UNIVERSITY OF SARGODHA
OFFICE OF THE REGISTRAR
(ACAD BRANCH)

NOTIFICATION

On the recommendations of Academic Council made in its 14th (1/2022) meeting held on 22.02.2022, the Syndicate in its 59th (1/2022) meeting held on 27.09.2022, approved the revised curriculum for DPT and BS (AHS) program w.e.f. session 2022-2023 onwards. Copies of approved curricula are annexed at **'A' & 'B'** respectively.

24/10/22.

(Asif Mehmood)
Deputy Registrar (Acad)

No. SU/Acad/615

Dated: 24.10.2022

Distribution:

- Incharge, Department of Allied Health Sciences
- Controller of Examinations
- Director, Information Technology
- Deputy Registrar (Affiliation) (with the request to inform the affiliated colleges concerned)
-

C.C:

- Director Academics
- Director QEC
- Secretary to the Vice-Chancellor
- PA to Registrar
- Notification file

AFFILIATION BRANCH ★ No 910 Date 28/10/22 ★ U.O.S. SGD

Annexure - 'B'

REVISED SYLLABUS & CURRICULUM

w.e.f. 2022-2023 onwards

FOR

BS- ALLIED HEALTH SCIENCES (BS AHS)

(Four Year Degree Program)

A: BS AHS (Pathology Lab Sciences)
B: BS AHS (Surgery / OT Lab Sciences)
C: BS AHS (Radiology Lab Sciences)
D: BS AHS (Public Health Lab Sciences)

Department of Allied Health Sciences
Sargodha Medical College Campus
University of Sargodha
Sargodha

Forwarded for
o/a P/.
24/10/22.

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Sargodha Medical College
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A: BS-AHS (PATHOLOGY LAB SCIENCES)

Allied Health Professionals are the professionals who have the technical expertise in a wide variety of disciplines to help the Physicians and surgeons in the Diagnosis and treatment of various diseases. Medical/Pathology Lab Sciences is the back bone of all the Medical Sciences and a Medical Lab Scientist is conducting all clinical tests of the patients from different specimens of the human body. It deals with the methods of disease diagnosis based on analysis and clinical examination of different specimens of human body.

GOALS OF THE PROGRAMME:

The purpose of BS pathology lab sciences (PLS) program is to prepare laboratory professionals/technologists who will:

1. Keep pace with the advancements in the modern diagnostic sciences.
2. Be primary provider of diagnostic care
3. Fulfill the health care system needs and should be well versed with the basic and advance diagnostic methods to improve the patient treatment.
4. Serve as responsible members in the professional community and are willing and able to assume leadership roles in the communities they serve.
5. Identify researchable problems, advocate and participate in research, and incorporate research findings into clinical practice.
6. Skillful, competitive and knowledgeable both practically and theoretically.
7. Cater the local and international needs for diagnosis.
8. Have the capacity, knowledge and capability to undertake career in enhancing patient diagnosis to improve treatment in community and health care systems.
9. Correlate theory with practice and think creatively about, react to, adapt or shape new practice environments.

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OBJECTIVES OF THE PROGRAMME:

Graduates of the pathology lab sciences programme will:

1. Be the primary member of the team involved in diagnosing the patients illness.
2. Develop accuracy and meticulousness to attain high levels of ethics and technical proficiency.
3. Develop good leadership, problem solving, planning and management skills.
4. Serve as responsible members in the professional community and are willing and able to assume leadership roles in the communities they serve.
5. Advocate evidence based practice and participate in high quality research programs.
6. Practice respecting the social, economic and cultural issues of practice and effectively advocate for changes in policy
7. Integrate theoretical and practical knowledge and should be creative and adaptive to different working environments.
8. Participate in continuous education for communities, patients, peers, students and others.

BS PLS Curriculum/Syllabus

1st YEAR

Sr. No.	Subject Title	Theory Marks	Practical / Clinical & G. Viva Marks	Total Marks
1	ANATOMY I	100	100	200
2	PHYSIOLOGY I	100	100	200
3	BIOCHEMISTRY & GENETICS I	100	100	200
4	FUNDAMENTALS OF MEDICAL LAB SCIENCES	100	100	200
5	ENGLISH	100	Not Applicable	100
6	INTRODUCTION TO COMPUTER	100	Not Applicable	100
	TOTAL	**600**	**400**	**1000**

2nd YEAR

Sr. No.	Subject Title	Theory Marks	Practical / Clinical & G. Viva Marks	Total Marks
1	ANATOMY II	100	100	200
2	PHYSIOLOGY II	100	100	200
3	BIOCHEMISTRY & GENETICS II	100	100	200
4	MEDICAL INSTRUMENTATIONS	100	100	200
5	ISLAMIC STUDIES	100	Not applicable	100
6	PAKISTAN STUDIES	100	Not applicable	100
	TOTAL	**600**	**400**	**1000**

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3rd YEAR

Sr. No.	Subject Title	Theory Marks	Practical / Clinical & G. Viva Marks	Total Marks
1	GENERAL PATHOLOGY AND MICROBIOLOGY	100	100	200
2	HAEMATOLOGY AND BLOOD BANKING	100	100	200
3	CHEMICAL PATHOLOGY, IMMUNOLOGY AND SEROLOGY	100	100	200
	TOTAL	**300**	**300**	**600**

4th YEAR

Sr. No.	Subject Title	Theory Marks	Practical / Clinical & G. Viva Marks	Total Marks
1	SCIENTIFIC INQUIRY, BIOSTATISTICS, RESEARCH METHODOLOGY	100	Not applicable	100
2	HISTOPATHOLOGY AND CYTOPATHOLOGY	100	100	200
3	LABORATORY MANAGEMENT	100	100	200
	TOTAL	**300**	**200**	**500**
	RESEARCH REPORT WRITING	Qualifying		

Note:

1. There shall be 01Question Paper in each subject having an equal contribution from all sections.
2. 10% marks are reserved for internal assessment based upon 3-5 Class Tests average, Class attendance, and Overall performance.

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.

Title	Recommended	Actual		
		Teaching	Clinical/Lab work	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	1500+1500+1200+1300=5500	300+600=900	6400/4=1600 hours/year

DIVISION OF STUDY HOURS

1st YEAR

Sr	Subject Title	Theory	Practical
1	Anatomy I	200	100
2	Physiology I	200	100
3	Biochemistry & Genetics I	200	100
5	Fundamentals of Medical Lab Sciences	200	200
6	English	100	--
7	Introduction to Computers	100	--

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`	**TOTAL**	**1500**

2nd YEAR

Sr	Subject Title	Theory	Practical
1	Anatomy II	200	100
2	Physiology II	200	100
3	Biochemistry & Genetics II	200	100
5	Medical Instrumentations	200	200
6	Islamic Studies	100	--
7	Pakistan Studies	100	--
	TOTAL	**1500**	

3rd YEAR

Sr	Subject Title	Theory	Practical
1	General Pathology and Microbiology	200	200
2	Haematology and Blood Banking	200	200
3	Chemical Pathology, Immunology and Serology	200	200
	TOTAL	**1200**	

4th YEAR

Sr	Subject Title	Theory	Practical
1	Scientific Inquiry, Biostatistics, Research Methodology	200	--
2	Histopathology and Cytopathology	200	200
3	Laboratory Management	200	200
	Report Writing	300	
	TOTAL	**1300**	

BREAK DOWN OF HOURS OF CLINICAL PRACTICE/LAB ROTATIONS

Year	Ward/Clinic	Hours	Period
3rd Year	Laboratory Rotation	300	06 Months
4th Year	Laboratory Rotation	600	06 Months
	TOTAL	**900**	

Grand Total

G. TOTAL (Theory + Practical + Report + Clinical)	**6400**

Note:

*2/3rd of the clinical training shall be provided in the morning whereas 1/3rd shall be provided in the evening. There shall be 02 months of summer vacations in an academic session.

