

CURRICULUM FOR BS MEDICAL LAB TECHNOLOGY



**WAZIR MUHAMMAD INSTITUTE OF PARAMEDICAL TECHNOLOGY
GANDHARA UNIVERSITY PESHAWAR**

Course Year	Title of subject	Content and examination method, Credit hours.	Assessment Method.	Undertaken at this
--------------------	-------------------------	--	---------------------------	---------------------------

1,2,3,4			Verbal = V Written = W Practical = P	institution Y/N
1 st Year	ANATOMY & HISTOLOGY	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To understand the basic concepts of anatomy beginning from the cell organization to organ system function • To understand the basic concepts of general anatomy including skeleton and muscular skeleton. • To Understand the anatomy of Thorax Abdomen and pelvis • To understand the anatomy of upper limb, lower limb and head and neck <p>COURSE CONTENTS:</p> <p>1.Introduction regarding:</p> <ul style="list-style-type: none"> • Anatomical Nomenclature. • Life span or a human being • Structural and functional organization • Terminology and body plan • Systematic anatomy. • Basic organization of the body. <p>2. Skin</p> <ul style="list-style-type: none"> • The structure of the hypodermis, dermis and epidermis. • Superficial fascia and deep fascia. <p>3. The Muscular Skeletal Systems:</p> <ul style="list-style-type: none"> • Muscles, bones and joints. • Components or the skeletal system •Description of axial and appendicular skeleton. The process of bone ossification. Growth, remodeling and repair. •Main features of the skull including all views. •Shape and regions of vertebral column. •Important features of the regional vertebrae. •Bones of the thoracic cage, including the types of the ribs. <ul style="list-style-type: none"> • The bones of the pectoral girdle and upper limb. •The bones of the pelvic girdle and lower limb. • Various types of joint and prime mover. •The movements of the arm, forearm and hand and the involved muscle groups. •Muscles of the trunk and the action they accomplish. •Movements of the thigh leg and foot with involved muscles groups. <p>4. The Nervous System:</p> <ul style="list-style-type: none"> •Division of the nervous system and characteristics of the each. 	W,V,P	Y

		<p>1. Central nervous system. II. Peripheral nervous system. III. Autonomic nervous system. IV. Special senses</p> <p>•Anatomical pathways and description of:</p> <ol style="list-style-type: none"> i. Olfactory system ---- Olfactory neurons. ii. Hearing and balance, structure of the outer middle and inner ear. iii. Visual --- chambers of the eye and structure of the rods and cones. iv. The structure of a neuron, nerve, nerve tract, nucleus, and ganglion. v. Cerebrospinal fluid and its circulation. viii. List the various cranial nerves. <p>5.The cardiovascular system.</p> <ul style="list-style-type: none"> • Anatomy of the heart --- the size, shape and location of the heart and chambers, valves and their location. • The location of the coronary arteries • The structure of the conduction system of the heart. • Pulmonary and systemic circulation. • The structure of arteries, capillaries and veins. • Major arteries and veins and the body areas, they supply. • Lymphatic system tonsils, lymph nodes the spleen and the thymus. <p>6. Respiratory System.</p> <ul style="list-style-type: none"> • The anatomy of the respiratory passages, beginning at the nose and ending with the alveoli. • The lobes of the lungs and the membranes that cover the lungs. • Pleural cavity •The muscles of the contraction of respiration. <p>7. The Digestive System.</p> <ul style="list-style-type: none"> • The structure or the organs that make up the digestive tract and their relations to other organs in thoracic and abdominal cavity. • Important secretory glands, the liver and pancreas (both exocrine and endocrine components). <p>8. Genitor-Urine system</p> <ul style="list-style-type: none"> • The structures and organs of the urinary system and is relations with other organs. • The structure of the nephron. • Formation of sex cells. • Organs of the male reproductive system. • Organs of the female reproductive system. <p>Practicals:</p> <ol style="list-style-type: none"> 1. Study Axial and Appendicular skeleton on 		
--	--	---	--	--

		<p>human skeletal model.</p> <ol style="list-style-type: none"> 2. Study musculoskeletal system on human musculoskeletal model. 3. Study and understand the anatomy of Upper limb, Lower limb, Head and Neck 4. Study and understand anatomy of Thorax, Abdomen and Pelvis through: <ol style="list-style-type: none"> a Human Models b Video demonstration. <p>Assessments: Examination Marks: 150 Theory Marks: 90 Practical Marks: 40 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: hours: 220 Practical Hours: hours: 80 Total Credit Hours: 06</p>		
1 st Year	BASIC PHYSIOLOGY	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To understand the basic concepts of physiology beginning from the organization of the systems to their role in the body. • Understand the organization and function of various systems • Understand the physiology of Blood, CVS, Nervous System and special senses <p>COURSE CONTENT: introduction to the human physiology a) Functional organization --- relationship between structure and function of the human body. b) Homeostasis its importance --- negative and positive feedback mechanism. 1) Integumentary system. a. Function of the skin, hair, glands and nails. b. Body temperature and its regulation. 2) The musculoskeletal System a) Functions of the bones and muscles b) Functional characteristics of skeletal Muscle, smooth muscle and cardiac muscle. c) The events of muscle contraction and relaxation in response to an action potential in motor neuron. d) Muscle hypertrophy and atrophy. 3) The nervous system: a. Functions of the central nervous system b. The functional areas of the cerebral cortex and their interactions c. Function of the parts of the brainstem diencephalons, basal nuclei limb ic system. And</p>	W,V,P	Y

cerebellum.

d. Functions of various cranial nerves. **e.** Functions of the somatic motor nervous system **f.** The function of neurons, neuroglial cells and their components.

g. Resting membrane potential and an action potential.

h. The function of a synapse and reflex are.

