

# **CURRICULUM FOR BS MEDICAL LAB TECHNOLOGY**



**KHYBER MEDICAL UNIVERSITY PESHAWAR**

# **CURRICULUM FOR BS MEDICAL LABORATORY TECHNOLOGY**

## **Objectives**

To prepare a cadre of health technologists and workers who can effectively assist senior health professionals in the delivery of quality health services.

To prepare paramedical workers for all levels of the health care delivery system from the primary to the tertiary level.

To introduce and impart standard technical education with new modern techniques, within the fields of medical technologies, by replacing the conventional methods of pre-service training (certificate level).

To provide paramedical workers a status and recognition in the health care delivery system through improving their capacity along with increasing awareness of their responsibilities, authority and job description.

To equip paramedical staff with modern skills and latest technical knowledge and bring them at par with other national and international level.

## **FRAME WORK FOR BS (HONS) Medical Laboratory Technology (4 YEAR PROGRAMME)**

¶ Total numbers of Credit hours	132 (HEC recommended:
¶ Duration	124-136) 4 years
¶ Semester duration	16-18 weeks
¶ Semesters	8
¶ Course Load per Semester	15-18 Credit hours
¶ Number of courses per semester	4-6

<b>COURSE CODES</b>			
<b>SEMESTER</b>	<b>NAME OF SUBJECT</b>	<b>CODE</b>	<b>C.HOURS</b>
<b>FIRST</b>	MEDICAL BIOCHEMISTRY-I	PMS-601	4(3+1)
	HUMAN PHYSIOLOGY-I	PMS-602	4(3+1)
	HUMAN ANATOMY-I	PMS-603	4(3+1)
	ENGLISH-I	PMS-604	2(2+0)
	PAK STUDIES	PMS-605	2(2+0)
	COMPUTER SKILLS	PMS-606	2(1+1)
<b>SECOND</b>	MEDICAL BIOCHEMISTRY-II	PMS-607	4(3+1)
	HUMAN PHYSIOLOGY-II	PMS-608	4(3+1)
	HUMAN ANATOMY-II	PMS-609	4(3+1)
	ENGLISH-II	PMS-610	2(2+0)
	ISLAMIC STUDIES	PMS-611	2(2+0)
<b>THIRD</b>	GENERAL PATHOLOGY-I	PMS-612	3(2+1)
	MEDICAL MICROBIOLOGY-I (NON MLT)	PMS-613	3(2+1)
	PHARMACOLOGY-I	PMS-614	3(2+1)
	COMMUNICATION SKILLS	PMS-615	2(1+1)
	HAEMATOLOGY-I	MLT-601	3(2+1)

	CLINICAL BACTERIOLOGY	MLT-602	3(2+1)
	MOLECULAR BIOLOGY	MLT-603	3(2+1)
			<b>17</b>
<b>FOURTH</b>	PHARMACOLOGY-II	PMS-616	3(2+1)
	PATHOLOGY-II	PMS-617	3(2+1)
	MEDICAL MICROBIOLOGY-II (NON-MLT)	PMS-618	3(2+1)
	BEHAVIORAL SCIENCES	PMS-619	2(2+0)
	HEMATOLOGY-II (NON-MLT)	MLT-604	3(2+1)
	RBCs DISORDER	MLT-605	3(2+1)
	DIAGNOSTIC BACTERIOLOGY	MLT-606	3(2+1)
	HUMAN GENETICS	MLT-607	3(2+1)
			<b>17</b>
<b>FIFTH</b>	WBC AND PLATELETS DISORDERS	MLT-608	3(2+1)
	CLINICAL PARASITOLOGY	MLT-609	3(2+1)
	CHEMICAL PATHOLOGY	MLT-610	3(2+1)
	CLINICAL PATHOLOGY	MLT-611	3(2+1)
	LABORATORY MATHEMATICS	MLT-612	3(2+1)
	BIOTECHNOLOGY	MLT-613	3(2+1)
			<b>18</b>
<b>SIXTH</b>	BLOOD BANKING	MLT-614	3(2+1)

	IMMUNOLOGY AND SEROLOGY	MLT-615	3(2+1)
	LABORATORY INSTRUMENTATION AND TECHNIQUES	MLT-616	3(2+1)
	CLINICAL VIROLOGY AND MYCOLOGY	MLT-617	3(2+1)
	CYTOLOGY AND CYTOGENETICS	MLT-618	3(2+1)
	HISTO-TECHNIQUES	MLT-619	3(2+1)
			<b>18</b>
<b>SEVENTH</b>	MED. LAB MANAGEMENT SKILLS	MLT-620	3(2+1)
	BIOINFORMATICS	MLT-621	3(2+1)
	RESEARCH METHODOLOGY	PMS-621	3(2+1)
	BIO-STATISTICS	PMS-622	3(2+1)
	EPIDIMIOLOGY	PMS-623	2(2+0)
	BIOSAFETY AND BIOSECURITY	MLT-624	2(1+1)
			<b>16</b>
<b>EIGHT</b>	TOXICOLOGY AND FORENSIC SEROLOGY	MLT-622	3(2+1)
	BIO ETHICS	PMS-625	2(2+0)
	RESEARCH PROJECT/FINAL PROJECT	PMS-626	6
	SEMINAR	PMS-627	1
			<b>12</b>
	<b>TOTAL CREDIT HOURS</b>		<b>132</b>

## **1<sup>st</sup> SEMESTER COURSES**

- 1. MEDICAL BIOCHEMISTRY -I**
- 2. HUMAN PHYSIOLOGY -I**
- 3. HUMAN ANATOMY -I**
- 4. ENGLISH-I**
- 5. PAK STUDIES**
- 6. COMPUTER SKILLS**

**Course objectives:**

After successful completion of this course, students will be able to,

- Describe the chemical composition, biochemical role, digestion and absorption of macro and micro molecules of the cell.
- Discuss different biochemical reactions in cell
- Explain mechanism of action of hormones

**Course contents:**

Acids, bases, pH and buffers, Biochemical composition and functions of the cell membrane, Transport across the cell membrane, Carbohydrates: Introduction, structure, function, digestion and absorption, Amino acids and proteins: Introduction, structure, function, digestion and absorption, Lipids: Introduction, structure, function, digestion and absorption, Vitamins and minerals, Fluid, electrolyte and acid base balance, Cell signaling and hormone action, Body secretions: Composition and function of saliva, gastric acid (HCL), pancreatic juice, bile, hormones and GI functions

**Practicals:**

1. Blood sample collection for biochemical analysis
2. Preparation and calculation of Solutions
3. Principles of MEDICAL BIOCHEMISTRY analyzers(spectrophotometer, flame photometer)
4. Determination of Cholesterol, Tg, HDL, LDL, sugar, calcium and phosphorus in blood

**Recommended Books**

- Harper's BIOCHEMISTRY Robert K. Murray, Daryl K. Granner 28<sup>th</sup> edition 20
- BIOCHEMISTRY by Dr. U. Satyanarayana, U Chakrapani Lehninger Principles of MEDICAL BIOCHEMISTRY, 6E
- Marks' Essentials of Medical BIOCHEMISTRY A Clinical Approach, Second Edition

**Course Objectives:**

After successful completion of this course, students will be able to,

- Describe the basic concepts of physiology beginning from the cell organization to organ system function.
- Discuss the organization of cell, tissue, organ and system with respect to their functions.
- Explain the physiology of Respiration, G.I.T, Urinary system and Endocrine system

**Course contents:**

Functional organization of human body, Mechanism of Homeostasis, Cell structure and its function, function of different Tissue, Functions of the skin, , Types and function of muscle, Neuromuscular junction, functions of the endocrine glands, Breathing Mechanism, Exchange of respiratory Gaseous, Transport of respiratory gases, Function of different part of Digestive system, Function of liver and pancreas, Digestion and Absorption in Gastrointestinal tract, Patho-Physiology of Gastrointestinal Disorders, Formation of Urine by the Kidney, Glomerular filtration, Renal and associated mechanism for controlling ECF, Regulation of Acid-Base Balance, Male Reproductive System ( Male ), Prostate gland, Spermatogenesis, Female Reproductive System, Menstrual Cycle and Pregnancy and parturition, Mammary Glands and Lactation and Fertility Control

**Practicals:**

1. Introduction to microscope
2. Bleeding time
3. Clotting time
4. WBCs count
5. RBCs count
6. Platelets count
7. Reticulocytes count