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1. PAPER PATTERNS & MARKS DISTRIBUTION OF UNIVERSITY EXAMINATIONS

PAPER PATTERN

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	**No of Questions**	**Marks for each Stem**	**Total marks**
Question 01:MCQs (20 stems with 04 possible options only 01 correct)	01	01	01x20 = 20
Question 02 to 09: SEQs (Requiring short answer of all)	08	05	08x05 = 40
Question 10 to 12: LEQs (Requiring detailed answer of any 02 Qs)	02	15	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	**No of Questions**	**Marks for each Stem**	**Total marks**
Question 01:MCQs (20 stems with 04 possible options only 01 correct)	01	01	01x20 = 20
Question 02 to 09:SEQs (Requiring short answer of all)	08	05	08x05 = 40
Question 10 to 12:LEQs (Requiring detailed answer of any 02 Qs)	02	15	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**

Note:

Passing marks in each paper will be at least 50% in theory and 50% in practical/viva voice (in the case of practical subjects).

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DETAILED COURSE OUTLINE PLS

1st Year

1.	Anatomy I	200 Marks
2.	Physiology I	200 Marks
3.	Biochemistry & Genetics I	200 Marks
4.	Fundamentals of Medical Lab Sciences	200 Marks
5.	English	100 Marks
6.	Introduction to Computer	100 Marks
	Total Marks	**1000 Marks**

ANATOMY I

COURSE DESCRIPTION

The main aim of this course is to train and teach the students of first year BS degree program in such a way that they can practically apply the concepts of this subject which forms the firm foundation for the art of healing (medicine). The curriculum equips the students with the clear and comprehensive study of human body structural organization. The knowledge sharing is done with the students as it is the science of macro/micro structure and forms of the human body. The topics within the domain of anatomy include general anatomy, histology or microscopic anatomy, embryology or developmental anatomy, regional or gross anatomy which highlights the importance of the study of structural anatomy. Our teaching methodology involves group discussions, lectures and practical. At the end of the course study, the student will be able to understand the basic knowledge of upper limb, lower limb and thorax of the human body.

LEARNING OBJECTIVES

- Define basic technical terminology and language associated with anatomy
- Describe the structure, composition and functions of the organs in the human body
- Comprehend the concepts (& associated principles) for each general type of anatomical structures
- Demonstrate skills in the surface markings of clinically important structures, on normal living bodies and the correlation of structure with function
- Describe concepts of embryology and histology
- Identify histological slides of the human body
- Describe the interdependency and interactions of the structural and functional components of upper limb

COURSE CONTENTS:

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

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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:

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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 respective year.

RECOMMENDED 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
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.

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PHYSIOLOGY I

COURSE DESCRIPTION:

Physiology is the integrative study of cellular and whole-body function and is the pivotal discipline linking other basic biomedical sciences on the one hand with the experimental and clinical medicine on the other. The course is designed to explain the physical and chemical mechanisms that are responsible for the origin, development, and progression of life. Two approaches are used to explain events that occur in the human body; one emphasizes the purpose of a body process and the other emphasizes the underlying mechanism by which this process occurs. Physiologists, however, explain how processes occur in the body in terms of cause and- effect sequences of physical and chemical processes. Emphasis in the course will be on normal structure and function of the human body and the approach will be to develop an understanding of the integrative nature of physiological systems to maintain the internal environment of the body within very narrow limits compatible with life.

LEARNING OBJECTIVES

- Define the terminology related to the structure and function of the human body systems
- Compare and contrast the structural and functional characteristics of the various human body cells
- Describe basic chemical concepts and principles as they apply to the structure and functioning of the blood and neuromuscular system
- Analyze the interrelationships of body organ systems, homeostasis, and the complementarity of structure and functioning of the blood and neuromuscular system
- Demonstrate advance techniques to investigate the body and interpret data to be used for diagnosis and treatment
- Define the principles behind medical instrumentation and their usage

COURSE CONTENTS

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 , 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

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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 O2 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 + SPORT PHYSIOLOGY

Practical

HEMATOLOGY

Use of the microscope. Determination of haemoglobin. Determination of erythrocyte sedimentation rate. Determining packed cell volume. Bleeding and clotting time tests. 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 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.

BIOCHEMISTRY & GENETICS I

COURSE DESCRIPTION

The knowledge and skills in fundamental and introductory biochemistry is provided that are essential for further studies. This course provides a basic understanding of life processes at the biochemical molecular level. It provides an understanding of the normal biochemical processes in the human body in which the function of the various organs and tissues are integrated. It covers

introduction to the biomolecules i.e. amino acid, proteins carbohydrates, fats, enzymes and nucleic acids, and the nutritional biochemistry concludes the course. It also familiarizes the students with laboratory instruments / equipment used in biochemistry laboratory.

LEARNING OBJECTIVES

At the end of the course, the student should be able to demonstrate his knowledge and understanding on the subject with following learning objectives:

- Describe molecular and functional organization of a cell, and sub-cellular components in the context of chemistry and human biochemistry.
- Basic knowledge of structure, function and interrelationship of biomolecules and consequences of deviation from normal.
- Learning and understanding the properties, classification and functions of biomolecules with emphasis on amino acid, peptides, proteins, carbohydrates, lipids and nucleic acid.
- Having a clear understanding of the fundamental aspects of enzymology & its clinical applications.
- Explain importance of nutritional biochemistry with emphasis on minerals, trace elements, vitamins and balance diet.

COURSE CONTENTS

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, Globular proteins, Hemo-proteins and their clinical implications (such as jaundice etc)

ENZYMES

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

CARBOHYDRATES

Definitions, Classification, Biochemical Functions & Significance of Carbohydrates, Structure & Properties of Monosaccharides & Oligosaccharides, Structure & Properties of Polysaccharides, Bacterial cell Wall, Hetero-polysaccharides, Glycosaminoglycans(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

Sources, RDA, Biochemical Functions & Clinical Significance of Calcium & Phosphorus. Sources, RDA, Biochemical Functions & Clinical Significance of Sodium, Potassium, Chloride. Biochemical Functions & Clinical Significance of Iron, Copper, Zinc, Manganese, Magnesium, Selenium, Iodine and Fluoride

VITAMINS

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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

Practical

1. Working SOPs for a Biochemistry Practical Laboratory. Introduction to Laboratory Equipments and Techniques. Preparation of solution (Normal, Molar Equivalent solution etc).
2. Molisch's Test & Iodine Test. Benedict's Test &Barfoed's Test. Selivanoff's Test &Phenylhydrazine Test. Sucrose Hydrolysis. Starch Hydrolysis.
3. Biuret Test, Heat Coagulation Test & Salt Saturation Test. Ninhydrin Test, Xanthoproteic Test &Millon-Nasse's Test. Aldehyde Test, Sakaguchi's Test. Determination of Isoelectric pH of casein Protein.
4. Emulsification of natural fat & Solubility of soap, Test for Cholesterol, Iodine & Peroxide value calculation. Saponification value calculation
5. 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).

FUNDAMENTALS OF MEDICAL LAB SCIENCES

COURSE DESCRIPTION

Allied health professionals are considered the backbone of any healthcare work force and greatly influence the health care delivery system. This course is designed to give knowledge to the students about Medical Lab Sciences and the role of Medical Lab Profession and the professionals in medical & healthcare field. General introduction, importance, infrastructure, problems and the solutions of the problems encountered in different laboratories related to various sub sections of Medical Laboratories are the main focus of this course. This course aims at familiarizing the students with the basic laboratory procedures, preparation of different types of solutions, and reagents used in medical laboratories.

LEARNING OBJECTIVES

At the end of this course, the students will be:

- Able to demonstrate the basics of Pathology Lab Sciences and its various sub-disciplines.
- Familiar with all the basic laboratory procedures and the principles for working in the clinical laboratories.
- Well aware of the responsibilities of Pathology Lab professionals
- Know about the proper use of PPEs

- Well aware about personal protection; hygiene and trouble shooting of laboratory procedures

COURSE CONTENTS

What is laboratory, Types of laboratories, Basic laboratory principles, Planning and Organization of clinical laboratory, Staffing in clinical laboratory, Importance and role of laboratory in health care, Laboratory service network, Medical laboratory profession and professionals, professionalism in laboratory workers, Code of professional conduct for laboratory personnel, Qualities/characteristics of medical laboratory professionals, Different sub-disciplines of clinical laboratory,

Specimens for laboratory investigations: Collection, transport and storage of different types of specimens for laboratory investigation.