4) The functions of the specialized sense organs.

a. Eye: physiology of site, accommodation, optic nerve and optic chiasma.

b. Ear: function of the internal, middle and external ear.

c. Physiology of the hearing and balance

d. Smell: physiology of olfactory nerve

e. Taste: physiology of taste **f.** Location of the taste buds

g. Physiology of speech

5) The endocrine system

a. Functions of the endocrine system

b. Chemical signals, receptors and hormones **c.** The endocrine Glands and their Hormones **d.** Other hormones

6) Blood.

a. Composition or blood anti plasma

b. Functions of blood

c. Fanned elements

d. Stages of cell development

e. Blood grouping **f.** Coagulation mechanism

7) The cardiovascular system.

a. Functions of the heart

b. Electrical activity of the heart origin and propagation of cardiac impulse.

c. Phases of the cardiac cycle

d. Heart sounds

e. Regulation of heart functions --- intrinsic and extrinsic.

f. Functions of the peripheral circulation

g. The physiology of circulation

h. The physiology of circulation

I. Pulmonary circulation

j. Systemic circulation: arteries

k. Veins

I. Local control of blood vessels

m. Nervous control of blood vessels

n. Regulations of arterial pressure

o. The function of lymphatic system, tonsils, lymph nodes, the spleen and the thymus.

8) Respiratory System

a. Functions of the respiratory system beginning at

the nose and ending with the alveoli.

- b. Ventilation and lung volumes
- c. Gas exchange and gas transport in the blood
- d. Rhythmic ventilation

9) The digestive system

- a. Function of each organ of the digestive system including major salivary gland
- b. Movement and secretion in each organ of the digestive system and their regulation
- c. Physiology of digestion, absorption and transport

10) Genito-Urinary system

- a. Urine production, urine movement
- b. Regulation-of urine concentration and-volume
- c. Body fluid compartments
- d. Regulation of extracellular fluid composition
- c. Regulation of Acid-Base balance
- f. Physiology of male reproductive system spermatogenesis and reproductive glands, hormones and their regulations.
- g. Physiology of female reproductive system --- ovulation, hormones and their regulations.

11) Immunity

- a. Define immunity, innate immunity, adaptive immunity
- b. Antigens and antibodies
- c. Primary and secondary responses lo an antigen
- d. Antibody-mediated immunity and cell mediated immunity
- e. Role of lymphocyte in immunity regulation.

Practicals:

1. Spirometer
2. Electrocardiography
3. Blood Pressure Measurement
4. Normal and abnormal ECG interpretation
5. Pulse rate measurement
6. Heart sounds

Recommended Books:

- Essentials of Medical Physiology K Sembulingam, Prema Sembulingam Sixth Edition 2013
- Concise Physiology Dr. Raja Shahzad 1st Edition 2012
- Guyton and Hall Textbook Of Medical Physiology John E. Hall, Arthur C. Guyton Professor and Chair 2006

Assessments:

		<p>Examination Marks: 150 Theory Marks: 90 Practical Marks: 40 Internal Assessment: 20 Study Hours: Theory Hours: 220 Practical Hours: 60 Total Credit Hours: 06</p>		
1 st Year	GENERAL PATHOLOGY	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To understand different pathological processes • To the processes blood coagulation and embolism • To understand the mechanism of wound healing and regeneration <p>COURSE CONTENTS Terms:</p> <ul style="list-style-type: none"> • Cell injury and adaption. • Cell injury • Reversible and irreversible injury • Fatty change • Necrosis and gangrene • Cellular adaptation • Atrophy, hypertrophy • Hyperplasia, metaplasia, aplasia. • Describe the responses to different types of injury at the cellular and sub cellular level • Enlist the differences between necrosis and apoptosis • Describe different morphological patterns of tissue necrosis Describe the different types of responses of the cells to stress. • Describe the different types of exogenous and endogenous pigmentations. • Describe the sequence of vascular changes in acute inflammation (vasodilation increased permeability) and their purpose. • Define the terms edema, transudate, and exudates • Describe the steps involved in phagocytosis and the role of IgG and C3b as opsonins and receptors. • Compare and contrast acute vs chronic inflammation with respect to causes, nature of the Inflammatory response and tissue changes 10. Describe the differences between the various cell types (i.e., labile, stable, and permanent cells) in terms of their regeneration potential. List examples of each cell type. • Distinguish between fibrinous, purulent, and serous inflammation 	W,V,P	Y

		<ul style="list-style-type: none"> • Define an abscess. Describe the systemic manifestations of inflammation and their general physiology, including fever, leukocyte left shift, and acute phase reactants. • Define and understand the process of excessive growth of different types of cell. <p>2. Inflammation</p> <ul style="list-style-type: none"> • Acute inflammation - vascular changes, chemo taxis opsonization and phagocytosis. • Enlist the cellular components and chemical mediators of acute inflammation • Differentiate between exudates and transudation • Chronic inflammation • Etiological factors, Granuloma <p>3. Cell repair and wound healing</p> <ul style="list-style-type: none"> • Regeneration and repair • Healing - steps or wound healing by first and second intention • Factors affecting healing <p>4. Homodynamic disorders</p> <ul style="list-style-type: none"> • Define and classify the terms edema. Hemorrhages, thrombosis, embolism, infarction and Hyperemia with at least two example of each. • Define and classify shock with causes of each • Describe the compensatory mechanism involved in shock • Describe the possible consequences of thrombosis • Describe the difference between arterial and venous emboli <p>5. Neoplasia</p> <ul style="list-style-type: none"> • Define the terms dysphasia and neoplasia with examples of each • Enlist the differences between benign and malignant neoplasms • Enlist the common etiological factors for neoplasia • Define and discuss the different modes of metastasis. <p>Practicals:</p> <ol style="list-style-type: none"> 1. Estimation of Prothrombin Time 2. Estimation of Clotting Time 3. Estimation of Bleeding Time 4. Estimation of Activated Partial 		
--	--	--	--	--