**Recommended Books:**

- Essentials of Medical Physiology K Sembulingam, Prema Sembulingam Sixth Edition 2013
- Concise Physiology Dr. Raja Shahzad 1<sup>st</sup> Edition 2012
- Guyton And Hall Textbook Of Medical Physiology John E. Hall, Arthur C. Guyton Professor and Chair 2006
- Ross and Wilson Anatomy and Physiology in Health And Illness 11<sup>th</sup> Edition Anne Waugh, Allison Grant 2010



**Course Objectives:**

After successful completion of this course, students will be able to,

- Identify the principle structures of tissues, organs and systems
- Discuss the different concepts and terms of general anatomy including skeleton and Musculo skeletal system.
- Explain the anatomy of Thorax, Abdomen and pelvis

**Course contents:** Musculo skeletal system(Axial and Appendicular),Axial Skeleton, Different bones of human body, Axial and Appendicular Skeleton, Classification on the basis of development, region and function, General concept of ossification of bones, parts young bone, Blood supply of long bones. Joints Structural Regional and functional classification of joints,Characteristics of synovial joints, Classification of synovial joints, Movements of synovial joints. Muscular System Parts of muscle Classification of muscles (skeletal, Cardiac, smooth) Thoracic wall: Muscles of thorax, Surface Anatomy, Trachea, lungs, pleura, mammary glands (breast), Heart and thoracic vessels. Thoracic cavity: Mediastinum, Lungs, bronchi, blood supply and lymphatic Abdominal wall: Skin, nerve and blood supply, Muscles of anterior abdominal wall. Abdominal cavity: General Arrangement of the Abdominal Viscera, Peritoneum, Omenta, mesenteries, Stomach, blood, nerve, lymphatic supply, Small intestine, blood, nervous and lymphatic supply, Large intestine: blood nerve and lymphatic supply. The pelvic wall: Anterior, posterior wall, diaphragm. Pelvic cavity: Ureters, urinary bladder Male genital organs, Female genital organs, Muscles of pelvic region, blood supply, nerve supply, Special Senses.

**Practicals:**

1. Study Axial and Appendicular skeleton on human skeletal model.
2. Study musculoskeletal system on human musculoskeletal model.
3. Study organs of special senses.
4. Study and understand anatomy of Thorax, Abdomen and Pelvis through:
5. Human Models
6. Video demonstration.

**Recommended Books:**

- Ross and Wilson Anatomy and Physiology in health and illness 11<sup>th</sup> Edition Waugh Grant.
- Clinical Anatomy (By regions) 9<sup>th</sup> edition, Richard S. Snell.

**Reference books:**

- Netter Atlas of human anatomy 5<sup>th</sup> Edition Saunders.
- Gray's Anatomy for students 2<sup>nd</sup> Edition Drake Vogal Mitcell.

**Course Objective:**

After successful completion of this course, students will be able to,

- Compose a well-constructed essay that develops a clearly defined claim of interpretation which is supported by close textual reading.
- Utilize literary terminology, critical methods, and various lenses of interpretation in their writing.
- Apply the rules of English grammar.
- Adhere to the formatting and documenting conventions of our discipline

**Course Contents:**

Vocabulary Building Skills: Antonyms, Synonyms, Homonyms, One word Substitute, Prefixes and suffixes, Idioms and phrasal verbs, Logical connectors, Check spellings, Practical Grammar & Writing Skill: Parts of Speech, Tenses, Paragraph writing: Practice in writing a good, unified and coherent paragraph, Précis writing and comprehension, Translation skills: Urdu to English, Reading skills: Skimming and scanning, intensive and extensive, and speed reading, summary and comprehension Paragraphs, Presentation skills: Developing, Oral Presentation skill, Personality development (emphasis on content, style and pronunciation)

**Recommended books:**

- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.

**Course Objectives:**

After successful completion of this course, students will be able to,

- 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.
- Inculcate patriotism in the hearts of students so that they may become a good citizen.

**Course Contents:**

Historical Perspective: Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah, Factors leading to Muslim separatism, People and Land, Indus Civilization, Muslim advent, Location and Geo-Physical features. Government and Politics in Pakistan, Political and constitutional phases:1947-58,1958-71,1971-77,1977-88,1988-99,1999 onward  
Contemporary Pakistan: Economic institutions and issues, Society and social structure, Ethnicity, Foreign policy of Pakistan and challenges, Futuristic outlook of Pakistan

**Books Recommended:**

- Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
- Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.
- Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
- Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.

**Course objectives:**

After successful completion of this course, students will be able to,

- Use technology ethically, safely, securely, and legally.
- Identify and analyze computer hardware, software, and network components.
- Design basic business web pages using current HTML/CSS coding standards.
- Install, configure, and remove software and hardware

**Course Contents:**

Introduction to Computer and Window XP/7; MS Office 2007 (Word, Excel, PowerPoint); Internet access and different data bases available on the internet; Email.

**Recommended Books:**

- Computer science by Muhammad Ashraf, edition 1<sup>st</sup> 2010

## **2<sup>nd</sup> SEMESTER COURSES**

- **MEDICAL BIOCHEMISTRY-II**
- **HUMAN PHYSIOLOGY-II**
- **HUMAN ANATOMY-II**
- **ENGLISH-II**
- **ISLAMIC STUDIES**

**Course objective:**

After successful completion of this course, students will be able to,

- Describe the synthesis of proteins, lipids, nucleic acids, carbohydrates and their role in metabolic pathways along with their regulation
- Discuss the clinical role of enzymes in human being.
- Interpret and apply nutritional concepts to evaluate and improve the nutritional health of individuals with medical conditions.

**Content:**

Carbohydrates metabolism (Glycolysis, Glycogenolysis, Gluconeogenesis, Glycogenesis, Pentose phosphate pathway, Fermentation and ethanol metabolism, Krebs cycle, ETC, Cori cycle, Glucose alanine cycle), Protein and amino acids metabolism (synthesis and degradation of amino acids, Lipid metabolism (Beta oxidation), Nucleotide metabolism ( Purine and pyrimidine degradation, uric acid formation), Nutrition (Major food groups, B a l a n c e d d i e t , Metabolic changes in starvation, Protein energy malnutrition, Obesity, kwashiorkor, Marasmus), Clinical diagnostic enzymology: clinical significance of ALT, AST, ALP, GGT, LDH and isoenzymes, CK and isoenzymes, Pancreatic lipase and amylase, cholinesterase, G6PD, ACP, cardiac troponins, ANP, BNP and pro- BNP)

**Practical:**

- Determination of liver, cardiac, pancreatic enzymes
- Determination of urea and uric acid
- Demonstration of ELISA, CMIA and CLIA instrument

**Books:**

BIOCHEMISTRY by Dr. U. Satyanarayana, U Chakrapani  
Marks' Essentials of Medical BIOCHEMISTRY A Clinical Approach, Second Edition Harper's Illustrated MEDICAL BIOCHEMISTRY a LANGE medical book twenty-sixth edition Lehninger Principles of BIOCHEMISTRY, 6E  
Mc Graw Hill's Manual of laboratory and diagnostic tests by DENISE D. WILSON, PHD, APN, FNP, ANP

**Course Objectives:**

After successful completion of this course, students will be able to,

- Demonstrate a systematic and coherent knowledge of the physiological functioning of the central nervous system, special senses (CNS & SS), cardiovascular system and respiratory system.
- Describe the formation of the formed element components of blood
- Identify the components and function of the lymphatic system and discuss the role of the innate immune response against pathogens

**Course Contents:**

Physiology of Nervous System, Function of various cranial nerves, Functions of somatic motor nervous system Functions of the autonomic nervous system, function of neurons, neuroglial cells and their components. Resting membrane potential and an action potential, function of a synapse and reflex arc, functions of the specialized sense organs: Eye, physiology of site, accommodation, optic nerve and optic chiasma, Ear, functions of the internal, middle and external ear Physiology of the hearing and balance, Smell, physiology of olfactory nerve. Taste, physiology of taste Location of the taste buds Physiology of speech, Blood: Composition and function of Blood , haematoposis, Blood grouping, Coagulation mechanism, Physiology of Cardiovascular system The Physiology of Pulmonary Systemic Circulation: Arteries Veins Local Control of Blood Vessels Nervous Control of Blood Vessels Regulation of Arterial Pressure, The function of Lymphatic System, tonsils, lymph nodes, the spleen and the thymus, Classification and physiology of Immune system, Antigens and Antibodies, Primary and secondary responses to an antigen Antibody-mediated immunity and cell-mediated immunity Role of lymphocyte in immunity regulation.