Patient preparation for tests, Phlebotomy techniques and guidelines, Collection of samples (Blood, Urine, Feces), transport of samples, anticoagulants, preservatives,

Quality assurance in collecting and processing of various types of laboratory specimens.

Introduction to basic equipments, chemicals, glass wares, plastic wares used in medical laboratories.

Personal protective equipments (PPEs): Types and uses of PPEs

General concepts of Microscopy: Microscopes; Definitions, Types, functions, uses, limitations

Water Bath: Working principle, component parts and their uses

Water Distillation unit: Procedure for preparing distilled water.

Incubators: operating principle, types, operation

Sterilization and disinfection – classification and methods of sterilization

- Definition of sterilization, Basic principle, Methods of sterilization
- Sterilization by heat.
  - By Dry Heat - Flaming, Red Heat, Hot air oven, incineration.
  - By Moist heat-Pasteurization, Inspissation, Tyndallisation & autoclave.
- Filtration Methods – in brief.
- Ionizing Radiations
- Disinfection – Mode of action and uses of important chemical disinfectants – phenol and phenolic compounds, alcohols, aldehydes halogens, dyes, acids and alkalies.
- Gaseous methods of sterilization

Common glassware in clinical laboratory, Cleaning, Care and Maintenance of Glassware.

Pipettes; Different types, uses and pipetting techniques, Calibration of pipettes and other volumetric equipments.

Refrigerators and Freezers; introduction, working principle and uses

Glucometers: Types, working principle, operation and uses

Balances: types of balancing equipments, Weighing Machines: Types, operating principles, calibration, maintenance and uses

Hot plate and its uses,

Bunsen burner and its uses in different section in the laboratory,

Fume hood: Procedure for use

Shaker: Types and uses

B.P Apparatus: Types, working principle and operation

Pulse Meters. Procedure for use

Scientific Calculators etc

Units of Measurements and laboratory calculations:

Different types of solutions used in medical laboratory. Standard solutions, calibrators, controls, Buffer solutions, Reagent solutions, Staining solutions etc.

Different types of hazards encountered in medical fields including Biological, electrical, mechanical hazards

Infection control:

Vetted

Practical

Use of PPEs, Preparation of solutions, Measurements of volume, Pipetting and dispensing practice, Handling of basic laboratory equipments, chemicals, reagents, Preparation of standards and control solutions, Preparing sample layout for laboratory record keeping, Sterilization of laboratory items. Collection, transport and storage of different types of specimens for laboratory investigations.

RECOMMENDED BOOKS

1. Medical laboratory Manual for Tropical Countries by Monica Cheesbrough Volume:1 Second Edition.
2. Baker & Silverton's Introduction to Medical Laboratory Technology Seventh Edition
3. Manual of Laboratory Medicine by AFIP

ENGLISH

COURSE DESCRIPTION

The course introduces the students to the underlying rules to acquire and use language in academic context. The course aims at developing grammatical competence of the learners to use grammatical structures in context in order to make the experience of learning English more meaningful enabling the students to meet their real life communication needs. The objectives of the course are to, reinforce the basics of grammar, understand the basic meaningful units of language, and introduce the functional aspects of grammatical categories and to comprehend language use by practically working on the grammatical aspects of language in academic settings. After studying the course, students would be able to use the language efficiently in academic and real life situations and integrate the basic language skills in speaking and writing. The students would be able to work in a competitive environment at higher education level to cater with the long term learners' needs.

LEARNING OBJECTIVES

Enable the students to meet their real life communication needs.

COURSE CONTENTS:

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 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.

INTRODUCTION TO COMPUTER

COURSE DESCRIPTION

This is an introductory course on information and communication technologies. Topics include ICT terminologies, hardware and software components, the internet and World wide web, and ICT based applications. Students will get basic understanding of computer software, hardware, and associated technologies. This course is aimed to introduce computer and its basic numerical methods, data bases, networking, etc. World wide web and basic terms of databases, ICT on internet will also be discussed and taught to the students. Techniques of information search, objectives include basic understanding of computer software, hardware, and associated technologies. How computers can be used in the workplace, how communications systems can help boost productivity, and how the Internet technologies can influence the workplace. The course is designed to equip and train students in basics of computers, internet resources, and several software required nowadays to complete the assignments, to design presentation. Course will also cover computer ethics and related social media norms and cyber laws.

LEARNING OBJECTIVES

After completing this course, a student will be able to:

- Understand different terms associated with computer and information technology.
- Identify various components of a computer system.
- Identify the various categories of software and their usage.
- Define the basic terms associated with communications and networking.
- Understand different terms associated with the Internet and World Wide Web.
- Use various web tools including Web Browsers, E-mail clients and search utilities.
- Use text processing, spreadsheets and presentation tools.
- The enabling/pervasive features of computer and information technology.

COURSE CONTENTS:

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

vetted

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 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

2nd Year

1. Anatomy II		200 Marks
2. Physiology II		200 Marks
3. Biochemistry and Genetics II		200 Marks
4. Medical Instrumentations		200 Marks
5. Islamic Studies		100 Marks
6. Pakistan Studies		100 Marks
	Total Marks	**1000 Marks**

ANATOMY II

COURSE DESCRIPTION

The main aim of this course is to train and teach the students of second year BS degree program in such a way that they can practically apply the concepts of this subject which forms the firm foundation for the art of healing (medicine). The curriculum equips the students with the clear and comprehensive knowledge of human body structural organization. The knowledge sharing is done with the students as it is the science of macro/micro structure and forms of the human body. The topics within the domain of Anatomy include Histology or Microscopic Anatomy, Embryology or Developmental Anatomy, Regional or Gross Anatomy and Neuroanatomy which highlight the importance of the structural Anatomy. Our teaching methodology involves group discussions, lectures and practical. At the end of the course study, the student will be able to understand the basic knowledge of structure, histology and development of the Abdomen, Pelvis, Head, Neck and Brain Regions.

LEARNING OBJECTIVES

- Describe gross anatomy of neuro-musculoskeletal and circulatory system of lower limb, abdominal wall and pelvis.
- Demonstrate anatomical landmarks and configuration of the lower limb, abdominal wall and pelvis through dissection/identification of structures in the manicans / smart board systems supplemented with the study of charts, models, prosected materials, and radiographs.
- Describe major stages of embryological development of the lower limb with development of the neurological and vascular supplies to the lower limb.

COURSE CONTENTS:

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

ABDOME; 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 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. Neuroanatomyby Richard S.Snell

Vetted

PHYSIOLOGY II

COURSE DESCRIPTION

Physiology is the integrative study of cellular and whole-body function and is the pivotal discipline linking other basic biomedical sciences on the one hand with the experimental and clinical medicine on the other. The course is designed to explain the physical and chemical mechanisms that are responsible for the origin, development, and progression of life. Two approaches are used to explain events that occur in the human body; one emphasizes the purpose of a body process and the other emphasizes the underlying mechanism by which this process occurs. Physiologists, however, explain how processes occur in the body in terms of cause and- effect sequences of physical and chemical processes. Emphasis in the course will be on normal structure and function of the human body and the approach will be to develop an understanding of the integrative nature of physiological systems to maintain the internal environment of the body within very narrow limits compatible with life.

LEARNING OBJECTIVES

- Describe functions of gastrointestinal tract, endocrinology and cardiovascular system
- Describe physiology at the molecular, metabolic/cellular, tissue and systems levels
- Differentiate the physiological responses in normal function and disease stages

COURSE CONTENTS:

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.

Clinical Module

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

REPRODUCTION

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.

Clinical Module

Male infertility. Female infertility. 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.

Practical

Nervous System

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

RECOMMENDED 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

BIOCHEMISTRY & GENETICS II

COURSE DESCRIPTION

The knowledge and skills in fundamental and introductory biochemistry is provided that are essential for further studies. This course provides a basic understanding of life processes at the biochemical molecular level. It provides an understanding of the normal biochemical processes in the function of the various organs and tissues with the principles of metabolic integration giving the genetic, biochemical and molecular understanding of the biochemical basis of various disease processes. It also familiarizes the students with laboratory instruments / equipment used in biochemistry laboratory with modem biochemical techniques and their uses in the diagnosis of diseases especially genetic diseases.