		<p>Tromboplastin Time</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Robbins Basic Pathology Kumar Abbas Aster 9th Edition 2013 • Review of General Pathology Moh. Firdaus 9th Edition • Short Text Book of Pathology Moh. Inam Danish 3rd Edition 2006 <p>Assessments: Examination Marks: 150 Theory Marks: 90 Practical Marks: 40 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 200 Practical Hours: 120</p> <p>Total Credit Hours: 06</p>		
1 st Year	BASIC PHARMACOLOGY	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To discuss the roles and responsibilities of the various members of the health care team in maintaining patient safety during drug therapy. • To define common terms related to pharmacology and drug therapy. • To discuss relevant historical, legal, and ethical issues related to pharmacology and drug therapy. <p>COURSE CONTENT:</p> <p>1. Introduction to pharmacology</p> <ol style="list-style-type: none"> Historical background Routes of administration Dosage forms Pharmacokinetics Pharmacodynamics Terminology: definitions with example Adverse drug effects <p>2. Gastrointestinal treat (GIT)</p> <ol style="list-style-type: none"> Antiemetic's Antiulcer Purgative <p>3. Respiratory System</p> <ol style="list-style-type: none"> Antitussives and mucolytic Bronchodilators and other drugs for asthma Antihistamines and drugs for common cold <p>4. Kidney</p> <ol style="list-style-type: none"> Diuretics. <p>5. Chemotherapy</p> <ol style="list-style-type: none"> Antibacterial agents 	W,V,P	Y

		<p>b. Antiprotozoal agent c. Antiseptics and disinfectants</p> <p>6. Non-Steroidal anti-inflammatory drugs (NSAIDs)</p> <p>7. Cardiovascular system (CVS) a. Antianginal drugs b. Antihypertensive</p> <p>8. Central Nervous system (CNS) a. Sedative Hypnotics b. Local anesthetics c. General anesthetics d. Analgesics</p> <p>9. Endocrinology a. Insulin and antidiabetic b. Corticoid steroids</p> <p>10. Drugs for emergency use a. Adrenaline b. Dopamine c. Atropine</p> <p>Practicals:</p> <ol style="list-style-type: none"> 1. Routes of drug administration 2. Dose-Response Curves 3. Effect of adrenaline on pulse rate 4. Effect of beta blockers on heart rate after exercise 5. Source of drug and identification of some raw materials that are source of drug <p>Recommended Books:</p> <ul style="list-style-type: none"> • Lippincott's pharmacology (text book) by Mycek 2nd Edition published by Lippincott Raven 2000. • Katzung textbook of pharmacology (Reference Book) by Bertram Katzung 8th Edition, Published by Appleton. dec 2007 <p>Assessments: Examination Marks: 150 Theory Marks: 90 Practical Marks: 40 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 200 Practical Hours: 50</p> <p>Total Credit Hours: 06</p>		
1 st Year	BIOCHEMISTRY	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To understand the chemical composition, biochemical role, digestion and absorption of macro and micro molecules of the cell. • To understand different biochemical 	W,V,P	Y

reactions in cell.

- To understand mechanism of action of hormones.

COURSE CONTENTS:

PHYSIOCHEMICAL PRINCIPLES:

1. Hydrogen ion con and pH notation
2. Acidity and alkalinity
3. Indicators and buffer solutions
4. PH and its determination
5. The colloidal state
6. Absorption
7. Structure and function of cell membrane and movement of materials across cell membrane
8. Osmosis and osmotic pressure
9. Surface tension
10. Viscosity

CARBOHYDRATES:

1. Introduction and classification of carbohydrates
2. Some important monosaccharide's, disaccharides and polysaccharides
3. Regulation of blood glucose level
4. Metabolism
5. Definition and end product of
6. Glycolysis
7. Citric acid cycle
8. Glycogenesis

PROTEINS AND AMINO ACIDS

1. Introduction importance, classification and properties of proteins.
2. Entry of amino acids into cells and peptide linkage
3. Metabolism
4. Special sources of proteins

Lipids

1. Introduction classification and function of lipids
2. Biosynthesis of fatty acids, natural fats or triglycerides
3. Fatty acid oxidation
4. Metabolism

VITAMINS AND MINERALS:

1. Classification of vitamins
2. Fat soluble vitamins and water soluble vitamins.
3. Deficiency effects.
4. Metabolism.

ENZYMES:

1. Introduction

		<p>2. Classification</p> <p>3. Chemical nature and properties of enzymes</p> <p>4. Regular enzymes.</p> <p>NUTRITION AND DIETETICS:</p> <p>1. Balanced diet</p> <p>2. Role of carbohydrates, fats and proteins, their dietary sources and uses in the body quantitative and qualitative daily requirements of carbohydrates, fats, proteins, vitamins and minerals.</p> <p>Practicals:</p> <ol style="list-style-type: none"> 1. Principles of Biochemistry analyzers (spectrophotometer, flame photometer) 2. Determination of Cholesterol, Tg, HDL, LDL, sugar, calcium and phosphorus in blood 3. SOP of centrifuge, water bath and microscope 4. Determination of liver, cardiac, pancreatic enzymes 5. Determination of urea and uric acid <p>Recommended Books</p> <ul style="list-style-type: none"> • Harper's Biochemistry Robert K. Murray, Daryl K. Granner 28th edition 2009 • Medical Biochemistry Mushtaq Ahmad vol. I and II 8th edition 2013 <p>Assessments: Examination Marks: 150 Theory Marks: 90 Practical Marks: 40 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 160 Practical Hours: 40</p> <p>Total Credit Hours: 04</p>		
1 st Year	ISLAMIC STUDIES	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To learn about Islam and its application in day to day life. • To provide Basic information about Islamic Studies • To enhance understanding of the students regarding Islamic Civilization • To improve Students skill to perform prayers 	W,V	Y