**Practicals**

1. Spirometry
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
- Guyton And Hall Textbook Of Medical Physiology John E. Hall, Arthur C. Guyton Professor and Chair 2006
- Ross and Wilson Anatomy and Physiology in Health And Illness 11<sup>th</sup> Edition Anne Waugh, Allison Grant 2010

**Course Objectives:**

After successful completion of this course, students will be able to,

- Identify bones of the upper limb and bony landmarks that articulate at each joint with all muscular compartments of the upper limb.
- Discuss bones of the lower limb and bony landmarks that articulate at each joint with all muscular compartments of the lower limb and identify these structures on radiographic images.
- Describe the topographical and functional anatomy of the head and neck, in particular the arrangement, relations and structure of the major skeletal, muscular and neurovascular components of the head and neck

**Course contents:**

The upper limb Bones of shoulder girdle and Arm, Muscles, Axilla, Brachial plexus, Cubital fossa, the forearm, hand bones, muscles, Blood supply, Nerve supply, lymphatics, The lower limb Fascia, Bones, Muscles, Femoral triangle, Blood supply, Nerve supply, Lymphatic supply. Head and neck Skull, Mandible, Cranial nerves, cranial cavity, Meninges, Brain, Orbit, Neck, Endocrine System Classification of endocrine glands, Pituitary glands, Thyroid Glands, Adrenal gland and differences between the cortex and medulla.

**Practicals:**

Study and understand the anatomy of Upper limb, Lower limb, Head and Neck through:

1. Human Models
2. Video demonstration
3. Study radiographs of upper and lower limb.

**Recommended Books:****Essential books** (text books)

- Ross and Wilson Anatomy and Physiology in health and illness 11<sup>th</sup> Edition Waugh Grant.
- Clinical Anatomy (By regions) 9<sup>th</sup> edition, Richard S. Snell.

**Reference books**

- Netter Atlas of human anatomy 5<sup>th</sup> Edition Saunders.
- Gray's Anatomy for students 2<sup>nd</sup> Edition Drake Vogal Mitcell.
- BD. Churasia Human Anatomy (All regions)



**Course Objectives:**

After successful completion of this course, students will be able to,

- Develop writing, reading and listening skills.
- Demonstrate integrative and independent thinking, originality, imagination, experimentation, problem solving, or risk taking in thought, expression, or intellectual engagement.
- Participate in discussions by listening to others' perspectives, asking productive questions, and articulating original ideas.

**Course contents:**

Writing Skill: CV and job application, Technical Report writing, Writing styles, Changing narration: Converting a dialogue into a report, Converting a story into a news report, Converting a graph or picture into a short report or story, Active and Passive voice, Letter / memo writing and minutes of the meeting, use of library and internet recourses, Essay writing, Phrases - Types and functions, Clauses - Types and functions, Punctuation: Tenses - Types, Structure, Function, Conversion into negative and interrogative. Speaking Skill: Group Discussion (Various topics given by the teacher), Presentation by the students (individually), Role Play Activities for improving Speaking. Listening Skill: Listening Various Documentaries, Movies, and online listening activities to improve the listening as well as pronunciation of the words.

**Recommended Books:**

- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492.
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
- 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.
- Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

**Course Objectives:**

After successful completion of this course, students will be able to,

- Recognize basic concept of Islam (faith, pillars and systems etc.) and express their impact on society.
- Present Islam as complete code of life and demonstrate understanding of Islamic Ethics.
- Demonstrate the role of a medical professional in Islam.

**Course contents:**

Fundamental beliefs of Islam, Belief of Tawheed, Belief in Prophet hood, Belief in the Day of Judgment, Worships, Salaat / Prayer, Zakat /Obligatory Charity, Saum / Fasting, Hajj / Pilgrimage, Jihad, Importance of Paramedics In Islam, Ethics, Religion and Ethics, Higher Intents / Objectives of Islamic Sharia and Human Health, Importance and Virtues of Medical Profession, Contribution and Achievements of Muslim Doctors, Knowledge of the Rights, Wisdom and Prudence, Sympathy /Empathy, Responsible Life, Patience, Humbleness, Self Respect, Forgiveness, Kindhearted, Beneficence, Self Confidence, Observing Promise, Equality, Relation among the Doctors, Jealousy, Backbiting, Envy, Etiquettes of Gathering, Relation between a Doctor and a Patient, Gentle Speaking, Mercy and Affection, Consoling the Patient, To inquire the health of Patient, Character building of the Patient, Responsibilities of a Doctor,

**Recommended Books:**

- Islamiyat (Compulsory) for Khyber Medical University, Medical Colleges and Allied Institutes

## **3<sup>rd</sup> Semester Courses**

- 1. GENERAL PATHOLOGY-I**
- 2. MEDICAL MICROBIOLOGY-I (Non MLT students)**
- 3. PHARMACOLOGY-I**
- 4. COMMUNICATION SKILLS**
- 5. HEMATOLOGY-I**
- 6. CLINICAL BACTERIOLOGY**
- 7. MOLECULAR BIOLOGY**

**Course Objectives:**

After successful completion of this course, students will be able to,

- Specify the abnormalities of cell growth and differentiation.
- Describe cellular responses to stress and noxious stimuli and inflammation.
- Discuss cell injury, cell death and mechanisms involved in wound healing.
- Explain the hemodynamic disorders and neoplasia.

**Course Contents:**

Introduction to pathology, Cell injury, Cellular adaptation, Acute Inflammation, Chronic Inflammation, Cell Repair & Wound Healing, Regeneration & Repair, Haemodynamic Disorders, Edema, Haemorrhage, Thrombosis, Embolism, Infarction & Hyperaemia, Shock, compensatory mechanism of shock, possible consequences of thrombosis & difference between arterial & venous emboli, Neoplasia, Dysplasia, benign and malignant neoplasms, metastasis

**Practicals:**

1. Estimation of Prothrombin Time
2. Estimation of Clotting Time
3. Estimation of Bleeding Time
4. Estimation of Activated Partial Tromboplastin Time

**Recommended Books:**

- Robbins Basic Pathology Kumar Abbas Aster 9<sup>th</sup> Edition 2013
- Review Of General Pathology Moh. Firdaus 9<sup>th</sup> Edition
- Short Text Book of Pathology Moh. Inam Danish 3<sup>rd</sup> Edition 2006

**Course objectives:**

- To introduce the students with basic concepts in bacteriology and mycology.
- To introduce the students with common bacterial and fungal infections.
- To introduce the students with diagnosis of common bacterial and fungal infections.

**Course contents:**

Historical review and scope of microbiology, sterilization, structure and function of prokaryotic cell, difference between prokaryotic and eukaryotic cell, bacterial growth, normal microbial flora of human body, mechanism of bacterial pathogenesis, host parasite interaction, Immune response to infection, pathogen prevailing in Pakistan, introduction to fungi, fungal characteristic, morphology, structure, replication and classification, mechanism of fungal pathogenesis, common fungal pathogen prevailing in Pakistan.

**Practical:**

1. Introduction and demonstration of Laboratory Equipments used in Microbiology.
2. Inoculation and isolation of pure bacterial culture and its antibiotic susceptibility testing.
3. Demonstration of different types of physical and chemical methods of sterilization, and disinfection.
4. Students should be thorough to work with compound microscope.
5. Detection of motility: Hanging drop examinations with motile bacteria, non-motile bacteria.
6. Simple staining methods of pure culture and mixed culture.
7. Gram's staining of pure culture and mixed culture.
8. AFB staining of Normal smear, AFB positive smear.
9. KOH preparation for fungal hyphae.
10. Germ tube test for yeast identification.
11. Gram stain for candida.

**Recommended books:**

- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4<sup>th</sup> ed. McGraw-Hill, 2003.
- Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3<sup>rd</sup> ed. MedMaster, 2004.
- Medical Microbiology and Infection at a Glance. Gillespie, S., H., Bamford, K., B., 4<sup>th</sup> ed. Wiley-Blackwell, 2012.
- Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005.
- Review of Medical Microbiology and Immunology. Levinson, W., 10<sup>th</sup> ed. McGraw Hill Professional, 2008.
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26<sup>th</sup> ed. McGraw-Hill Medical, 2012.