LEARNING OBJECTIVES

At the end of the course, the student should be able to demonstrate his knowledge and understanding on the subject with following learning objectives:

- To learn basic understanding with the homeostatic mechanisms through the concepts of

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inter-regulation of carbohydrates, lipids and protein metabolism and its relation to hormone actions in the human body.

- To learn and understand the basic biochemical processes taking place in the body, and understanding their relation with normal and abnormal human metabolism.
- To learn how large molecules are synthesized and used, and how energy is generated, stored, and retrieved (metabolism). And to have understanding and knowledge about how diseases are related to biochemical defects.
- To learn and describe respiration at cellular and molecular level and to explain the various biochemical pathways related to metabolism of carbohydrates, protein, lipids and nucleic acid.
- Applying basic knowledge of protein synthesis, post translational modification and targeting to its cellular destination.
- To learn and understand the molecular mechanisms of gene expression, the principles of genetic engineering & their applications in medicine.
- To learn and understand the basics of Molecular Medicine, Gene therapy and Stem Cell therapy in Physical Therapeutics.
- To have the basic principles and to make use of techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis.

COURSE CONTENTS:

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, Alcohol Metabolism

METABOLISM OF LIPIDS

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

Metabolism of Nucleic Acids

HORMONES

Classification & Mechanism of Action of Hormones, Signal Transduction, Second Messengers and Receptors, Hypothalamic & Pituitary Hormones, Steroid Hormones: Glucocorticoids and Mineralocorticoids, Insulin & Glucagon and brief introduction to the Diseases related to hormones abnormalities

MOLECULAR BIOLOGY

Structural Organization of Chromosome and Genes, Replication, Transcription and Translation (Protein synthesis)in Prokaryotes & Eukaryotes, Regulation of Gene Expression, Mutations and DNA repair mechanisms,Recombinant DNA Technology, Polymerase Chain Reaction, Blotting Techniques, Nucleic acid hybridization assays

Practical

1. Techniques of Instruments in Clinical Biochemistry with examples.
2. Visible Spectrophotometry. Flame photometry. UV & IR spectrophotometry. Atomic Absorption spectrophotometry. pH Metry. Chromatography and determination of Amino Acids in Urine by paper chromatography

3. Clinical quantitative analysis in Biochemistry
   - Serum Glucose Estimation. Glucose tolerance Test (GTT). Serum Cholesterol estimation (Total, HDL and HDL cholesterol). Serum Bilirubin Estimation (Total, Direct and Indirect bilirubins). Serum Proteins Estimation (Total, Albumin & Globulin). Serum Total lipids Estimation. Serum calcium Estimation (total, ionized & unionized). Serum Uric acid Estimation. Serum Urea Estimation. Serum Creatinine Estimation. Enzymes Estimation in Serum: AST, ALT, ALP, Creatine Kinase (CK) and LDH.

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. Biochemistry by Stryer (Latest Edition).by Stryer, Lubert, Latest Ed

MEDICAL INSTRUMENTATIONS

COURSE DESCRIPTION

This course is designed to provide general knowledge of basic clinical laboratory instrumentations to undergraduate students of Medical Lab Sciences. Emphasis is placed on theoretical concepts of instruments, components, functions and their operations, calibration and troubleshooting of instruments. Getting the right diagnosis is a key aspect of health care which provides an explanation of patient's health problem and appraises subsequent health care decisions. This interactive course covers the various chemicals used in variety of clinical laboratories for testing the clinical specimens to obtain the information about patients in diagnosis, treatment and prevention of diseases. By the end of this course, students will be familiar with the working principle, operation, quality control and assurance, and maintenance of sate of the art instruments used in clinical laboratories for testing clinical specimens to obtain the quality results.

LEARNING OBJECTIVES

Upon completion, students will possess the theoretical knowledge, skills, and abilities to:

- Understand the working principles, components and their functions of biomedical instruments & Chemicals used in the field of Allied Health Sciences for diagnostic and research.
- Operate and calibrate all these instruments mention in course content list efficiently.
- Understand importance of precaution to be taken while working with instruments & Chemicals.
- Detect errors and dealing with the accidents due to mishandling.
- Ask for routine instruments service in time.
- Selection and buying of medical instruments.
- Care and routine maintenance of these instruments.

COURSE CONTENTS

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, 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.

Microscopes; Types, functions, uses, limitations etc. Advanced Microscopy techniques.

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University of Sargodha

Colorimeters & Photometers: advanced UV visible & IR Spectrophotometers including different types of Chemistry Analyzers.
Haematology Analyzers; Working principle, its parts, scope, working, limitations & uses etc.
Flame Photometers. Working principle, component parts, operation, uses, care and maintenance
Turbidimetry, Component parts, working principle and uses
Nephelometry, Principle and operation, uses
ISE (Ion Selective Electrode). Their working principle, component parts, uses and applications.
ELISA Apparatus; Working principle and types of ELISA. Component parts of ELISA apparatus, working, limitations and uses.
Chromatography; including Paper, Thin layer, Gel and other types of chromatographics & advanced chromatographic techniques e.g. Gas Chromatography, GLC, HPLC etc.
Amino Acid Analyzer;
Electrophoresis Apparatus; its types, functioning the Papers, Gel electrophoresis and Iso-electric Focusing etc.
Microtomy: Definition, Types of Microtomes; parts, working, limitations & uses,
PCR: Basic principle, types and applications.
Blotting techniques including Western blot, Southern blot and Northern blot.
Blood gas analyzer.
Cryofuge. Storage cabinet in blood banking, Plasma extractor, Platelet apheresis,
Centrifuge Machines; types, functions, uses, limitations.
Autoclave: Principle, Types, component parts and operations, Uses etc.
Balances: types of balancing equipments, Weighing Machines: Types, operating principles, calibration, maintenance and uses
Water Distillation unit: Procedure for preparing distilled water.
Power Lab System: Construction, working principle and applications.
Biosafety & Biosecurity: Biosafety cabinets (BSCs): classification, uses, airflow (HEPA filters) in biosafety cabinets. Working with BSC, Biosafety levels, Biosafety and Biosecurity controls, culture vs climate, Behavioural cues development.
General overview of quality control and quality assurance
Calibrators: standards, low, normal, elevated control sera's and cells

Practical

Use of PPEs, Donning and doffing, Responding to sharp injuries, Handling and maintenance of laboratory instruments, Trouble shootings of laboratory instruments, Calibration of instruments, Preparation of standards and control sera's, Methods of measurements and calculation of results obtained through specimen analysis, Construction of control charts etc. Emergency evacuation, Spill management, Shipping of infectious material, waste management.

RECOMMENDED BOOKS

1. Medical laboratory Manual for Tropical Countries by Monica Cheesbrough Volume:1.
2. Baker & Silverton's Introduction to Medical Laboratory Technology Seventh Edition
3. Manual of Laboratory Medicine by AFIP
4. Good Clinical Laboratory Practices in Pakistan. Editors:2019 Aamir Ikram, Rita Guenther and Benjamin Rusek.
5. Clinical Chemistry techniques, principles, correlations sixth edition Michael L. Bishop.
6. Introduction to Medical Laboratory Technology Seventh Edition by F.J Baker.
7. Tietz Fundamental of clinical chemistry 7th edition

Vetted

ISLAMIC STUDIES

COURSE DESCRIPTION

This course is aimed at to provide Basic information about Islamic Studies, enhance understanding of the students regarding Islamic civilization, improve student's skill to perform prayers and other worships, enhance the skill of the students for understanding of issues related to faith and religious life. Enhance the general knowledge of the students regarding the Muslim world and its current political, economic, social, and defence problems. Students will discuss different current issues being faced by the Muslim World and the importance of unity and cooperation among Muslim countries. In this regard, they will learn about different projects and cooperation among Muslim countries, the Islamic religious tradition within historical, social and cultural contexts; visual, performative and oral expressions of the heritage of Islam, including language, literature, art, and architecture; intra-Islamic differences and issues of inter-cultural diversity and integration within the Islamic world; the political systems of Muslim majority countries.

LEARNING OBJECTIVES

This course is aimed at:

1 To provide Basic information about Islamic Studies
2 To enhance understanding of the students regarding Islamic Civilization
3 To improve Students skill to perform prayers and other worships
4 To enhance the skill of the students for understanding of issues related to faith and religious life.

