Annexure-II

CURRICULUM

of

BS Medical Laboratory Technology (MLT)

(W.e.f, Fall 2024)

DEPARTMENT OF ALLIED HEALTH SCIENCES

UNIVERSITY OF SARGODHA

RATIONALE

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

BS Medical Laboratory Technology (MLT) is a 4-year degree program that imparts scientific knowledge and skills to train students in the basic to advanced medical laboratory techniques used in Clinical Chemistry, Hematology, Blood Banking, Microbiology, Histopathology and Molecular Biology laboratories.

GOALS OF THE PROGRAMME:

The purpose of BS Medical Laboratory Technology (MLT) program is to prepare laboratory professionals/technologists who will:

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

OBJECTIVES OF THE PROGRAMME:

Graduates of the Medical Laboratory Technology (MLT) programme will:

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

Eligibility Criteria

HSSC/A-levels/Equivalent (12 years of schooling) in Pre-Medical Group with minimum of 60% marks

or

F.SC (Medical Lab technology) with minimum 60 % Marks

BS Medical Laboratory Technology (MLT)

FIRST PROFESSIONAL YEAR			
FIRST SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-5201	ANATOMY-I	4(3-1)	Inter Disciplinary
MDLT-5202	PHYSIOLOGY-I	3(2-1)	Inter Disciplinary
MDLT-5203	FUNDAMENTALS OF MEDICAL LAB TECHNOLOGY	3(2-1)	Major
URCG-5118	ENGLISH-I (FUNCTIONAL ENGLISH)	3(3-0)	General Education
URCG-5122	IDEOLOGY AND CONSTITUTION OF PAKISTAN **	2(2-0)	General Education
URCG5123	APPLICATIONS OF INFORMATION COMMUNICATION TECHNOLOGIES (ICT)	3(2-1)	General Education
URCG-5111	TRANSLATION OF THE HOLY QURAN–I	***NonCredit***	Compulsory Course
	Credit Hours	**18**	
SECOND SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-5204	ANATOMY-II	4(3-1)	Inter Disciplinary
MDLT-5205	PHYSIOLOGY-II	3(2-1)	Inter Disciplinary
MDLT-5206	BIOCHEMISTRY-I	3(2-1)	Major
URCG-5119	ENGLISH-II (EXPOSITORY WRITING)	3(3-0)	General Education
URCG-5105	ISLAMIC STUDIES ** (OR) RELIGIOUS EDUCATION / ETHICS IN LIEU OF ISLAMIC STUDIES ONLY FOR NON-MUSLIM STUDENTS	2(2-0)	General Education
URCG-5125	CIVICS AND COMMUNITY ENGAGEMENT	2(2-0)	General Education
URCG-5127	SEERAT OF THE HOLY PROPHET (SAW)	1(1-0)	General Education
	Credit Hours	**18**	
SECOND PROFESSIONAL YEAR			
THIRD SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-5207	BIOCHEMISTRY -II	3(2-1)	Major
MDLT-5208	GENERAL PATHOLOGY	3(2-1)	Major
MDLT-5209	GENERAL MICROBIOLOGY AND STERILIZATION	3(2-1)	Major
MDLT-5210	MOLECULAR BIOLOGY	3(2-1)	General Education
MDLT-5211	HEALTH AND WELLNESS	2(2-0)	General Education

URCG-5120	QUANTITATIVE REASONING	3(3-0)	General Education
URCG-5111	TRANSLATION OF THE HOLY QURAN-II **(*Non-Credit*)**	***Non Credit***	Compulsory Course
	Credit Hours	**17**	
FOURTH SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-5212	HAEMATOLOGY-I	3(2-1)	Major
MDLT-5213	CLINICAL BACTERIOLOGY	3(2-1)	Major
MDLT-5214	IMMUNOLOGY AND SEROLOGY	3(2-1)	Major
URCG-5116	SCIENCE OF SOCIETY-I	2(2-0)	General Education
URCG-5124	ENTREPRENEURSHIP	2(2-0)	General Education
URCG-5121	TOOLS FOR QUANTITATIVE REASONING	3(3-0)	General Education
MDLT-5216	PROFESSIONAL PRACTICE (LAWS, ETHICS AND ADMINISTRATION)	2(2-0)	General Education
	Credit Hours	**18**	
THIRD PROFESSIONAL YEAR			
FIFTH SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-6217	CLINICAL VIROLOGY	3(2-1)	Major
MDLT-6218	MEDICAL LABORATORY INSTRUMENTATION	3(2-1)	Major
MDLT-6219	BLOOD BANKING AND TRANSFUSION MEDICINE	3(2-1)	Major
MDLT-6220	HAEMATOLOGY-II	3(2-1)	Major
MDLT-6221	CLINICAL PATHOLOGY	3(2-1)	Major
MDLT-6222	CLINICAL LAB PRACTICE-I	3(0-3)	Major
URCG-5111	TRANSLATION OF THE HOLY QURAN–III **(*Non-Credit*)**	***Non Credit***	Compulsory Course
	Credit Hours	**18**	
SIXTH SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-6223	PARASITOLOGY AND MYCOLOGY	3(2-1)	Major
MDLT-6224	HISTOPATHOLOGY AND HISTOTECHNOLOGY	3(2-1)	Major
MDLT-6225	BIOSAFETY AND BIOSECURITY	3(2-1)	Major
MDLT-6226	PHARMACOLOGY	2(2-0)	Inter Disciplinary
MDLT-6227	COMMUNITY MEDICINE & BEHAVIORAL SCIENCES	3(3-0)	Inter Disciplinary
MDLT-6228	CLINICAL LAB PRACTICE-II	3(0-3)	Major
	Credit Hours	**17**	

FOURTH PROFESSIONAL YEAR			
SEVENTH SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-6229	CLINICAL BIOCHEMISTRY	3(2-1)	Major
MDLT-6230	CYTOPATHOLOGY AND CYTOTECHNOLOGY	3(2-1)	Major
MDLT-6231	HUMAN GENETICS AND BIOINFORMATICS	3(2-1)	Major
MDLT-6232	BIOTECHNOLOGY	3(2-1)	Major
MDLT-6233	RESEARCH METHODOLOGY & SCIENTIFIC INQUIRY	2(2-0)	Major
MDLT-6234	CLINICAL LAB PRACTICE-III	3(0-3)	Major
URCG-5111	TRANSLATION OF THE HOLY QURAN–IV	**(*Non- Credit*)**	Compulsory Course
	Credit Hours	17	
EIGHTH SEMESTER			
Course code	**Course title**	**Credit hours**	**Category**
MDLT-6235	CLINICAL LABORATORY MANAGEMENT AND SUPERVISION	3(2-1)	Major
MDLT-6236	QUALITY ASSURANCE IN CLINICAL LABORATORY	2(2-0)	Major
MDLT-6237	CLINICAL ENDOCRINOLOGY	3(2-1)	Major
MDLT-6238	FORENSIC SCIENCE	2(2-0)	Major
MDLT-6239	AI APPLICATIONS IN HEALTH CARE	2(2-0)	Inter Disciplinary
MDLT-6240	RESEARCH / CAPSTONE PROJECT	6 (0-6)	Major
	Credit Hours	**18**	
	TOTAL CREDIT HOURS	**141**	
	Total theory/Lectures for eight Semesters	98	
	Total Practical Hours for eight Semesters	28	
	Total Clinical Hours for eight Semesters	09	
	Total Research Hours for eight Semesters	06	

Note *

- *Credit hours distribution is as following:*

Theory: one credit hour shall be equal to one hour of teaching per week throughout the semester.
Practical / lab: one credit hour shall be equal to two hours of lab work per week throughout the semester.
Clinical: one credit hour shall be equal to three hours of clinical work per week throughout the semester.
Research: One credit hour shall be equal to three hours of research work per week throughout the semester.

FIRST PROFESSIONAL YEAR

FIRST SEMESTER

COURSE CODE	COURSE TITLE	CREDIT HOURS
MDLT-5201	ANATOMY-I	4(3-1)
MDLT-5202	PHYSIOLOGY-I	3(2-1)
MDLT-5203	FUNDAMENTALS OF MEDICAL LAB TECHNOLOGY	3(2-1)
URCG-5118	ENGLISH-I (FUNCTIONAL ENGLISH)	3(3-0)
URCG-5122	IDEOLOGY AND CONSTITUTION OF PAKISTAN	2(2-0)
URCG-5123	APPLICATIONS OF INFORMATION COMMUNICATION TECHNOLOGIES (ICT)	3(2-1)
URCG-5111	TRANSLATION OF THE HOLY QURAN – I	1(0-1) (Non-Credit)

DETAILS OF COURSES

MDLT-5201 ANATOMY- I CREDIT HOURS 4(3-1)

COURSE DESCRIPTION

The focus of this course is an in-depth study and analysis of the general and regional organization of the human body. Emphasis is placed upon structure and function of human movement. A comprehensive study of human anatomy histology, embryology, with emphasis on the nervous, musculoskeletal, and circulatory systems is incorporated. Introduction to general anatomy lays the foundation of the course. Dissection and identification of structures in the cadaver supplemented with the study of charts, models, prosected materials and radiographs are utilized to identify anatomical landmarks and configurations of the upper limb

LEARNING OBJECTIVES

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

COURSE CONTENTS

GENERAL ANATOMY AND FUNCTIONAL ANATOMY

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

BONES AND CARTILAGES

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

THE MUSCLE

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

STRUCTURES RELATED TO MUSCLES & BONES

- Tendons
- Aponeurosis
- Fasciae
- Synovial bursae
- Tendon Synovial sheaths
- Raphaes
- Ligaments
- Condyle
- Epicondyle
- Ridge
- Tuberosity
- Tubercle
- Foramen
- Canal
- Groove
- Process
- Spur

THE JOINTS

- Introduction
- Functional classification
- Structural classification
- Structures comprising a Synovial joint

- Movements of joints
- Blood supply of Synovial joints, their nerve supply and lymphatic drainage
- Factors responsible for joint stability
- Development of joints

CARDIOVASCULAR SYSTEM

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

NERVOUS SYSTEM

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

GENERAL HISTOLOGY

- Cell
- Epithelium
- Connective tissue
- Bone
- Muscle tissue
- Nerve tissues
- Blood vessels
- Skin and appendages
- Lymphatic organs

GENERAL EMBRYOLOGY

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

UPPER LIMB

OSTEOLOGY

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

MYOLOGY

- Muscles connecting upper limb to the axial skeletal

- Muscles around shoulder joint
- Walls and contents of axilla
- Muscles in brachial region
- Muscles of forearm
- Muscles of hand
- Retinacula
- Palmar apouenrosis
- Flexor tendon dorsal digital expansion

NEUROLOGY

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

ANGIOLOGY (CIRCULATION)

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

ARTHROLOGY

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

DEMONSTRATION

- Shoulder joint, attached muscles and articulating surfaces
- Elbow joint
- Wrist joint
- Radioulnar joint
- MCP and IP joints
- Acromioclavicular joint
- Sternoclavicular joint
- Brachial plexus
- Blood supply of brain
- Structure of bones

LAB WORK

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

Note

The students are expected to make a practical note book. The book is a collection of evidence that learning has taken place. It is a reflective record of their achievements. The practical note book shall contain a record of the surface landmarks and cross-sectional views of parts which student would have observed

RECOMMENDED BOOKS

1. *Gray's Anatomy by Prof. Susan Standing 41st Ed., Elsevier.*
2. *Clinical Anatomy for Medical Students by Richard S. Snell.*
3. *Clinically Oriented Anatomy by Keith Moore.*
4. *General Anatomy by Prof.*
5. *Ghulam Ahmad, latest Ed.*
6. *Clinical Anatomy by R. J. Last, Latest Ed.*
7. *Cunningham's Manual of Practical Anatomy by G. J. Romanes, 15th Ed., Vol-I, II and III.*
8. *The Developing Human. Clinically Oriented Embryology by Keith L. Moore, 6th Ed.*
9. *Wheater's Functional Histology by Young and Heath, Latest Ed.*
10. *Medical Histology by Prof. Laiq Hussain.*
11. *NeuroaSnatomy by Richard S. Snell 7th edition.*
12. *Jancquera textbook of histology*
13. *Colourd atlas of histology by defiero*
14. *Langman`s embryology*
15. *Clinicaly oriented developmental anatomy by k.l.moore*

MDLT-5202 PHYSIOLOGY- I CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

The course is designed to study the function of the human body at the cellular, tissue and systems levels. The course will help students in understanding the complexities of the cells, tissues, and major organs and systems of the human body, concentrating on basic mechanisms underlying human life processes and important diseases affecting normal human function

LEARNING OBJECTIVES

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

COURSE CONTENTS

CELL PHYSIOLOGY

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

NERVE AND MUSCLE

- Structure and function of neuron
- Physiological properties of nerve fibers
- Action potential
- Conduction of nerve impulse
- Nerve degeneration and regeneration
- Synapses
- Physiological structure of muscle
- Skeletal muscle contraction
- Smooth and cardiac muscle contraction
- Neuromuscular junction and transmission
- Excitation contraction coupling
- Structure and function of motor unit

CARDIOVASCULAR SYSTEM

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

RESPIRATORY SYSTEM

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

BLOOD

- Composition and general functions of blood
- Plasma proteins their production and function
- Erythropoiesis and red blood cell function
- Structure, function, production and different types of haemoglobin
- Iron absorption storage and metabolism

- Blood indices, Function, production and type of white blood cells
- Function and production of platelets
- Clotting mechanism of blood
- Blood groups and their role in blood transfusion
- Complications of blood transfusion with reference to ABO & RH incompatibility
- Components of reticuloendothelial systems, gross and microscopic structure including tonsil, lymph node and spleen
- Development and function of reticuloendothelial system

LAB WORK

- Use of the microscope
- Determination of haemoglobin
- Determination of erythrocyte sedimentation rate
- Determining packed cell volume
- Measuring bleeding and clotting time
- RBC count
- Red cell indices
- WBC count
- Leukocyte count
- Prothrombin and thrombin time.
- Blood indices in various disorders
- Clotting disorders
- Blood grouping and cross matching

Note

The students are expected to make a practical note book. The book is a collection of evidence that learning has taken place. It is a reflective record of their achievements

RECOMMENDED BOOKS

1. *Textbook of Physiology by Guyton and Hall, 12th Ed.*
2. *Review of Medical Physiology by William F. Ganong, 23rd Ed.*
3. *Physiology by Berne and Levy, 6th Ed.*
4. *Human Physiology: The Basis of Medicine by Gillian Pocock, Christopher D.Richards 4th Ed.*
5. *Physiological Basis of Medical Practice by John B. West and Taylor, 12th Ed.*

MDLT-5203 FUNDAMENTALS OF MEDICAL LAB TECHNOLOGY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

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

LEARNING OBJECTIVES

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

- Able to demonstrate the basics of Medical Laboratory Technology and its various sub-disciplines.
- Familiar with all the basic laboratory procedures and the principles for working in the clinical laboratories.
- Well aware of the responsibilities of Medical Lab professionals
- Know about the proper use of PPEs
- Well aware about personal protection; hygiene and trouble shooting of laboratory procedures

COURSE CONTENTS

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

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

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

Qualities and responsibilities of a phlebotomist.

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

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

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

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

Water Bath: Working principle, component parts and their uses

Water Distillation unit: Procedure for preparing distilled water.

Incubators: operating principle, types, operation

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

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

Refrigerators and Freezers; introduction, working principle and uses

Glucometers: Types, working principle, operation and uses

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

Hot plate and its uses,

Bunsen burner and its uses in different section in the laboratory,
Fume hood: Construction and working principle, Procedure for use.
Shaker: Types and uses
B.P Apparatus: Types, working principle and operation
Pulse Meters. Procedure for use
Scientific Calculators etc
Units of Measurements and laboratory calculations:
Different types of solutions used in medical laboratory. Standard solutions, calibrators, controls, Buffer solutions, Reagent solutions, Staining solutions etc.
Different types of hazards encountered in medical fields including Biological, electrical, mechanical hazards
Infection control:

Practical
Use of PPEs, Preparation of solutions, Measurements of volume, Pipetting and dispensing practice, Handling of basic laboratory equipments, chemicals, reagents, Preparation of standards and control solutions, Preparing sample layout for laboratory record keeping, Collection, transport and storage of different types of specimens for laboratory investigations.
Collection of blood specimens:
Types of blood specimens used in clinical laboratory, Blood collection equipments and their uses/function/application, Blood collection techniques (Venipuncture, Capillary/dermal puncture and arterial puncture), Trouble shootings a phlebotomist encountered during specimen collection, Procedural error risks in phlebotomy,
Evacuated blood collection vacautainers, Types, Uses, Rational for the use and the CLSI order of draw of blood specimen.

RECOMMENDED BOOKS

1. *Cheesbrough, M. (2005). District laboratory practice for tropical countries, update Vol. 1Bulterworth.*
2. *Baker, F. J., & Silverton, R. E. (2014). Introduction to medical laboratory technology. Butterworth-Heinemann.*
3. *Booth, K. A., & Mundt, L. A. (2013). Phlebotomy: a competency-based approach. 5th Ed. y McGraw-Hill Education*
4. *Manual of Laboratory Medicine by AFIP*

URCG-5118 ENGLISH- I (FUNCTIONAL ENGLISH) CREDIT HOURS 3(3-0)

COURSE DESCRIPTION

The course aims at providing understanding of a writer's goal of writing (i.e. clear, organized and effective content and to use that understanding and awareness for academic reading and writing. The objectives of the course are to make the students acquire and master the grammatical academic writing skills. The course would enable the students to develop argumentative writing techniques. The students would be able to logically add specific details on the topics such as facts, examples and statistical or numerical values. The course will also provide insight to convey the knowledge and ideas in an objective and persuasive manner. Furthermore, the course will also enhance the students' understanding of ethical considerations in writing academic assignments and topics including citation, plagiarism, formatting and referencing the sources as well as the technical aspects involved in referencing.

Contents

1. Developing Analytical Skills
2. Transitional devices (word, phrase and expressions)
3. Development of ideas in writing
4. Reading Comprehension
5. Precis Writing
6. Developing argument
7. Sentence structure: Accuracy, variation, appropriateness, and conciseness
8. Appropriate use of active and passive voice
9. Organization and Structure of a Paragraph
10. Organization and structure of Essay
11. Types of Essays

Recommended Texts

1. *Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). New York: Routledge.*
2. *Eastwood, J. (2011). A Basic English grammar. Oxford: Oxford University Press.*
3. *Swales, J. M., & Feak, C. B. (2012). Academic writing for graduate students: Essential tasks and skills (3rd ed.). Ann Arbor: The University of Michigan Press.*
4. *Swan, M. (2018). Practical English usage (8th ed.). Oxford: Oxford University Press.*

Suggested Readings

1. *Biber, D., Johansson, S., Leech, G., Conrad, S., Finegan, E., & Quirk, R. (1999). Longman grammarof spoken and written English. Harlow Essex: MIT Press.*
2. *Cresswell, G. (2004). Writing for academic success. London: SAGE.*
3. *Johnson-Sheehan, R. (2019). Writing today. Don Mills: Pearson.*
4. *Silvia, P. J. (2019). How to write a lot: A practical guide to productive academic writing. Washington: American Psychological Association*
5. *Thomson, A. J., & Martinet, A. V. (1986). A Practical English Grammar. Oxford: Oxford University Press.*

URCG-5122 IDEOLOGY AND CONSTITUTION OF PAKISTAN CREDIT HOURS 2(2-0)

COURSE DESCRIPTION

This course focuses on ideological background of Pakistan. The course is designed to give a comprehensive insight about the constitutional developments of Pakistan. Starting from the Government of India Act, 1935 till to date, all important events leading to constitutional developments in Pakistan will be the focus of course. Failure of the constitutional machinery and leading constitutional cases on the subject. Moreover, students will study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. It will also cover the entire Constitution of Pakistan 1973. However, emphasis would be on the fundamental rights, the nature of federalism under the constitution, distribution of powers, the rights and various remedies, the supremacy of parliament and the independence of judiciary

CONTENTS:

- **Ideology of Pakistan**

  Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama MuhammadIqbal and Quaid-e-Azam Muhammad Ali Jinnah.

  Two Nation Theory and Factors leading to Muslim separatism.