**Course Objectives:**

After successful completion of this course, students will be able to,

- Describe common terms related to pharmacology and drug therapy.
- Identify a range of drugs used in medicine and discuss their mechanisms of action.
- Report the clinical applications, side effects and toxicities of drugs used in medicine.

**Course Contents:**

Introduction to Pharmacology, Pharmacokinetics, Pharmacodynamics, Adverse effects of drugs, Classification of drugs, Drugs affecting the Autonomic Nervous System, NSAID, Opioids, Drugs Affecting Endocrine system(Corticosteroids, Thyroid and Anti Thyroid), Gastrointestinal Drugs(PPI,H2 blockers and Antacids), Anti-Histamines, Anesthetics(General and local anesthetics),

**Practical:** 1. Introduction to drug dosage form 2. Study of the action of drugs (Atropine) on the rabbit's eye

**Recommended books:**

Lippincott s pharmacology (text book) by Mycek 6th Edition published by Lippincott Raven 2012. **I** Katzung textbook of pharmacology (Reference Book) by Bertram Katzung 12th Edition, Published by Appleton.

**Course Objectives**

After successful completion of this course, students will be able to,

- Communicate effectively both verbally and non-verbally
- Apply the requisite academic communication skills in their essay writing and other forms of academic writing
- Use various computer-mediated communication platforms in their academic and professional work
- Relate the interpersonal and organizational dynamics that affect effective communication in organizations.

**Course contents:**

Introduction to Communication , Meaning and definition of Communication, The process of communication, Models of communication, Effective Communications in Business, Importance and Benefits of effective communication, Components of Communication, Communication barriers, Non verbal communication, Principles of effective communication, Seven Cs, Communication for academic purposes, Introduction to academic writing, Summarizing, paraphrasing and argumentation skills, Textual cohesion, Communication in Organizations, Formal communication networks in organizations, Informal communication networks, Computer- mediated communication (videoconferencing, internet, e-mail, skype, groupware, etc), Business Writing , Memos, Letters, Reports, Proposals, Circulars, Public Speaking and Presentation skills, Effective public presentation skills, Audience analysis, Effective argumentation skills, Interview skills.

**Recommended Books:**

- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492.
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
- 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.
- Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

**Course Objectives:**

By the end of this semester the students of BS technology 3<sup>rd</sup> semester will be able to

- Discuss basic concepts in Hematology and acquire skill in practical work to produce students steeped in knowledge of Hematology
- Interpret the tests result of the basic hematological procedures for accurate diagnosis and patient's monitoring

**Content:**

Introduction to hematology, physiology of blood and composition, Introduction to bone marrow, structure and function of bone marrow, Blood formation in the body (Intra-uterine and extra-uterine), factors governing hematopoiesis, Erythropoiesis, different stages and factor effecting on erythropoiesis, Granulopoiesis, different stages and factor effecting on granulopoiesis, Introduction to hemoglobin, structure, synthesis and function of hemoglobin, complete blood count (CBC) and its importance, Morphology of red blood cells and white blood cells and its importance in various hematological disorders, Introduction to anemia its classification, Introduction to hemolysis (physiological and pathological), Introduction to WBC disorders, introduction to leukemia, etiology, pathogenesis and its classification, Leukocytosis, leukopenia, Neutrophilia, condition related to neutrophilia, Eosinophilia, condition related to eosinophilia, Monocytosis, condition related to monocytosis, Lymphocytosis, condition related to lymphocytosis, Introduction to hemostasis, mechanism of hemostasis, function of platelets and coagulation factors, Coagulation cascade, quantitative disorder of platelets, , qualitative disorder of platelets.

**Practical:**

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. Determine bleeding time; prothrombin time; activated partial thromboplastin time

**Books:**

- Essential of Hematology, A.V Hoff Brand, 6th edition 2006
- Essential of hematology by JP
- Clinical Hematology, G.C Degrunchi, 5th edition 2002

Practical Hematology, Dacie J.V. 10th edition 2012



**Course Objectives:**

- To introduce the students with basic concepts in clinical bacteriology.
- 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:**

Introduction to clinical bacteriology, sterilization, disinfection and antisepsis, structure and function of prokaryotic cell, difference between prokaryotic and eukaryotic cell, bacterial growth and metabolism, bacterial classification, normal microbial flora of human body, mechanism of bacterial pathogenesis, host parasite interaction, Immune response to infection, Gram positive and negative cocci, Gram positive and negative rods, Gram negative cocco-bacilli, Nocardia and Actinomyces, Mycobacteria, Spirochete, Mycoplasma, Rickettsia and Chlamydia, minor bacterial pathogen.

**Practical:**

1. Introduction and demonstration of Laboratory Equipments used in clinical bacteriology.
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. ZN staining of Normal smear, AFB positive smear.
7. Isolation and identification of pure bacterial isolate.

**Recommended Book:**

Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4<sup>th</sup> ed. McGraw-Hill, 2003.

District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2<sup>nd</sup> ed. Cambridge University Press, 2006.

Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3<sup>rd</sup> ed. MedMaster, 2004.

Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12<sup>th</sup> ed. Elsevier Mosby, 2007.

Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005

Review of Medical Microbiology and Immunology. Levinson, W., 10<sup>th</sup> ed. McGraw Hill Professional, 2008.

Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26<sup>th</sup> ed. McGraw-Hill Medical, 2012.

**Course Objectives:**

At the end this semester the students of BS MLT 3rd semester will be able

- to
- Discuss the basic concept of molecular biology
- Apply Basic techniques used in recombinant molecular biology.

**Content:**

Central dogma of Molecular Biology, One gene one 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 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

**Practical:**

Extraction of DNA and RNA

Restriction fragment length polymorphism

**Books:**

Cell and molecular Biology By Gerald Karp, 5<sup>th</sup> edition 2005.

Molecular Biology By Robert F. Weaver 3<sup>rd</sup> edition 2010

## **4<sup>th</sup> Semester Courses**

1. PHARMACOLOGY-II
2. PATHOLOGY-II
3. MEDICAL MICROBIOLOGY-II (Non MLT)
4. BEHAVIORAL SCIENCES
5. HEMATOLOGY-II (Non MLT)
6. RBCs DISORDERS
7. DIAGNOSTIC BACTERIOLOGY
8. HUMAN GENETICS

**Course objectives:**

To provide quality patient care in routine as well as advanced procedures.

To understand the mechanism of drug action at molecular as well as cellular level, both desirable and adverse.

To understand the principles of pharmacokinetics i.e. drug absorption, distribution, metabolism and excretion and be able to apply these principles in therapeutic practice.

**Course contents:**

Drugs acting on cardiovascular system; Drugs for heart failure, anti-hypertensive drugs, antianginal drugs, Anti Hyperlipidemic drugs, Blood drugs(Anticoagulants), Diuretics, Chemotherapeutics drugs([Anti- protozol, Anti-Malarial], Anti-Fungal, Anthelmintic), Antibiotics(Penicillin's, cephalosporin's, macrolides, aminoglycosides, fluroquinolones), Drugs acting on Respiratory system(Asthma).

**Practical:**

1. Routes of drug administration 2. Study of action pilocarpine on rabbit eye

**Recommended books:**

Lippincott s pharmacology (text book) by Mycek 6th Edition published by Lippincott Raven 2012. Katzung textbook of pharmacology (Reference Book) by Bertram Katzung 12<sup>th</sup> Edition, Published by Appleton.

**Course Objectives:**

- To introduce students with different environmental hazards
- To gain knowledge of some basic systemic diseases

**Course contents:**

Health effects of climate change, toxicity of chemical and physical agents, environmental pollution, effect of tobacco, effect of alcohol, injury by therapeutic drugs and drugs of abuse, general principles of microbial pathogenesis, special techniques for identifying infectious agents, agents of bioterrorism, heart failure, congenital heart diseases, ischemic heart diseases, hypertensive heart diseases, arrhythmias, atelectasis, chronic obstructive pulmonary disease, asthma, bronchiectasis, pneumonias, pneumothorax, hemothorax, nephrotic syndrome, renal stone, hydronephrosis, aphthous ulcer, gastritis, peptic ulcer, hemorrhoid, jaundice, liver cirrhosis, viral hepatitis, cholecystitis, urinary tract infections, arthritis, facial palsy

**Practicals:**

1. Helicobacter pylori test
2. Diagnosis methods of UTI
3. Determination of renal function tests
4. Determination of liver function tests
5. Determination of cardiac profile

**Recommended Books:**

- Robbins Basic Pathology Kumar Abbas Aster 9<sup>th</sup> Edition 2013
- Review Of General Pathology Moh.Firdaus, 9<sup>th</sup> Edition
- Short Text Book of Pathology Moh. Inam Danish 3<sup>rd</sup> Edition 2006

**Course objectives:**

- To introduce the students with basic concepts in virology and parasitology.
- To introduce the students with common viral and parasitic infections.
- To introduce the students with diagnosis of common viral and parasitic infections.