		<p>and other worships</p> <ul style="list-style-type: none"> • To enhance the skill of the students for understanding of issues related to faith and religious life. <p>COURSE CONTENTS: Holy Quran and Sunnah 1. Holy Quran</p> <ul style="list-style-type: none"> • Introduction • Importance and characteristics • Sura-e-Hujaraat with translation • Sura-e-Al-Furqan: Verses 63-77 with translation and explanation <p>2. Sunnah</p> <ul style="list-style-type: none"> • Importance of sunnah • Twenty selected Hadith with translation (Mention in Islamiat Compulsory for degree classes, published by Allama Iqbal Open University, Islamabad). <p>3. Fundamental Doctrine of Islam</p> <ul style="list-style-type: none"> • Islam with reference to Holy Quran & Hadith • Tawheed (oneness of Allah) • Prophet hood • The day of judgement(Akhirat) <ul style="list-style-type: none"> • Salat & Nimaz (Abadat) • Zakat • Hajj • Jihad <p>4. Life of Holy Prophet</p> <ul style="list-style-type: none"> • Study of the life of the Holy Prophet & Seerat • Life of the Holy Prophet at Makkah from birth to Hijra (Migration to Madina) • Method of Preaching & difficulties • Life of Holy Prophet at Madina • Amicable Accords(Mowkhat) • Treaty of Madina(Misaq-e-Mukarama) • Conquest of Makkah Al-Mukarama • Hajat-ul-wida <p>5. The Ethical View of Islam & Characteristics Islamic Cultural</p> <ul style="list-style-type: none"> • Character Buildings • The concepts of Ethics • The Moral Values: Truthfulness, Taqwa, Fulfillment of Promises, Simplicity. <p>6. Influence of the Islamic civilization</p> <ul style="list-style-type: none"> • Panacea of our problems • Our future, unity, political stability <p>7. Islamic Medical Ethics</p>		
--	--	--	--	--

		<p>Contribution of the Muslims in Medicine, Science and Technology Note: while keeping the Islamic values and basic Characteristics of Islamic Society the proper guide line may be provided in such a way that should be applicable in business and trade.</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Islamiyat (Compulsory) for Khyber Medical University, Medical Colleges and Allied Institutes. <p>Assessments: Examination Marks:60 Theory Marks:60 Study Hours: 70 Theory Hours: 02</p>		
1 st Year	PAKISTAN STUDIES	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideological background of Pakistan. • To study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. <p>COURSE CONTENTS: I Chapter One • Ideology of Pakistan II Chapter Two • Background of ideology of Pakistan a. Reformation movement b. Educational movement c. Political movement III Chapter Three Movement of Pakistan (Since Allama Iqbal Address at Ala Bad 1930 till 14th August 1947) IV Chapter Four Establishment of Pakistan (Political, Social financial Problems) V Chapter Five Constitutional and Political Developments in Pakistan VI Chapter Six Geographical condition of Pakistan</p>	W,V	Y

		<p>VII Chapter Seven Pakistan and Muslim World</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Akbar, S. Zaidi. <i>Issue in Pakistan's Economy</i>. Karachi: Oxford University Press, 2000. • Mehmood, Safdar. <i>Pakistan Kayyun Toota</i>, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd. • Amin, Tahir. <i>Ethno - National Movement in Pakistan</i>, Islamabad: Institute of Policy Studies, Islamabad. • Afzal, M. Rafique. <i>Political Parties in Pakistan</i>, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998. <p>Assessments: Examination Marks:40 Theory Marks:40 Study Hours:70 Total Credit Hours: 02</p>		
2 nd Year	HEMATOLOGY I	<p>Course Objectives:</p> <ul style="list-style-type: none"> • To introduce the students about the basic concepts in Hematology and acquire skill in practical work to produce students steeped in knowledge of Hematology. • To equip students with latest advancements in the field of hematology. <p>COURSE CONTENTS:</p> <ol style="list-style-type: none"> 1. Introduction to Hematology, Phlebotomy, Microscope: Principle, types and use, Anticoagulants types and mode of action, Hematopoiesis: Blood cell sand stages of development, blood formation, intrauterine and extra uterine hemopoiesis. Hemoglobin formation and estimation; chemistry and metabolism of hemoglobin. Red blood cell morphology and count, preparation of diluting fluid. Reticulocytes; count, staining and normal values. Rowmanowski's stains. Hematocrit values, MCV, MCH, MCHC, correlation of hemoglobin, hematocrit and RBC count and its importance and interpretation. ESR: methods and principle of sedimentation. 	W,V,P	Y

Leucocytes: origin, types, maturation process, count and morphology. Neubauer chamber and its uses. Platelets: origin maturation cycle, morphology count and diluted fluid. Anemia's: detailed comments, classification, types, investigations required for each type. Peripheral blood smear examination: morphology of normal and abnormal red blood cells and white blood cells. Sickling test. RBC fragility test, G6PD and Coombs test, acid elution test, Hemoglobin electrophoresis. Hemoglobinopathies: general comments, hemoglobin S, F, C, D, sickle cell anemia, thalassemia and its types; investigations for detection of abnormal hemoglobin's. Quality control in hematology.

Practicals:

1. Collection of blood sample
2. Preparation and staining of peripheral blood smear
3. Total leucocyte count, rbc count
4. determination of absolute values
5. Differential leucocyte count; platelets count and reticulocytes count
6. To determine the ESR
7. staining, preparation and procedure of staining
8. Automated cells counts
9. HB Electrophoresis, procedure and importance
10. Ham's test, procedure and importance
11. Iron stain, procedure and importance
12. Osmotic Fragility test, procedure and importance
13. G6PD assay, procedure and importance.

Recommended Books:

- Essential of Hematology, A.V Hoff Brand, 6th edition 2006.
- Clinical Hematology, G.C Degrunchi, 5th edition 2002.
- Practical Hematology, Dacie J.V. 10th edition 2012

Assessments:

Examination Marks: 200

		Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20 Study Hours: Theory Hours: 228 hours: Practical Hours: 114 hours Total Credit Hours: 06		
2 nd Year	MICROBIOLOGY I	COURSE OBJECTIVES: <ul style="list-style-type: none"> • To introduce the students with basic concepts in clinical bacteriology. • To introduce the students with diagnosis of common bacterial infections. • To introduce the students with epidemiology and pathology of bacterial infections. • To introduce the students with basic and differential diagnosis of bacterial infections. • To introduce the students with technical skills used in clinical bacteriology. COURSE CONTENTS: <ul style="list-style-type: none"> • Introduction to Microbiology Historical development of Microbiology and its scope. Microorganisms and their respective place in the living world. • Cell, Difference between prokaryotes and eukaryotes • Ultra-structure of prokaryotic cell, chemical composition and functions of cell wall, cell membrane, cellular organelles (Lysosome, Glyoxysome, Nucleus, Ribosomes, Flagella, Pili, Spores etc.) Cytoskeleton. • Microscopy: An outline of the principles and applications of light and ^[1]electron microscope • Growth, Growth Curve, nutrition (physical and nutritional requirement and reproduction, Environmental factors effecting growth • Microbial genetics: plasmid, Chromosome Mutations, Conjugation, Transformation, transduction • Normal Flora • Introduction: Host-parasite interactions. Stages of Pathogenesis • Determination of pathogenicity and molecular mechanisms of pathogenesis. • Antimicrobial drugs and drug resistance • Vaccines, Probiotics and Prebiotics • Introduction to clinical bacteriology <ol style="list-style-type: none"> 1. Structure of bacterial Cell 	W,V,P	Y