- **Constitutional Developments**

  Salient Feature of the Government of India Act 1935
  Salient Feature of Indian Independence Act 1947
  Objectives Resolution
  Salient Feature of the 1956 Constitution
  Developments leading to the abrogation of Constitution of 1956Salient
  features of the 1962 Constitution
  Causes of failure of the Constitution of 1962
  Comparative study of significant features of the Constitution of 1956, 1962 and 1973

- **Fundamental rights**
- **Principles of policy**

Federation of Pakistan President Parliament
The Federal Government

- **Provinces**

  Governors
  Provincial Assemblies
  The Provincial Government

- **The Judicature**
- **Supreme Court High Courts**
- **Federal Shariat Courts Supreme Judicial Council**

Administrative Courts and tribunals

- **Islamic Provisions in Constitution**
- **Significant Amendments of Constitution of Pakistan 1973**

Recommended Books:

1. *Constitutional and Political History of Pakistan by Hamid Khan*
2. *Mahmood, Shaukat and Shaukat, Nadeem. Constitution of the Islamic Republic of Pakistan, 3rd re edn. Lahore: Legal Research Centre, 1996.*

3. *Munir, Muhammad. Constitution of the Islamic Republic of Pakistan: Being a Commentary on the Constitution of Pakistan, 1973. Lahore, Law Pub., 1975.*
4. *Rizvi, Syed Shabbar Raza. Constitutional Law of Pakistan: Text, Case Law and Analytical Commentary. 2nd re edn. Lahore: Vanguard, 2005.*
5. *The Text of the Constitution of the Islamic Republic of Pakistan, 1973 (as amended).*

URCG5123 APPLICATIONS OF INFORMATION COMMUNICATION TECHNOLOGIES (ICT) **CREDIT HOURS: 3(2-1)**

COURSE DESCRIPTION

The course introduces students to information and communication technologies and their application in the workplace. Objectives include basic understanding of computer software, hardware, and associated technologies. How computers can be used in the workplace, how communications systems can help boost productivity, and how the Internet technologies can influence the workplace. Students will get basic understanding of computer software, hardware, and associated technologies. They will also learn how computers are used in the workplace, how communications systems can help to boost productivity, and how the Internet technologies can influence the workplace.

Contents

1. Introduction, Overview of Information Technology.
2. Hardware: Computer Systems & Components, Storage Devices.
3. Software: Operating Systems, Programming and Application Software.
4. Databases and Information Systems Networks.
5. File Processing Versus Database Management Systems.
6. Data Communication and Networks.
7. Physical Transmission Media & Wireless Transmission Media.
8. Applications of smart phone and usage.
9. The Internet, Browsers and Search Engines.
10. Websites and their types.
11. Email Collaborative Computing and Social Networking.
12. E-Commerce.
13. IT Security and other issues.
14. Cyber Laws and Ethics of using social media.
15. Use of Microsoft Office tools (Word, Power Point, Excel) or other similar tools depending on the operating system.
16. Other IT tools/software specific to field of study of the students if any.

Recommended Texts

1. *Discovering Computers 2022: Digital Technology, Data and Devices by Misty E. Vermaat, Susan L. sebok; 17th edition.*

Suggested Readings

1. *Computing Essentials 2021 by Timothy J. O'Leary and Linda I. O'Leary, McGraw Hill Higher Education; 26th edition.*
2. *Computers: Understanding Technology by Fuller, Floyd; Larson, Brian: edition 2018.*

URCG-5111 TRANSLATION OF THE HOLY QURAN – I CREDIT HOURS 1 (0-1) (Non-Credit)

Topic	Details
Semester/Level	In some discipline 1st semester and in some discipline 2nd Semester/ ADP Program 1st Year
Course Code	URCG-5111
Course Title	Translation of the Holy Quran – I
Credit Hours	1(0-1)
Objectives	• To familiarize the students to keys and fundamentals of recitation of the holy Quran. • To develop the skill of the students of recitation the last revelation. • Students will learn the basic Arabic grammar in a practical way. • To develop an eagerness among the students to explore the last divine Book.
Course Contents:	• تیسواں پارہ-ناظرہ مع تجوید • بنیادی عربی گرامر اسم اور اسکے متعلقات: اسم فاعل، مفعول، تفضیل، مبالغہ فعل اور اسکی اقسام: ماضی، مضارع، امر، نہی حرف اور اسکی اقسام: حروف علت، حروف جارہ، مشبہ بالفعل
Memorization:	تیسویں پارے کی آخری بیس سورتیں (حفظ مع ترجمہ)

SECOND SEMESTER

COURSE CODE	COURSE TITLE	CREDIT HOURS
MDLT-5204	ANATOMY-II	4(3-1)
MDLT-5205	PHYSIOLOGY-II	3(2-1)
MDLT-5206	BIOCHEMISTRY-I	3(2-1)
URCG-5119	ENGLISH-II (EXPOSITORY WRITING)	3(3-0)
URCG-5105	ISLAMIC STUDIES ** (OR)	2(2-0)
	RELIGIOUS EDUCATION / ETHICS IN LIEU OF ISLAMIC STUDIES ONLY FOR NON-MUSLIM STUDENTS	
URCG-5125	CIVICS AND COMMUNITY ENGAGEMENT	2(2-0)
URCG-5127	SEERAT OF THE HOLY PROPHET	1(1-0)

MDLT-5204 ANATOMY- II CREDIT HOURS 4(3-1)

COURSE DESCRIPTION

The focus of this course is an in-depth study and analysis of the regional and systemic organization of the body. Emphasis is placed upon structure and function of human movement. A comprehensive study of human anatomy with emphasis on the nervous, musculoskeletal and circulatory systems is incorporated. Introduction to general anatomy lays the foundation of the course. Dissection and identification of structures in manikins/smart board systems supplemented with the study of charts, models, prosected materials and radiographs are utilized to identify anatomical landmarks and configurations of the lower limb, abdomen and pelvis. At the end of the course study, the student will be able to understand the basic knowledge of structure, histology and development of the Abdomen, Pelvis, Head, Neck and Brain Regions.

LEARNING OBJECTIVES

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

COURSE CONTENTS

ABDOMEN

ABDOMINAL WALL

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

PELVIS

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

- Brief description of perineum
- Nerves of perineum

EMBRYOLOGY

- Introduction to developing human
- Gametogenesis, Spermatogenesis, Oogenesis
- Fertilization and phases of fertilization
- Germ layers
- Development of limbs, Muscular system and Nervous system

THE HEAD AND NECK

THE NECK:

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

THE FACE:

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

THE SKULL:

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

NEURO ANATOMY

Central Nervous System:

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

SPINAL CORD

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

LOWER LIMB

OSTEOLOGY

- Brief over view of all bones of lower limb and pelvis along with their markings

MYOLOGY

- Muscles of gluteal region
- Muscles around hip joint

- Muscles of thigh
- Muscles of lower leg and foot

NEUROLOGY

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

ANGIOLOGY

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

ARTHROLOGY

- Pelvis
- Hip joint
- Knee joint
- Ankle joint
- Joints of the foot
- Surface Anatomy of lower limb
- Surface Marking of lower limb

LAB WORK

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

Note

The students are expected to make a practical note book. The book is a collection of evidence that learning has taken place. It is a reflective record of their achievements

RECOMMENDED BOOKS

1. *Gray's Anatomy by Prof. Susan Standing 41st Ed., Elsevier.*
2. *Clinical Anatomy for Medical Students by Richard S. Snell.*
3. *Clinically Oriented Anatomy by Keith Moore.*
4. *General Anatomy by Prof. Ghulam Ahmad, latest Ed.*
5. *Clinical Anatomy by R. J. Last, Latest Ed.*
6. *Cunningham's Manual of Practical Anatomy by G. J. Romanes, 15th Ed., Vol-I, II and III.*
7. *The Developing Human. Clinically Oriented Embryology by Keith L. Moore, 6th Ed.*
8. *Wheater's Functional Histology by Young and Heath, Latest Ed.*
9. *Medical Histology by Prof. Laiq Hussain.*
10. *Neuroanatomy by Richard S. Snell 7th edition.*
11. *Jancquera textbook of histology*
12. *Colourd atlas of histology by defiero*
13. *Langman`s embryology*
14. *Clinicaly oriented developmental anatomy by k.l.moore*

MDLT-5205 PHYSIOLOGY- II CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

The course is designed to study the function of the human body at the molecular, cellular, tissue and systems levels. These topics are addressed by a consideration of the cardiovascular, gastrointestinal, and endocrinological systems. The integrative nature of physiological responses in normal function and disease is stressed throughout the course. Emphasis in the course will be on normal structure and function of the human body and the approach will be to develop an understanding of the integrative nature of physiological systems to maintain the internal environment of the body within very narrow limits compatible with life.

LEARNING OBJECTIVES

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

COURSE CONTENTS

GASTROINTESTINAL TRACT

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

CARDIOVASCULAR SYSTEM

- Heart and circulation
- Function of cardiac muscle
- Cardiac pacemaker and cardiac muscle contraction
- Cardiac cycle
- ECG: recording and interpretation
- Common arrhythmias
- Types of blood vessels and their function
- Haemodynamics of blood flow (local control systemic circulation its regulation and control). Peripheral resistance its regulation and effect on circulation

- Arterial pulse
- Blood pressure and its regulation
- Cardiac output and its control
- Heart sounds and murmurs Importance in circulation and control of venous return.
- Coronary circulation
- Splanchnic, pulmonary and cerebral circulation
- Triple response and cutaneous circulation

NERVOUS SYSTEM

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

BODY FLUIDS AND KIDNEY

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

ENDOCRINOLOGY

- Classification of endocrine glands
- Mechanism of action
- Feedback and control of hormonal secretion
- Functions of the hypothalamus

- Hormones secreted by the anterior and posterior pituitary and their mechanism of action and function.
- Function of the thyroid gland
- Function of the parathyroid gland
- Calcium metabolism and its regulation
- Secretion and function of calcitonin
- Hormones secreted by the adrenal cortex and medulla, and their function and mechanism of action
- Endocrine functions of the pancreas and control of blood sugar
- The endocrine functions of the kidney and Physiology of growth.

REPRODUCTION

- Production and function of testosterone and Physiological changes during male puberty,
- Function of the female reproductive system,
- Production and function of oestrogen, and progesterone,
- Menstrual cycle,
- Physiological changes during female puberty and menopause.

LAB WORK/PRACTICAL:

- Clinical significance of cardiac cycle, correlation of ECG and heart sounds
- Examination of arterial pulses
- Arterial blood pressure
- Pregnancy test
- Jaundice and liver function tests
- Renal function tests
- Effects of exercise and posture on blood pressure

Note

The students are expected to make a sketch book. The sketch book is a collection of evidence that learning has taken place. It is a reflective record of achievements

RECOMMENDED BOOKS

1. *Textbook of Physiology by Guyton and Hall, 12th Ed.*
2. *Review of Medical Physiology by William F. Ganong, 23rd Ed.*
3. *Physiology by Berne and Levy, 6th Ed.*
4. *Human Physiology: The Basis of Medicine by Gillian Pocock, Christopher D.Richards 4th Ed.*
5. *Physiological Basis of Medical Practice by John B. West and Taylor, 12th Ed.*

MDLT-5206 BIOCHEMISTRY-I CREDIT HOURS: 3(2-1)

COURSE DESCRIPTION

This course provides the knowledge and skills in fundamental organic chemistry and introductory biochemistry that are essential for further studies. This course provides a basic understanding of life processes at the biochemical level. It provides an understanding of the normal biochemical processes in the human body in which the function of the various organs and tissues are integrated. It covers introduction and the chemistry of the biomolecules i.e. amino acids, proteins carbohydrates, fats, enzymes and nucleic acids. The nutritional biochemistry concludes the course

LEARNING OBJECTIVES

- Describe cell and body fluids in the context of chemistry and human biochemistry
- Discuss the properties, classification and functions of biomolecules with emphasis on amino acid, peptides, proteins, enzymes, carbohydrates, lipids and nucleic acid
- Explain importance of nutritional biochemistry with emphasis on minerals, trace elements, vitamins and balance diet

COURSE CONTENTS

CELL

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

BODY FLUIDS

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

BIOMOLECULES

AMINO ACIDS, PEPTIDES & PROTEINS

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

ENZYMES

- Introduction
- Classification & Properties of Enzymes
- Coenzymes

- Isozymes & Proenzymes
- Regulation & Inhibition of Enzyme activity & enzymes inhibitors
- Clinical Diagnostic Enzymology

CARBOHYDRATES

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

LIPIDS

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

NUCLEIC ACIDS

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

NUTRITIONAL BIOCHEMISTRY MINERALS & TRACE ELEMENTS

- Sources and RDA of Macro and Micro Minerals
- Biochemical Functions & Clinical Significance of Sodium, Potassium, Chloride, Calcium & Phosphorus
- Biochemical Functions & Clinical Significance of Iron, Cu, Zn, Mg, Mn, Se, I, F.

VITAMINS

- Sources, RDA and structural and functionals forms of each Vitamin.
- Biochemical Functions & Clinical Significance of Fat Soluble Vitamins
- Biochemical Functions & Clinical Significance of Water Soluble Vitamins.

NUTRITION

- Dietary Importance of Carbohydrates, Lipids & Proteins
- Balanced Diet.

PRACTICAL

1. Working SOPs for a Biochemistry Practical Laboratory. Introduction to Laboratory Equipments and Techniques. Preparation of solution (Normal, Molar Equivalent solution etc).
2. Molisch's Test & Iodine Test. Benedict's Test & Barfoed's Test. Selivanoff's Test & Phenylhydrazine Test. Sucrose Hydrolysis. Starch Hydrolysis.
3. Biuret Test, Heat Coagulation Test & Salt Saturation Test. Ninhydrin Test, Xanthoproteic Test &

Millon-Nasse's Test. Aldehyde Test, Sakaguchi's Test. Determination of Isoelectric pH of casein Protein.

4. Emulsification of natural fat & Solubility of soap, Test for Cholesterol, Iodine & Peroxide value calculation. Saponification value calculation
5. Sample Collection & Physical Evaluation of Urine. Analysis of Normal Urine. Analysis of Abnormal Urine

RECOMMENDED BOOKS

1. *Harper's Biochemistry by Robbert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, Latest Ed.*
2. *Lippincott's Illustrated Review of Biochemistry by Pamela C. Champe and Richard A. Harvey, Latest Ed.*
3. *Practical Clinical Biochemistry by Varley.*
4. *Textbook of Biochemistry by Devlin, 5th Ed.*
5. *Textbook of Medical Biochemistry Vol-I and II by M.A. Hashmi. Biochemistry by Stryer, Lubert, Latest Ed.*

URCG-5119 ENGLISH-II (EXPOSITORY WRITING) CREDIT HOURS 3(3-0)

COURSE DESCRIPTION:

This course prepares undergraduates to become successful writers and readers of English. The course helps students develop their fundamental language skills with a focus on writing so that they can gain the confidence to communicate in oral and written English outside the classroom. The course is divided into five units and takes a Project-based Learning approach. Unit themes target the development of 21st century skills and focus on self-reflection and active community engagement. The course completion will enable the students to develop communication skills as reflective and self-directed learners. They will be able to intellectually engage with different stages of writing process, and develop analytical and problem-solving skills to address various community-specific challenges.

Contents

1. Self-Reflection
    - Introduction to the basics of the writing process
    - Introduction to the steps of essay writing
    - Prewriting activities: Brainstorming, listing, clustering and freewriting
    - Practicing Outlining of the essay
2. Personalized Learning
    - Learning Process, Learning Styles, Goal Setting and Learning Plan
3. Oral Presentation
    - Structure and Significance, Content Selection and Slide Presentation, Peer Review
4. Critical Reading Skills
    - Introducing Authentic Reading (Dawn and non-specialist academic books/texts)
    - Reading Strategies and Practice: Skimming, scanning, SQW3R, Annotating, Detailed reading and note-taking, Standard Test Practice: TOEFL and IELTS, Model Review Reports and Annotated Bibliographies
5. Community Engagement
    - Student-led brainstorming on local versus global issues, Identifying research problems
    - Drafting research questions, Drafting interview/survey questions for community research (in English or L1)

- Engaging students in Critical reading, Presenting interview/ survey information, Field work
- Writing Community Engagement Project

6. Letter to the Editor
    - Types of letters, Format and purpose of letter to the editor, Steps in writing letter-to-editor

Recommended Texts

1. *Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). New York: Routledge.*
2. *Swales, J. M., & Feak, C. B. (2012). Academic writing for graduate students: Essential tasks and skills (3rd ed.). Ann Arbor: The University of Michigan Press.*

Suggested Readings

1. *Cresswell, G. (2004). Writing for academic success. London: SAGE.*
2. *Johnson-Sheehan, R. (2019). Writing today. Don Mills: Pearson.*
3. *Silvia, P. J. (2019). How to write a lot: A practical guide to productive academic writing. Washington: American Psychological Association.*

URCG-5105 Islamic Studies (Compulsory) 2(2-0)

Course Description

Islamic Studies engages in the study of Islam as a textual tradition inscribed in the fundamental sources ofIslam; Qur'an and Hadith, history and particular cultural contexts. The area seeks to provide an introductionto and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political)and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology). It offers opportunities to get fully introductory foundational bases of Islam in fields that include Qur'anic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qir'an and Sunnah..

Course Objectives

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

1. To make students understand the relevance and pragmatic significance of Islam in their lives.
2. To make learners comprehend the true spirit of Islam with reference to modern world.
3. To generate a sense of Islamic principles as a code of living that guarantee the effective solutions tothe current challenges of being.
4. To provide Basic information about Islamic Studies
5. To enhance understanding of the students regarding Islamic Civilization
6. To improve Students skill to perform prayers and other worships
7. To enhance the skill of the students for understanding of issues related to faith and religious life.

Course Outline

Introduction to Qur'anic Studies

1) Basic Concepts of Qur'an
2) History of Quran
3) Uloom-ul-Quran

مطالعہ قرآن (تعارف قرآن، منتخب آیات کا ترجمہ و تفسیر: سورۃ البقرہ آیات 1-5، 284-286؛ سورۃ الحجرات آیات 1-18؛ سورۃ الفرقان آیات 63-77؛ سورۃ المومنون آیات 1-11؛ سورۃ الاحزاب آیات 6، 21، 32-33، 40، 56-59؛ سورۃ الانعام آیات 151-153؛ سورۃ الصف آیات 1-14؛ الحشر آیات 18-20؛ آل عمران آیات 190-192؛ النحل آیات 12-14؛ لقمن آیت 20، حم السجدہ آیت 53)

Introduction to Sunnah

1) Introduction of Hadith
2) Legal Status of Hadith
3) History of the compilation of Hadith
4) Kinds of Hadith

حدیث کا تعارف، حدیث کی دینی حیثیت، حفاظت و تدوین حدیث، حدیث کی اقسام

متن حدیث: 1 درج ذیل موضوعات پر احادیث کا مطالعہ

1۔ اعمال کا اجر نیت پر منحصر ہے۔ 2۔ بہترین انسان قرآن کا طالب علم اور اس کا معلم ہے۔ 3۔ کتاب و سنت گمراہی سے بچنے کا ذریعہ ہیں 4۔ ارکان اسلام 5۔ اسلام، ایمان، احسان اور قیامت کی نشانیاں، 6۔ بچوں کی نماز کی تلقین 7۔ دین کا گہرا فہم اللہ کی خاص عنایت ہے 8۔ حصول علم، حلاوت قرآن اور عمل کی اہمیت و فضیلت، 9۔ روز محشر کا محاسبہ، 10۔ حقوق اللہ

کے ساتھ ساتھ حقوق العباد کا خیال رکھنا بھی لازم ہے 11۔ حسن خلق کی عظمت اور فحش و بد گوئی کی مذمت 12۔ دنیا و آخرت کی بھلائی کی ضامن چار چیزیں، 13۔ ہلاک کر دینے والی سات چیزیں، 14۔ بے عمل مبلغ کا عبرت ناک انجام 15۔ ہر شخص نگران ہے اور ہر شخص مسئول

1) Sirah of the Prohet
2) Importance of the Study of Sirah
3) Character building method of the Prophet

(سیرت النبی ﷺ(مطالعہ سیرت کی ضرورت و اہمیت، تعمیر، سیرت و شخصیت کا نبوی منہاج اور عملی نمونے، اقامت دین کا نبوی طریق کار، اقامت دین بعہد خلافت راشدہ، میثاق مدینہ، خطبہ حجۃ الوداع، اخلاقی تعلیمات، تشکیل اجتماعیت اور اسوہ حسنہ، قرآن مجید میں سیرت سرور عالم کا بیان، غزوات نبوی ﷺ کے مقاصد و حکمتیں)

Islamic Culture & Civilization
1) Basic Concepts of Islamic Culture & Civilization
2) Historical Development of Islamic Culture & Civilization
3) Characteristics of Islamic Culture & Civilization
4) Islamic Culture & Civilization and Contemporary Issues

4.اسلامی تہذیب و تمدن (اسلامی تہذیب کا مفہوم، اسلامی کے عوامل و عناصر، اسلامی تہذیب کی خصوصیات،، اسلامی تہذیب، علمی، معاشرتی اور سماجی اثرات، تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ، تہذیبی تصادم کے اثرات و نتائج، طبعی، حیاتیاتی اور معاشرتی علوم میں مسلمانوں کا کردار، نام ور مسلمان سائنسدان)

Pre-Requisite: Nil

Recommended Books

1) Hameed ullah Muhammad, —Emergence of Islam‖ , IRI, Islamabad
2) Hameed ullah Muhammad, —Muslim Conduct of State
3) Hameed ullah Muhammad, _Introduction to Islam
4) Ahmad Hasan, —Principles of Islamic Jurisprudence‖ Islamic Research, Institute, International Islamic University, Islamabad (1993)
5) Dr. Muhammad Zia-ul-Haq, —Introduction to Al Sharia Al Islamia‖ Allama Iqbal Open University, Islamabad (2001)
6) Dr. MuhammadShahbaz Manj, Teleeemat-e- Islam

URCG-5126 **Religious Education/Ethics** **2(2-0)**

Course Description

Ethics is the branch of philosophy that explores and examines concepts of right and wrong, moral principles, and ethical decision-making. This course will provide students with a comprehensive understanding of ethical theories, principles, and their applications in various contexts. Ethics plays a crucial role in our personal lives, professional endeavors, and interactions within society. It helps the students to navigate complex moral dilemmas, make informed choices, and develop a strong moral compass. By studying ethics, students will explore into the fundamental questions of human behavior, values, and the principles that guide our actions.