**Course contents:**

Introduction to virology, Viral morphology, structure, replication and classification, general properties of virus, pathogenesis and control of virus, common viral pathogen prevailing in Pakistan, introduction to parasitology, Parasite (protozoan and helminthes) morphology and classification, general principal of pathogenesis, immunology and diagnosis of parasitic infection, common parasitic pathogen prevailing in Pakistan.

**Practical:**

1. Cleaning of new and used glass wares for microbiological purposes.
2. Students should be familiar to use autoclave, hot air oven, water bath, steamer etc.
3. Macroscopic and microscopic examination of stool for adult worms, ova, cysts, larvae.
4. Visit to hospital for demonstration of biomedical waste management.
5. Demonstration of common serological tests used for the diagnosis of viral and parasitic infection.
6. Demonstration of malarial parasites in blood and bone marrow.
7. Demonstration of leishmania in blood film.
8. Concentration techniques for intestinal parasites in stool.

**Recommended books:**

- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4<sup>th</sup> ed. McGraw-Hill, 2003.
- Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3<sup>rd</sup> ed. MedMaster, 2004.
- Medical Microbiology and Infection at a Glance. Gillespie, S., H., Bamford, K., B., 4<sup>th</sup> ed. Wiley-Blackwell, 2012.
- Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005.
- Review of Medical Microbiology and Immunology. Levinson, W., 10<sup>th</sup> ed. McGraw Hill Professional, 2008.
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26<sup>th</sup> ed. McGraw-Hill Medical, 2012.

**Course Objectives**

- Conducting diagnostic interviews
- Formulating and clarifying diagnostic findings and treatment recommendations
- Documenting evaluation and treatment procedures, involving duties such as recording results of diagnostic interviews, lab studies, and/or treatment plans in a timely way according to the medical records protocols of the rotation site

**Course Contents:**

Introduction to Behavioral Sciences and its importance in health: Bio-Psycho-Social Model of Health Care and the Systems Approach, Normality vs Abnormality, Importance of Behavioral sciences in health, Desirable Attitudes in Health Professionals Understanding Behavior: Sensation and sense organs, Perception, Attention and concentration, Memory, Thinking, Communication, Individual Differences: Personality, Intelligence, Emotions, Motivation, Learning, Stress and Stressors, Life Events, Stress, Management, Interviewing / Psychosocial History Taking, Allied Health Ethics-Hippocratic oath, Culture and Allied Health practice, Psychological reactions, Breaking Bad News, Pain, Sleep, Consciousness.

**Recommended Books:**

- Behavioral Sciences by M.H Rana 2007, edition 5<sup>th</sup>
- Sociology in a Changing World by William Kornblum 8<sup>th</sup> edition 2007
- Changing Behavior: Immediately Transform Your Relationships with Easy-to-Learn, Proven Communication Skills by Georgiana Donadio 2011, edition 5<sup>th</sup>

**Course Objectives:**

- To introduce the students about the basic 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 advancements in the field of hematology.

**Course Outlines:**

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 B<sub>12</sub> 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.

ABO and Rh D group system, Kell blood group system, Kidd 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, Coombs test, types and importance, introduction to hemolytic disease of newborn, types, pathophysiology, diagnosis and management, hemolytic transfusion reactions and management.

**Practical:**

1. ABO blood grouping (Forward and Reverse grouping)
2. Rh Blood grouping
3. Antibodies screening
4. Cross matching (Major and Minor)
5. Coombs tests (Direct and Indirect)
6. Separation of different blood components
7. Du Test

**Recommended books**

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



**Course Objectives:**

- To introduce the students about the basic 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 advancements in the field of hematology.

**Course Outlines:**

Introduction to erythropoiesis, bone marrow aspiration and trephine biopsy, procedure and importance, peripheral smear, preparation, drying & staining of peripheral smears, types of stains & methods of preparation, Criteria for good smear, introduction to anemia, classification, microcytic hypochromic anemia, iron metabolism, iron deficiency anemia, diagnosis and differential diagnosis of iron deficiency anemia, thalassemia, classification, pathophysiology and diagnosis and differential diagnosis of thalassemia, sideroblastic anemia, macrocytic anemia, folate and vitamin B<sub>12</sub> metabolism, introduction to megaloblastic anemia, etiology, pathophysiology and diagnosis, enzymopathy, introduction to G6PD deficiency, pathophysiology, diagnosis and differential diagnosis, membranopathies, introduction to hereditary spherocytosis, etiology, pathophysiology diagnosis and differential diagnosis, introduction to sickle cell anemia, etiology, pathophysiology and diagnosis, hereditary elliptocytosis, pathophysiology and diagnosis, introduction to hemolytic anemia, immune hemolytic anemia, non Immune hemolytic anemia, introduction to aplastic anemia, etiology and diagnosis, introduction to disseminated intravascular coagulation, etiology and diagnosis.

**Practical:**

1. staining, preparation and procedure of staining
2. Automated cells counts
3. Hb Electrophoresis, procedure and importance
4. Ham's test, procedure and importance
5. Iron stain, procedure and importance
6. Osmotic Fragility test, procedure and importance
7. G6PD assay, procedure and importance.

**Recommended Books:**

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

**Objectives:**

- To introduce the students with basic concepts in diagnostic bacteriology.
- To introduce the students with laboratory procedure used in diagnostic bacteriology.
- To introduce the students with basic and differential diagnosis of bacterial infections.
- To introduce the students with technical skills used in diagnostic bacteriology.

**Course content:**

Introduction to diagnostic bacteriology, Collection, preservation, transport and processing of clinical specimens for the diagnosis of bacterial infections, detailed study of different methods of antibiotic susceptibility tests, media used, selection of drugs, quality control, beta lactamase detection, MRSA detection, antibiotic assay in blood and body fluids, detailed study of the principle, preparation of media and reagents, methods, interpretation and quality control of the biochemical test used for the Identification of bacteria, detail study of principles and method of preparation, pH adjustments, sterilization, storage of different types of media, transport media, anaerobic media, quality control in media preparation, cultivation of bacteria, Inoculation methods, incubation methods, Inoculation on different types of culture media in Petri dish, slopes, butt, broths, morphological study of bacterial colonies on plated media, anaerobic culture methods with recent advance.

**Practical:**

1. Different methods & interpretation of antibiotic sensitivity testing and minimal inhibitory concentration.
2. MTB culture by concentration method.
3. Biochemical tests used for the identification of bacteria.
4. Preparation of commonly used laboratory medias, sterilization, Quality control and storage.
5. Collection, transportation and processing of all type of clinical specimens for the diagnosis of bacterial infections discussed in theory.
6. Inoculation and isolation of pure and mixed bacterial culture.
7. Identification of medically important bacteria from pure culture.
8. Special stains used in bacteriology.

**Recommended Books:**

- Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12<sup>th</sup> ed. Elsevier Mosby, 2007.
- A Photographic Atlas *f o r t h e* Microbiology Laboratory. Leboffe, M., J., & Pierce, B., E., 4th ed. Douglas N. Morton, 2010.
- Principles and Practice of Clinical Bacteriology. Gillespie, S., H., & Hawkey, P., M., 2<sup>nd</sup> ed. Wiley-Blackwell, 2005.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2<sup>nd</sup> ed. Cambridge University Press, 2006.

**Course objectives:**

By the end of this course the students of 4<sup>th</sup> semester BS MLT will be able to

- Discuss the basic concept of human genetics
- Apply basic procedure and use of various instrumentation in human genetics for acquisition of competencies

**Content:**

Introduction to genetics, cell cycle, chromosomes, chromosomal structure abnormalities, X chromosome inactivation and formation of Bar Bodies, Modes of Inheritance, Gene, Locus, Allele, Genotype, Phenotype, Homozygote, Dominant, Recessive, Pedigree Nomenclature population genetics, Factors causing Genetic variation in Population , Mutations: Deletion, Insertion, Frame Shift/in-frame, Loss of function, prenatal testing and diagnostic procedure, genetic counseling, gene therapy, genetic of gender i.e. determination of male and female gender. Gene Mapping, linkage analysis, Genetic diagnosis and its applications, whole genome/whole exon (introduction only), microarray analysis

**Practical:**

1. CVS sampling techniques
2. Amniocentesis
3. Pedigree drawing

**Books:**

Human genetics By Robertson, 2007, edition 4<sup>th</sup>.