		<p>2. Bacterial Classification and nomenclature 3. Antibacterial Drugs and antibacterial drug resistance</p> <ul style="list-style-type: none"> • Gram positive Cocci <ol style="list-style-type: none"> 1. Staphylococcus 2. Streptococcus • Gram negative cocci <ol style="list-style-type: none"> 1. Neisseria • Gram positive Rods <ol style="list-style-type: none"> 1. Bacillus (<i>B.anthraxis, B.Cerus</i>) 2. Clostridium (<i>C.Perfringens,c.difficile,C.botulinm</i>) 3. Listeria monocytogens • <i>Corynebacterium diphtheria</i> • Gram negative rods • Nocardia and Actinomyces • Mycobacteria • Spirochete • Mycoplasma • Rickettsia and Chlamydia • Minor bacterial pathogen. <p>Practicals:</p> <ol style="list-style-type: none"> 1. Introduction and demonstration of Laboratory Equipment's used in Microbiology. 2. Demonstration of different types of physical and chemical methods of sterilization, and disinfection. 3. Students should be thorough to work with compound microscope. 4. Simple staining methods of pure culture and mixed culture. 5. Gram's staining of pure culture and mixed culture. 6. AFB staining of Normal smear, AFB positive smear. 7. Students should be thorough to work with compound microscope. 8. Simple staining methods of pure culture and mixed culture. 9. Gram's staining of pure culture and mixed culture. 10. ZN staining of Normal smear, AFB positive smear. 11. Isolation and identification of pure bacterial isolate. 		
--	--	---	--	--

		<p>Recommended books:</p> <ul style="list-style-type: none"> • Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003. • Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3rd ed. MedMaster, 2004. • Medical Microbiology and Infection at a Glance. Gillespie, S., H., Bamford, K., B., 4th ed. WileyBlackwell, 2012. • Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003. • District Laboratory Practice in Tropical Countries, Part 1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006. • Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12th ed. Elsevier Mosby, 2007. • Review of Medical Microbiology and Immunology. Levinson, W., 10th ed. McGraw Hill Professional, 2008. • Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26th ed. McGraw-Hill Medical, 2012. <p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 228 Practical Hours: 114</p> <p>Total Credit Hours: 06</p>		
2 nd Year	HISTOLOGY I	<p>Course Objectives:</p> <ul style="list-style-type: none"> • To introduce the students with the basic concepts in Histology and acquire skill in practical work. • To produce a team of Medical Technologists steeped in knowledge of Pathology. • To equip Medical Technologists with latest advances in techniques in the field of Pathology. <p>COURSE CONTENTS: Histology: Introduction Structure of animal cell: Cytoplasmic inclusions and organelles. Nucleus Appearance of nucleus in resting and dividing cells</p>	W,V,P	Y

		<p>Four basic tissues of the body The epithelize: classification, type and structure The connective tissue: classification, types and structure The muscular tissue: classification, types and structure The nervous tissue: microscopic structure of nerve cells and nerve fibers, Normal histology of skin, lymph node, liver, spleen, uterus, ovary & bone marrow.</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Ross and Wilson Anatomy and Physiology in health and illness 11th Edition Waugh Grant. • Clinical Anatomy (By regions) 9th edition, Richard S. Snell. <p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 228 Practical Hours: 114 Total Credit Hours: 06</p>		
2 nd Year	CLINICAL PATHOLOGY-I	<p>Course Objectives:</p> <ul style="list-style-type: none"> • To introduce the students with basic concepts in clinical pathology and acquire skill in practical work to produce a team of Medical Technologists steeped in knowledge of Pathology. • To equip Medical Technologists with latest advancement in the field of Pathology <p>Course Contents: Urine: Physical, chemical and microscopic composition of urine. Faeces: Physical, chemical and microscopic composition of faeces, Cerebrospinal fluid: Physical, chemical and microscopic composition of CSF. Aspiration fluids: Physical, chemical and microscopic composition of ascetic, pleural, pericardial and synovial fluids. Semen analysis: Physical, chemical and microscopic composition of seminal fluid, Urinary Calculi.</p>	W,V,P	Y

		<p>Practicals:</p> <ol style="list-style-type: none"> 1. Physical, chemical and microscopic examination of urine 2. Physical, chemical and microscopic examination of feces 3. Physical, chemical and microscopic examination of CSF 4. Physical, chemical and microscopic examination of ascetic, pleural, pericardial and synovial fluids 5. Physical, chemical and microscopic composition of seminal fluid 6. 6. Physical and chemical composition of urinary Calculi <p>Recommended Books</p> <ul style="list-style-type: none"> • Manual of Laboratory medicines AFIP, Third Edition 2005 Publication Armed Forces Institute of Pathology Rawalpindi Pakistan. • District laboratory practice in tropical countries Vol. 1 & 2 Monica Cheesbrough Cambridge University Press Low Price Edition 2000. • Clinical chemistry: principles, methods & interpretation 2nd Edition by Prof. Dr. Abdus Salam Khan Gandapur 2003. Tahir Instruments Ltd Singapura Road Lahore-Pakistan. <p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 228 Practical Hours: 114</p> <p>Total Credit Hours: 06</p>		
3 rd Year	MICROBIOLOGY-II	<p>Course objectives:</p> <ul style="list-style-type: none"> • To introduce the students with basic concepts in clinical Virology. • To introduce the students with epidemiology and pathology of viral infections. • To introduce the students with basic and differential diagnosis of viral infections. • To introduce the students with technical 	W,V,P	Y

skills used in clinical virology.