Course Objectives

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

1. Understand the definition and scope of ethics as a branch of philosophy.
2. Identify the key components of ethical inquiry and the relevance of ethics in personal and professional life.
3. Explore the intersection between ethics and religious beliefs, science & law and relevant ethical implications and responsibilities.
4. Apply ethical theories and principles to real-life scenarios, demonstrating the ability to evaluate moral dilemmas and make ethically informed decisions.
5. Trace the origins of morality in human instinct and evolutionary development.
6. Analyze different theories moral theories and their applications in daily life.
7. Enhance communication skills to articulate ethical viewpoints effectively, engaging in respectful and persuasive discussions.
8. Explore ethical considerations for professionals, students and teachers as well as entrepreneurs

Course Outline

1. Meaning and Scope of Ethics
2. Relation of Ethics with
   - 2.1 Religion
   - 2.2 Science
   - 2.3 Law
3. Historical Development of Morality
   - 3.1 Instinctive Moral Life
   - 3.2 Customary Morality
   - 3.3 Reflective Morality
4. Moral Theories
   - 4.1 Hedonism (Mill)
   - 4.2 Intuitionism (Butler)
   - 4.3 Kant's Moral Theory
5. Moral Ethics and Society
   - 5.1 Freedom and Responsibility
   - 5.2 Tolerance
   - 5.3 Justice
   - 5.4 Punishment (Theories of Punishment)
6. Moral Teachings of Major Religions
   - 6.1 Judaism
   - 6.2 Christianity
   - 6.3 Islam
7. Professional Ethics

7.1 Medical Ethics
7.2 Ethics of Students
7.3 Ethics of Teachers
7.4 Business Ethics

Recommended Texts:

1. Lille, W. (Latest edition). An Introduction to Ethics. London: Methuen & Co.
2. Titus, H. H. (Latest edition). Ethics for Today. New York: American Book.
3. Hill, T. (Latest edition). Ethics in Theory and Practice. N.Y.: Thomas Y. Crowel.
4. Ameer A., S. (Latest edition). The Ethics of Islam. Culcutta: Noor Library Publishers.
5. Donaldson, D. M. (Latest edition). Studies in Muslim Ethics. London.
6. Sayeed, S. M. A. (Tr.) Ta'aruf-e-Akhlaqiat. Karachi: BCC&T, University of Karachi.

URCG-5125 CIVICS AND COMMUNITY ENGAGEMENT Credit Hours 2(2-0)

COURSE DESCRIPTION:

The Civics and Community Engagement course is designed to provide students with an understanding of the importance of civic participation, culture and cultural diversity, basic foundations of citizenship, group identities and the role of individuals in creating positive change within their communities. The course aims at developing students' knowledge, skills and attitudes necessary for active and responsible citizenship.

Learning outcomes

After completing this course, students will be able to

- Understand the concepts of civic engagement, community development, and social responsibility.
- Understand rights and responsibilities of citizenship
- Understand cultural diversity in local and global context
- Analyze the significance of civic participation in promoting social justice, equity, and democracy.
- Examine the historical and contemporary examples of successful civic and community engagement initiatives.
- Identify and assess community needs, assets, and challenges to develop effective strategies for community improvement.
- Explore the ethical implications and dilemmas associated with civic and community engagement.
- Develop practical skills for effective community organizing, advocacy, and leadership.
- Foster intercultural competence and respect for diversity in community engagement efforts.
- Collaborate with community organizations, stakeholders, and fellow students to design and implement community-based projects.
- Reflect on personal growth and learning through self-assessment and critical analysis of community engagement experiences.

Course Content:

Introduction to Civics & Community Engagement

- Overview of the course: Civics & Community Engagement
- Definition and importance of civics
- Key concepts in civics: citizenship, democracy, governance, and the rule of law
- Rights and responsibilities of citizens

Citizenship and Community Engagement

- Introduction to Active Citizenship: Overview of the Ideas, Concepts, Philosophy and Skills
- Approaches and Methodology for Active Citizenship

Identity, Culture, and Social Harmony

- Concept and Development of Identity, Group identities
- Components of Culture, Cultural pluralism, Multiculturalism, Cultural Ethnocentrism, Cultural relativism, Understanding cultural diversity, Globalization and Culture, Social Harmony,
- Religious Diversity (Understanding and affirmation of similarities & differences)
- Understanding Socio-Political Polarization
- Minorities, Social Inclusion, Affirmative actions

Multi-cultural society and inter-cultural dialogue

- Inter-cultural dialogue (bridging the differences, promoting harmony)
- Promoting intergroup contact/ Dialogue
- Significance of diversity and its impact
- Importance and domains of Inter-cultural dialogue

Active Citizen: Locally Active, Globally Connected

- Importance of active citizenship at national and global level
- Understanding community
- Identification of resources (human, natural and others)
- Utilization of resources for development (community participation)
- Strategic planning, for development (community linkages and mobilization)

Human rights, constitutionalism and citizens' responsibilities

- Introduction to Human Rights
- Human rights in constitution of Pakistan
- Public duties and responsibilities
- Constitutionalism and democratic process

Social Institutions, Social Groups, Formal Organizations and Bureaucracy

- Types of Groups, Group identities, Organizations
- Bureaucracy, Weber's model of Bureaucracy
- Role of political parties, interest groups, and non-governmental organizations

Civic Engagement Strategies

- Grassroots organizing and community mobilization
- Advocacy and lobbying for policy change
- Volunteerism and service-learning opportunities

Social issues/Problems of Pakistan

- Overview of major social issues of Pakistani society

Social Action Project

Recommended Texts

1. *Kennedy. J. K., & Brunold, A. (2016). Regional context and Citizenship education in Asia and Europe. New Yourk: Routledge, Falmer.*
2. *Henslin, James M. (2018). Essentials of Sociology: A Down to Earth Approach (13th ed.). New York: Pearson Education*
3. *Macionis, J. J., & Gerber, M.L. (2020). Sociology. New York: Pearson Education*

Suggested Readings

1. *Glencoe McGraw-Hill. (n.d.). Civics Today: Citizenship, Economics, and Youth.*
2. *Magleby, D. B., Light, P. C., & Nemacheck, C. L. (2020). Government by the People (16th ed.). Pearson.*
3. *Sirianni, C., & Friedland, L. (2005). The Civic Renewal Movement: Community-Building and Democracy in the United States. Kettering Foundation Press.*
4. *Bloemraad, I. (2006). Becoming a Citizen: Incorporating Immigrants and Refugees in the UnitedStates and Canada. University of California Press.*
5. *Kuyek, J. (2007). Community Organizing: Theory and Practice. Fernwood Publishing.*
6. *DeKieffer, D. E. (2010). The Citizen's Guide to Lobbying Congress. TheCapitol.Net.*
7. *Rybacki, K. C., & Rybacki, D. J. (2021). Advocacy and Opposition: An Introduction to Argumentation (8th ed.). Routledge.*
8. *Kretzmann, J. P., & McKnight, J. L. (1993). Building Communities from the Inside Out: A Path Towards Finding and Mobilizing a Community's Assets. ACTA Publications.*
9. *Patterson, T. E. (2005). Engaging the Public: How Government and the Media Can ReinvigorateAmerican Democracy. Oxford University Press.*
10. *Love, N. S., & Mattern, M. (2005). Doing Democracy: Activist Art & Cultural Politics. SUNY Press.*

Seerat of the Holy Prophet مطالعہ سیرت النبی صلی اللہ علیہ وسلم

Course Code URCG-5127

Title	Description
Semester	
Nature of Course	
No. of C.Hrs.	1(1-0)
Total Teaching weeks	18
Objectives of the Course	۱۔ طلباء کو مطالعہ سیرۃ طیبہ کی ضرورت واہمیت سے آگاہ کرنا ۲۔ تعمیر شخصیت میں مطالعہ سیرۃ طیبہ کے کردار کو واضح کرنا ۳۔ بعثت نبوی کے موقع پر اقوام عالم کی عمومی صورت حال سے آگاہ کرنا ۴۔ رسول اکرم صلی اللہ علیہ وسلم کی مکی اور مدنی زندگی کا اس طرح مطالعہ کروانا کہ طلباء ان واقعات سے نتائج کا استنباط کر سکیں ۵۔ طلباء کو عہد نبوی کی معاشرت، سیاست، معیشت سے آگاہ کرنا

Course Description

S.No.	Title	Description
1	حضور صلی اللہ علیہ وسلم کے ابتدائی حالاتِ زندگی	۱۔ حضور صلی اللہ علیہ وسلم کا خاندانی حسب ونسب ۲۔ پیدائش اور ابتدائی تربیت ۳۔ لڑکپن اور جوانی کے حالات زندگی
2	بعثت نبوی کے وقت دنیا کے حالات (۱)	۱۔ بعثت نبوی کے وقت اہم تہذیبیں ۲۔ عرب، مصر، حبشہ، بازنطینی، ساسانی
3	بعثت نبوی	۱۔ مکی عہد میں دعوت اسلام
4	بعثت نبوی	۱۔ مدنی عہد میں دعوت اسلام
5	خصائص النبیؐ	آپؐ بطور پیغامبر امن
6	خصائص النبیؐ	بحیثیت استاد و معلم
7	خصائص النبیؐ	بحیثیت تاجر
8	خصائص النبیؐ	بحیثیت سربراہ ریاست
9	خصائص النبیؐ	ذاتی محاسن اور عالمگیر اثرات

ناموس رسالت	خصائص النبیؐ	10
غیر مسلموں سے تعلقات	اسوہ حسنہ اور عصر حاضر	11
اسوہ حسنہ کی روشنی میں گھریلو زندگی	اسوہ حسنہ اور عصر حاضر	12
مستشرقین اور مطالعہ سیرت	اسوہ حسنہ اور عصر حاضر	13
وطن سے محبت اور سیرت	اسوہ حسنہ اور عصر حاضر	15
مستشرقین کے اعتراضات اور ان کے جوابات	اسوہ حسنہ اور عصر حاضر	16

نصابی کتب

نمبر شمار	نام مؤلف	نام کتاب
1	ابن ہشام	السیرۃ النبویۃ
2	مولانا شبلی نعمانی، سید سلمان ندوی	سیرۃ النبی صلی اللہ علیہ وسلم
3	قاضی محمد سلیمان سلمان منصور پوری	رحمۃ للعالمین
4	مولانا سید ابوالحسن علی ندوی	نبی رحمت صلی اللہ علیہ وسلم
5	ڈاکٹر یسین مظہر صدیقی	عہد نبوی کا نظام حکومت
6	ڈاکٹر خالد علوی	انسان کامل ؐ

حوالہ جاتی کتب

نمبر شمار	نام مؤلف	نام کتاب
1	سید ابوالاعلیٰ مودودی	سیرت سرور عالم صلی اللہ علیہ وسلم
2	مولانا صفی الرحمن مبارکپوری	الرحیق المختوم
3	پیر محمد کرم شاہ الازہری	ضیاء النبی صلی اللہ علیہ وسلم
4	ڈاکٹر اکرم الضیاء العمری	السیرۃ النبویۃ الصحیحۃ
5	مولانا عبدالرؤف دانا پوری	اصح السیر

THIRD SEMESTER

COURSE CODE	COURSE TITLE	CREDIT HOURS
MDLT-5207	BIOCHEMISTRY II	3(2-1)
MDLT-5208	GENERAL PATHOLOGY	3(2-1)
MDLT-5209	GENERAL MICROBIOLOGY AND STERILIZATION	3(2-1)
MDLT-5210	MOLECULAR BIOLOGY	3(2-1)
MDLT-5211	HEALTH AND WELLNESS	2(2-0)
URCG-5120	QUANTITATIVE REASONING	3(3-0)
URCG-5111	TRANSLATION OF THE HOLY QURAN–II	1(0-1) (Non-Credit)

MDLT-5207 BIOCHEMISTRY-II CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

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

LEARNING OBJECTIVES

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

- To learn basic understanding with the homeostatic mechanisms through the concepts of inter-regulation of carbohydrates, lipids and protein metabolism and its relation to hormone actions in the human body.
- To learn and understand the basic biochemical processes taking place in the body, and understanding their relation with normal and abnormal human metabolism.
- To learn how large molecules are synthesized and used, and how energy is generated, stored, and retrieved (metabolism). And to have understanding and knowledge about how diseases are related to biochemical defects.
- To learn and describe respiration at cellular and molecular level and to explain the various biochemical pathways related to metabolism of carbohydrates, protein, lipids and nucleic acid.
- Applying basic knowledge of protein synthesis, post translational modification and targeting to its cellular destination.
- To have the basic principles and to make use of techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis.

COURSE CONTENTS:

BIOENERGETICS

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

METABOLISM OF CARBOHYDRATES

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

METABOLISM OF LIPIDS

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

METABOLISM OF PROTEINS & AMINO ACIDS

- Digestion of Proteins & Absorption of Amino Acids
- Transamination & Deamination of Amino Acids
- Urea cycle and Specialized products formed from Amino Acids

Metabolism of Nucleic Acids

- Metabolism of purines and pyrimidines.
- Structure and properties of nucleotides and nucleic acids.
- Hydrolysis of nucleic acids.
- Abnormalities in nucleic acid metabolism

Brief overview of Hormones

Classification & Mechanism of Action of Hormones, Signal Transduction, Second Messengers and Receptors, Hypothalamic & Pituitary Hormones, Steroid Hormones: Glucocorticoids and Mineralocorticoids, Insulin & Glucagon.

Practical

1. Techniques of Instruments in Biochemistry with examples.
   Visible Spectrophotometry. Flame photometry. UV & IR spectrophotometry. Atomic Absorption spectrophotometry. pH Metry. Chromatography and determination of Amino Acids in Urine by paper chromatography
2. Clinical quantitative analysis in Biochemistry
   - Serum Glucose Estimation. Glucose tolerance Test (GTT).
   - Serum lipids Estimation/Lipid profile (Serum Total Cholesterol, Triglyceride, HDL and LDL cholesterol).
   - Serum Bilirubin Estimation (Total, Direct and Indirect bilirubins).
   - Serum Proteins Estimation (Total, Albumin & Globulin).
   - Serum calcium Estimation (total, ionized & unionized).
   - Serum Uric acid Estimation.
   - Serum Urea Estimation. Serum Creatinine Estimation.
   - Enzymes Estimation in Serum: AST, ALT, ALP, Creatine Kinase (CK) and LDH.

Recommended Books

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

MDLT-5208 GENERAL PATHOLOGY Credit Hours 3(2-1)

COURSE DESCRIPTION

General pathology course is offered as vital subject matter at undergraduate level programs to students who are engaged in medical studies. This subject deals with the diagnosis of diseases which is ultimately back bone of healthcare system. A good diagnosis leads to excellent treatment and prognosis. In general pathology, students learn about the abnormal functions of the body and with the investigation of those pathological mechanisms which are common to all tissue and cell pathology. Students will be able to describe and demonstrate the processes of cellular adaptation, inflammation, repair, immunology, cellular accumulation, and neoplasia. In this course, students will gain knowledge about the interaction of human body with these organisms and how these organisms cause diseases in humans.

LEARNING OBJECTIVES

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

- Define hyperplasia, hypertrophy, atrophy, and metaplasia and their causes
- Describe mechanism of necrosis and gangrene
- Describe the causes, process and types of inflammation
- Understand and explain the cause and pathogenesis of myocardial infarction, deep venous thrombosis, pulmonary thromboembolism
- Explain various types of shock, their pathogenesis, manifestations, and complications
- Contrast benign from malignant tumors
- Describe etiologic factors in carcinogenesis and clinical effects of neoplasm

COURSE CONTENTS

- **Cell Injury and Death:** Causes of cell injury, Reversible and Irreversible Injury, Fatty change, Pigmentation, calcification (Metastatic / Dsytrophic), Necrosis and gangrene, Apoptosis and Sub cellular responses.
- **Cellular Adaptations:** Hyperplasia, Hypertrophy, Atrophy, Aplasia, Metaplasia and Intracellular accumulation.
- **Inflammation:**
  Acute inflammation. Vascular events/changes, Chemotaxis, Opsonization and Phagocytosis, Cellular events and Chemical mediators in inflammation. Differentiate between exudates and transudate.
  Chronic Inflammation. General, Granulomatous and Morphologic patterns of acute and chronic inflammation. Etiological factors, Granuloma.

- **Healing and Repair/ Cell repair and wound healing:** Normal controls, Repair by connective tissue and Wound healing. Regeneration and Repair, Healing--- steps of wound healing by first and second intention, Factors affecting healing, Enlist the complications of wound healing.

- **Haemodynamic Disorders**:
  Define and classify the terms Edema, Haemorrhage, Thrombosis, Embolism, Infarction & Hyperaemia/ congestion with examples of each. Define and classify Shock with causes of each. Describe the compensatory mechanisms involved in shock. Describe the possible consequences of thrombosis. Describe the difference between arterial and venous emboli
- **Diseases of Immunity:** General features, Hypersensitivity reactions, Immune deficiencies, Autoimmunity and Amyloidosis.
- **Neoplasia:** Nomenclature, Molecular basis, Carcinogenic agents and Clinical aspects.
  Define the terms Dysplasia, Metaplasia 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

Practical

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

RECOMMENDED BOOKS

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

MDLT-5209 GENERAL MICROBIOLOGY AND STERILIZATION 3(2-1)

Course description

This course is designed to provide the students with the basic knowledge about microbiology, microorganisms and their respective places in the living world. General overview of the morphology, arrangement, anatomy and classification of the microorganisms like bacteria, viruses, fugus and parasites. In this course, students will gain knowledge about the interaction of human body with these organisms and how these organisms cause diseases in humans. Students will get familiar with different techniques of microbiology which includes the identification and quantification of microorganisms that cause human disease (qualitative and quantitative analysis) which will provide diagnostic information for therapeutic support in the clinical management of patients.

Course objectives

- After completing this course, a student will be able to:
- Recognize the structural and functional causes of human disease.
- Know about the Microbiology, Microorganisms and their respective place in the living world.
- Identify the bacterial taxonomy and nomenclature, and the basis of classification of bacteria.

- Know the general methods of studying microorganisms: cultivation, isolation, purification and characterization.
- Control of microorganisms by physical and chemical methods.

Contents:

- Fundamentals of microbiology.
- Microorganisms and their respective place in the living world.
- Differentiation between eukaryotic and prokaryotic cells,
- Historical development of Microbiology and its scope.
- Microscopy: An outline of the principles and applications of light and electron microscope.
- Morphology, arrangement and detailed anatomy of bacterial cell.
- Bacterial taxonomy and nomenclature, basis of classification of bacteria.
- Growth, nutrition (physical and nutritional requirement and nutritional types; sources of energy, C, N, H, O, S, P, trace elements, growth factors) and reproduction.
- General methods of studying microorganisms: cultivation, isolation, purification and characterization.
- Control of microorganisms by physical and chemical methods.
- Chemotherapeutic agents and antibiotics. Modes of action of antibiotics on microorganisms.
- Basic properties of viruses and fungi.

Sterilization and disinfection – classification and methods of sterilization

- Definition of sterilization, Basic principle, Methods of sterilization
- Physical methods–Sterilization by heat.
- By Dry Heat - Flaming, Red Heat, Hot air oven, incineration.
- By Moist heat-Pasteurization, Inspissation, Tyndallisation & autoclave.
- Filtration Methods – in brief.
- Ionizing Radiations

Disinfection

- Mode of action and uses of important chemical disinfectants – phenol and phenolic compounds, alcohols, aldehydes halogens, dyes, acids and alkalies.
- Antiseptics and disinfectants, Definition and examples.
- Gaseous methods of sterilization

Practical:

- Laboratory safety: Containment and decontamination.
- Equipment / Materials / Glassware etc. used in microbiology
- Inoculation techniques. Pour plate, spread plate & streak plate methods
- An introduction to microscopy: Gram stain technique, Acid fast staining
- Study of motility of bacteria, Hanging drop preparation.
- Preparation and use of different culture media; Blood Agar, Chocolate Agar, MacConkey Agar, Mannitol Salt Agar, TCBS Agar, SDA Agar.
- Antibiotic Susceptibility testing by disc diffusion method.
- Estimation of minimum inhibitor concentration (MIC) by broth and agar dilution methods.
- Anaerobic culture methods.

Recommended Books:

1. *Kathleen P. T., and Arthur, T. 2001. Foundations in Microbiology: Basic Principles McGrawHill Companies*

2. Tortora, G. J., Christine, L. Case, C. L., Funke, B. R., Funke, B., Case, C., 2006. Microbiology: An Introduction, Publisher: Pearson Education.
3. Alcamo, I. E., 2001. Fundamentals of Microbiology published by Jones and Bartlett Publishers, USA.
4. Black, J. G., 2005. Microbiology: principles and explorations, by 6th Edition, J. Wiley & Sons, USA.