Human Genetics concepts and application By Ricki Lewis, edition 9<sup>th</sup>

## **5<sup>TH</sup> SEMESTER COURSES**

1. WBCs AND PLATELETES DISORDERS
2. CLINICAL PARASITOLOGY
3. CHEMICAL PATHOLOGY
4. CLINICAL PATHOLOGY
5. LABORATORY MATHEMATICS
6. BIOTECHNOLOGY

**Course Objectives:**

- 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.

**Course contents:**

leucopoiesis, introduction to WBC,s disorders, investigations towards WBC,s disorders, 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, myeloproliferative disorders, introduction to plasma cell discrasias, classification, multiple myeloma, lymphoma classification, introduction to hemostasis, primary hemostasis, secondary hemostasis, coagulation, coagulation factors, inhibitors of coagulation, fibrinolytic system, introduction to hemophilia, classification, diagnosis, thrombotic thrombocytopenic purpura, pathogenesis, and diagnosis, hemolytic uremic syndrome, pathogenesis, diagnosis, won vallibrand diseases, classification and diagnosis, glanzman thrombastenia, barnad soliar syndrome, immune thrombocytopenic purpura Correction Studies.

**Practical:**

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

**Recommended Books:**

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

**Course Objectives:**

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

**Course Contents:**

Introduction to clinical parasitology, Parasite (protozoan and metazoan) morphology and classification, general principal of pathogenesis, immunology and diagnosis of parasitic infection, **Protozoan:** Sporozoa (Plasmodium, Toxoplasma, Cryosporidium, Isospora), Rhizopods (Entamoebahistolytica, Naegleria, Acanthamoeba, Balantidium coli), Flagellates (Gardialamblia, Trichomonas vaginalis, Leishmania, Trypanosoma), **Metazoan:** Intestinal nematodes (Enterobiusvermicularis, Trichuristrichiura, Ascarislumbricoides, Nectar americanus, Ancylostomaduodenale, Strongyloidesstercoralis), Tissue nematode (Wuchereriabancrofti, Brugiamalayi, Onchocerca volvulus, Loa loa, Dracunculusmedinensis), Cestode (Teniasaginata & solium, Diphyllbothriumlatum, Hymenolepis nana, Echinococcus) and Trematode (Paragonimus, Clonorchis, Schistosoma, Fasciola species).

**Practical:**

1. Identification of parasites of Medical importance dealt in the theory.
2. Macroscopic and microscopic examination of stool for adult worms, ova, cysts, larvae.
3. Concentration techniques for intestinal parasites in stool.
4. Collection of blood and preparation of thick & thin smears.
5. Staining of blood smears for blood parasites.
6. Examination of blood smears for malaria & microfilaria and their identification.
7. 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., 4<sup>th</sup> ed. McGraw-Hill, 2003.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2<sup>nd</sup> ed. Cambridge University Press, 2006.
- Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3<sup>rd</sup> ed. MedMaster, 2004.
- Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26<sup>th</sup> ed. McGraw-Hill Medical, 2012.

**Course Objectives:**

- To introduce students with advance techniques in Chemical Pathology and acquire skill in practical work to produce a team of Medical technologists steeped in knowledge of Pathology.
- To equipped Medical Technologists with latest advances in the field of Pathology.

**Course Contents:**

Synthesis, function and clinical significance of urea, uric acid and creatinine, determination of Lipids in blood, Cortical hormone, sex hormone, thyroid hormones, Tumour markers: alpha fetoprotein, CEA, HCG, CA, PSA, CA 125, Phenylketonuria, Aminoaciduria, Glycogen storage disease, Proteinuria, Ketonuria. Nephrotic syndrome, Malabsorption syndrome, Hyperbilirubinaemia & Jaundice, Hypoalbuminaemia, Cushing disease, Myxedema, Hypo & Hyperpituitarism, Amenorrhea, Hirsutism, Rickets, Osteomalacia, Chronic renal failure, OGTT.

**Practicals:**

1. Analysis of kidney function test
2. Analysis of lipids profile test
3. Analysis of hormones and different tumors markers

**Recommended Books:**

- John A. Koepre, Guide to clinical laboratory diagnosis 3<sup>th</sup> edition 2013
- Todd Sanford, Clinical diagnosis Saunders Co. USA By laboratory Method 13<sup>th</sup> edition 2009
- Fundamental of clinical chemistry, Carl A. Burtis. Saunders Elsevier, 6<sup>th</sup> edition, 2008.

**Course Objectives:**

- 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

**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.

**Practicals:**

1. Physical, chemical and microscopic examination of urine
2. Physical, chemical and microscopic examination of faeces
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. Physical and chemical composition of urinary Calculi

**Recommended Books**

- 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.



**Course Objectives:**

At the end of this course the students will be able to:

- Calculate concentration of different solutions used in clinical laboratory
- Calculate molar, normal, osmolar, and percent concentrations
- Describe various terms related to dilutions and concentrations
- Describe how to make independent, serial and fold dilutions and show their application

**Content:** Introduction to laboratory calculations, Types of solutions, Expressions of concentration (parts per parts and percentage), Molarity, Molality, Normality, Osmolarity and Osmolality, Density, Dilution Equations, Changing Concentrations ( $C_1V_1 = C_2V_2$ ), Dilutions- Expression of dilutions, calculating concentrations of diluted substances, Dilution volumes, Dilution concentration, dilutions as correction factors, dilution series (independent and serial dilutions, fold serial dilution), Application of dilutions (Standard curves, Titrations, Antibiotic MIC calculation, Antibody titers), Statistical calculations (Measures of central tendency), Measures of variability, Sensitivity, Specificity and Predictive Values, Normal distribution

**Practical:**

- **Preparation of stock solutions and serial dilutions**
- **Preparation of antibody titers**
- **Preparation of molar, molal, normal and percent solution/ Hypertonic/Isotonic/ Hypotonic**
- **Finding osmolarity of serum and urine samples**
- **Preparation of buffer solution**

**Books:**

1. Fundamental Laboratory Mathematics **Required Calculations for the Medical Laboratory Professionals** by Lela Buckingham, PhD
2. ELSEVIER'S Medical Laboratory Science Examination review by Linda J. Graeter

**Course Objectives:**

- Basic techniques used in recombinant DNA technology.
- Practical use of genetic engineering.
- Understanding to the potential problems related to genetic engineering.

**Course Contents:**

Introduction and scope, Restriction and modification system, Properties of restriction endonucleases, their occurrence and recognition sequences, Practical uses of endonucleases, DNA sequencing, PCR: its application, Labeling methods of probes, Construction of genomic libraries, important enzymes production, vaccine production, cloning, Introduction to nanotechnology

**Practicals:**

1. Methods of nucleic acid isolation (DNA & RNA)
2. Gel electrophoresis
3. Restriction Fragments Length Polymorphism
4. Southern, Northern and Western blotting Techniques.
5. Polymerase Chain Reaction

**Recommended Books:**

- James, D. W. 2013 Molecular Biology of Gene. Benjamin Cumming 7<sup>th</sup> edition 2013.
- Snustad, D.P and Simmons . M.J., 2012. Genetics, 6th Edition. John Wiley and Sons

## **6<sup>TH</sup> SEMESTER COURSES**

- 1. BLOOD BANKING**
- 2. IMMUNOLOGY AND SEROLOGY**
- 3. LABORATORY INSTRUMENTATION AND TECHNIQUES**
- 4. CLINICAL MYCOLOGY AND VIROLOGY**
- 5. CYTOLOGY AND CYTOGENETICS**
- 6. HISTO-TECHNIQUES**

**Course Objectives:**

- To introduce to the students 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.
- To equip Medical Technologist with latest advance techniques in the field of transfusion medicines. To establish safe blood transfusion practice.