- To introduce the students with basic concepts in clinical mycology & parasitology.
- To introduce the students with epidemiology and pathology of fungal & parasitic infections.
- To introduce the students with basic and differential diagnosis of fungal & parasitic infections.
- To introduce the students with technical skills used in clinical mycology & parasitology.

COURSE CONTENTS:

Virology:

Introduction Features, structure and classification of viruses Virus isolation Storage and transport Tissue Culture Animal techniques

Viral disease: Its nature and difference from bacterial diseases Common Pathogenic

Viruses Hepatitis

viruses: types and detailed study and laboratory diagnosis

HIV: types and detailed description and laboratory diagnosis Herpesvirus

Cytomegalovirus Dengue hemorrhagic virus

Tumor virus Specimen collection & isolation of viruses Microscopy Light microscopy. Dark field microscopy.

Fluorescent microscopy Electron

Microscopy

Parasitology:

Introduction and classification of parasites Characteristics, life cycles and Pathogenicity of common parasites

Protozoa: Types, morphology, characteristics, life cycle & Pathogenicity

Cestodes: Types, morphology, characteristics, lifecycle & Pathogenicity

Trematodes and nematodes: Types, morphology, characteristics, lifecycle & pathogenicity.

Stool examination: direct and concentration method

Malarial parasites and leishmania: Types, lifecycle, Pathogenicity, drugs and laboratory diagnosis

Mycology:

Basic mycology, introduction and classification
Staining in mycology
Laboratory diagnosis.

Practicals:

1. Demonstration of serological methods/ICT devices for the diagnosis of viral infection.
2. Demonstration of PCR for the diagnosis of HBV, HCV and HIV.
3. Demonstration of PCR for the genotyping of HBV and HCV.
4. Study of growth characteristics, microscopic examination and identification of medically important fungi, collection, transportation and processing of specimens for mycological examination.
5. KOH preparation for the identification of fungal hyphae.
6. Germ tube test for yeast identification.
7. Preparation of Medias and stains used in mycology.
8. Identification of parasites of Medical importance dealt in the theory.
9. Macroscopic and microscopic examination of stool for adult worms, ova, cysts, larvae.
10. Concentration techniques for intestinal parasites in stool.
11. Collection of blood and preparation of thick & thin smears.
12. Staining of blood smears for blood parasites.
13. Examination of blood smears for malaria & microfilaria and their identification.
14. Microscopic examination of urine for trichomonas vaginalis and shistosoma egg.

Recommended Books:

- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006.
- Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3rd ed
- MedMaster, 2004. Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12th ed. Elsevier Mosby, 2007.
- Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005

		<p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 228 Practical Hours: 114</p> <p>Total Credit Hours: 06</p>		
3 rd Year	HEMATOLOGY & BLOOD BANKING-II	<p>Course Objectives:</p> <ul style="list-style-type: none"> • To introduce the students with the concepts in Hematology and acquire skill in practical work to produce a team of Medical Technologists steeped in knowledge of Pathology. • To equip Medical Technologists with latest advancement in the field of Pathology • To introduce to the student's basic concepts in Blood banking and transfusion medicine & acquire skill in practical work. • To produce a team of Medical Technologists steeped in knowledge of Blood banking and transfusion medicine. <ul style="list-style-type: none"> • To establish safe blood transfusion practice. <p>COURSE CONTENTS:</p> <ul style="list-style-type: none"> • Iron metabolism, introduction to iron deficiency anemia, different stages and diagnosis, • introduction to thalassemia, classification, pathophysiology and its diagnosis, • introduction to Sideroblastic anemia, etiology and diagnosis, • folate and vitamin B12 metabolism, • introduction to megaloblastic anemia, etiology and diagnosis, • introduction to G6PD deficiency anemia, pathophysiology and diagnosis, • introduction to sickle cell anemia, pathophysiology and diagnosis, • introduction to hereditary spherocytosis, pathophysiology and diagnosis, • introduction to hemolytic anemia, Immune hemolytic anemia, non-immune hemolytic anemia, • aplastic anemia, etiology and diagnosis. • Leucopoiesis • Introduction to WBC's disorders, Quantitative and Qualitative investigations towards WBC's disorders 	W,V,P	Y

- Introduction to leukemia, causes, classification and diagnosis
- Introduction to acute leukemia, classification, diagnosis
- Introduction to acute lymphoblastic leukemia, diagnosis
- Acute myeloid leukemia, classification and diagnosis
- Chronic leukemia, classification and diagnosis
- Chronic myeloid leukemia, pathogenesis, diagnosis and differential diagnosis of chronic myeloid leukemia
- Chronic lymphocytic leukemia, classification, diagnosis and differential diagnosis,
- Chronic myeloproliferative disorders

BLOOD BANKING

- ABO and RhD group system, blood group system, blood group system, Duffy blood group system, donor selection criteria, phlebotomy of donor, blood products, preparation, storage and its importance, hemovigilance in blood bank, cross match, types of cross match, procedure and its importance, blood grouping and its importance, comb's test, types and importance, introduction to hemolytic disease of newborn, types, pathophysiology, diagnosis and management, hemolytic transfusion reactions and management.

Practicals:

1. Morphology of leukemic slides
2. Automated differential count
3. Flowcytometry
4. Sudan Black B
5. Myeloperoxidase stain
6. Periodic acid shift
7. Esterase stain
8. Leukocytes alkaline phosphatase Score
9. Prothrombin Time
10. Partial Thromboplastin time
11. Fibrinogen Assay
12. FDP's and D-Dimer
13. Clot solubility test for factor XIII
14. Hess's test
15. ABO blood grouping (Forward and Reverse grouping)
16. Rh Blood grouping
17. Antibodies screening