MDLT-5210 MOLECULAR BIOLOGY Credit Hours 3(2-1)

COURSE DISCRIPTION

This course covers the brief overview of the cellular & molecular biology, membrane physiology, introduction to molecular medicine. Th students will learn about the basic knowledge of nitrogenous basis, nucleosides, nucleotides, structure of nucleic acids (DNA & RNA), replication, transcription, translation, post-transcriptional modifications and post-translational modifications and gene Expression

Objective:

- Gain basic knowledge at a molecular level about the structure and metabolism of nucleic acids as well as about the regulation of transfer of genetic information from genes to proteins.
- The principles about DNA replication, mutation, repair as well as RNA transcription, posttranscriptional modifications and protein synthesis.
- To understand the potentials of microorganisms and utilizations of beneficial microorganisms

CONTENTS:

Chemistry of Nucleic Acids:

Nitrogenous bases, Nucleosides, Nucleotides, transformation and semiconservative model of DNA. DNA as genetic Material, Double Helical Structure of DNA

Discovery of DNA as a genetic material.

Central dogma of Molecular Biology:

DNA replication;

Origin of replication, replication Mechanism, enzymes involved in replication, differences in replication of Prokaryotic and Eukaryotic genomes, mutation, recombination and repair. DNA damage (Mutations) and DNA repair mechanisms (Nucleotide and base excision repair, mismatch repair, double strand break repair). Concept of Gene; Genes, Allels, One gene one Enzyme theory,

Introduction to RNA;

mRNA, rRNA, tRNA, siRNA,

Transcription;

Structure of gene and transcript in prokaryotes and eukaryotes, promoters, bacterial and eukaryotic RNA polymerase. Transcription in Prokaryotes, Transcription in Eukaryotes, Post-transcriptional modifications

Translation;

Protein synthesis, composition of prokaryotic and eukaryotic ribosomes, general mechanism of translation. Translation in Prokaryotes, Translation in Eukaryotes, Post-Translational modifications

Gene regulation:

Gene regulation in prokaryotes, Gene regulation in eukaryotes. Phages. Transposable elements and its mechanism.

PRACTICALS:

1. DNA extraction protocol
2. RNA extraction protocol

3. DNA/RNA purification
4. Instrumentation of PCR
5. Instrumentation of Gel Electrophoresis
6. Instrumentation of blotting techniques
7. Quantification of DNA by spectrophotometer
8. Troubleshooting and Optimization of PCR reaction
9. Miniprep for plasmid isolation
10. Restriction Enzyme Digestion.
11. Ligation.
12. Transformation of Host.
13. Growth of Transformant.
14. Selection for recombinant.
15. Use of restriction enzymes to construct vector

RECOMMENDED BOOKS:

1. Molecular Biology of the Cell by Alberts, 2002. Garland Science, New York.
2. Molecular Biology by David Clark, 2005. ELSEVIER Academic Press.
3. Lehninger Principles of Biochemistry by Nelson and Cox, Freeman Publishers. Latest edition.
4. Molecular Biology of Gene by Watson, Cold Spring Harbor Lab Press.
5. Gene Cloning and DNA Analysis: An Introduction by T.A. Brown, Blackwell Science Publishers.
6. Molecular Cloning: A laboratory manual, Cold Spring Harbor Lab Press.
7. Current Protocols in Molecular Biology, Wiley Publishers.
8. Cell and Molecular Biology: Concepts and Experiments by Gerald Karp, 2010. 6th Edition, John Wiley and Sons.
9. Lodish H, Berk A, Zipursky SL. Molecular cell biology. 5th edition. WH Freeman and company, New York.

MDLT-5211 HEALTH AND WELLNESS Credit Hours 2(2-0)

COURSE DESCRIPTION

This course will facilitate discussion on cultural or historical significance of health practices, the role of art therapy in wellness, the theories of health and wellness, including motivational theory, locus of control, public health initiative, psycho-social, spiritual, and cultural. The course will cover health history, risks, screening, and assessment considering epidemiological principles. This will also cover risk reduction strategies for primary and secondary prevention, including programs for special populations

LEARNING OBJECTIVES

- Define Health, wellness, and fitness.
- Cultural or historical significance of health practices
- The role of art therapy in wellness
- Philosophical and ethical dimensions of health care
- Describe healthy people and role of Allied Health professionals in Health and wellness.
- Explain the key concepts of physical and mental fitness
- Explain health and wellness issues in child, adolescence and old age
- Discuss Women health issues

COURSE CONTENTS

PREVENTION PRACTICE

A HOLISTIC PERSPECTIVE FOR HEALTH

- Defining Health
- Predictions of Health Care
- Comparing Holistic Medicine and Conventional Medicine
- Distinguishing Three Types of Prevention Practice.

Cultural or historical significance of health practices

- Traditional Medicine Systems
- Medical Beliefs and Rituals
- Folk Medicine and Remedies
- Influence of Religion and Spirituality
- Medical Traditions in Different Cultures

The role of art therapy in wellness

- History of Art Therapy
- Benefits of Art Therapy
- Applications of Art Therapy
- Cultural Considerations in Art Therapy

Philosophical and ethical dimensions of health care

- Ethical Theories in Healthcare
- Patient Autonomy and Informed Consent
- Healthcare Professional-Patient Relationships
- Ethical Issues in Research and Clinical Trials
- Technological Advances in Healthcare

HEALTHY PEOPLE

- Definition of healthy people
- Health education Resources
- Allied Health professional role for a healthy community.

SCREENING FOR HEALTH, FITNESS, AND WELLNESS

- Distinguishing Screening, Evaluation &Examination
- Interviewing for Health, Fitness and Wellness
- Vital Signs, 3-minute Step Test, and Borg perceived Scale of Exertion

HEALTH, FITNESS, AND WELLNESS ISSUES DURING CHILDHOOD AND ADOLESCENCE

- Structure and Function
- Recognizing and Reporting Child abuse
- Special Concerns in Pediatrics

HEALTH, FITNESS, AND WELLNESS DURING ADULTHOOD

- Tasks of Adulthood
- Adult Health and Wellness Risks
- Screening Tools for Adulthood
- Adult Educational Materials

WOMEN'S HEALTH ISSUES: FOCUS ON PREGNANCY

- Screening for Women‘s Health
- Women‘s Heart Disease
- Female Athlete Triad
- Pre-partum and Postpartum Exercises

PREVENTION PRACTICE FOR OLDER ADULTS

- Ageism
- Anatomical and Physiological Changes with Aging
- Common Health Problems of Older Adults
- Screening Older Adult for Health Fitness and Wellness

RESOURCES TO OPTIMIZE HEALTH AND WELLNESS

- Chronic Illness
- Nutrition
- Progressive Relaxation
- Time management

HEALTH PROTECTION

- Infection Control
- Injury Prevention during Childhood
- Injury prevention during Adolescence
- Injury Prevention during Adulthood
- Injury Prevention during Older Adulthood

MARKETING HEALTH AND WELLNESS

- Definition of Marketing
- Marketing Strategies for health and wellness Centers

RECOMMENDED BOOKS

- *Principles of Biomedical Ethics" by Tom L. Beauchamp and James F. Childress*
- *Art as Therapy" by Alain de Botton and John Armstrong*
- *Doing Right: A Practical Guide to Ethics for Medical Trainees and Physicians" by Philip C. Hebert*
- *A Physical Therapist's Guide to Health, Fitness, and Wellness, By Catherine R Thompson, PhD,*

URCG-5120 QUANTITATIVE REASONING Credit Hours 3(3-0)

Since ancient times, numbers, quantification, statistics and mathematics has played a central role in scientific and technological development. In the 21st century, Quantitative Reasoning (QR) skills are essential for life as they help to better understand socio-economic, political, health, education, and many other issues, an individual now faces in daily life. The skills acquired by taking this course will help the students to apply QR methods in their daily life and professional activities. This course will also change student's attitude about statistics and mathematics. It will not only polish their QR skills, but also enhance their abilities to apply these skills.

Contents

1. Introduction to quantitative reasoning
2. Overview of contributions of Mathematicians and Statisticians especially Muslim scholars.
3. Types of standard numbers
4. Proportions, rates, ratio and percentages
5. Odds and odds ratio
6. Scale of measurements
7. Number sequence and series
8. Unit analysis as a problem-solving tool
9. Data handling (small and large)
10. Data errors, absolute and relative and their applications

11. Descriptive statistics
12. Rules of counting: multiplication rule, factorial, permutation and combination
13. Probability and its application in real life
14. A graphical perspective through Venn Diagram
15. Financial indicator analysis, and money management (profit, loss, simple and compound interest)
16. Practical scenarios involving algebraic expressions: linear and quadratic

Recommended Texts

1. Akar, G. K., Zembat, İ. Ö., Arslan, S., & Thompson, P. W. (2023). Quantitative Reasoning in Mathematics and Science Education. 1st Ed., Springer, USA.
2. Peck, R., Olsen, C., & Devore, J. L. (2015). Introduction to statistics and data analysis. 5th Ed., Brooks Cole, USA.
3. Devlin, K. J. (2012). Introduction to mathematical thinking. Palo Alto, CA: Keith Devlin.

Suggested Readings

1. Triola, M. F., Goodman, W. M., Law, R., & Labute, G. (2006). Elementary statistics. Reading, MA: Pearson/Addison-Wesley.
2. Blitzer, R., & White, J. (2005). Thinking mathematically. Pearson Prentice Hall.

URCG-5111 TRANSLATION OF THE HOLY QURAN – II CREDIT HOURS 1 (0-1) (Non-Credit)

Translation of the Holy Quran- II

Topic	Details
Semester/Level	In some discipline 3rd semester and in some discipline 4th Semester/ ADP Program 2nd Year
Course Code	URCG-5111
Course Title	Translation of the Holy Quran – II
Credit Hours	1(0-1)
Objectives	▪ Students will come to know about the real nature, significance and relevance of the Islamic beliefs in light of the text of the Holy Quran. ▪ Students will seek knowledge of translation and transliteration of the Holy Book Quran. ▪ To familiarize the students with the concept of Ibādah (Its significance, scope and relevance) and its types in Islam. ▪ Students will learn literal and idiomatic way of translation of the Holy Book. ▪ Students will learn about the polytheism and its incompatibility in Islam highlighted by the Holy Quran. ▪ To highlight the significance of learning through using all human faculties provided by the almighty Allah and familiarize the students about condemnation of ignorance mentioned in the Quranic text. ▪ To develop Awareness among the students about rights and duties of different circles of society in the light of Holy Quran. ▪ To introduce the students to Quranic Arabic grammar in practical manner.
Course Contents:	○ ایمانیات اور عبادات اللہ پر ایمان، فرشتوں پر ایمان، رسولوں پر ایمان، آسمانی کتابوں پر ایمان یوم آخرت پر ایمان، تقدیر پر ایمان نماز، روزہ، زکوۃ، حج، جہاد ○ معاشرے کے حقوق • خاندان کی تکوین • حق مہر • رضاعت و حمل • اولاد کو قتل کرنے کی ممانعت • شوہر کی نافرمانی • طلاق • بیوہ کی عدت کے احکام • نکاح کا پیغام بھیجنا • عورت کی وراثت (اس کے شوہر کی طرف سے) • والدین کے حقوق • بیویوں اور اولاد کے مابین عدالت ○ خاندان کے حقوق • مہمان کی عزت

	• اجازت طلب کرنے کے اصول • مجلس کے آداب • تعاون اور بھائی چارہ • گروہ بندی • محبت • لوگوں کے درمیان صلح • عفو ودرگزر، غصہ پر قابو اور معاف کرنا • شعوب وقبائل • لوگوں کے مابین اختلافات • حمایت وطرفداری
Grammar:	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)
Details of Chapters and verse Numbers:	• منتخب آیات مع ترجمہ وتجوید • البقرہ((۱۷۷،۲۳۸،۲۴۵،۲۷۷،۲۱۹،۱۱۰،۴۵،۱۵۳،۲۴۷،۲۰۱،۲۸۵،۳۴،۲۸۵،۱۲۹،۲۵۳،۹۸،۲۶۲،۱۲۶،۲۸۵،۲۵۶،۷۷،۱۷۷،۱۳۶، ۱۸۹،۲۰۰،۱۸۳،۱۸۳،۲۱۸،۱۵۸،۲۴۱،۱۹۹،۲۲۷،۲۲۶،۲۲۸،۲۳۷،۲۳۱،۲۲۹،۲۳۵،۲۳۰،۸۲،۱۸۳،۲۳۳،۱۸۲،۱۶۰،۸۳) • النساء،(۹۵،۹۲،۵۹،۱۳۶،۲۹،۸۰،۸۶،۶۹،۱۳،۸۰،۳۶،۷۶،۱۲،۳۵،۱۲۸،۳۴،۱۱،۷۶،۴،۲۴،۲۵،۱۱،۱۱،۱۲۸،۱۹۱،۳۵،۲۰،۳۵،۲۴۰،۱۹۱، ۱،۲۰،۱۶،۱۴۶،۵۴،۱۲۸،۸۱) • الأنعام(۴۲،۱۳۷،۱۴،۹۲،۱۵۱،۴۸،۵۴) • آل عمران(۹۷،۳۹،۸۵،۱۲۵،۸۴،۱۴۴،۱۹،۱) • المائدہ(۵۴،۲،۹۲،۳۹،۱۹،۸۲،۲،۵) • الأعراف(۳۵،۱۸۹،۱۸۹) • التوبہ(۲۰،۷۱،۱۹) • ہود(۱۲) • الزمر(۶) • النور(۵۴،۲۸،۵۲،۲۷،۶۰،۲۹) • محمد(۳۳) • انفال(۸۲،۲۰) • الرعد(۳) • الطلاق(۴) • الحج(۵) • ابراہیم((۲۳،۴۴) • الاسراء(۴۳،۴۴) • الاحقاف(۱۵) • المومنون(۲۷) • العنکبوت(۲۵،۴۸،۸) • النحل (۲۲) • لقمان(۱۵،۴،۱۴) • الاحزاب((۳۵،۵۰،۳۸،۳۹) • الشعراء(۷) • الروم(۲۱) • مریم(۱۴،۲۶) • المجادلہ (۱۲،۱۱)

FOURTH SEMESTER

COURSE CODE	COURSE	CREDIT HOURS
MDLT-5212	HAEMATOLOGY-I	3(2-1)
MDLT-5213	CLINICAL BACTERIOLOGY	3(2-1)
MDLT-5214	IMMUNOLOGY AND SEROLOGY	3(2-1)
URCG-5116	SCIENCE OF SOCIETY-I	2(2-0)
URCG-5124	ENTREPRENEURSHIP	2(2-0)
URCG-5121	TOOLS FOR QUANTITATIVE REASONING	3(3-0)
MDLT-5216	PROFESSIONAL PRACTICE (LAWS, ETHICS AND ADMINISTRATION)	2(2-0)

MDLT-5212 HAEMATOLOGY-I CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

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

LEARNING OBJECTIVES

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

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

COURSE CONTENTS

Orientation and introduction to study of Haematology. Review of vascular system and Blood Constituents. Methods for Securing Blood. Method for securing Bone Marrow. Origin and Development of Blood cells, Blood formation; Intrauterine & Extrauterine. Factors which govern Haematopoiesis. Principles of Normal

cell Maturation. Erythrocytes; Definition, Maturation and Erythropoesis. Enumeration of Erythrocytes. Haemoglobin; Definitions of terms. Chemistry of Haemoglobin. Metabolism. Compounds of Haemoglobin. Haemoglobinometery. Correlation of Haemoglobin, Haematocrit, and Erythrocyte Count. Erythrocyte Sedimentation Rate. Maturation of Leukocytes, Leukocyte Count. Introduction: Definition, Origion & Functions and biological Properties. Maturation of Granulocytic Series. Maturation of Lymphocytic Series. Maturation of Monocytic Series. Enumeration of Leukocytes:- Maturation of Thrombocytes. Haemostasis and Blood Coagulation. Pathology of Erythrocytic series, Including abnormal Haemoglobin syndromes and Indices. The Indices & Abnormal Forms: Reticulocyte Count, Fragility of Erythrocytes, Sickle cell studies: Principle of tests for sickle cell studies, Laboratory Diagnosis. Preparation of Blood Smears and Differential Blood Count. Total Eosinophil Count. Pathology of Erythrocytic series, Including abnormal Haemoglobin syndromes and Indices.

LAB WORK

- Hemoglobin estimation
- RBCs count
- PCV/HCT
- Red cell indices: MCV, MCH, MCHC
- TLC, DLC
- ESR
- Reticulocyte Counts
- Platelets count
- Fragility of Erythrocytes
- Peripheral blood film examination
- Malarial Parasites

Note

The students are expected to make a practical note book. The book is a collection of evidence that learning has taken place. It is a reflective record of their achievements

RECOMMENDED BOOKS

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

MDLT-5213 CLINICAL BACTERIOLOGY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

This course aims to provide a comprehensive overview of medically important bacteria, their pathogenicity, clinical features, and laboratory diagnosis. The course covers a wide range of bacterial pathogens, including gram-positive and gram-negative cocci and rods, anaerobic bacteria, mycobacteria, actinomycetes, mycoplasmas, spirochetes, chlamydiae, and rickettsiae. It also delves into molecular and immunological methods for studying bacteria and bacterial infections, as well as antibacterial drugs, their modes of action, and antimicrobial resistance. The practical component of the course covers various techniques such as staining methods, culturing bacterial pathogens, identifying bacterial colonies on culture media, performing

biochemical tests, and using multiple test systems and automated systems for bacterial identification. Additionally, the course touches on reporting procedures for culture and sensitivity testing in bacterial infections.

COURSE OBJECTIVES

- Understand the pathogenicity, clinical features, and laboratory diagnosis of medically important bacteria.
- Gain knowledge of the characteristics, classification, and identification methods for various bacterial pathogens, including gram-positive and gram-negative cocci and rods, anaerobic bacteria, mycobacteria, actinomycetes, mycoplasmas, spirochetes, and chlamydiae.
- Learn about molecular and immunological methods for studying bacteria and bacterial infections.
- Understand the modes of action of antibacterial drugs and the mechanisms of antimicrobial resistance.
- Develop practical skills in staining methods, culturing bacterial pathogens, identifying bacterial colonies on culture media, performing biochemical tests, and using multiple test systems and automated systems for bacterial identification.
- Learn how to report culture and sensitivity results for bacterial infections.

Contents:

Overview of the pathogenicity, clinical features and laboratory diagnosis of Medically Important Bacteria /Major Pathogens & Introduction to Anaerobic Bacteria.

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

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

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

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

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

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

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

Molecular and Immunological Methods to study bacteria and bacterial infections. Antibacterial drugs; mode of action. Antimicrobial resistance.

Practical:

Staining methods in bacteriology,

Culturing bacterial pathogens, Identification of bacterial colonies on culture media.

Identification of unknown microorganisms, Identification of Staphylococci, Streptococci, Enterobacteriaceae, Pseudomonas, Vibrio.

Biochemical test including, Catalase, Coagulase, DNAse, Citrate Utilization, Glucose fermentation, Lactose and Sucrose fermentation, methyl red, urease, Voges Proskauer. Multiple Test Systems including API 20E, API 20NE, and Automated systems.

Reporting of culture and sensitivity for bacterial infections

Recommended Books:

1. *Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006*
2. *Levinson, W. Review of Medical Microbiology and Immunology, 12th Edition, Mc Graw Hill Medical, New York.*
3. *Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.*
4. *Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010.*
5. *Gillespie S, Hawkey PM, editors. Principles and practice of clinical bacteriology. John Wiley & Sons; 2006.*
6. *Leboffe MJ, Pierce BE. Microbiology: laboratory theory and application. Morton Publishing Company; 2012.*

MDLT-5214 IMMUNOLOGY AND SEROLOGY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

This course comprised of theory and application of basic immunology, including the immune response, principles of antigen-antibody reactions, and the principles of serological procedures as well as quality control, quality assurance, and safety. Immunology is the study of the immune system and is a very important branch of the medical and biological sciences. The immune system protects the body from infection through various lines of defense. If the immune system is not functioning as it should, it can result in diseases, such as autoimmunity, allergy and cancer. While serology is the scientific study or diagnostic examination of blood serum, especially with regard to the response of the immune system to pathogens or introduced substances.