COURSE CONTENTS:

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 یک نظر میں مولانا صدر الدین اصلاحی
4. قرآن اور تعمیر سیرت ڈاکٹر میر ولی الدین

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Sardar Bahadur Medical College
University of Baluchistan

PAKISTAN STUDIES

COURSE DESCRIPTION

The course is designed to acquaint the students of BS Programs with the rationale of the creation of Pakistan. The students would be apprised of the emergence, growth and development of Muslim nationalism in South Asia and the struggle for freedom, which eventually led to the establishment of Pakistan. While highlighting the main objectives of national life, the course explains further the socioleconomic, political and cultural aspects of Pakistan's endeavours to develop and progress in the contemporary world. For this purpose, the foreign policy objectives and Pakistan's foreign relations with neighbouring and other countries are also included. This curriculum has been developed to help students analyse the socio-political problems of Pakistan while highlighting various phases of its history before and after the partition and to develop a vision in them to become knowledgeable citizens of their homeland.

LEARNING OBJECTIVES

- Develop vision of historical perspective, government, politics, Contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

COURSE CONTENTS:

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

3rd Year

1. General Pathology and Microbiology	200 Marks
2. Hematology and Blood Banking	200 Marks
3. Chemical Pathology, Immunology and Serology	200 Marks
Total Marks	**600 Marks**

Vetted MES

GENERAL PATHOLOGY AND MICROBIOLOGY

COURSE DESCRIPTION

General pathology and microbiology courses are offered as vital subject matter at undergraduate level programs to students who are engaged in medical studies. This subject deals with the diagnosis of diseases which is ultimately back bone of healthcare system. A good diagnosis leads to excellent treatment and prognosis. In general pathology portion, students learn about the abnormal functions of the body and with the investigation of those pathological mechanisms which are common to all tissue, cell pathology. Students will be able to describe and demonstrate the processes of cellular adaptation, inflammation, repair, immunology, cellular accumulation, and neoplasia. While, microbiology course is designed to teach students about microorganism like bacteria, viruses, fugus and parasites. In this course, students will gain knowledge about the interaction of human body with these organisms and how these organisms cause diseases in humans. Students will get familiar with different techniques of microbiology which includes the identification and quantification of microorganisms that cause human disease (qualitative and quantitative analysis) which will provide diagnostic information for therapeutic support in the clinical management of patients. At the end of this course, students will be able to collect samples and process this sample according to microbiological protocols to generate microbiology report.

LEARNING OBJECTIVES

After completing this course, a student will be able to:

- Recognize the structural and functional causes of human disease.
- Describe the aspects of a disease process that form the core of pathology
- Describe the cause of a disease (etiology)
- Describe the mechanisms of disease development (pathogenesis)
- Describe the structural, biochemical and molecular alterations induced in cells and tissues by the disease (morphologic ,molecular & biochemical changes)
- Describe the functional consequences of these changes (clinical significance)
- Describe the infectious diseases.

COURSE CONTENTS

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

Basic Bacteriology

Bacteria Compared with Other Microorganisms, Structure of Bacterial Cells, Growth, Genetics, Classification of Medically Important Bacteria, Normal Flora, Pathogenesis,, Host Defenses, Laboratory Diagnosis, Antimicrobial Drugs: Mechanism of Action, Antimicrobial Drugs: Resistance, Bacterial Vaccines, Sterilization & Disinfection, Biosafety and bio risk management,

Clinical Bacteriology

Overview of the Major Pathogens & Introduction to Anaerobic Bacteria.

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Gram-Positive Cocci; *Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus saprophyticus, Streptococcus pyogenes, Streptococcus agalactiae, Enterococcus faecalis,* Viridans streptococci, *Streptococcus bovi and S. pneumoniae*

Gram-Negative Cocci; *Neisseria meningitides* and *Neisseria gonorrhoeae.*

Gram-Positive Rods; *Bacillus anthracis, Bacillus cereus, Clostridium tetani, Clostridium botulinum, Clostridium perfringens, Clostridium difficile, Corynebacterium diphtheria* and *Listeria monocytogenes.*

Gram-Negative Rods Related to the Enteric Tract; *E. coli, Salmonella* species, *Shigella* species, *Vibrio cholerae, Vibrio parahaemolyticus, Vibrio vulnificus, Campylobacter jejuni, Helicobacter pylori, Klebsiella, Enterobacter, Serratia, Proteus, Providencia, Morganella, Pseudomonas spp., Bacteroides & Prevotella.*

Gram-Negative Rods Related to the Respiratory Tract; *Haemophilusinfluenzae, Bordetella pertussis*, and *Legionella pneumophila*

Gram-Negative Rods Related to Animal Sources (Zoonotic Organisms); *Brucella* species, *Francisella tularensis, Yersinia pestis*, and *Pasteurellamultocida*

Mycobacteria, Actinomycetes, Mycoplasmas, Spirochetes, Chlamydiae, Rickettsiae, Minor Bacterial Pathogens

Basic Virology

Structure, Replication, Genetics, Classification of Medically Important Viruses, Pathogenesis, Host Defenses, Laboratory Diagnosis, Viral Vaccines.

Clinical Virology

Herpes Viruses, Rabies Virus, Polio Virus, Hepatitis Viruses, Human Immunodeficiency Virus, Dengue Virus.

Mycology

Basic Mycology, Cutaneous & Subcutaneous Mycoses, Systemic Mycoses, Opportunistic Mycoses,

Parasitology

Intestinal & Urogenital Protozoa, Blood & Tissue Protozoa, Minor Protozoan Pathogens, Cestodes, Trematodes, Nematodes.

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.

Practical

- Acute Inflammation
- Chronic Inflammation
- Necrosis
- Gangrene
- Pigmentation
- Calcification
- Urine Examination
- Sterilization
- Culture Media
- Antibiotic Sensitivity testing
- Culturing bacterial pathogens
- Examination of different clinical specimens

- Blood Culture
- Anaerobic Culture
- Gram Staining
- ZN Staining
- Biochemical tests to identify bacteria (Conventional, API 20E, API 20NE, Automated systems)
- PCR
- KOH preparation for scraping
- Stool Examination
- ELISA
- Reporting of culture and sensitivity for bacterial and fungal infections

RECOMMENDED BOOKS

1. Basic Pathology by Robbins Latest Edition
2. Clinical Pathology Interpretations by A.H. Nagi
3. Pocket Companion to Robbins, Pathologic basis of disease Cotran, Kumar
4. Theory and Practice of Histological Techniques by John D Bancrof

HAEMATOLOGY AND BLOOD BANKING

COURSE DESCRIPTION

The main aim of this course is the study of blood cells in normal and abnormal conditions. This subject is designed to provide the students with the basic concepts of human blood cells production, characteristics, functions and normal counts. At undergraduate level, this course demonstrates the basic understanding of the normal hematopoiesis and cellular functions, components and characteristics of all types of blood cells including red blood cells, white blood cells and platelets. In this course, the students are familiarized with the theory and practical application of hematology procedures, including quality control, quality assurance, safety, manual and/or automated methods as well as blood cell maturation sequences, and normal & abnormal morphology with associated diseases. After studying this course, the students will be equipped with the skills of counting each type of blood cells, measurement of hemoglobin, red cell indices, and interpretation of the morphology of normal and abnormal blood cells. The students are also able to diagnose and manage transfusion medicine issues in diverse patient populations. The students are familiarized with the principles of pre-transfusion testing including blood grouping, compatibility testing and the preparation of various blood products.

LEARNING OBJECTIVES

After completing this course, a student will be able to:

- Develop competency in techniques of hematology and blood bank, histopathology and cytology.
- Acquire knowledge and understand the formation of blood cells, structure, functions and methods of estimating different parameters.
- Learn about different haematological diseases and role of laboratory for identification of abnormalities.
- Perform special laboratory methods used in investigation of anemias.
- Learn about bone marrow aspiration and biopsy techniques, preparation of smears and staining.
- Understand the detailed aspects of blood coagulations, disorders of hemostasis, principles and methods of assessment of coagulation.

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- Collect blood by various methods to efficiently perform routine and special investigations in clinical hematology laboratory.

COURSE CONTENTS

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. 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. Organization of Blood banking, Standard operating procedures in blood banking, blood products and blood component preparation, Apheresis.