		<p>18. Cross matching (Major and Minor) 19. Coombs tests (Direct and Indirect) 20. Separation of different blood components</p> <p>Recommended Books:</p> <ul style="list-style-type: none"> • Practical Hematology, Dacie J.V. 10th edition • Introduction to Immunohematology: Bryant Neville J, third edition, 1994 • Essential of Hematology, A.V Hoff Brand, 6th edition 2006 • Clinical Hematology, G.C Degrunchi, 5th edition 2002 • Practical Hematology, Dacie J.V. 10th edition 2012 <p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 228 Practical Hours: 114 Total Credit Hours: 06</p>		
3 rd Year	HISTOLOGICAL TECHNIQUES & CYTOLOGY	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To introduce the students with the basic concepts in Histopathology and acquire skill in practical work. 2. To produce a team of Medical Technologists steeped in knowledge of Pathology. 3. To equip Medical Technologists with latest advances in techniques in the field of Pathology. 4. To introduce the students with basic concept of cytology and cytogenetics 5. To equip the student with techniques involved in cytology and cytogenetics <p>COURSE CONTENTS: HISTOPATHOLGY TECHNIQUES Reception and Fixation of Biopsy Fixatives: Purpose, types and preparation of fixatives Qualities of good fixative, factors affecting fixation Gross Examination Processing of tissues: manual and automation Steps in processing: dehydration, clearing and impregnation Embedding and cutting of sections Microtome & tissue sectioning techniques Floating water bath</p>	W,V,P	Y

		<p>Decalcification of bone Knife sharpener H and E staining FROZEN SECTIONS: Procedure and importance, cryostat SPECIAL STAINS IN HISTOPATHOLOGY PAS: stain, Congo red stain, oil red stain, Zeihl neelsen and Giemsa stain.</p> <p>Cytology: introduction & importance Cell and structure Basic principles of exfoliate cytology Exfoliation, sites from which exfoliated cells can be obtained & methods of obtaining them Benign and Pathologic processes affecting cells- inflammation, Repair and regeneration. Hyperplasia and hypertrophy Collection of cytology specimens. Techniques used in cytology. Features of a typical and malignant cells Malignant Tumors Female genital tract Methods for obtaining smears and them fixation Normal cells of female genital tract Abnormal cells other than malignant cells Diagnosis of carcinoma of female genital tract Pap Smear</p> <p>Respiratory tract: Methods for obtaining smears and them fixation Normal cells of respiratory tract Abnormal cells other than malignant cells Diagnosis of cancer of respiratory tract FNA: significance, advantages and disadvantages of FNA Cytology of body fluids: Ascitic, Pleural, CSF, semen, synovial & pericardial fluid.</p> <p>Practicals:</p> <ol style="list-style-type: none"> 1. Morphology of normal and abnormal cells 2. Karyotyping technique 3. Immuno-histochemistry techniques 4. FNAC technique 5. Collection of different biopsy and cytology specimens. 6. Performing fixation, clearing, embedding, cutting and staining of histopathology specimens <p>Recommended Books:</p> <ul style="list-style-type: none"> • Lynch’s Medical Laboratory Technology • Diagnostic Cytology Koss. Volume I & II • Henry’s Clinical Diagnosis & Management by Laboratory method. 		
--	--	--	--	--

		<ul style="list-style-type: none"> • Basic Histopathology – Stevens. • Practical Cytology – Astarita. • Hand book of Medical Laboratory Technology – Robert H. Carman • Manual of Laboratory Medicines AFIP, 3rd Edition 2005 Publication Armed Forces Institute of Pathology, Rawalpindi, Pakistan • Wheater’s Functional Histology by Paul R.Wheater 3rd Edition 1995 ELBS with Churchill Livingstone UK 6th edition 2013 <p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 228 Practical Hours: 114</p> <p>Total Credit Hours: 06</p>		
3 rd Year	IMMUNOLOGY & SEROLOGY	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • To introduce the students with basic concepts in immunology and serology. • To introduce the students with diagnostic techniques in immunology and serology. • To introduce the students with immuno and sero diagnosis of infectious diseases. • To introduce the students with technical skills used in immunology and serology <p>COURSE CONTENTS: Introduction to immunity, cellular basis of the immune response, antibodies, humoral immunity, cell mediated immunity, major histocompatibility complex & transplantation, complement, antigen–antibody reactions in the laboratory, hypersensitivity (Allergy), tolerance & autoimmune disease, tumor Immunity, immunodeficiency, introduction to serology, introduction to serology, reactions in serology, serology of bacterial, viral, fungal and parasitic infections.</p> <p>Practicals:</p> <ol style="list-style-type: none"> 1. Demonstration of ELISA 2. Demonstration of Different antibody titer e.g. ASO titer. 	W,V,P	Y

		<ol style="list-style-type: none"> 3. Demonstration of chem-iluminescent 4. immune assays for the detection of HBV 5. and HCV. 6. VDRL Test, RPR, TPHA. 7. Brucella agglutination test. 8. Hemagglutinin and Hem agglutination inhibition test. 9. RIA. <p>Recommended Books:</p> <ul style="list-style-type: none"> • Clinical Immunology and Serology. Stevens, C., D., 3rd ed. F.A. Davis Company, 2009 • Color Atlas of Immunology. Burmester, G., R., & Pezzutto, A., Thieme, 2003. • Medical Immunology. Virella, G., 6th ed. CRC press, 2007. • Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003. • Review of Medical Microbiology and Immunology. Levinson, W., 10th ed. McGraw Hill Professional, 2008. • Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26th ed. McGraw-Hill Medical, 2012. <p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 114 Practical Hours: 76</p> <p>Total Credit Hours: 06</p>		
Final Year	MOLECULAR BIOLOGY	<p>COURSE OBJECTIVES:</p> <ul style="list-style-type: none"> • Basic techniques used in recombinant DNA technology. • Practical use of genetic engineering. • Understanding to the potential problems related to genetic engineering. <p>COURSE CONTENTS: Central dogma of Molecular Biology, one gene on Enzyme theory, introduction to nucleotides and DNA, structure of DNA, DNA replication in prokaryotes and eukaryotes, introduction to transcription, transcription in prokaryotes and eukaryotes, post transcriptional modification, Introduction to</p>	W,V,P	Y