LEARNING OBJECTIVES

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

- Describe the basic function of immune system
- Demonstrate the essential components of Immune system
- Describe and understand the basic function of humoral and cell mediated immunity
- Describe and understand about the role of different arms of immunity to combat with foreign particles
- Demonstrate maturation processes of different immune cells
- Describe the balance of body in order to response against antigens and anergy
- Demonstrate knowledge of different factors and mechanisms of autoimmunity
- Demonstrate knowledge of autoimmune diseases, their mechanisms and diagnosis
- Demonstrate knowledge of basics of serological testing
- Demonstrate knowledge of different serological tests, including their principle, procedure and interpretation
- Describe and understand issues involved with serological testing and how to maintain quality control in serological testing

COURSE CONTENTS

General Immunology

What is Immunology, Immunity and the Immune system. Immune response, Immune cells and molecules. Lines of defence system. Innate and adaptive immunity. Cell mediated and humoral immunity. Antigen and

antigenicity, Properties of Antigens. Antibodies and immunoglobulins, Properties/Features, Types and Classes of Antibodies, Structure of Antibodies/Immunoglobulins, Primary and Secondary Abs, Monoclonal and Polyclonal Abs. Hypersensitivity. Autoimmunity. Immune mediated diseases. Immunization. Immune deficiency

Immunological Techniques

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

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

Immuno histological Tests:

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

Serological Techniques

- Tests for circulating antibodies to autoantigens in tissue sections by indirect immunofluorescence and enzyme-labelled techniques
- Tests for antibodies to other autoantigens by agglutination, precipitation, complement fixation and radioimmunoassay
- Tests for antibodies to non-microbial environment and food allergens
- Tests for antibodies to selected microbiological antigens
- Tissue Typing For HLA-Antigens: Serological And DNA Based

Practical

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

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

1. Antigen-Antibody reaction techniques
2. ELISA Technique
3. Widal test:
4. Typhidot test
5. Brucella Agglutination test.
6. Antistreptolysin O titre.
7. Bacterial Haemagglutination test.
8. Paul Bunnel reaction.
9. RA Factor Test
10. CRP test.
11. RPR test
12. VDRL test.
13. Complement fixation test
14. PCR
15. Preparation of immunological and serological test reports

RECOMMENDED BOOKS

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

URCG-5116 Science of Society-I 2 (2-0)

Course Description:

This course will introduce students with the subject matter of social science, its scope, nature and ways of looking at social phenomenon. It will make the participants acquaintance with the foundations of modern society, state, law, knowledge and selfhood. While retaining a focus on Pakistani state and society, students will encounter theoretical concepts and methods from numerous social science disciplines, including sociology, politics, economics anthropology and psychology and make them learn to think theoretically by drawing on examples and case studies from our own social context. Students will be introduced to the works of prominent social theorists from both western and non-western contexts. Instruction will include the use of written texts, audio-visual aids and field visits.

Learning Outcomes:

The course has following outcomes:

It will

- Introduce student with the nature of human social behavior and foundations of human group life
- Analyze the reciprocal relationship between individuals and society.
- Make student aware with the nature of societies existing in modern world
- Make students familiar with the philosophy of knowledge of social sciences
- Introduce students with the works of prominent theories explain human group behavior
- Help students to understand the foundations of society including culture, socialization, politics and economy
- Introduce students with various dimensions of social inequalities with reference to gender, race, ethnicity and religion
- Make them aware about the understanding of various themes pertains to social science in local context
- Help them recognize the difference between objective identification of empirical facts, and subjective formulation of opinionated arguments

Course Outlines:

1. Introduction to Social Sciences

- Social world, Human Social behavior, Foundations of society
- Evolution of Social sciences
- Philosophy of Science
- Scope and nature of social sciences
- Modernity and social sciences
- Branches of social science: Sociology, Anthropology, Political Science, Economics

Society and Community, Historical evolution of Society

- Types of Societies
- Foraging society, Horticultural society, Pastoralist society
- Agrarian societies, Industrial society, Postindustrial society

2. Philosophy of Knowledge in social Science and social inquiry

- Understanding social phenomenon
- Alternative ways of knowing
- Science as a source to explore social reality
- Objectivity, Value-Free research
- Positivism vs Interpretivism
- Qualitative vs Quantitative

3. Culture and Society

- Idea of Culture, Assumptions of Culture

- Types, Components, Civilization and culture
- Individual and culture. Cultural Ethnocentrism, Cultural Relativism
- Outlook of Pakistani culture
- Global Flows of culture, Homogeneity, Heterogeneity

4. Social Stratification and Social inequality

- Dimensions of inequality, Social class
- Gender, Race, Religion, Ethnicity, Caste
- Patterns of social stratification in Pakistan
- Class, caste system in agrarian society
- Ascription vs Achievement, Meritocracy
- Global stratification in modern world, Global patterns of inequality

5. Personality, Self and Socialization

- Concept of self, Personality
- Nature vs Nurture, Biological vs Social
- Development of Personality
- Socialization as a process, Agents of socialization
- Socialization and self/group identity

6. Gender and Power

- Understanding Gender
- Social construction of Patriarchy
- Feminism in Historical context, Gender Debates
- Gender and Development
- Gender issues in Pakistani society, Women Participation in politics, economy and education
- Toward a gender sensitive society, Gender mainstreaming

Pakistan: State, Society, Economy and Polity

- Colonialism, colonial legacy, National identity
- Transformation in Pakistani society: Traditionalism vs Modernism
- Economy, Informality of Economy, Modern economy and Pakistan
- Political Economy, Sociology of Economy

Recommended Textbooks and Reading Materials:

1. Giddens, A. (2018). Sociology (11th ed.). UK: Polity Press.
2. Henslin, J. M. (2018). Essentials of Sociology: A Down-to-Earth Approach.(18th Edition) Pearson Publisher.
3. Macionis, J. J. (2016). Sociology (16th ed.). New Jersey: Prentice-Hall.
4. Qadeer, M. (2006) Pakistan - Social and Cultural Transformation in a Muslim Nation.
5. Smelser, N.J. and Swedburg, R., The Handbook of Economic Sociology, Chapter 1 'Introducing Economic Sociology', Princeton University Press, Princeton.
6. Systems of Stratification | Boundless Sociology (no date). Available at: https://courses.lumenlearning.com/boundless-sociology/chapter/systems-of-stratification/

Jalal, A. (ed.) (1995) 'The colonial legacy in India and Pakistan', in Democracy and

URCG-5124 ENTREPRENEURSHIP CREDIT HOURS 2(2-0)

Course description:

This course addresses the unique entrepreneurial experience of conceiving, evaluating, creating, managing,and potentially selling a business idea. The goal is to provide a solid background with practical application of important concepts applicable to the entrepreneurial environment. Entrepreneurial discussions regarding the key business areas of finance, accounting, marketing and management include the creative aspects of entrepreneurship. The course relies on classroom discussion, participation, the creation of a feasibility plan,and building a business plan to develop a comprehensive strategy for launching and managing a new venture. The

core learning objectives of course are: to enhance the 'entrepreneurial intentions' of the students by improving their natural willingnessto start a business; to understand the process of entrepreneurship and learn the ways to manage it by workingindividually in the class and in the form of groups outside the class to conduct field assignments; to educate the students about the practical underpinnings of the entrepreneurship with the aid ofpractical assignments and idea pitching.

Contents

1. **Background:** What is an Organization, Organizational Resources, Management Functions, Kindsof Managers, Mintzberg's Managerial Roles.
2. **Forms of Business Ownership:** The Sole proprietorship, Partnership, Joint Stock Company
3. **Entrepreneurship:** The World of the Entrepreneur, what is an entrepreneur? The Benefits of Entrepreneurship, The Potential Drawbacks of Entrepreneurship, Behind the Boom: Feeding the Entrepreneurial Fire.
4. **The Challenges of Entrepreneurship:** The Cultural Diversity in Entrepreneurship, The Power of "Small" Business, Putting Failure into Perspective, The Ten Deadly Mistakes of Entrepreneurship,How to Avoid the Pitfalls, Idea Discussions & Selection of student Projects, Islamic Ethics of Entrepreneurship.
5. **Inside the Entrepreneurial Mind:** From Ideas to Reality: Creativity, Innovation, and Entrepreneurship, Creativity – Essential to Survival, Creative Thinking, Barriers to Creativity, Howto Enhance Creativity, The Creative Process, Techniques for Improving the Creative Process, Protecting Your Ideas, Idea Discussions & Selection of student Projects.
6. Products and technology, identification opportunities
7. **Designing a Competitive Business Model and Building a Solid Strategic Plan:** Building a strategic plan, Building a Competitive Advantage, The Strategic Management Process, Formulatestrategic options and select the appropriate strategies, Discussion about execution of Students' Project.
8. **Conducting a Feasibility Analysis and Crafting a Winning Business Plan:** Conducting a Feasibility Analysis, Industry and market feasibility, Porter's five forces model, Financial feasibility analysis. Why Develop a Business Plan, The Elements of a Business Plan, What Lendersand Investors Look for in a Business Plan, Making the Business Plan Presentation.
9. **Building a Powerful Marketing Plan:** Building a Guerrilla Marketing Plan, Pinpointing the Target Market, Determining Customer Needs and Wants Through Market Research.Plotting a Guerrilla Marketing Strategy: How to Build a Competitive Edge, Feed Back & Suggestions on Student Project, Islamic Ethics for Entrepreneurial Marketing
10. **E-Commerce and the Entrepreneur:** Factors to Consider before Launching into E-Commerce, Ten Myths of E-Commerce, Strategies for E-Success, Designing a Killer Web Site, Tracking WebResults, Ensuring Web Privacy and Security, Feed Back & Suggestions on Student Project.
11. **Pricing Strategies:** Three Potent Forces: Image, Competition, and Value, Pricing Strategies and Tactics, Pricing Strategies and Methods for Retailers, The Impact of Credit on Pricing
12. **Attracting Venture Capitalist:** Projected Financial Statements, Basic Financial Statements, Ratio Analysis, Interpreting Business Ratios, Breakeven Analysis, Feed Back &Suggestions on Student Project,
13. **Idea Pitching:** Formal presentation, 5-minutes pitch, funding negotiation and launching.

Recommended Texts

1. Scarborough, N. M. (2011). *Essentials of entrepreneurship and small business management*. Publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey 07458..

Suggested Readings

1. Burstiner, I. (1989). S*mall business handbook*. Prentice Hall Press.

URCG-5121 TOOLS FOR QUANTITATIVE REASONING CREDIT HOURS 3(3-0)

Course description:

This course is based on quantitative reasoning course. It will enhance the quantitative reasoning skills learned in quantitative reasoning 1 course. Students will be introduced to more tools necessary for quantitative reasoning skills to live in the fast paced 21st century. Students will be introduced to importance of mathematical skills in different professional settings, social and natural sciences. These quantitative reasoning skills will help students to better participate in national and international issues like political and health issues. This course will prepare the students to apply quantitative reasoning tools more efficiently in their professional and daily life activities. This course will help them to better understand the information in form of numeric, graphs, tables, and functions. Students will be introduced to the above listed concepts, and they will be prepared to apply these concepts to practical life scenarios. This course will enhance their ability to deal with scenarios involving quantitative reasoning skills in a logical manner which they can face in their practical lives. It will prepare students to deal with different forms of data occurring in professional, social and natural sciences. Students will be introduced to scenarios involving functions and probability in different disciplines. This course will prepare the students to apply the quantitative reasoning skills in other disciplines. This course will provide solid foundation for students to use the quantitative reasoning skills in solving practical life problems.

Contents

1. Investigating relationships between variables. Exploring tools to find relationship between variables Resources and population growth. Dealing with Economical, environmental and social issues.
2. Graphical and analytical approaches to solve a problem. Applications of graphical & analytical approaches in social & economic problems.
3. Understanding inequalities around us. Dealing with practical problems involving inequalities in different disciplines.
4. Golden ratio in sculptures. Comparison of statements and their use in social and economic problems. Number patterns and their applications.
5. Survival in the modern World. Propositions and truth values. Applications of logic.
6. Exploring and summarizing data, misleading graphs. Finding a representative value in a data. Measure and spread of a data, measuring degree of relationship among variables. Counting the odds.

Recommended Texts

1. *Bennett, J. & Briggs, W. (2015). Using and understanding mathematics (6th Edition). Pearson Education, Limited.*
2. *Blitzer, R. (2014). Precalculus. (5th Edition). Pearson Education, Limited.*
3. *Stewart, J., Redlin, L. & Watson, S. (2011). Pre-calculus: Mathematics for Calculus (7th edition). Cengage Learning.*

Suggested Readings

1. *Aufmann, R., Lockwood, J., Nation, R. & Clegg, D. (2007). Mathematical thinking and reasoning. Brooks Cole.*
2. *Montgomery, D. C., & Runger, G. C. (2010). Applied statistics and probability for engineers. John wiley & sons.*
3. *DasGupta, A. (2008). Asymptotic theory of statistics and probability (Vol. 180). New York: Springer.*

MDLT-5216 PROFESSIONAL PRACTICE (LAWS, ETHICS AND ADMINISTRATION) **CREDIT HOURS 2(2-0)**

COURSE DESCRIPTION:

This course is designed to introduce students to the professional aspects of Medical Laboratory Technology. It covers the principles and practices of medical laboratory professionals, including laws, ethics, and administration in the field. The course explores the concept of professionalism, the history and evolution of the profession, ethical principles and standards, and the roles and responsibilities of medical laboratory technologists/scientists in various settings. Additionally, it addresses contemporary practice issues, professional development, competence, and expertise in the field of medical laboratory technology.

COURSE OBJECTIVES:

1. To define and understand the concept of a profession and the characteristics of professions, with a focus on Medical Laboratory Technology.
2. To introduce the principles of ethics, different classifications of ethics, and their application in the field of Medical Laboratory Technology.
3. To familiarize students with the principles of confidentiality, privacy, rights, and obligations of medical laboratory professionals.
4. To understand the duties and responsibilities of medical laboratory professionals, patient's bill of rights, and the code of conduct in the laboratory setting.
5. To explore contemporary practice issues, including the vision for the future, curriculum requirements, plan of care, social responsibility, and career development in Medical Laboratory Technology.
6. To discuss the roles of laboratory technologists/scientists as clinical/diagnostic experts, consultants, critical inquirers, educators, and administrators.
7. To examine the ethical and legal issues associated with each role of the medical laboratory professional.
8. To introduce the professional development continuum, from competence to expertise, and the activities that promote professional development.

CONTENTS

PROFESSIONAL PRACTICE IN MEDICAL LABORATORY TECHNOLOGY (Laws, Ethics & Administration)

THE MEDICAL LABORATORY TECHNOLOGY AS PROFESSION AND PROFESSIONAL

What does professional mean?, Preliminary definitions of profession and professional, Sociological perspective, Structural approach, Processual approach, Characteristics of professions cited in the literature, Power approach, Dimensions of occupation & profession, Autonomy, self-regulation of ethical standards, and accountability, Privileges of autonomous practice in 2020, Self-regulation of ethical standards, Accountability of professionals, Individual professionalism—professionalism without professions?, The history of a profession and Professional recognition.

History of medical laboratory science, History of ethics, Classification of ethics, Principles of ethics, characteristics of professional and ethical behavior, Interpersonal relationships, Principles of confidentiality and privacy responsibility, Rights and obligations of medical laboratory professionals, Duties and responsibilities of medical laboratory professionals, Patient's bill of rights, Medical Laboratory code of conduct, Good Laboratory Practices (GLPs).

CONTEMPORARY PRACTICE ISSUES

A vision for the future, The BS in Medical laboratory technology, Perspective of the profession, Perspective of the practitioner, Direct access issue, Selected curriculum requirements from evaluative criteria for laboratory technologists/scientists, Plan of care, Social responsibility, Career development, Laboratory

technology practice patterns, Components of a practice pattern, Important factors that affect health

THE ROLES OF THE LABORATORY TECHNOLOGISTS/SCIENTISTS

THE LABORATORY TECHNOLOGIST AS CLINICAL/DIAGNOSTIC EXPERTS

Perform diagnostic tests, supervise the technical staff working in clinical laboratory, Trouble shooting of the laboratory instrumentations, Inventory control in clinical laboratory, Quality control and quality assurance in clinical laboratory, Good communication skills, Interpersonal relationships, Ethical and legal issues, Informed consent and Managed care and fidelity, Patients and specimen data confidentiality.

THE LABORATORY SCIENTIST AS CONSULTANT

Laboratory consultation, Building a consulting business, The consulting process, The skills of a good consultant, Trust in the consultant/client relationship, Ethical and legal issues in consultation and Components of a consulting agreement

THE LABORATORY TECHNOLOGIST/SCIENTIST AS CRITICAL INQUIRER

History of critical inquiry, Evidence-based Practices, Outcomes research, Whose responsibility is research? Roles of the laboratory staff in critical inquiry, Collaboration in research (Basic and Applied/Clinical), Ethical and legal issues in critical inquiry

THE LABORATORY SCIENTIST/TECHNOLOGIST AS EDUCATOR

History of Clincal laboratory education, Contemporary educational roles of the lab technologist, Teaching opportunities in continuing education, Academic teaching opportunities, Theories of teaching and learning in professional education, Ethical and legal issues in medical laboratory education

THE LABORATORY TECHNOLOGIST/SCIENTIST AS ADMINISTRATOR

History of laboratory administration, Patient/client management, First-line management, Midlevel managers and chief executive officers, Leadership and Ethical and legal issues.

PROFESSIONAL DEVELOPMENT, COMPETENCE, AND EXPERTISE

Lifelong process of skill enhancement, The professional development continuum: from competence to expertise, Activities that promote professional development, Evaluation of competence and professional development, Professional development planning, Possible evaluators of professional achievement, Career advancement and Organizational impact on professional development.

FUTURE CHALLENGES IN LABORATORY TECHNOLOGY

Medical Laboratory technology moral mission, The future in three realms, individual, institutional & societal, Professionalism and the laboratory technologist/scientist.

RECOMMENDED BOOKS

1. *Aamer Ikram, Rita Guenther and Benjamin Rusek. Good clinical laboratory practices in Pakistan. 2019.*
2. *AFIP. Manual of Laboratory medicine. Latest Edition.*
2. *Baker & Silverton's Introduction to Medical Laboratory Technology Seventh Edition.*
3. *Kramme, R., Hoffmann, K. P., & Pozos, R. S. (Eds.). (2011). Springer handbook of medical technology. Springer Science & Business Media.*
4. *Booth, K. A., & Mundt, L. A. (2013). Phlebotomy: a competency-based approach.*

FIFTH SEMESTER

COURSE CODE	COURSE	CREDIT HOURS
MDLT-6217	CLINICAL VIROLOGY	3(2-1)
MDLT-6218	MEDICAL LABORATORY INSTRUMENTATION	3(2-1)
MDLT-6219	BLOOD BANKING AND TRANSFUSION MEDICINE	3(2-1)
MDLT-6220	HAEMATOLOGY-II	3(2-1)
MDLT-6221	CLINICAL PATHOLOGY	3(2-1)
MDLT-6222	CLINICAL LAB PRACTICE-I	3(0-3)
URCG-5111	TRANSLATION OF THE HOLY QURAN–III (*Non-Credit*)	1(0-1) (Non-Credit)

MDLT-6217 CLINICAL VIROLOGY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION:

This course covers various aspects of virology, including the history, introduction, properties, structure, classification, and nomenclature of viruses. The course delves into the Baltimore classification system, the basic steps in the viral life cycle, transmission mechanisms, viral pathogenesis, and host defenses against viral infections. It also focuses on viral laboratory diagnosis techniques, antiviral drugs, and viral vaccines. The course provides an in-depth exploration of medically important RNA and DNA virus families, covering their classification, laboratory diagnosis methods, and specific details about significant viral diseases. These include hepatitis viruses (A, B, C, D, E, G), human immunodeficiency virus (HIV), cytomegalovirus, dengue hemorrhagic virus, human papillomavirus, SARS-CoV, Crimean-Congo hemorrhagic fever virus, Ebola virus, bacteriophages, smallpox, herpes viruses, poliovirus, influenza virus, mumps virus, measles virus, rabies virus, rubella virus, rotavirus, and oncogenic viruses. The practical component of the course covers hemagglutination assays, ELISA for hepatitis B surface antigen and anti-HCV, molecular methods for detecting viral infections, sample collection for fungal diseases, fungal culture media, and determining the antifungal activity of agents like nystatin and amphotericin B.

COURSE OBJECTIVES:

- Understand the history, introduction, properties, structure, classification, and nomenclature of viruses.
- Gain knowledge of the Baltimore classification system, the basic steps in the viral life cycle, transmission mechanisms, viral pathogenesis, and host defenses against viral infections.
- Learn about viral laboratory diagnosis techniques, antiviral drugs, and viral vaccines.
- Develop an understanding of medically important RNA and DNA virus families, their classification, laboratory diagnosis methods, and specific details about significant viral diseases.
- Gain knowledge of viral diseases such as hepatitis viruses, HIV, cytomegalovirus, dengue hemorrhagic virus, human papillomavirus, SARS-CoV, Crimean-Congo hemorrhagic fever virus, Ebola virus, bacteriophages, smallpox, herpes viruses, poliovirus, influenza virus, mumps virus, measles virus, rabies virus, rubella virus, rotavirus, and oncogenic viruses.
- Develop practical skills in hemagglutination assays, ELISA for viral antigens, molecular methods for detecting viral infections, sample collection for fungal diseases, fungal culture media, and determining the antifungal activity of agents.

Contents

- History of Virology, Introduction to Virology and Properties of viruses
- Introduction to viruses, Nomenclature of viruses
- Features, structure and classification of viruses
- Baltimore classification, Basic steps in viral life cycle
- Transmission of viruses, Viral Pathogenesis, Host Defenses

- Viral Laboratory Diagnosis techniques, Antiviral Drugs, Viral Vaccines
- Classification of medically important viruses, RNA and DNA virus families
- Laboratory Diagnosis of Viral Diseases Microscopy, Demonstration of viral antigen, Virus isolation.
- History, General properties, Replicative Cycle, Transmission & Epidemiology, Clinical Findings, laboratory diagnosis, Treatment & Prevention of Hepatitis A, B, C,D,E,G viruses
- Human Immunodeficiency virus. Cytomegalovirus: Dengue hemorrhagic virus: Human Papilloma Virus, SARC, CCHF and Ebola virus, Bacteriophase, Small pox, Herpes viruses, Polio virus, Influenzae virus, Mumps virus, Measles virus, Rabies virus, Rubella virus, Rota virus, Oncogenic viruses, HIV.

