVANT DISCIPLINES

Radiology / Ultra sound

PRACTICALS

General aspects of report
Components of report
General Pattern of lab report
Interpretation of Lab reports
Normal and abnormal values Hematology reports
Normal and abnormal values Chemical pathology reports
Normal and abnormal values Microbiological reports
Normal and abnormal values Immunological reports
Abnormal aspects of reports

RECOMMENDED BOOKS

1. Basic Pathology by Robbins Latest Edition.
2. Text book of clinical chemistry by NW Tietz Latest Edition.
3. Practical Heamtology By Dacie And Lewis Latest Edition.
4. Medical Bacteriology: A Practical Approach by Peter Hawky Latest Edition
5. Basic Medical Lab Technology by CJ Kirk and RN Peel Latest Edition
6. HENRY'S Clinical Diagnosis and Management by Laboratory Methods, 22nd Edition

PAPER II: MEDICAL LAB ESTABLISHMENT

1. **LEADERSHIP AND MANAGEMENT**
   Operation management
   Human Resource Management
   Financial Management
   Marketing Management
   Quality Systems Management
2. **STRATEGIC PLANNING**

3. **LABORATORY DESIGN AND SERVICE MODELS**
   Assessment
   Physical Design
   Identify Space for offices
   Personal Facilities
   Storage
   Conference/Library area
   Students Area
   Fume Hoods and Biological safety cabinets
   Furniture
   Noise control
   Eye wash station
   Laboratory counters

4. **REGULATIONS, ACCREDITATION AND LEGISLATION**
   Prospective Payment System
   Deficit Reduction Act
   Clinical Laboratory Improvement Act of 1988 (CLIA '88)
   Physician Self-referral Ban
   Ergonomic Safety and Health Program Management Guidelines
   Three-Day Rule
   Occupational Exposure to Hazardous Chemicals in Laboratories
   Occupational Exposure to Blood-Borne Pathogens
   Health Insurance Portability and Accountability Act:
   OIG Compliance Guidelines
   CMS National Coverage Determinations:
   Hazardous Material Regulations
   Laboratory-Related Governmental Agencies
5. **SAFETY**
6. **BIOLOGICAL HAZARD**
7. **CHEMICAL HAZARD**
8. **ERGONOMIC HAZARD**
9. **WASTE DISPOSAL**

PRACTICALS

Recruitment of Staff
Documentation
Equipments
Test methods
Test Report design/ Certificates
Design of Lab
Size of Lab
Building requirement
Specified areas in lab
Safety
Hygiene
Disposal of Waste

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4. HENRY'S Clinical Diagnosis and Management by Laboratory Methods, 22nd Edition

PAPER III: SUPERVISED CLINICAL LABS PRACTICES

Purpose of this subject to make technologist be responsible for the supervision and operation of a clinical laboratory within the field of specialization indicated by the title within the group; to perform the most difficult and highly complex test, analyses and examinations within the assigned laboratory; and to do related work as required**.**

1. INTRODUCTION TO PRINCIPLES OF GOOD LAB PRACTICE

Introduction
The fundamental points of good lab practice
The good lab practice principles

2. RESOURCES

Management
Personnel
Facilities : buildings and equipment

3. CHARACTERIZATION

THE TEST ITEM

- Date of dispatch
- Number of containers or items, type of contents and quantity
- identity of the test item
- batch numbers
- identity of the person responsible for the dispatch
- Name of the transporter and type of carrier.

4. QUALITY ASSURANCE

- Protocol (or study plan) review
- Sop review
- Planning (master schedule, inspection plan)
- Audits and inspections
- Quality assurance statement
- Qa inspections of suppliers and contractors
- Issuing and archiving of QA files and reports

PRACTICALS

Internal Audit
External Audit
Proficiency testing
Accreditation
Lab Record Keeping
Laboratory information system
Optimizing Laboratory workflow and performance
Procurements of Lab Consumables and instruments
Budgeting of Labs
Inspections of Labs

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3. Basic Medical Lab Technology by CJ Kirk and RN Peel Latest Edition