Practical

- Hemoglobin estimation
- RBCs count
- PCV/HCT
- Red cell indices: MCV, MCH, MCHC
- TLC, DLC
- ESR
- Reticulocyte Counts
- Platelets count
- Fragility of Erythrocytes
- Peripheral blood film examination
- Malarial Parasites
- Coagulation studies: PT, APTT, TT, Bleeding time, Clotting time, Fibrinogen level, FDP, D-Dimer, Clotting factors
- Blood Grouping: ABO grouping, Rh grouing,
- Donor screening
- Compatibility testing,
- Cross Matching: Major and Minor cross match
- Antibody titre
- Preparation of haematology and blood banking reports

RECOMMENDED BOOKS

1. Kumar, V., Abbas, A.K., & Aster, J.C. (2017). Robbins basic pathology. Elsevier Health Sciences.
2. Hoffbrand, A.V., & Steensma, D.P. (2019). Hoffbrand's essential haematology. John Wiley & Sons
3. Examinations, U. (2004). AH Nagi Clinical Pathology Interpretations.
4. Cheesbrough, M. (2006). District laboratory practice in tropical countries. Cambridge university Press
5. Pocket Companion to Robbins, Pathologic basis of disease Cotran, Kumar

CHEMICAL PATHOLOGY, IMMUNOLOGY AND SEROLOGY

COURSE DESCRIPTION

Chemical pathology is an important sub branch of pathology and deals with study of most common and frequent routine laboratory investigations. This course is designed to help students to understand different biochemicals in human body and role of these in aetiology of different diseases. The other portion of this course is immunology which comprised of theory and application of basic immunology, including the immune response, principles of antigen-antibody reactions, and the principles of serological procedures as well as quality control, quality assurance, and safety. Immunology is the study of the immune system and is a very important branch of the medical and

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biological sciences. The immune system protects us from infection through various lines of defence. If the immune system is not functioning as it should, it can result in diseases, such as autoimmunity, allergy and cancer. While serology is the scientific study or diagnostic examination of blood serum, especially with regard to the response of the immune system to pathogens or introduced substances. After learning this subject, students will be able to apply principles of safety, quality assurance and quality control in chemical pathology and immunology, evaluate specimen acceptability and describe the principals involved in different diseases.

LEARNING OBJECTIVES

After completing this course, a student will be able to:

- Describe the basic function of immune system
- Demonstrate the essential components of Immune system
- Describe and understand the basic function of humoral and cell mediated immunity
- Describe and understand about the role of different arms of immunity to combat with foreign particles
- Demonstrate maturation processes of different immune cells
- Describe the balance of body in order to response against antigens and anergy
- Demonstrate knowledge of different factors and mechanisms of autoimmunity
- Demonstrate knowledge of autoimmune diseases, their mechanisms and diagnosis
- Demonstrate knowledge of basics of serological testing
- Demonstrate knowledge of different serological tests, including their principle, procedure and interpretation
- Describe and understand issues involved with serological testing and how to maintain quality control in serological testing
- Describe the basic concepts and principals essential for chemical pathology laboratory practices.
- Describe the Clinical Interpretation of the laboratory test results and Pathophysiology of associated disease states.
- Proper operation various Instruments & procedures in the laboratory.
- Develop in the students concepts of Quality Assurance in Laboratory work and to teach its practical applications.
- Manage lab, including workload assessment, cost assessment, troubleshooting and development of SOPs & IPPs for the lab.
- Carry out the correct technique of collection & handling of various specimens.
- Comprehend the significance of patient preparation, sample requirement for a particular test & analyte stability to produce quality results.
- Operate independently Instruments & procedures used in Chemical Pathology lab.
- Perform different assays on semiautomatic & automatic instruments with achievable analytical accuracy & reproducibility.
- Understand and implement Quality Control procedures in the lab.
- Interpret critically the results of lab investigations in the context of the clinical profile.
- Do trouble shooting of pre-analytical, analytical and post-analytical errors.

COURSE CONTENTS

i. Chemical Pathology

Chemical Changes in Gastrointestinal tract: Digestion and digestive enzymes, their control and mechanism of secretion, Absoprtion of water, Minerals, Fats, Carbohydrate and proteins.

Blood glucose and diabetes: Definition and types of diabetes mellitus, Reference ranges, Abnormal values and their clinical significance

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Liver function tests: Classification of liver function tests, methods of determination, abnormal values, clinical significance

Renal Function Tests. Classification of renal function tests used in clinical assessment of renal function. Blood urea nitrogen. Serum Urea. Serum creatinine. Creatinine Clearance. Serum Uric Acid. Electrolytes. methods of determination, abnormal values, clinical significance.

Lipid profile tests: methods of determination, abnormal values, clinical significance.

Cardiac Function tests: Cardiac protein markers, Cardiac enzymes, Reference values, Abnormal values and their clinical significance

Minerals: Macro-mineral and micro-minerals/trace elements. Metabolism of Na, K, Ca, P, Mg, Fe, Zn, Cu, Se, Mn and Co,

Electrolyte balance and imbalance.

Water Balance: Distribution of body fluids, were intake and output, dehydration and edema. **Acid Base balance and imbalance:** Metabolic acidosis and alkalosis, Respiratory acidosis and alkalosis.

Hormones:

Parathyroid hormones: Parathyroid effects on Ca and phosphorus metabolism,

Thyroid functions and chemistry, Thyroid function tests, effects of thyroid hormones on metabolism.

Pituitary hormones: Anterior and posterior pituitary hormones

Growth hormone:

Gonadal and other steroid hormones: Male and female reproductive hormones, Adrenal hormones, Abnormal values and their clinical significance.

Tumor markers: Types, methods of determination and clinical significance.

Urine: Composition of glomerular filtrate and change which occur in the tubules, normal urine, physical properties, and composition, pathological constituents and their determination, **Quantitative Analysis of Urine:** Amino acids, Bence-Jones proteins, Calcium, Coproporphyrins, creatinine, glactose, phosphates, nitrogen, PH, specific gravity, Ca, p, Oxalates and urates. Determination of Urea (qualitative and Quantitative) pathological Constituents: Sugar, Albumin, Ketone bodies, Blood, Bile pigments and Urobillinogen in urine.

Inulin and Creatinine clearance (GFR).

Ketone bodies in urine, methods of detection, clinical significance.

Renal calculi: Different types of renal stones, methods of determinations, clinical significance

Haemoglobin, Myoglobin and Haemosiderin in Urine: Haematuria. Detection of Haemoglobin in urine. Myglobinuria. Haemosiderin; prussian blue reaction. Indicanuria. Phenylketonuria. Examination of Urinary Calculi.

Examination of various body fluids: Cerebrospinal fluids, Pleural fluids, Ascites

Semen analysis

Quality control and quality assurance in clinical laboratory: Quality control and quality assurance, Internal and external quality controls, Construction of quality control charts, Interpretation of QC charts/graphs, Westgard Rules.

Practical

i. Practical work shall be related to the relevant sub section of this speciality. Quantitative Analysis of Blood: Use of the visual colorimeter and photoelectric colorimeters, instruction on calculation of the concentration of the substances determined. The following blood analytical procedures will be performed. Liver function tests, renal function tests, lipid profile, Serum electrolytes, Glucose, OGTT, Glucose challenge test, Phosphates, iron, plasma proteins,

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calcium, Cardiac function tests. Hand on semi-automated and fully automated chemistry analyzers. Preparation of reports for different tests of chemical pathology.

ii. 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.

iii. 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
-

Practical

Different serological tests, their principle, interpretation of results and clinical significance

Principles of QUALITY CONTROL and the use of reference preparations as laboratory standards

1. Antigen-Antibody reaction techniques
2. ELISA Technique
3. Widal test:
4. Typhidot test
5. Brucella Agglutination test.