**Course Contents:**

Introduction to blood bank, immunoglobulin, structure, different type of immunoglobulin, antigen antibodies reactions, requirements of a standard blood bank, preparation of basic reagents, different anticoagulant use in blood bank, ABO and Rh D group system, kell blood group system, duffy blood group system, MNS blood group system, ked blood group system, other blood group system, donor selection criteria, phlebotomy of donor, processing of donor blood, blood products, preparation, storage and its importance, hemovigilance in blood banking, cross match, types of cross match, procedure and importance of cross match, anti-human globulin test, types, procedure and importance and quality control of AHG, check cells, preparation and importance of check cells, transfusion reactions, investigation and management of transfusion reaction, hemolytic disease of newborn, classification, pathophysiology, diagnosis and management of HDN, quality control, external quality control, internal quality control in blood bank.

**Practicals:**

1. ABO blood grouping (Forward and Reverse grouping)
2. Rh Blood grouping
3. Antibodies screening
4. Cross matching (Major and Minor)
5. Coombs tests (Direct and Indirect)
6. Separation of different blood components

**Recommended Books:**

- Practical Hematology, Dacie J.V. 10<sup>th</sup> edition
- Introduction to Immunohematology: Bryant Neville J, third edition, 1994

**Objectives:**

- 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 serodiagnosis of infectious diseases.
- To introduce the students with technical skills used in immunology and serology.

**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, reactions in serology, serology of bacterial, viral, fungal and parasitic infections.

**Practical:**

1. Demonstration of ELIZA.
2. Demonstration of Different antibody titer e.g. ASO titer.
3. Demonstration of chemiluminescent immunoassays for the detection of HBV and HCV.
4. VDRL Test, RPR, TPHA.
5. Brucella agglutination test.
6. Haemagglutination and Haemagglutination inhibition test.
7. RIA.

**Recommended Books:**

- Clinical Immunology and Serology. Stevens, C., D., 3<sup>rd</sup> ed. F.A. Davis Company, 2009
- Color Atlas of Immunology. Burmester, G., R., & Pezzutto, A., Thieme, 2003.
- Medical Immunology. Virella, G., 6<sup>th</sup> ed. CRC press, 2007.
- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4<sup>th</sup> ed. McGraw-Hill, 2003.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2<sup>nd</sup> ed. Cambridge University Press, 2006.
- Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12<sup>th</sup> ed. Elsevier Mosby, 2007.
- Review of Medical Microbiology and Immunology. Levinson, W., 10<sup>th</sup> ed. McGraw Hill Professional, 2008.
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26<sup>th</sup> ed. McGraw-Hill Medical, 2012.

**MLT- 616                      Laboratory instrumentation and techniques    Credit hours 3(2+1)**

**Course Objectives:**

At the end of this course the students will be able to:

- Describe the principle, procedure and maintenance of various instruments used in medical laboratory.
- Operate, calibrate and maintain the quality control of various instruments used in medical laboratory
- Understand emerging and advanced techniques used in medical laboratory

**Content:** Principle, procedure, calibration and maintenance of Microscope, Colorimeter, Flame Photometer, spectrophotometry, Water Bath, Centrifuge, Balance, Incubator, pH Meter, Vortex Mixer, Hot air Oven, Water Still, Deionizer, Electrophoresis Assembly, Thermo-Cycler, Chromatography, Hematology Analyzer, Apheresis machine Autoclave, Fluorescence in-situ hybridization (FISH), Radio immuno-assay, Enzyme linked immunosorbent assay (ELISA) and Chemiluminescence microparticle immuno assay (CMIA), Blotting techniques, Flowcytometry

**Practical: Demonstration and hands on practice of:**

1. ELISA
2. Microscope
3. Spectrophotometer
4. pH meter
5. Electrophoresis assembly
6. Thermo- cycler
7. chromatography
8. Hematology analyzer

**Books:**

- Medical Instrumentation by Kaplin, edition 5<sup>th</sup>

**Course objectives:**

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

**Course contents:**

Introduction to clinical mycology, introduction to fungi, fungal characteristic, morphology, structure, replication and classification, mechanism of fungal pathogenesis, growth and isolation of fungi, laboratory approaches to diagnose fungal infection, clinical categorization of fungal infections, superficial mycoses, cutaneous mycosis, subcutaneous mycoses, systemic mycoses and opportunistic fungi, introduction to clinical virology, Viral morphology, structure, replication and classification, general properties of virus, pathogenesis and control of virus, DNA viruses (envelop and nonenvelop), RNA viruses (envelop and non envelop), Hepatitis viruses, Arboviruses, tumor viruses, slow viruses and Prions, minor viral pathogens.

**Practical:**

1. Study of growth characteristics, microscopic examination and identification of medically important fungi, collection, transportation and processing of specimens for mycological examination.
2. KOH preparation for the identification of fungal hyphae.
3. Germ tube test for yeast identification.
4. Demonstration of serological methods/ICT devices for the diagnosis of viral infection.
5. Preparation of medias and stains used in mycology.
6. Demonstration of PCR for the diagnosis of HBV, HCV and HIV.
7. Demonstration of PCR for the genotyping of HBV and HCV.

**Recommended Books:**

Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4<sup>th</sup> ed. McGraw-Hill, 2003.

District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2<sup>nd</sup> ed. Cambridge University Press, 2006.

Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3<sup>rd</sup> ed. MedMaster, 2004.

Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12<sup>th</sup> ed. Elsevier Mosby, 2007.

Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005

Review of Medical Microbiology and Immunology. Levinson, W., 10<sup>th</sup> ed. McGraw Hill Professional, 2008.

Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26<sup>th</sup> ed. McGraw-Hill Medical, 2012.

**Course Objective:**

- Describe how various sample should be collect, preserve and transport for analysis
- Demonstrate the routine and advance techniques in cytology and cytogenetic

**Content:**

Introduction to cytology, cyto-morphology of cells, collection, preservation and fixation of pleural fluid, peritoneal, pericardial, CSF, urine cytology, sputum and female genital tract, reagents and stains used in cytology, Routine and special stains i.e. pap stain, gram stain, florescence stain, ZN stain. Introduction to Immunocytochemistry. Liquid based cytology, body cavity fluid cytology, FNAC, Immunocytochemistry

**Conventional cytogenetic:** Introduction to cytogenetic, sample requirement and sample collection for cytogenetic analysis, Karyotyping and identification of chromosome, cell culture and banding.

**Books:**

The principle of clinical cytogenetic by Steven L, gersen martha b keagle 2nd edition,

Diagnostic Cytology Koss. Volume I & II

Effusion cytology a practical guide to cancer diagnosis, parvin ganjei azar.



**Course Objectives:**

- To introduce the students with the basic concepts in Histopathology 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.

**Course Contents:**

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, Decalcification of bone, Knife sharpener, H and E staining, frozen sections: Procedure and importance, cryostat, PAS: stain, Congo red stain, oil red stain, Zeihl neelsen, giemsa and reticulocytes stain.

**Practicals:**

1. Collection of different biopsy and cytology specimens
2. Performing fixation, clearing, embedding, cutting and staining of histopathology specimens

**Recommended Books:**

- 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 6<sup>th</sup> edition 2013

## **7<sup>th</sup> Semester Courses**

1. MEDICAL LABORATORY MANAGEMENT SKILLS
2. BIOINFORMATICS
3. RESEARCH METHODOLOGY
4. BIostatISTICS
5. EPIDEMIOLOGY
6. BIOSAFETY AND BIOSECURITY

**Course Objectives:**

To introduced the students with management of different laboratories sections, equipments, records and duties.

**Course Contents:**

Introduction to quality, The quality management system model, Laboratory design, Safety management programme, Personal protective equipment, Equipment Selecting and acquiring equipment, Implementing an equipment maintenance programme, Equipment maintenance documentation, Purchasing and inventory, Implementing an inventory management programme, Forms and logs, Receipt and storage of supplies, sample management, The laboratory handbook, Collection and preservation, Sample storage, retention and disposal, Sample transport, Control materials, Establishing the value range for the control material, Graphically representing control ranges, Interpreting quality control data, Using quality control information, audits, External audit, Internal audit, external quality assessment, International standards and standardization bodies, Certification and accreditation, Personnel, Recruitment and orientation, Competency and competency assessment, Training and continuing education, Employee performance appraisal, Personnel records, Customer service, Customer satisfaction surveys, Occurrence management, Quality indicators, Documents and records, Standard operating procedures (SOPs), Computerized laboratory information systems, Organizational requirements for a quality management system

**Recommended Books**

1. A handbook of “Laboratory Quality Management System” by World Health Organization, 2011, ISBN 978 92 4 154827 4

**Course Objective:**

- To train students to analyze genetics data for research.