		<p>RNA; mRNA, rRNA, tRNA, siRNA, introduction to translation, translation in prokaryotes and eukaryotes, post translation modification, introduction to mutation, nonsense and missense mutation. DNA damage and repair, Introduction to Gene, Locus, Allele, Genotype, Phenotype, Homozygote, Dominant, Recessive, Pedigree Nomenclature and Analysis</p> <p>Practicals:</p> <ol style="list-style-type: none"> 1. Extraction of DNA and RNA 2. Restriction fragment length polymorphism 3. PCR amplification of genes 4. Use of Gel documentation 5. Preparation of pedigree 6. Instrumentation of PCR 7. Instrumentation of Gel Electrophoresis 8. Instrumentation of Western Blotting, Northern Blotting, Southern Blotting <p>Recommended Books:</p> <ul style="list-style-type: none"> • Cell and molecular Biology By Gerald Karp, 5th edition 2005. □ Molecular Biology By Robert F. Weavet 3rd edition 2010 • James, D. W. 2013 Molecular Biology of Gene. Benjamin Cumming 7th edition 2013. • Snustad, D.P and Simmons . M.J., 2012. Genetics, 6th Edition. John Wiley and Sons <p>Assessments: Examination Marks: 300 Theory Marks: 140 Practical Marks: 140 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 228 Practical Hours: 114</p> <p>Total Credit Hours: 06</p>		
Final Year	BIostatistic & RESEARCH METHODOLOGY	<p>Course Objectives:</p> <ul style="list-style-type: none"> • To introduce the student with the significance of bio-statistics, statistics means basic concept, describing and exploring data, normal distribution, sapling distribution and hypothesis testing, • basic concept of probability and application of statistics and social research. <p>Course Contents: Introduction to Biostatistics and its types;</p>	W,V,P	N

Descriptive and inferential statistics, Measure of central tendency, Measure of dispersion, Statistical data, Presentation of Data by Graphs, Data and Its types, Data collection tools, Data analysis tools Health Related Data, Presentation of quantitative data, The concept of sampling, types and methods of sample, sample distribution, error of sampling, Variable and its types, Tests used in biostatistics the iris and interpretation (t-tests, Chi-square ANOVA, Regression and correlation) Hypothesis formulation and testing on the basis of statistics and statistical tests, Sample and population, Basic consideration in sampling, random sampling, stratified random sampling, cluster sampling, systematic sampling, determination of sample size, elimination of sampling bias, two types of errors, acceptance and rejection Regions, Two sided and one sided tests, general steps in hypothesis testing, test about means, confidence interval for mean, Preparing data analysis by various software, Use of SPSS

Introduction to research (in simple term and a scientific term), concept of research, why do need research, advantage and scope of research, identification of research needs and its qualities, Types of research; Qualitative, Quantitative and their sub types, Research process Introduction (Deciding, formulating research questions, planning, conduct of study, data collection, processing and analysis, Research writing and reporting), Literature review (What, why, where from, how and qualities of good literature and its use), Writing a research problem/question and selection of the title of study, Identification of various research variables, Hypothesis its types, formulation and testing of hypothesis, Research study designs used in qualitative and quantitative studies, Designing of data collection tools/questionnaires, Selection of appropriate sampling technique in various study designs, Concept of validity and reliability, Research proposal writing, Ethical principles of Research and their examples to apply those principles, Data collection and processing/displaying techniques, Writing of research report (Chapter in research report/thesis, Outline/Abstract of research, Referencing and Bibliography.

Recommended Books:

- Statistical methods for psychology by howell DC in 7th edition 2013.

		<ul style="list-style-type: none"> • A guide to research methodology, biostatistics and medical writing by college of physicians and surgeons Pakistan by WHO collaboration center • Reading understanding multivanant statistics giimm LG Yard AD PR, in 1995 publisher American Psychological association • Ilyas Ansari's community medicine (Text Book) by Ilyas and Ansari 2003 published by Medical division Urdu Bazaar Karachi. <p>Assessments: Examination Marks: 200 Theory Marks: 90 Practical Marks: 90 Internal Assessment: 20</p> <p>Study Hours: Theory Hours: 152 Practical Hours: 152</p> <p>Total Credit Hours: 06</p>		
Final Year	Research Project	<p>Course Objectives:</p> <ul style="list-style-type: none"> • Students will learn some basic research methodology and gain knowledge about research. • It will hopefully result in some of presentation or publication for the students and will provide a research oriented environment. <p>Course Contents: During last year each student should select a topic of research report with consultation of his/her supervisor and shall prepare and submit research report to University by the end of final year</p> <p>Practical: A hard copy of research project should submit to examination for degree requirements fulfillment.</p> <p>Assessments: Examination Marks: 200 Theory Marks:170 Internal Assessment:30</p> <p>Study Hours: Theory Hours: 156</p> <p>Total Credit Hours: 06</p>	P	N

➤ *Credit hours' distribution is as following:*

- **Theory:** One credit hour shall be equal to one hour of teaching per week throughout the Annual system.
 - **Practical / lab:** One credit hour shall be equal to two hours of lab work per week throughout the Annual system.
 - **Clinical:** One credit hour shall be equal to three hours of clinical work per week throughout the Annual system.
 - **Research:** One credit hour shall be equal to three hours of research work per week throughout the Annual system.
- **Areas of Clinical Practice:**
- Department of Pathology, Naseer Teaching Hospital Nasir Bagh road Peshawar, Pakistan.

For any further queries about the course, please feel free to contact:

Principal/ Assistant Professor: Mr. Hamid Rasul Niazi
Wazir Muhammad Institute of Paramedical Technology- Gandhara University Peshawar, Pakistan.
Email: niaxee@gmail.com
Phone: +92-321-9018846
Official Link: <https://www.gandhara.edu.pk/WMIPT/Faculty.html>

Vice Principal / Assistant Professor: Miss. Nausheen tabasum
Wazir Muhammad Institute of Paramedical Technology- Gandhara University Peshawar, Pakistan.
Email: Naushin.ajmal@gmail.com
Phone: +92-345-3228285
Official Link: <https://www.gandhara.edu.pk/WMIPT/Faculty.html>

Links: <https://gandhara.edu.pk/wmiahs/>
https://www.gandhara.edu.pk/WMIPT/admissions/WMIPT_Prospectus.pdf
<https://www.gandhara.edu.pk/WMIPT/Faculty.html>