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6. Antistreptolysin O titre.
7. Bacterial Haemagglutination test.
8. Paul Bunnel reaction.
9. RA Factor Test
10. CRP test.
11. RPR test
12. VDRL test.
13. Complement fixation test
14. PCR
15. Preparation of immunological and serological test reports

RECOMMENDED BOOKS

1. Bishop, M. L., Fody, E. P., & Schoeff, L. E. (Eds.). (2013). Clinical chemistry: principles, techniques, and correlations (7th ed.). Philadelphia: Lippincott Williams & Wilkins
2. McPherson, R. A., & Pincus, M. R. (2017). Henry's clinical diagnosis and management by laboratory methods (23rd ed.). New York: Elsevier Health Sciences.
3. Examinations, U. (2004). AH Nagi Clinical Pathology Interpretations.
4. Cheesbrough, M. (2006). District laboratory practice in tropical countries. Cambridge university press.
5. Baron, D. N., Whicher, L. T., & Lee, K. E. (1993). New short textbook of chemical pathology. London: ELBS, 1993.
6. Anwar, M., Waqar, M. A., Khan, F. A., Tariq, W. U. Z., Ahmed, S., Mushtaq, S., ... & Dawood, M. M. (2005). Manual of laboratory medicine. Armed forces institute of pathology, Rawalpindi, Pakistan, 257-260.
7. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2019). Basic Immunology: Functions and Disorders of the Immune System (6th ed.). New York: Elsevier Health Sciences.
8. Rich, R. R. (Ed.). (2018). Core Laboratory Technologies in Clinical Immunology (1st ed.). Elsevier Health Sciences.
9. Kumar, V., Abbas, A. K., Fausto, N., & Aster, J. C. (2014). Robbins and Cotran pathologic basis of disease (9th ed.). New York: Elsevier Health Sciences.
10. Pocket Companion to Robbins, Pathologic basis of disease Cotran, Kumar

4th Year

1.	Scientific Inquiry, Biostatistics, Research Methodology	100 Marks
2.	Histopathology and Cytopathology	200 Marks
3.	Laboratory Management	200 Marks
	Report Writing	Qualifying
	Total Marks	**500 Marks**

SCIENTIFIC INQUIRY, BIOSTATISTICS, RESEARCH METHODOLOGY

COURSE DESCRIPTION

This course includes discussion on basic quantitative methods and designs, including concepts of reliability and validity, interpretation of inferential statistics related to research designs, co relational statistic & designs, interclass correlation coefficients, and critical appraisal of the literature. It involves selection of appropriate statistical techniques to address questions of medical relevance; select and apply appropriate statistical techniques for managing common types of medical data; use

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various software packages for statistical analysis and data management; interpret the results of statistical analyses and critically evaluate the use of statistics in the medical literature; communicate effectively with statisticians and the wider medical community, in writing and orally through presentation of results of statistical analyses; explore current and anticipated developments in medical statistics

LEARNING OBJECTIVE

- Identify the basic concepts of research and scientific inquiry and its methodologies
- Identify appropriate research topics
- Define appropriate research problem and parameters
- Construct a project proposal to undertake a research project.
- Discuss scientific Inquiry, its principle and application in medical research.
- Describe Search techniques for literature review
- Differentiate between different levels of evidence, appraisal and different studies with respect to their effectiveness in literature.
- Discuss necessary concepts of statistics to enable them to realize a research project in the field of Physiotherapy
- Explain Fundamentals of reading and understanding research methods, design, and statistics

COURSE CONTENTS

i. SCIENTIFIC INQUIRY

- Describe scientific inquiry, Evidence based approach to scientific inquiry, Principles of scientific inquiry, the application of scientific inquiry to physical therapy.
- Access digital libraries and different research databases, Effective searching and reviewing literature material.
- Interpret Critical appraisal of published research in the areas of Examination and Evaluation, Diagnosis, Prognosis, Intervention
- Interpret Critical evaluation of Randomized Control Trial (RCT), Systemic review, Diagnosis and screening tests, Case reports
- Discuss how to conduct clinical research and hierarchy of evidences in clinical researches

ii. BIOSTATISTICS

- Define 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. Exercises.

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. Exercises.

MEASURES OF CENTRAL TENDENCY

- Explain 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. Exercises.

MEASURES OF DISPERSION

- Describe 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. Exercises.

PROBABILITY AND PROBABILITY DISTRIBUTIONS

- Define Discrete And Continuous Distributions: Binomial, Poisson And Normal Distribution. Exercises.

SAMPLING AND SAMPLING DISTRIBUTIONS

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• Describe 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. Exercises.

iii. Research Methodology

Research Fundamentals; Research, Theory in 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
Implementing Research; Implementing a Research Project and Publishing and Presenting Research

RECOMMENDED BOOKS

1. Essentials of clinical research By Stephan P. Glasser.
2. Rehabilitation Research (Principles and Applications) 3rd Edition By Elizabeth Domholdt.
3. Walpole RE. Students study guide: introduction to statistics. 3rd ed. 1982.
4. Muhammad F. Statistical methods and data analysis. Faisalabad: KitabMarkaz; 2000
5. R. L Ott, Micheal T longnecker. An introduction to statistical methods and data analysis, 7th ed.
6. Brooks/Cole, Cengage Learning 2015

HISTOPATHOLOGY AND CYTOPATHOLOGY

COURSE DESCRIPTION

This subject will demonstrate students that how to do diagnosis of special diseases including histopathological and cytopathological diseases. In this course, students will learn about the techniques for the preparation of tissue sections from biopsy specimens and smears from the aspirates for the histopathological and cytopathological examination. At the end of this course, students will be able to collect biopsies and process these samples according to standard protocols to generate lab report.

LEARNING OBJECTIVES

After completing this course, a student will be able to:

- Develop competency in techniques of histopathology and cytology.
- Demonstrate collection, preservation and examination of body fluids to report the abnormalities.
- Learn about various histotechniques, handling, decalcification, processing, cutting of paraffin and frozen tissue specimens as well as staining procedures.
- Learn about theory of staining and perform routine as well as special staining techniques.
- Understand the principles of immunohaematology, blood collection and infectious marker determination
- Apply safety precautions, quality assurance, in histopathology and cytology.
- Demonstrate cytological investigations including collection, handling, processing and staining procedures for different clinical specimens.
- Demonstrate basic techniques of immunohistochemistry.

COURSE CONTENTS

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/Cytopathology**

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.

Practical

i. 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

ii. Cytology/Cytopathology:

- FNA Cytology
  Pap Smear

RECOMMENDED BOOKS

1. Suvarna, K. S., Layton, C., & Bancroft, J. D. (Eds.). (2018). Bancroft's theory and practice of histological techniques (8th ed.). UK: Elsevier Health Sciences.
2. Kumar, V., Abbas, A. K., Fausto, N., & Aster, J. C. (2014). Robbins and Cotran pathologic basis of disease (9th ed.). New York: Elsevier Health Sciences.
3. Anwar, M., Waqar, M. A., Khan, F. A., Tariq, W. U. Z., Ahmed, S., Mushtaq, S., ... & Dawood, M. M. (2005). Manual of laboratory medicine. Armed forces institute of pathology, Rawalpindi, Pakistan, 257-260.

LABORATORY MANAGEMENT

COURSE DESCRIPTION

A medical laboratory is a laboratory where clinical examinations are carried out on clinical specimens to obtain the information about patients health to aid in the diagnosis, treatment and prevention of diseases. In hospital and other patient care settings, laboratory medicine is provided by variety of medical laboratories working on multiple specialty areas of pathology. Credibility of medical laboratories is paramount to the health and safety of the patients relying on the clinical services provided by these laboratories. This course is designed with the main aims of providing the

knowledge to medical lab sciences students in their undergraduate studies to understand the principles of establishing and working of medical laboratories providing the information about patient health. The core focus of this course is the leadership, management, laboratory design, service models and the strategies for establishing a medical laboratory in a specialty area. This course also describes the regulations, accreditation and legislation for the establishment of a medical laboratory to provide quality results about patient health. In this course, students will gain theoretical and practical knowledge about the standards of establishing and managing of medical laboratories.

LEARNING OBJECTIVES

After completing this course, a student will be able to:

- Explain and apply the major principles and practices of laboratory administration, supervision of various lab disciplines and budgeting.
- Use leadership skills, help his/her team and organization make progress and act in the right way.
- Use quality assurance principles and practices to ensure the accuracy and reliability of laboratory tests.
- Interpret and evaluate patient results and suggest appropriate additional confirmatory tests.
- Understand lab investigations and form an accurate differential diagnosis.
- Implement standard operating procedures (SOPs) & influence the other staff to adhere with biosafety measures.
- Explain the working principles, methodologies and clinical significance of laboratory procedures in diagnosis and treatment of disease.
- Use educational methods to present information and develop instructional materials.
- Communicate effectively with laboratory personnel, other health care professionals, patients and the public.