**Course Contents:**

Introduction to information technology and Bioinformatics Basic concepts, genome database and human genome project, Biological databases, protein identification, Data retrieval and analysis using computer programs NCBI, GenBank, Swiss prot, Expassy Finding Genes in DNA, complimentary sequence generation, Structure of proteins, codon redundancy, Concept of coding sequence, non- coding sequences, Codons, Start codon, stop codon, Application of Bioinformatics: DNA microarrays, Deducing protein primary sequence from DNA or RNA sequences.

**Practicals:**

1. Use of Bioinformatics software for data analysis

**Recommended Books:**

- Introduction to Bioinformatics By Arthur M. Lesk, 3<sup>rd</sup> edition 2002.
- Bioinformatics: Sequence and genome analysis By David W. Mount, 2<sup>nd</sup> Edition 2004.

**Course Objectives:**

After successful completion of this course, students will be able to,

- Recognize the basic concepts of research and the research process.
- Develop understanding on various kinds of research, objectives of doing research, research designs and sampling.
- Conduct research work and formulating research synopsis and report.

**Course Contents:**

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 (Chapters in research report/thesis, Outline/Abstract of research, Referencing and Bibliography)

**Practical Work:**

- Literature Search
- Survey conduct
- Citation and Referencing
- Proposal writing
- Data collection and displaying

**Recommended Books:**

- Research Methodology by Ranjit Kumar 3<sup>rd</sup> Edition
- Foundation of Clinical Research by Portney LG Walkais MP in 1993, Publisher by Appleton and lauge USA
- A guide to Research Methodology, Biostatistics and Medical writing by college of physicians and surgeons Pakistan by WHO collaboration center
- Health system research project by Corlien M Varkerisser, Indra Pathmanathan, Ann Brownlee in 1993 by International Development Research Center in New Dehli, Singapore.

**Course objectives:**

After successful completion of this course, students will be able to,

- State the principal concepts about biostatistics; collect data relating to variable/variables.
- Examine and calculate descriptive statistics from collected data.
- Interpret data via binomial distribution and the concept of sampling.
- Apply hypothesis testing via some of the statistical distributions.

**Course Contents:**

Introduction to Biostatistics and its types; 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 their use 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 considerations 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, Tow 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

**Practical Work:**

- Manual calculation related to measure of central tendency and measure of Dispersion
- Defining variables in SPSS
- Entry of data in SPSS
- Analysis of data in SPSS

**Recommended Books:**

- 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, publisher American Psychological association
- Ilyas Ansari's community medicine (Text Book) by Ilyas and Ansari 2003 published by Medical division Urdu Bazaar Karachi

**Course objectives:**

After studying this course the students will be able to:

- Explain epidemiological terminologies
- Apply the knowledge to calculate disease risk, prevalence and incidence
- Select and choose an appropriate study design in research
- Explain confounding and Biases in studies
- Appraise SWOT analysis

**Course Contents:**

Introduction to Epidemiology and basic terms used in Epidemiology, Measures of Disease Occurrence; Incidence and Prevalence, Incidence, Rates and its types, Dynamics of disease transmission, Measurement of disease frequency, risk, rate and proportion, Calculation of: Prevalence, Incidence, Duration, Mortality and Morbidity, Study Design Options, Research study Designs, Case Control Study, Cohort Study, Experimental Study, RCT, Meta-analysis and systematic review, The Cross-Sectional Study, Case-Reports, Sources of Error; Confounding and Biases, Odds ratio and relative risk, SWOT analysis, Reliability of tests by using Sensitivity and specificity

**Recommended Books:**

- Calculation of Sensitivity and specificity
- Calculation of Incidence and prevalence
- Finding risk of disease, rate and frequency
- SWOT analysis

**Recommended Books:**

- 1.An\_Introduction\_to\_Epidemiology\_for\_Health\_Professionals
- Epidemiology by Leon Gordis 5<sup>th</sup> Edition

**Course Objectives:**

1. To empower students with the skills, tools, and confidence on sustainable bio-risk management.
2. To enable them to apply principles of biosafety and biosecurity in facilities
3. To reduce/eliminate the risk of infection in laboratory setting

**Course Contents:**

Introduction to Biosafety and Biosecurity, **Risk assessment and Mitigation** (Gather information, Evaluate the risks, develop a risk strategy, Select and implement control measures, Review risks and control measures), **Core requirements** (Good microbiological practices and procedures, Personnel competence and training, Facility design, Sample receipt and storage, Decontamination and waste management, Personal protective equipment, Laboratory equipment, Emergency/incident response plan, Occupational health) **Heightened and Maximum control measures** (Operational working practices and procedures, Personnel competence and training, Facility design, Sample receipt and storage, Decontamination and waste management, Personal protective equipment, Laboratory equipment, Emergency/incident response plan, Occupational health), **Transfer and transportation** (Transfer within the laboratory, Transfer within a building, Transfer between buildings on the same site, Off-site transport of infectious substances) **Biosafety program management** (Biosafety culture, Biosafety policy) **Laboratory biosecurity** (Biosecurity risk assessment, Inventory control, Information control, Personnel control, Physical security control, Transport control, Emergency/incident response plan, Emerging biotechnology, Dual use research of concern

**Practicals:**

- Donning and doffing of PPE
- Hand washing/hand sanitizing technique using glow gel
- Spill management
- Management of needle prick injury
- Working in biosafety cabinet
- Triple Packaging and labelling of biological samples
- Beaking Method of gloves removal

**Recommended Books:**

1. WHO Laboratory Biosafety Manual (Fourth Edition)
2. Biosafety in Microbiological and Biomedical Laboratories (BMBL) 6th edition, U.S. Department of Health and Human Services and NIH



## **8<sup>th</sup> Semester Courses**

1. TOXICOLOGY AND FORENSIC SEROLOGY
2. BIOETHICS
3. RESEARCH PROJECT
4. SEMINAR

**Course Objectives:**

- To describe the samples required for toxicological analysis, methods of collection, and preservation.
- To ensure that the student understand nature of the toxicological investigations undertaken in forensic laboratories
- To ensure that the student can differentiate different type of poisoning and its diagnosis

**Course Contents:**

Collection and preservation of biological material for forensic examination, Forensic Examination of biological fluids (gastric aspirate/lavage, Blood, urine, stains & other material), Introduction to toxicology, Different Types of poisoning (Metallic poison, agricultural poison, Corrosive poison), Drug of abuse (hypnotics, Sedatives, CNS stimulants,) and its diagnosis, Asphyxiants and its diagnosis.

**Practicals:**

- Carbon monoxide testing from suspected blood
- Benzidine test for suspected blood on cloth
- Semen examination from suspected stain cloth (Florence test, Barberio's Test, Acid phosphatase test)
- Silver nitrate taste for phosphine

**Recommended Books:**

- Text book of Medical Jurisprudence, Forensic medicine and Toxicology, BV Subrahmanyam Seventh edition.
- The Synopsis of Forensic Medicine and Toxicology, Dr.K.S.Narayan Reddy. Twenty-eight Edition.

**Course Objectives:**

After successful completion of this course, students will be able to,

- Identify ethical issues in medicine, health care and life sciences.
- Describe rational justification for ethical decisions.
- Practice the ethical principles of the Universal Declaration on Bioethics and Human Rights.
- Recognize and distinguish an ethical issue from other issues.

**Course Contents:**

Introduction to bioethics, ethical principles, autonomy , informed consent, intentional non-disclosure , patient self- determination act, the health insurance portability and accountability act of 1996 (HIPAA) privacy and security rules, non-maleficence, slippery slope arguments, beneficence, paternalism, justice, social justice, the patient protection and affordable care act, professional patient relationship, unavoidable trust, human dignity , patient advocacy, moral suffering, ethical dilemmas.

**Recommended Books:**

I Introduction to bioethics and ethical decision making by Karen L. Rich (chapter 2) 2015

**Objectives:**

- The student will learn some basic research methodology, gain knowledge of the specific area of radiology being researched and have the opportunity for more extensive one-on-one interaction with a member of the radiological staff. It will hopefully result in some form of presentation or publication for the student. This is most suitable for students planning to enter radiology as a career.

**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 Khyber Medical University by the end of last year.

**Practical:**

A hard copy of research project should submit to examination for degree requirements fulfillment.

During last year each student should select a topic of research work with consultation of his/her supervisor and shall present his/her research work through a seminar.