Practical:

Hemagglutination assays for viral diseases.
ELISA for HBsAg and Anti-HCV
Molecular methods for diction of viral infections
Sample collection for fungal diseases.
Fungal culture media.
Determination of antifungal activity of (nystatin, amphotericin B etc.)

Recommended Books:

1. *Levinson, W. Review of Medical Microbiology and Immunology, 12th Edition, Mc Graw Hill Medical, New York.*
2. *Cann, A. J., 2001. Principles of Molecular Virology Academic Press*
3. *Griffin, R., Martin, M. A, Straus, H., Griffin, D. E., Robert, G., LMICRO, A., Howley, P. M., Roizman, B., Straus, S. E., David, M., 2001. Fundamental Virology Lippincott Williams and Wilkins.*
4. *Flint, S. J., Racaniello, V. R., Enquist, L. W. and Skalka, A. M. 2003. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. CMICROridge University Press.*
5. *Zuckerman, A. J., Banatvala, J. E., Pattison, J. R., Griffiths, P., Schoub, B., 2004. Principles and Practice of Clinical Virology, 5th Edition. John Wiley and Sons Limited.*

MDLT-6218 MEDICAL LABORATORY INSTRUMENTATION CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

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

LEARNING OBJECTIVES

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

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

- Ask for routine instruments service in time.
- Selection and buying of medical instruments.
- Care and routine maintenance of these instruments.

COURSE CONTENTS

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

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

Colorimeters & Photometers: advanced UV visible & IR Spectrophotometers including different types of Chemistry Analyzers.

Flame Photometers. Working principle, component parts, operation, uses, care and maintenance

Turbidimetry, Component parts, working principle and uses

Nephelometry, Principle and operation, uses

ISE (Ion Selective Electrode). Their working principle, component parts, uses and applications.

ELISA Apparatus; Working principle and types of ELISA. Component parts of ELISA apparatus, working, limitations and uses.

Microtomy: Definition, Types of Microtomes; parts, working, limitations & uses,

Blood gas analyzer.

Cryofuge, Storage cabinet in blood banking, Plasma extractor, Platelet apheresis,

Centrifuge Machines; types, functions, uses, limitations.

Autoclave; Principle, Types, component parts and operations, Uses etc.

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

Water Distillation unit: Procedure for preparing distilled water.

Power Lab System: Construction, working principle and applications.

General overview of quality control and quality assurance

Calibrators: standards, low, normal, elevated control sera's and cells

Chromatography; including Paper, Thin layer, Gel and other types of chromatographics & advanced chromatographic techniques e.g. Gas Chromatography, GLC, HPLC etc.

Haematology Analyzers; Working principle, its parts, scope, working, limitations & uses etc.

Amino Acid Analyzer;

Electrophoresis Apparatus; its types, functioning the Papers, Gel electrophoresis, Iso-electric Focusing etc.

PCR: Basic principle, types and applications.

Blotting techniques including Western blot, Southern blot and Northern blot.

Practical

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

RECOMMENDED BOOKS

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

MDLT-6219 BLOOD BANKING AND TRANSFUSION MEDICINE CREDIT HOURS 3(2-1

COURSE DESCRIPTION:

The main aim of this course is the study of blood and blood products, history of blood transfusion, different types of blood group systems, antigen-antibody reactions, blood donors and the blood transfusion reactions. The students will also be able to diagnose and manage transfusion medicine issues in diverse patient populations. The students are familiarized with the principles of pre-transfusion testing including blood grouping, compatibility testing and the preparation of various blood products.

COURSE OBJECTIVES:

- To introduce to the students' basic concepts in blood banking and transfusion.
- The course provide knowledge of principle and techniques involved in blood banking

Contents

- Introduction to blood bank, History of Blood Transfusion.
- Antigen – Antibody theory. Antigen, Antibody, Immunization. immunoglobulin, structure, different type of antibodies important related to transfusion like cold antibodies etc. Classification of antibodies.
- Agglutinogen-Agglutinin theory. Agglutinogen, Agglutinin.
- Landsteiner's Postulates,
- Requirements of a standard blood bank, preparation of basic reagents, different anticoagulant used in blood bank.
- Blood Groups ABO systems. Sub groups of "A" and "B". Techniques for blood grouping-slide test. Techniques for reverse blood grouping-tube test. Sources of error,
- Rh – Hr typing, Cause of sensitization to the Rh – Hr factor, Techniques for Rh typing, Sources of error Controls.
- Other Blood group system. kell blood group system, duffy blood group system, MNS blood group system, ked blood group system etc.
- Blood Donors. Selection Criteria, Donor screening.
- Cross Matching procedures: Purpose of crossmatch. Methods of crossmatching. Crossmatching problems; Rouleaux. Cold Agglutinins. Hyperproteinemia and hyperglobulinemia.
- Antiglobulin tests: Direct Coomb's. Indirect Coomb's. Sources of error, controls. Rh Antibody tests: Screening tests using a cell panel; Slide test. Tube test. Titrations.
- Preciptin, Lysin, Agglutinoid, Complete/Bivalent Antiglobulin test.
- Controls in blood bank, general. Low titered groups "O" blood.
- Transfusion reactions. Erythroblastosis foetalis (Review of clinical and Laboratory findings), Causes: Due to Rh incompatibility. Methods of testing. Due to ABO incompatibility. Methods of testing. Organization of Blood banking, Standard operating procedures in blood banking,
- Blood products and blood component preparation, Apheresis.

PRACTICALS:

1. Blood collection & preservation using different anticoagulants& preservative solutions.
2. Component preparation
3. ABO grouping
4. Rh typing
5. Antibody direction & titration
6. Coombs test
7. Compatibility testing cross matches
8. Investigation of transfusion reactions

9. Investigation of hemolytic disease of new born
10. HBsAg & HIV antibody testing in blood bank
11. Cross matching (Major and Minor)
12. Coombs tests (Direct and Indirect)
13. Separation, uses and preservation of different blood components

RECOMMENDED BOOKS:

1. Practical Hematology, Dacie J.V. 10th edition
2. Introduction to Immunohematology: Bryant Neville J, third edition, 1994
3. Cheesbrough, M. (2006). District laboratory practice in tropical countries. Cambridge university Press

MDLT-6220 HAEMATOLOGY-II CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

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

LEARNING OBJECTIVES

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

- Develop competency in techniques of hematology.
- Acquire knowledge and understand the abnormalities of blood cells and methods of estimating different blood parameters.
- Learn about different haematological diseases and role of laboratory for identification of abnormalities.
- Perform special laboratory methods used in investigation of anemias.
- Learn about bone marrow aspiration and biopsy techniques, preparation of smears and staining.
- Understand the detailed aspects of blood coagulations, disorders of hemostasis, principles and methods of assessment of coagulation.
- Understand the detailed aspects of white blood cells disorders i-e Leukaemia, lymphoma, myeloma etc.
- Collect blood by various methods to efficiently perform routine and special investigations in clinical hematology laboratory.

CONTENTS

Thalassemia and hemoglobinopathies (in brief) Definition, Classification, Laboratory diagnosis of various types of anemia, polycythaemica Vera, leukocytosis, leucopenia, lymphopenia, monocytosis, neutropenia and Agranulocytosis, infectious mono-nucleosis. Definition and FAB/ WHO-2008 classification of leukemia, Acute and Chronic leukemia, blood and bone marrow findings in acute myeloid Leukemia (AML), acute

lymphoid leukemia (ALL), chronic myeloid leukemia (CML), chronic lymphatic leukemia,(CLL), Erythroleukemia, Eosinophilic Leukemia, megakaryocytic leukemia, Leukemoid blood reactions, FAB classification, Multiple Myeloma (in brief) Systemic methods of examination of blood film (blood Picture) and reporting, LE cell phenomenon and demonstration of LE cells, principle, method and significance of osmotic fragility test, Acid hemolysis (ham's test), G6PD estimation and its significance. Mechanism of blood coagulation, laboratory tests used in investigation of coagulation disorders Assay of coagulation factors, Hemophilia and its laboratory parameters, Measurement of life span of platelets. Cytochemistry – Peroxidase, Sudan block, and Esterases, Perl's staining and estimation of Iron content in bone marrow smears and its significance. Automation and recent advances in hematological techniques.

Practical:

- PT, APTT
- D Dimer
- Hb Electrophoresis / Determination of fetal hemoglobin
- Osmotic fragility test
- Malarial Parasite identification and reporting
- LE cell phenomenon
- Heinz body preparation
- Determination of G-6-PD
- Demonstration of slides of various disorders of anemia and leukemia

Recommended Books:

1. *Blann A, Ahmed N. Blood Science: Principles and Pathology. John Wiley & Sons; 2014 Jan 2.*
2. *Hoffbrand AV, Catovsky D, Tuddenham EG, editors. Postgraduate haematology. John Wiley & Sons;*
3. *2008 Apr 15.*
4. *Ciesla B. Hematology in practice. FA Davis; 2011 Aug 11.*

MDLT-6221 CLINICAL PATHOLOGY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION:

This comprehensive course covering the analysis of various bodily fluids such as urine, feces, sputum, cerebrospinal fluid, aspiration fluids, and semen for disease diagnosis and monitoring. It provides a thorough understanding of fluid composition, properties, pathological constituents, and their examination through physical, chemical, and microscopic techniques. The course explores quantitative analysis methods, pathological conditions related to fluid abnormalities, water and acid-base balances, hyperbilirubinemia, tumor markers, therapeutic drug monitoring, and chemical toxicology. Practical sessions allow hands-on experience in fluid collection, processing, and examination, preparing students for professional practice in clinical pathology laboratories.

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.

Contents

Urine: Composition of glomerular filtrate and change which occur in the tubules, normal urine, physical properties, and composition, pathological constituents and their determination,

Urine Examination: Physical, chemical and microscopic examination of urine.

Quantitative Analysis of Urine: Amino acids, Bence-Jones proteins, Calcium, Coproporphyrins,

creatinine, glactose, phosphates, nitrogen, PH, specific gravity, Ca, p, Oxalates and urates. Determination of Urea (qualitative and Quantitative) pathological Constituents: Sugar, Albumin, Ketone bodies, Blood, Bile pigments and Urobillinogen in urine.

Amino acids, Bence-Jones proteins, Calcium, phosphorus, Oxalates and urates.

Inulin and Creatinine clearance (GFR).

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

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

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

Faecal/Stool examination: Physical, chemical and microscopic composition of faeces,

Sputum examination: Method of collection, transportation, processing, storage, decontamination of sputum sample, sputum smear microscopy (Preparation, fixing and staining).

Cerebrospinal fluid: Physical, chemical and microscopic composition of CSF.

Aspiration fluids: Physical, chemical and microscopic composition of ascetic, pleural, pericardial and synovial fluids.

Semen; method of collection examination of semen for time for liquefaction, volume, color, reaction pH, motility of sperm, sperm count and other findings in staining and morphological study of spermatozoa, semen fructose determination, anti-sperm antibodies.

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

Malabsorption syndrome

Hyperbilirubinaemia & jaundice, Hypoalbuminaemia, Hyperbilirubinaemia

Hyperuricaemia

Tumor markers: Definition, Types, methods of determination and clinical significance. Alfa feto protein, CEA, HCG, CA, PSA, CA125, etc.

Therapeutic drug monitoring

Measurement of therapeutic medication levels to optimize dosage, Therapeutic drug monitoring and chemical toxicology

PRACTICALS:

1. Urine-collection, processing, physical, chemical and microscopic examination.
2. Faecal examination: Physical, chemical and microscopic.

Sputum collection and microscopic examination of sputum for AFB.

3. CSF: Physical, chemical and microscopic examination of CSF
4. Physical, chemical and microscopic examination of ascetic, pleural, pericardial and synovial fluids
5. Semen: Physical, chemical and microscopic examination of seminal fluid
6. Physical and chemical composition of urinary Calculi

RECOMMENDED BOOKS:

1. *Manual of Laboratory medicines AFIP, Third Edition 2005 Publication Armed Forces Institute of Pathology Rawalpindi Pakistan.*
2. *District laboratory practice in tropical countries Vol. 1 & 2 Monica Cheesbrough Cambridge University Press Low Price Edition 2000.*
3. *Clinical chemistry: principles, methods & interpretation 2nd Edition by Prof. Dr. Abdus Salam Khan Gandapur 2003. Tahir Instruments Ltd Singapura Road Lahore-Pakistan.*

MDLT-6222 CLINICAL LAB PRACTICE-I CREDIT HOURS 3(0-3)

Course description

This course is designed to help medical Laboratory technology students to understand different techniques used in Clinical Laboratory for the estimation of different Biochemical and Hematological substances in human body fluids and role of these in aetiology of different diseases.

Learning objectives

- To perform the basic diagnostic techniques confidently
- To analyse the body fluids for selective biochemical substances
- To analyse the blood for selective hematological parameters

Contents

1. Patient Preparation, sample Collection, Processing and Handling,
2. Point-of-Care Testing (POCT)
3. Terminology, Different methods of blood collection & Preparation of anticoagulant bottles.
4. Separation of Serum and Plasma
5. Non-Blood Specimens (Urine, Stool, Other)
6. Estimation of blood glucose, serum creatinine, bilirubin, albumin, triglycerides, cholesterol, HDL and LDL cholesterol, uric acid, alkaline phosphatase, SGPT, SGOT, acid phosphatases, serum Amylase, serum inorganic phosphorous, serum sodium, serum Potassium, urinary calcium, pH of water,
7. Different methods of Hemoglobin estimation
8. Blood smear formation and smear Staining (Giemsa)
9. Identification of RBCs, WBCs and Platelets in peripheral films.
10. Identification of malarial parasites.
11. TLC by Haemocytometer
12. Red Blood Cell count
13. Platelet count,
14. Erythrocyte Sedimentation rate,
15. Pack cell volume (Haematocrit)
16. Coagulation (e.g., PT, APTT, Clotting time, bleeding time)
17. Mean cell volume, mean cell hemoglobin, mean cell hemoglobin concentration,
18. Differential leukocyte count.
19. Eosinophil count, reticulocyte count.
20. Screening of blood for infectious agents-HIV test, HBV, HCV, V.D.R.L, malaria.
21. Serology; Widal test, VDRL test, RPR, Anti-streptolysin O test, CRP, ANA, Typhoid's and para typhoid antibodies, Tuberculin skin test for the diagnosis of tuberculosis, Skin prick testing for allergic diseases
22. Complete/ routine Urinalysis

RECOMMENDED BOOKS

1. *Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006, Part I & II.*
2. *Lieseke CL, Zeibig, EA. Essentials of Medical Laboratory Practice. F.A. Davis Company, Philadelphia, 2012*
3. *Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.*
4. *Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010.*

URCG-5111 TRANSLATION OF THE HOLY QURAN – III CREDIT HOURS 1 (0-1) (Non-Credit)

Topic	Details
Semester/Level	In some discipline 5th semester and in some discipline 6th Semester/ BS (5th Semester intake) 1st / 2nd
Course Code	URCG-5111
Course Title	Translation of the Holy Quran - III
Credit Hours	1(0-1)
Objectives	• To introduce ethics and highlight its importance, need and relevance for individual and collective life. • To illuminate the students with the Quranic norms of Morality i.e. truthfulness, patience, gratitude, modesty, forgiving, hospitality etc. • To familiarize the students with immoral values like falsify, arrogance, immodesty, extravagance, backbiting etc. • To inculcate ethical and moral values in our youth. • To develop a balanced dynamic and wholesome personality. • To introduce the students to Quranic Arabic grammar in practical manner.
Course Contents:	○ اخلاق (تعارف، ضرورت واہمیت، اقسام، معنویت) اخلاق حسنہ: • برائی کو نیکی سے مٹانا • نیکی کے کاموں میں مسابقت • لوگوں کے درمیان صلح • عدل وانصاف • سچائی • ایثار • سلیم قلب • مہمان نوازی • لغویات سے اعراض • عاجزی وانکساری • نگاہ اور آواز کو پست رکھنا • چال میں میانہ روی • شرمگاہوں کی حفاظت • صبر • شکر • امور میں میانہ روی اخلاق سیئہ: • ظلم اور زیادتی • غرور وتکبر • نفسانی خواہشات کی پیروی • بدگمانی • جھوٹ • چغلی اور تہمت

	• تمسخر اور شیخی خوری • لہو ولعب • برے ناموں سے پکارنا • احسان جتانا اور تکلیف دینا • فضول خرچی اور حد سے بڑھنا • حسد اور تنگ دل • بے پردگی
Grammar:	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)
Details of Chapters and verse Numbers:	• منتخب آیات مع ترجمہ و تجوید • البقرہ(۱۱۴،۲۴۵،۸۳،۱۸۲،۱۷۲،۱۵۲،۱۷۲،۱۵۳،۵۲،۱۷۷،۲۵۰،۲۵۵،۲۴۲،۲۷،۲۷۷،۱۸۲،۱۴۸،۱۸۷،۱۰۹،۲۶۴،۲۶۳،۲۶۲، ۲۱۲،۲۳۱،۹۷،۱۰،۲۴۴،۳۴،۲۵۸،۲۷،۱،۸۳،۲۲۶،۱۹۵،۷۶) • آل عمران(۱۵۴،۱۴،۱۸۵،۲۴،۱۳۴،۱۴۸،۱۳۴،۱۴۵،۱۷،۲۰۰،۱۲۵،۱۳۳،۱۱۴،۱۰۴،۱۰۴،۲۶،۱۰۳،۱۴۱،۱۴۷،۱۵۹) • النساء(۱۳۵،۲۳،۲۲،۱۰۸،۱۰۷،۱۰۵،۵۴،۲۷،۴۰،۱۷۳،۳۶،۲۵،۲۴،۴۷،۵۷،۲۴) • المائدۃ(۵۸،۵۷،۹۳،۱۳،۶،۴۱،۱۹) • النحل(۱۲۶،۹۰،۱۰۵،۱۱۳،۳۰،۱۲۶،۱۲۵) • الرعد(۲۵،۲۰،۲۴،۲۲،۶) • الاعراف(۳۱،۶۶،۵۱،۱۴۶،۴۰،۴،۲۰،۱۴۴،۱۹۹،۹۵،۸۱) • القصص(۵۴،۸۴) • فصلت(۳۴) • الانعام(۳۲،۷۰،۷۰،۱۳۰،۱۵۵،۱۶۰) • النمل(۹۰،۴۶) • الحج(۳۰،۵۸،۶۰،۸۸،۷۷) • الحجرات(۹،۱۱،۶،۱۱،۳،۱۲،۱۵،۱۰) • الاحزاب(۴۳،۵۰،۵۸،۵۸،۵۲،۵۵،۵۹،۳۵،۴۴،۳۵) • الحشر(۹) • طٰہٰ(۷۲) • الانعام(۱۶۴،۱۴۱،۱۱۹،۱۵۱،۶۳،۱۴۷) • ق(۳۴) • الانفال(۲۷،۴۶،۶۱) • الفتح(۱۵) • یونس(۱۰،۱۹،۱۲،۶۶،۲۲،۲۲) • الفرقان(۶۳،۲۱،۶۷،۶۳) • النور(۲۳،۶،۴،۳۰،۳۱،۳۳،۳۳،۶۱،۳۱،۲۲) • لقمان(۶،۳۳،۱۹،۳۲،۱۸) • الاسراء(۳۷،۳۷،۱۱۰،۵،۳۷) • المزمل(۱۸) • المدثر(۶،۴) • المدثر(۴۴) • قاطر(۳۲) • الفتح(۲۹)

▪ البلد(۱۷) ▪ الزمر(۱۰،۳) ▪ الحجر(۸۵) ▪ النجم(۳۱) ▪ الرحمٰن(۶۰) ▪ صور(۸،۱۰۲،۳) ▪ الکہف(۵۶،۴) ▪ الشوریٰ(۳۷) ▪ غافر(۲۸،۲۷) ▪ الحدید(۲۰،۲۰) ▪ مریم(۵۹) ▪ النازعات(۴۱) ▪ التوبہ(۶۵،۶۴،۷۷) ▪ الھمزہ(۱)	

SIXTH SEMESTER

COURSE CODE	COURSE	CREDIT HOURS
MDLT-6223	PARASITOLOGY AND MYCOLOGY	3(2-1)
MDLT-6224	HISTOPATHOLOGY AND HISTOTECHNOLOGY	3(2-1)
MDLT-6225	BIOSAFETY AND BIOSECURITY	3(2-1)
MDLT-6226	PHARMACOLOGY	2(2-0)
MDLT-6227	COMMUNITY MEDICINE & BEHAVIORAL SCIENCES	3(3-0)
MDLT-6228	CLINICAL LAB PRACTICE-II	3(0-3)

MDLT-6223 PARASITOLOGY AND MYCOLOGY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION:

This comprehensive course covers two main areas: parasitology and mycology. The parasitology section introduces clinical parasitology, parasite morphology, classification, pathogenesis, immunology, and diagnosis of parasitic infections. It covers protozoan and metazoan parasites of medical importance, including their life cycles, pathogenesis, clinical findings, laboratory diagnosis, culture, prevention, and control. The course delves into the epidemiology and diseases caused by various parasites, such as Plasmodium spp. (malaria), Giardia lamblia, Entamoeba histolytica, Balantidium spp., Ascaris spp., Taenia spp., Brugia spp., Hymenolepsis spp., Leishmania spp., Trichomonas spp., Wuchereria bancrofti, Toxoplasma spp., Trichuris trichiura, Negleria spp., Ancylostoma spp., Necator spp. (hookworms), Echinococcus spp., Trichinella spp., Schistosoma spp., Diphyllobothrium latum spp., and various flukes.