COURSE CONTENTS

- Introduction to Health Facility, Management & Standards of Laboratory Practice
- Laboratory Infrastructure & Resources
- Quality Laboratory Management Systems
- Laboratory Safety
- Laboratory Commodity Management
- Laboratory Management of Information Systems
- Systemic approach to specimen Management & Processes
- Systemic approach to Laboratory processes
- Support Supervision
- Data Interpretation & its Commutation
- Effective administration of Laboratory Services
- Defining Standards of performance
- Procurement and budget processing
- Document control through complaints
- Control of Records, Internal Audits & Management Review

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

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. Clinical laboratory standards and indicators.

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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, Safety, Biological Hazard, Chemical Hazard, Ergonomic Hazard, Waste Disposal.

INTRODUCTION TO PRINCIPLES OF GOOD LAB PRACTICE: Introduction, The fundamental points of good lab practice, The good lab practice principles, 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

RESOURCES; Management, Personnel, Facilities: buildings and equipment

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.

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.

Quality Assurance and Lab Management

- Basic Concepts and Definitions
- Internal and External Quality Control Program
- Pre-analytical, Analytical and Post-analytical Errors
- Westguard rules
- Identifying sources of Analytical Errors
- The role of statistics in analytical work
- Sources of variation in analytical work
- Selection of Analytical Methods
- Basic concept of Lab Management
- Human Resource Management

Practical

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

RECOMMENDED BOOKS

1. Bishop, M. L., Fody, E. P., & Schoeff, L. E. (Eds.). (2013). Clinical chemistry: principles, techniques, and correlations (7th ed.). Philadelphia: Lippincott Williams & Wilkins

Vetted

Incharge
Department of Allied Health Sciences
Sargodha Medical College
University of Sargodha

2. Kumar, V., Abbas, A. K., Fausto, N., & Aster, J. C. (2014). Robbins and Cotran pathologic basis of disease (9th ed.). New York: Elsevier Health Sciences.
3. Anwar, M., Waqar, M. A., Khan, F. A., Tariq, W. U. Z., Ahmed, S., Mushtaq, S., ... & Dawood, M. M. (2005). Manual of laboratory medicine. Armed forces institute of pathology, Rawalpindi, Pakistan, 257-260.
4. McPherson, R. A., & Pincus, M. R. (2017). Henry's clinical diagnosis and management by laboratory methods (23rd ed.). New York: Elsevier Health Sciences.
5. Cheesbrough, M. (2006). District laboratory practice in tropical countries. Cambridge university press.

RESEARCH REPORT WRITING

In the final year, a project will be allocated to a single or group of students, depending on available facilities. The In-charge / chairperson of the concerned department/institute shall allot a supervisor. This report shall be evaluated by a panel of examiners notified by the office of the controller examination from an approved panel comprising external and internal examiners. Every student shall be evaluated keeping in view their contribution, thorough understanding of work done and comprehensive presentation. If the student cannot defend his/her work in 1st annual examination, they shall reappear in the 2nd annual/supplementary examination. The details of the report are given below

- Title page
- Names of students
- Students I.D number
- Supervisor's name
- Program name
- Name of the department
- Project title
- Abstract

Abstract

A maximum of one page (200 words) on the work performed and your main conclusions. Abstract should be single line spacing, should not contain any figures, contain a maximum of 2 references, and written in Arial / New Times Roman font size II. The title of the project should be on the first line (Arial / New Times Roman size 11, bold). The name of the student and their supervisor should appear on the next line (Arial / New Times Roman size 11, italic).The abstract should be then be included as a single paragraph. References (if required) should be included at the end (Arial / New Times Roman, size 9).

Points into account while writing Abstract

Explain the purpose of your study/paper. This should optimally be only one sentence long. State the primary objectives and scope of the study or the reasons why the document was written (unless these things are already clear from the title of the document or can be derived from the rest of the abstract). Also state the rationale for your research. Why did you do the research? Is the topic you are researching an ignored or newly discovered one? In terms of Methodology (research methods), clearly states the techniques or approaches used in your study. If you want to introduce new methods or approaches in your abstract, keep in mind the need for clarity.

Describe your results (the findings of your experimentation), the data collected, and effects observed as informatively and concisely as possible. These results of course may be experimental or theoretical, but remember the difference between conjecture and fact and note them in your abstract. Give special priority in your abstract to new and verified events and findings that contradict previous theories. Mention any limits to the accuracy or reliability of your findings.

By stating your conclusions, you are in essence describing the implications of the results: why are the results of your study important to your field and how do they relate to the purpose of your

Investigation? Often conclusions are associated with recommendations, suggestions and both rejected and accepted hypotheses. You may wish to include information that is incidental to the main purpose of your paper, but is valuable to those outside your area of study. If you choose to include such information, be careful not to exaggerate its relative importance to the abstracted document

Declaration of Originality

Place on a separate page;
"We hereby declare that this project is entirely our own work other than the counsel of our supervisor and that it has not been submitted for any academic award, or part thereof, at this or any other Educational Institution"
Signed: Authors
Counter signed: Supervisor

Acknowledgements (Optional)

To include those individuals or groups of individuals you would like to thank in relation to the support you received.

Table of Contents

You should list all of the sections and sub-sections, together with their corresponding page numbers
List of Tables
List of Figures
List of Appendices

Suggested Chapter Structure

The following outlines a chapter structure suitable to a project, which involved a distinct component of data collection. The structure of the main body is flexible and you should discuss an appropriate structure with your supervisor. The content and importance of each section will depend on the type of project you are undertaking and again should be discussed with your supervisor before submission.

Chapter 1. Introduction

i) Introduction (Very brief review of literature and indicate significance of study)
ii) Statement of Problem (Should include clear purpose of study)
iii) Questions/Hypothesis
iv) Outline Methodology
v) Definition of Terms

The introduction should 'set the scene' for the examiners and enable them to appreciate the relevance of your work in a particular research area.

Chapter 2. Literature Review

A literature review is an extended essay, which is based on source material. In simple terms, the merit of your literature review is proportional to the comprehensive nature and originality of your sources. Your writing should be confined to the questions/hypothesis being examined. A literature review is more than a listing of references. You should attempt to synthesize a new understanding of your topic, and provide a critique of what other commentators have had to say on the subject.

Chapter 3. Methodology

i) Participant Selection (Including ethical considerations)
ii) Experimental Design
iii) Measurement Procedures

- Data collection procedures
- Rationale for selecting these procedures/questions

iv) Analysis of Data

The methodology should describe the characteristics of the subjects, award of ethical approval, and where appropriate the apparatus, calibration procedures, reliability of the methods used, experimental protocols and the statistical treatments of the data. Diagrams and photographs may be appropriate to illustrate procedures.

Chapter 4. Analysis of Results

Vetted
Incharge
Department of Allied Health Sciences

Your results should consist of tables of your findings, illustrated with graphs where appropriate. The results section should contain text, which takes the reader through your graphs and tables, pointing out the salient features. Tables should wherever possible summarize the data from several subjects in the form of means and standard deviations. You do not need to give tables of every piece of original data. If you feel it is essential to include these put them in an appendix.

Chapter 5. Discussion of Results

It is good practice to begin with a summary of your findings. This is your opportunity to interpret your data in the context of what is already known from existing literature. However, make every effort to explain your findings first, justifying the arguments by reference to previously published work. NOT the other way around. The discussion is the place for explanations and opinions. Link your findings with the purpose/questions/hypothesis of your project. Include critical appraisal of your own work and that of others. Address what you would do differently with hindsight?

Chapter 6. Conclusion

- Summary of main findings
- Recommendations (Impact of findings and future research)
- Conclusion

This section should summarize main findings, highlight areas where more work is needed and suggest avenues for future development of this work. An overall conclusion from the study should be included to complete the project.

References: A list of references must be included at the end of the project document and appropriately referenced within the text according to a recognized standard of the University.

Appendices: In this section, if required, include any raw data, interview transcript, computer program listings, and questionnaires etc., which were not in the results section, but which may need to be consulted.

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