The mycology section introduces medical mycology, including the history, general composition of fungal cells, taxonomy, and classification of medically important fungi. It covers fungal species associated with AIDS, general characteristics, pathogenesis, clinical findings, laboratory diagnosis, epidemiology, diseases, prevention, and control of various fungi, such as Aspergillus spp., Candida albicans, Fusarium spp., Cryptococcus neoformans, Histoplasma capsulatum, Sporothrix spp., Trichophyton microsporum, Epidermophyton spp., Blastomyces dermatitidis, Coccidioides immitis, and Paracoccidioides brasiliensis. The course also covers antifungal sensitivity tests, antifungal drugs, and antifungal therapy.

The practical component includes various techniques for parasitological and mycological investigations.

COURSE OBJECTIVES:

- To introduce the students with basic concepts in 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 diagnosing parasitic infections
- Will enable students to become familiar with medically important fungi and to diagnose the infections caused by fungi.

Contents

Parasitology

Introduction to clinical parasitology, Parasite (protozoan and metazoan) morphology and classification, general principal of pathogenesis, immunology and diagnosis of parasitic infection.Features and classification of parasites of medical importance. Procedures for collection and preservation of clinical specimens for laboratory diagnosis and parasitic infections. Life cycle, pathogenesis, clinical findings, laboratory diagnosis, culture, prevention and control.Epidemiology and diseases caused by the following parasites:Plasmodium spp., Glardia lamblia, Entamoeba histolytica, Balantidium spp., Ascaris spp., Taenia spp., Brugia spp., Hymenolepsis spp., Leishmania spp., Trihomonas spp., Wucheria bancrofti, Toxoplasma

spp., Trichurus trichura, Negleria species, Anacylostoma spp & Necator spp (Hookworm)., Echinococcus spp., Trichinella spp., Schistosomes spp., Diphyllobothrium latum spp., Flukes: blood flukes, intestinal flukes, lung flukes. Entomology introduction. Medically important vectors etc

Mycology

- Introduction to medical mycology. History
- General composition of fungal cell.
- Taxonomy of medical mycology.
- Classification of medical mycology
- Introduction, Classification of medically important fungi, Fungal species associated with AIDS.
- General characteristics of medically important fungi and their significance to human beings,
- Opportunistic fungi.
- Specimen Preparation
- Procedures for collection and preservation of clinical specimens for diagnostic purposes.
- General Characteristics, Pathogenesis, Clinical Findings, Laboratory Diagnosis,
- Epidemiology and Diseases, Prevention and Control of the following Fungi 30 hours
- Aspergillus spp., Candida albicans, Fusarium spp., Cryptococcus neoforman,
- Histoplasma capsulatum, Sporothrix spp., Philophora spp., Trichophyton microsprum,
- Epidermphyton spp., Blastomyces dermastitidis, Coccidiodes,immitens,
- aracoccidioides brasiliensis.
- Antifungal sensitivity test, Antifungal drugs
- Antifungal agents and therapy.

Practicals:

- Orientation, Use of the Microscope, and Introduction to Parasitological Specimens
- Collection and processing of clinical samples Direct, indirect & Molecular methods
- Urine examination for Parasitological investigations microscopic and macroscopic methods
- Different methods for stool Examination microscopic and staining methods
- Microscopic examination saline wet mount, iodine wet mount,
- Permanent stained smears Iron hematoxyline stain, Trichrome stain
- Modified acid stain
- Concentration techniques for feacal parasites
- Sedimentation and floatation techniques
- Formol detergent concentration technique
- Cellophane Thick fecal Smear technique
- Intestinal parasites Diagnosis of Entameoaba histolytica trophozoites and cysts
- Trichrome staining technique for staining E.histolytica
- Acridine orange technique for E.Histolytica
- Examination of Giardia lamblia trophozoites & cysts from clinical specimen
- Identification of Trichomonas vaginalis
- Blood examination thick and thin blood films methods
- Staining blood films leishman stain, Giemsa stain, Field stain
- Blood concentration methods
- Examination of trypanasomes
- Detection of different stages of malarial parasites in blood
- Field’s Thick film Technique

- Field's Thin Film Technique
- Identification and diagnosis of leishmania parasite
- Identification of male & female worms of Enterobius vermicularis and demonstration of ova
- Demonstration of Ascaris Ova in Stools Saturated Sodium chloride technique
- Demonstration of characteristics eggs of Trichuris trichuria by Zn Sulphate floatation method
- Preservation of parasites Different methods & Fixatives
- Preservation of cyst, eggs, amoebae and flagellates in faeces
- Preservation of Schistosome eggs in urine
- Molecular Techniques for parasite identification e.g PCR
- Quality control and quality assurance in Medical Parasitology lab.

Mycology

Study of growth characteristics, microscopic examination and identification of medically important fungi, collection, transportation and processing of specimens for mycological examination.
KOH preparation for the identification of fungal
hyphae. Germ tube test for yeast identification.
Preparation of medias and stains used in mycology.

Recommended Books

1. *Pearson, R.D., Gillespie, S.H., 2009. Principles and Practice of Clinical Parasitology.1st Edition .Wiley, John & Sons*
2. *Sun, T., 2012. Progress in Clinical Parasitology. Springer-Verlag New York, LLC.*
3. *Zeibig, E., 2012. Clinical Parasitology: A Practical Approach. 2nd edition. Elsevier Health Sciences.*
4. *Manual of Labortary Medicine: A Publication of Armed forces Institute of Pathology: fourth edition, 2012.*

MDLT-6224 HISTOPATHOLOGY AND HISTOTECHNOLOGY CREDIT HOURS 3(2-

COURSE DESCRIPTION

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

COURSE OBJECTIVES

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

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

COURSE CONTENTS

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

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

Stains: Object of staining, Classification of stains, Acids and basic dyes & Basophilic and acidophilic tissue components. Routine Haematoxyline-Eosin Staining of Paraffin Sections. The procedure of haematoxyline-eosin staining and mounting sections & The relation of various steps in this procedure. Special Staining Techniques. GMS, Mucicarmine and Alcian Blue. Stains for Connective Tissue Elements. Mallory's connective tissue stain, Aldehyde fuchsin and Verhoff's stain for elastic fibers, Gordon + Sweet stain for reticular fibres, Toluidine blue staining of mast cells & Von- Geison, Masson's Trichome. Stains for Nervous Tissues: Nissel Stain. Stains for myelin. Histochemical demonstration of lipids: Choice of fixative, Choice of sectioning Technique, Sudan Black B Stain & Staining for frozen section. Histochemical demonstration of glycogen: Choice of fixative and sectioning & best's Carmine staining for paraffin sections. Demonstration of: Calcium, Iron, Melanin, Muscle Tissue PTAH, Amyloid Material, Mucinous Material The PAS Technique: The Schiff reaction, Significance of the Schiff reaction & Procedure of the PAS staining. Special Gross Anatomical Techniques. Preserving and mounting gross anatomical specimen: Preservative fluids: Kaiserling Solution I & II, Mounting specimens in fluid media & Mountings specimens in plastics. Immunohistochemistry. Introduction and significance, Methods of Immunohistochemistry: Direct and Indirect, PAP / Avidin Biotin method, Steps involved in Immunohistochemistry (starting from dewaxing to the final chromogen application), Significance of interpretation of the results: scoring/ staining intensity, Antigen retrieval methods, Types of fixatives, buffering media, enzyme labels and chromogens used in Immunohistochemistry & List of commonly used tumor markers in different diseases and their clinical utility. Biopsy and types of biopsies. Merits and demerits of different types of biopsies, Fixation methods with salient gross and microscopic morphological changes in common diseases of: Gastrointestinal Tract, Genitourinary System (Male and Female), Respiratory tract, Brain and spinal cord, Skin and subcutaneous tissues. Heart and blood vessels, Lymphatic system including tonsils, lymph nodes, the spleen and thymus.

Practical

- Squamous Cell Carcinoma and Papilloma
- Characteristics of Malignancy
- Haemangioma
- Fibroadenoma
- Colloid Goiter
- Leiomyoma and Leiomyosarcoma
- Hyperplasia

- Lipoma
- Osteogenic Sarcoma
- Papillary Carcinoma Thyroid
- Fibroadenoma and carcinoma breast
- Endometrial Hyperplasia
- BPH
- Carcinoma Prostate
- Renal cell carcinoma
- Acute Appendicitis
- Tuberculosis of intestine
- Chronic Cholecystits
- Meningioma

RECOMMENDED BOOKS

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

MDLT-6225 BIOSAFETY AND BIOSECURITY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION:

This is a comprehensive course that provides an in-depth understanding of critical biosafety, biosecurity, and biocontainment aspects in laboratory settings, equipping students with knowledge and skills to assess and manage biohazard risks to ensure personnel, environmental, and community safety. It covers the history of laboratory-acquired infections, biosafety and biosecurity concepts, risk assessment and management strategies, program management, risk communication, biocontainment facility design, operational practices for handling infectious agents, biological safety cabinets, decontamination, waste management, transportation of infectious substances, and emergency planning and response, with practical sessions for hands-on experience.

COURSE OBJECTIVE:

- This course provides an overview of the critical aspects of biosecurity, biosafety and biocontainment.
- Technologists/students will learn how to assess risks for biohazards in the laboratory setting and the strategies to appropriately manage these risks.
- By the end of the course, students will be familiar with international best practices in biorisk management.

COURSE CONTENTS:

1) Introduction to Biosafety

History and incidence of laboratory-acquired infections (LAI), Incidents of secondary transmission from the laboratory, types of laboratory accidents leading to LAIs. Importance of biosafety and biocontainment in minimizing the risk of LAIs

2) Biosafety Concepts and Strategies

Microorganisms into risk groups, relationship between risk groups and biosafety levels. Concepts of primary and secondary barriers.

3) Biosecurity Concepts and Strategies

Relationship between biosecurity and biosafety, challenges of a biosecurity program for microorganisms.

Key components of a biosecurity program (physical security, pathogen accountability, personnel reliability, transport security, information security). Emergency response plan for breaches of biosecurity

4) Risk Assessment

Risk assessment for microorganisms, factors affecting risk assessment (agent, host, environment, behavioural), risk management strategies, ideal risk assessment for laboratories handling dangerous pathogens

5) Biosafety Program Management

Structure of a biosecurity and biosafety program

6) Risk Communication

Explain what is meant by risk communication, communicating crisis information to the public, communication of laboratory accidents and breaches

7) Biocontainment Facilities

New biocontainment laboratory from conceptualization through to certification

8) Operational Biosafety Practices and Procedures

General biosafety practices and procedures applicable to all laboratories handling infectious agents, biosafety practices and procedures applicable to BSL2, BSL3 laboratories.

9) Biological Safety Cabinets

Classes and types of biological safety cabinets (BSC)

10) Disinfection and Decontamination

Define disinfection, germicide, sanitizer, virucide, sterilant and other applicable terms used to describe decontaminants

11) Waste Management

Outline the types of infectious waste generated in the laboratory, treatment methods

13) Transportation of Infectious Substances

Outline the regulatory framework governing the transportation of infectious substances, classification, packaging, labeling, documentation and shipping requirements.

14) Emergency Planning and Response

Responding to spill of infectious materials and other accidents in the laboratory

Practical Work:

- Donning and Doffing of Gloves (Beak method)
- Hand washing steps
- Behavioral cues development
- Responding to NSI
- Responding to unconscious individuals
- Emergency laboratory evacuation
- Donning and Doffing of PPEs
- Spill kit
- Spill management inside BSC and outside BSC
- Recapping of needles
- Booties dance
- Distinguishing safety culture and climate
- Working in Biosafety cabinets, last in- First out rule
- Shipping and packaging of biological substances
- First aid box
- Waste management, disposal, autoclaving etc

RECOMMENDED TEXTBOOKS:

1. Laboratory Biosafety Manual. World Health Organization. 2004

2. Laboratory Biosafety Guidelines. Public Health Agency of Canada. 2004

3. Guidance on Regulations for the Transport of Infectious Substances. World Health Organization. 2007
4. Infectious Substances Shipping Guidelines. International Air Transport Association 2006

MDLT-6226 PHARMACOLOGY CREDIT HOURS 2(2-0)

COURSE DESCRIPTION:

This course covers the fundamental concepts and principles of pharmacology and drug therapy, with a focus on the roles and responsibilities of healthcare professionals in ensuring patient safety. It defines common pharmacological terms, explores relevant historical, legal, and ethical issues, and delves into pharmacokinetics, including drug absorption, distribution, metabolism, and excretion. The course examines mechanisms of drug action, receptors, dose-response relationships, and drug interactions. Additionally, it provides an overview of various drug classes acting on different body systems, such as the parasympathetic system, cardiovascular system, gastrointestinal tract, respiratory tract, and endocrine system. General drug classifications, including analgesics, antibiotics, cardiac medications, CNS stimulants, and diagnostic imaging agents, are also covered.

OBJECTIVES:

- 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.

CONTENTS:

Definitions of a Pharmacology, Clinical pharmacology, therapeutics, Pharmacogenetics, therapeutic index, Pharmacokinetics (Absorption, distribution, metabolism, excretion): Drug passage across cell membrane, Plasma half-life, Steady state concentration, biological half-life, Absorption: sites, enterohepatic circulation, bioavailability, factors affecting systemic availability, pre-systemic elimination, effect of food on drug kinetics, Distribution: protein binding, Metabolism: results of metabolism of drugs, sites of metabolism, phases of metabolism, enzyme induction, enzyme inhibition, Elimination: Excretion, Mechanism of drug action: Different mechanisms of drug action. Receptors: Drug binding to receptors, second messenger, receptor regulation. Dose-response relationship: agonist, antagonist, affinity, potency, efficacy, factors modifying drug response. Drug interactions: Definitions. Types of interaction: harmful and useful. Pharmacological basis of drug interaction: pharmacokinetic interactions; pharmacodynamics interactions; antagonism, synergism. An overview of Drugs acting on parasympathetic system, Antihypertensive drugs, An overview of Analgesics: Narcotics and Non-narcotics, An overview of Drugs acting in gastrointestinal tract, Drugs acting on respiratory tract, An overview of Drugs acting on endocrine system.

General Classification of drugs; Analeptics, analgesics, anesthetics, antibiotics, anticoagulants, anticonvulsants, antidiuretics, antiemetics, cardiac medications, CNS stimulants, coagulants, contrast media, diuretics, dyes, Emetics, gastric medications, Hemostatic agents, Hormones, irrigation solutions, narcotics antagonists, narcotics, neuromuscular blocking agents, obstetrical agents, ophthalmic medications, sedative / hypnotics agents and tranquilizers. Diagnostic Imaging agents.

RECOMMENDED BOOKS:

1. *Lippincott's pharmacology (text book) by Mycek 2nd Edition published by Lippincott Raven 2000.*
2. *Katzung textbook of pharmacology (Reference Book) by Bertram Katzung 8th Edition, Published by Appleton. 2007*

MDLT-6227 COMMUNITY MEDICINE & BEHAVIORAL SCIENCES CREDIT HOURS 3(3-0)

COURSE DESCRIPTION

This course is designed for the students in order to develop strong background knowledge regarding the community health and wellbeing. It provide awareness about the problems faced by people in community at all levels and effective strategies to solve these issues. This course also increase awareness of psychosocial issues faced by individuals and their significant reference groups at various points on the continuum of health and disability. Personal and professional attitudes and values are discussed as they relate to developing therapeutic relationships. Communication skills are emphasized for effective interaction with clients, health-care professionals and others.

LEARNING OBJECTIVES

- Describe impact of environmental, biological, social and behavioral risk factors on health and disease through the epidemiologic methods.
- Discuss agent, host and environmental factors determining health and disease.
- Discuss the community health, diagnosis & to take remedial measure for improving community health
- Explain psychological and ethical factors that influence values about health promotion, wellness, illness and disability
- Demonstrate Skills to effective physical therapist-client relationship for better health care outcomes.

COURSE CONTENTS

COMMUNITY BASED MEDICINE INTRODUCTION

History of Community medicine & rehabilitation. Definition, concept of Health & illness of diseases. Natural History of diseases, levels & prevention.

ENVIRONMENTAL SANITATION & MEDICAL ENTOMOLOGY

Water, waste disposal, Environmental problems & pollution.

GENETICS: Prevention of genetic diseases, Genetic counseling.

GENERAL EPIDEMIOLOGY DESCRIPTIVE EPIDEMIOLOGY: Time, Place, Person.

ANALYTICAL EPIDEMIOLOGY: Case control, Cohort studies.

EXPERIMENTAL EPIDEMIOLOGY RANDOMIZED CONTROL TRIAL SYSTEMIC

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

NON-COMMUNICABLE DISEASES

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

OCCUPATIONAL HEALTH PROBLEMS

M.C.H. and family welfare Programmes, Health care delivery in the community, National Health Policy, National Health programmes including, Programmes, Health Planning Organization.

STRUCTURE OF HEALTH CARE SYSTEM IN THE COUNTRY

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

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

INTRODUCTION OF BEHAVIORAL SCIENCES: Define Behavioral Sciences, discuss its importance in health, Discuss Bio-Psycho-Social Model of Healthcare

BEHAVIOR OF INDIVIDUAL

Nature/nurture debate, Behaviorism and learning theories, Behavioral modifications

COGNITION: Cognition, cognitive development throughout lifespan

SCIENCE OF RELATIONSHIP

Define and discuss communication skills, its types, modes, barriers and factors affecting, Discuss Counseling: steps, scope, indication and contraindications in health setting. Discuss conflict management: Dealing with real life crisis and conflict situations in health settings. Discuss interviewing and its psychosocial factors in health care. Define clinician-patient / client relationship. Discuss concept of boundaries and psychological reactions in clinician – patient relationship such as transference and counter transference. Discuss Problem solving and decision making strategies in health care

STRESS MANAGEMENT

Define and classify of stress, Discuss effects of stress on health and coping strategies, Discuss Relationship of stress and stressors with illness, Define Anxiety, Discuss Psychological defense mechanisms, Adjustment and maladjustment

APPLICATION OF BEHAVIORAL PRINCIPLES IN HEALTH AND DISEASE

Importance of psychological consideration in physical therapy management of Mentally, emotionally and physically compromised patients. Terminally ill and home bound patients

ETHICS

Define ethics, medical ethics, and values, value system, virtues, mores, moral rules and morality. Discuss ethical theories. Discuss principle based approach for physical therapist in ethics such as; Non-maleficence, beneficence, autonomy, fidelity, veracity, paternalism, and Justice. Discuss code of ethics for physical therapist. Discuss ethical dimension of the physical therapist patient relationship, confidentiality, information sharing, and informed consent and ethical dilemmas.

RECOMMENDED BOOKS

1. *Textbooks of Community Medicine, by Prof. H. A. Siddique (2nd Edition).*
2. *Parks text book of preventive & social medicine –K Park.*
3. *Rana MH, Ali S & Mustafa M. A handbook of behavioral sciences for medical and dental students. 2nd ed. Lahore : university of health sciences; 2013.*
4. *Dowrick C. Medicine in society: behavioral sciences for medical students. CRC Press; 2001*

MDLT-6228 C L I N I C A L LAB PRACTICE-II CREDIT HOURS 3(0-3)

Course Description:

This course is designed to help medical Laboratory sciences students to understand different techniques used in Clinical Laboratory for the investigation of Microbiological related diseases, Biochemical,Molecular and Histopathological procedures and role of these in aetiology of different diseases.

Learning Objectives

This course is especially designed for Medical Laboratory Professional to learn the clinical Laboratory skills practically and after reading this course students will be able:

- To perform the basic diagnostic techniques confidently in microbiology department
- To analyze the body fluids for selective substances and viruses using molecular techniques like PCR
- To process the histological biopsies for histological study

Course contents

- Demonstration of equipment used in Bacteriology.
- Identification of unknown bacteria.
- Preparation of culture media; Blood agar, Chocolate agar, MacConkey agar and broth, CLED agar, SS agar, Nutrient agar and broth, Mueller Hinton agar and broth,
- Inoculation and isolation techniques; culture of bacteria on liquid and solid media, streaking plate method,

- Study of cultural characteristics, Biochemical reactions and antibiotic sensitivity of the medically important bacteria *Staphylococcus, Streptococcus, E. coli, Salmonella, Shigella, Pseudomonas, Klebsiella, Proteus, and Vibrio*.
- Antimicrobial susceptibility testing by disc diffusion method, Measurement of Minimum
- Inhibitory Concentration (MIC) and Minimum bactericidal concentration (MBC),
- TB Culture and GenXpert Assay.
- Parasitological examination of Stool, Urine, and Blood.
- Polymerase chain reaction (PCR) for the detection of infectious diseases like HBV, HCV, Coronavirus etc.
- ABO grouping-Cell and serum grouping, Rh grouping, Test for Du antigen,
- Compatibility test-Major and Minor cross matching & Coombs cross matching, Coombs test-Direct and Indirect.
- Immunological tests for immunological disorders (ANA, anti-dsDNA)

RECOMMENDED TEXTBOOKS

1. *Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006, Part I & II.*
2. *Lieseke CL, Zeibig, EA. Essentials of Medical Laboratory Practice. F.A. Davis Company, Philadelphia, 2012*
3. *Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.*
4. *Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010.*

SEVENTH SEMESTER

COURSE CODE	COURSE	CREDIT HOURS
MDLT-6229	CLINICAL BIOCHEMISTRY	3(2-1)
MDLT-6230	CYTOPATHOLOGY AND CYTOTECHNOLOGY	3(2-1)
MDLT-6231	HUMAN GENETICS AND BIOINFORMATICS	3(2-1)
MDLT-6232	BIOTECHNOLOGY	3(2-1)
MDLT-6233	RESEARCH METHODOLOGY & SCIENTIFIC INQUIRY	2(2-0)
MDLT-6234	CLINICAL LAB PRACTICE III	3(0-3)
URCG-5111	TRANSLATION OF THE HOLY QURAN – II	1 (0-1) (Non-Credit)

MDLT-6229 CLINICAL BIOCHEMISTRY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION:

Clinical biochemistry also known as Chemical pathology is an important sub branch of pathology and deals with study of most common and frequent routine laboratory investigations. This course is designed to help students to understand different Biochemical substances in human body and role of these in aetiology of different diseases.

COURSE OBJECTIVE

This basic course is designed to help MLT students and after completing this course participants will be able to:

- To define and understand various biochemical parameters in human fluids and their role in the development of different diseases.
- Demonstrate the role of different biochemical substances in our body and the relation with various diseases like digestive and metabolic enzymes, their control and mechanism of secretion, water, Minerals, Fats, Carbohydrate and proteins, acid base balance and urine
- Analyse different fluids including blood and urine samples in clinical chemistry Lab
- Explain the clinical role of Macromolecules and Micromolecules in respect to diseases

Contents:

Introduction

What is clinical biochemistry?

General clinical biochemistry

Blood glucose and diabetes:

Definition and types of diabetes mellitus, Reference ranges, abnormal values and their clinical significance

Liver function tests:

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

Renal Function Tests.

Classification of renal function tests used in clinical assessment of renal function. Blood urea nitrogen. Serum Urea. Serum creatinine. Creatinine Clearance. Serum Uric Acid.

Electrolytes.

Methods of determination, abnormal values, clinical significance.

Lipid profile tests:

Methods of determination, abnormal values, clinical significance.

Cardiac Function tests:

Cardiac protein markers, Cardiac enzymes, Reference values, abnormal values and their clinical significance

Clinical enzymology: Determinations of the activity of different enzymes of diagnostic importance.

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

Water Balance:
Distribution of body fluids, were intake and output, dehydration and oedema.

Acid Base balance and imbalance:
Metabolic acidosis and alkalosis, Respiratory acidosis and alkalosis.

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

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

Internal and external quality controls
Construction of quality control charts, Interpretation of QC charts/graphs, Westgard Rules.

Practical:
Practical work shall be related to the relevant sub section of this speciality.

1. Collection of Blood Sample and separation of Serum for Clinical lab testing.
2. Liver function tests,
3. Renal function tests,
4. Lipid profile,
5. Serum electrolytes,
6. Glucose,
7. Cardiac function tests.
8. Electrolytes and Mineral estimation
9. Enzymes
10. Hand on semi-automated and fully automated chemistry analyzers. Preparation of reports for different tests of chemical pathology.

RECOMMENDED TEXTBOOKS

1. *Textbook Of Clinical Chemistry By Warley*
2. *Bishop, M. L., Fody, E. P., & Schoeff, L. E. (Eds.). (2013). Clinical chemistry: principles,*
3. *techniques, and correlations (7th ed.). Philadelphia: Lippincott Williams & Wilkins*
4. *Fennema's Clinical Chemistry. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.*
5. *Cheesbrough, M. (2006). District laboratory practice in tropical countries. Cambridge university press.*
6. *Baron, D. N., Whicher, L. T., & Lee, K. E. (1993). New short textbook of chemical pathology. London: ELBS, 1993*
   Marks Basic Medical Biochemistry, A Clinical Approach By Colleen Smith, Allan D. Marks. Michael Lieberman.

MDLT-6230 CYTOPATHOLOGY AND CYTOTECHNOLOGY CREDIT HOURSE 3(2-1)

COURSE DESCRIPTION:

This course introducing the fundamental concepts of cytology and cytopathology, equipping students with techniques in these fields. It covers cell and tissue structure, classification, exfoliative cytology principles, methods for obtaining exfoliated cells, cell morphology, physiology, functions of epithelial cells, and characteristics of cancer cells. The course delves into cytological analysis of body fluids, normal and abnormal urine cytology, pathologic processes affecting cell morphologies like inflammation, repair, regeneration, benign and malignant tumors, and cytology of the female and male genital tracts, respiratory, urinary, gastrointestinal tracts, and circulating blood. It discusses specimen preparation, fixation, staining techniques, and introduces immunocytochemistry, its significance, methods, antigen retrieval, buffering media, enzyme labels, and chromogens used.

COURSE OBJECTIVES:

- To introduce the students with basic concept of cytology and cytopathology
- To equip the student with techniques involved in cytology and cytopathology

Contents

Cell and its structure, classification of cells and tissues, Basic principles of exfoliative cytology, Exfoliation, sites from which exfoliated cells can be obtained and methods for obtaining them. Cell morphology and physiology, Cell functions –lining membrane epithelia, stratified squamous epithelia, columnar epithelia, epithelia serving reproductive function and miscellaneous epithelia. Various cells seen in cytological preparations. Body fluids: method of collection transport and macroscopic and microscopic of Ascitic fluid, pleural fluid, and synovial fluid with special reference to cytology. cytology of normal urine- voided urine and catheterized urine. Cancer cells: Morphologic characters of cancer cells. Morphologic difference between normal cells and cancer cells. Fine Needle Aspiration Cytology (FNAC). Clinical procedures: Preparation and fixation of smears and fluid specimens.

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

Practicals:

Collection of samples and processing.
Cytological fixatives and fixation.
Collection and preparation of fluid sediment for cytological examination
Morphology of normal and abnormal cells
FNA Cytology
Pap Smear
Immunocytochemistry
Preparation and fixation of sputum smears for cytology and preparation.
Preparation and fixation of vaginal and cervical smears for cytology.
Hormonal evaluation of vaginal smears.
Papanicolaou staining-principles and staining procedures.

Maygrunwarld staining-principles and staining procedures.
Identification of cells.
Differentiation between malignant and benign cells.

Recommended Books:

Bancroft's Theory and Practice of Histological Techniques. Elsevier Health Sciences; 2013.
Diagnostic cytology and its Histopathological Basis-Vol-1-E.G.Koss

MDLT-6231 HUMAN GENETICS AND BIOINFORMATICS CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

The course outlines of genetics will assist the students to understand the basic role of genes in human beings. They will be able to diagnose and interpret the genetic disorders and which factors causing the genetic variations.

COURSE OBJECTIVES

On the completion of this course students will be able to understand the:

- Course outlines will lead to discuss the basic concept of human genes, genotype and phenotype, chromosomes and mode of inheritance.
- Basic knowledge about the population genetics, inherited disorders, parental testing and diagnostic procedures.
- Apply basic procedure and use of various instrumentation in human genetics for acquisition of competencies.
- To train students to analyze genetics data for research.

Contents

HUMAN GENETICS

1. **Introduction to genetics**
   Gene, Locus, Allele, Genotype, Phenotype, Homozygote, Dominant, Recessive
   Mutations: Deletion, Insertion, Frame Shift/in-frame, Loss of function
   Genetics and genomics in medicines, The human genome and chromosomal basis of Heredity
2. **HUMAN CHROMOSOME**
   Chromosomes, chromosomal structure abnormalities, X chromosome inactivation and formation of Bar Bodies.
   Cell cycle, Karyotype and chromosome analysis, common chromosomal disorders
3. **MODE OF INHERITANCE**
   The inheritance of one gene segregation
   Mendalian gene inheritance in humans
   The inheritance of two gene independent assortment
   Pedigree analysis
   Sex linked mode of inheritance
4. **Population genetics:**
   Population genetics, Factors causing Genetic variation in Population
   Prenatal testing and diagnostic procedure
   Apply Hardy-Weinberg Equilibrium
5. **Genetic testing & treatment:**
   Genetic counseling, gene therapy

Genetic of gender i.e. determination of male and female gender. Gene Maping, linkage analysis
Genetic diagnosis and its applications, whole genome/whole exon (introduction only), microarray analysis
Prenatal diagnosis, personalized genetic medicines, genetic screening in population, Screening of genetic susceptibility to disease, Ethical issues in Medical Genetics.

BIOINFORMATICS

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:

- Pedigree drawing
- Microarray technique
- Current and Emerging Techniques for Diagnostic Mutation Detection
- Association Studies and Linkage disequilibrium

RECOMMENDED BOOKS:

1. *Human genetics By Robertson, 2007, edition 4th.*
2. *Human Genetics concepts and application By Ricki Lewis, edition 9th*
3. *Introduction to Bioinformatics By Arthur M. Lesk, 3rd edition 2002.*
4. *Bioinformatics: Sequence and genime analysis By David W. Mount, 2nd Edition*

MDLT-6232 BIOTECHNOLOGY CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

This course aims to introduce students to various diagnostic tools, immunization techniques, and therapeutic applications in the field of health biotechnology. The course covers topics such as the molecular basis of diseases, molecular and genetic markers, detection of mutations and infectious agents, active and passive immunization methods (including different types of vaccines), organ transplantation and transplant rejection, applications of transgenic animals, drug delivery systems, blood transfusion, grafting techniques, pharmacogenetics, strategies of gene therapy, biopharmaceuticals from plants, and the use of stem cell technology. The practical component of the course includes hands-on training in techniques like DNA/RNA extraction, PCR, gel electrophoresis, blotting techniques, DNA quantification, troubleshooting PCR reactions, understanding the role of mutagenic agents, and instrumentation techniques like LC-MS and FTIR.

COURSE OBJECTIVE:

- Basic knowledge of Biotechnology and its branches
- To understand the potentials of microorganisms and utilizations of beneficial microorganisms
- To acquaint the student with diagnostic tools, immunization and therapeutics
- Basic techniques used in recombinant DNA technology.

CONTENTS:

Introduction and scope of Biotechnology, Introduction to Health biotechnology, Social acceptance of medical biotechnology, Green revolution, Restriction and modification system, Properties of restriction endonucleases, their occurrence and recognition sequences, PCR: its application and primer designing, Labeling methods of probes, Plasmid as Vector and types. Construction of genomic libraries, Introduction to

cloning. The molecular basis of disease, Molecular and genetic markers, Detection of mutations, Detection of infectious agents, Active and passive immunization, vaccines (live, killed, recombinant DNA vaccines, subunit vaccines, DNA vaccines, edible vaccines), Organ transplantation, transplant rejection, Applications of transgenic animals (animal models of diseases, pharming, farm animals improvement), Drug delivery systems, Blood transfusion, Grafting techniques, Pharmacogenetics, Strategies of gene therapy, gene delivery vehicles, genetic disorders and gene therapy, Biopharmaceuticals from plants, Uses of stem cell technology.

PRACTICALS:

1. DNA extraction protocol
2. RNA extraction protocol
3. DNA/RNA purification
4. Instrumentation of PCR
5. Instrumentation of Gel Electrophoresis
6. Instrumentation of blotting techniques
7. Quantification of DNA by spectrophotometer
8. Troubleshooting and Optimization of PCR reaction
9. Instrumentation of Gel Electrophoresis
10. Instrumentation of blotting techniques
11. Quantification of DNA by spectrophotometer
12. Troubleshooting and Optimization of PCR reaction
13. Role of mutagenic agents in mutation
14. Instrumentation of LC-MS (Brief overview)
15. Instrumentation of FTIR

RECOMMENDED BOOKS:

1. Molecular Biology of Gene by Watson, Cold Spring Harbor Lab Press.
2. Gene Cloning and DNA Analysis: An Introduction by T.A. Brown, Blackwell Science Publishers.
3. Molecular Cloning: A laboratory manual, Cold Spring Harbor Lab Press.
4. Current Protocols in Molecular Biology, Wiley Publishers.
5. Lodish H, Berk A, Zipursky SL. Molecular cell biology. 5th edition. WH Freeman and company, New York
6. Medical Biotechnology by Judit Pongracz, Mary Keen "(2009). Published by Elsevier Health Sciences.
7. Biotechnology and Your Health: Pharmaceutical Applications by Bernice Zeldin Schacter, Bernice Schacter (2005). Published by Chelsea House Publishers,
8. Health and Pharmaceutical Biotechnology by D.M. Chetan, K.P. Dinesh, D.M. Chetan (2006). Published by Firewall Media.

MDLT-6233 RESEARCH METHODOLOGY & SCIENTIFIC INQUIRY CREDIT HOURS 2(2-0)

COURSE DESCRIPTION

This course includes discussion on basic quantitative methods and designs, including concepts of reliability and validity, interpretation of inferential statistics related to research designs, co relational statistic & designs, interclass correlation coefficients, and critical appraisal of the literature.

LEARNING OBJECTIVE

- Identify the basic concepts of research and scientific inquiry and its methodologies
- Identify appropriate research topics

- Define appropriate research problem and parameters
- Construct a project proposal to undertake a research project.
- Discuss scientific Inquiry, its principle and application in medical research.
- Describe Search techniques for literature review
- Differentiate between different levels of evidence, appraisal and different studies with respect to their effectiveness in literature.

COURSE CONTENTS

RESEARCH FUNDAMENTALS

- Research in physical therapy and rehabilitation
- Role, importance, principles and application of Ethics in Rehabilitation research.
- Basic vs applied research.
- Research Problems / Questions, and Hypotheses, Research Paradigms, Research Validity and reliability

SAMPLING

- Discuss Selection of sample: sample & population, basic considerations in sampling, determination of sample size, elimination of sampling bias and types of sampling such as: Random sampling, stratified random sampling, cluster sampling and systematic sampling.

RESEARCH DESIGN

- Describe different research designs
- Differentiate between experimental & non-experimental, qualitative and quantitative and epidemiological research designs.
- Discuss different research methodologies used in experimental, and non-experimental, qualitative and qualitative and epidemiological research designs

RESEARCH PROJECT

- Discuss various components of research synopsis and Thesis
- Develop a Research Plan while taking into account, the ethical, legal and professional obligations

INSTRUMENTATION AND DATA COLLECTION

- Discuss, objectivity and standardization, types of tests and scales, validity and reliability of an instrument, assessment of validity and reliability, development of tests/scale

DATA ANALYSIS & INTERPRETATION

- Analyze data
- Describe types of measurement scales, descriptive statistics and inferential statistic.
- Perform data entry and Analysis using statistical package for Social Sciences (SPSS)

PREPARATION OF A RESEARCH REPORT

- Use Formatting & styling, citation, references & bibliography
- Differentiate theses writing, dissertations & journal articles writing.

SCIENTIFIC INQUIRY

- Describe scientific inquiry, Evidence based approach to scientific inquiry, Principles of scientific inquiry, the application of scientific inquiry to medical laboratory.
- Access digital libraries and different research databases, Effective searching and reviewing literature material.
- Interpret Critical appraisal of published research in the areas of:
    - Examination and Evaluation
    - Diagnosis
    - Prognosis
    - Intervention
    - Harm

- Interpret Critical evaluation of Randomized Control Trial (RCT), Systemic review, Diagnosis and screening tests, Case reports
- Discuss how to conduct clinical research and hierarchy of evidences in clinical researches

RECOMMENDED BOOKS

1. *Essentials of clinical research* By Stephan P. Glasser.
2. *Foundation of Clinical Research by Portney LG Walkais MP in 1993, Publisher by Appleton and lauge USA*
3. *A guide to Research Methodology, Biostatistics and Medical writing by college of physicians and surgeons Pakistan by WHO collaboration center*
4. *Health system research project by Corlien M Varkerisser, Indra Pathmanathan, Ann Brownlee in 1993 by International Development Research Center in New Dehli, Singapore.*

MDLT-6234 CLINICAL LAB PRACTICE III CREDIT HOURS 3(0-3)

COURSE DESCRIPTION:

This course is designed to help medical Laboratory sciences students to understand different techniques used in Clinical Laboratory for the investigation of Microbiological related diseases, Biochemical, Molecular and Histopathological procedures and role of these in aetiology of different diseases.

COURSE OBJECTIVES

This course is especially designed for Medical Laboratory Professional to learn the clinical Laboratory skills practically and after reading this course students will be able:

- To perform the basic diagnostic techniques confidently in immunology/serology department
- To analyze the body fluids for selective substances and viruses using molecular techniques like PCR
- To process the histological biopsies for histological study

Course contents

- Polymerase chain reaction (PCR) for detection of infectious diseases like HBV, HCV, Coronavirus etc. Quantitative PCR for the quantification of viral load and therapeutic response.
- Tuberculin skin test for the diagnosis of tuberculosis, Skin prick testing for allergic diseases,
- Immunological tests for immunological disorders (ANA, anti-dsDNA),
- Routine Histopathology; Introduction to surgical specimens and biopsy, Tissue Processing; Basic steps in tissue processing fixation, dehydration, clearing (Aim of cleaning, different cleaning agents), impregnation, embedding, techniques of casting Blocking, microtome, staining, mounting of histological preparations. Decalcification, Routine Hematoxylin-Eosin staining of paraffin Sections.
- Fine needle aspiration (FNA) cytology, Collection and processing of FNA, Sample collection and smear preparation techniques for specimens from the Female genital tract. Collection and processing of FNA, Sample collection and smear preparation techniques for specimens from the Female genital tract, Respiratory tract, Body cavities and urinary tract. Staining of smears; including PAP, Wright, and Romanowsky stains, Processing of clots and sediments from fluids, Cytological features of normal cellular constituents, Common changes shown in cells in relation to disease and associated malignancy, Role and limitations of cytology in diagnostic pathology. Basic cytological identifications of benign and malignant cells.
- Special Staining Techniques in Histopathology and cytopathology.
- Special staining techniques used in Hematology.

RECOMMENDED TEXTBOOKS

5. *Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006, Part I & II.*
6. *Lieseke CL, Zeibig, EA. Essentials of Medical Laboratory Practice. F.A. Davis Company, Philadelphia, 2012*
7. *Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.*
8. *Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010.*

URCG-5111 TRANSLATION OF THE HOLY QURAN – IV CREDIT HOURS 1 (0-1) (Non-Credit)

Topic	Details
Semester/Level	In some discipline 7th semester and in some discipline 8th Semester/ BS (5th Semester intake) 3rd / 4th
Course Code	URCG-5111
Course Title	Translation of the Holy Quran – IV
Credit Hours	1(0-1)
Objectives	• To familiarize the students with commandments of trade and inheritance mentioned in the Quranic text (with the help of Urdu translation). • Students • To introduce the students to scientific facts and miracles of the Holy Quran and Quranic stress on deep study of Allah's explored universe. • To motivate the students for reading and exploring the last Holy Book revealed by Almighty Allah. • Through memorization students will develop their relation with last revelation.
Course Contents:	○ تجارت اور وراثت: • مال کی تقسیم • تاوان کمال • عوام الناس کا مال • عورتوں کا مال • یتیموں کا مال • کفار کا مال • جائز مال • معاہدے • ربا • قرض
	○ سائنسی حقائق: • تخلیق کائنات • اجرام فلکی • شجر و حجر • زمین و آسمان کے اسرار • ہوائیں اور طوفان • بہائم اور مویشی • حشرات الارض • پہاڑ اور سمندر
Grammar :	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (متن قرآنی پر اطلاق سے توضیحات)
Details of	• منتخب آیات مع ترجمہ و تجوید

Chapters and verse Numbers:	▪ البقرہ(۲۶۱،۲۱۵،۲۶۵،۲۱۹،۲۶۳،۲۷۵،۱۸،۲۶۵،۱۷۷،۲۶۵،۱۶،۲۷۵،۲۸۲،۲۹۲،۲۷۳،۲۷۱،۸۳،۱۷۷،۲۱۵،۲۷۶،۲۷۸،۱۶، ۲۷،۲۲۳،۲۹،۲۵۵،۱۶۳،۲۶۶،۱۶۳،۱۶۳،۵۰،۶۰،۱۶۳،۵۷،۲۱۰،۱۹،۲۶،۷۱،۹۲،۹۳) ▪ آل عمران(۱۱۷،۱۳۳،۱۳۰،۱۹۰،۲۷،۵۹) ▪ النساء(۲۹،۲،۲۹،۱۶۱) ▪ المائدہ(۸۹،۹۵،۷۵،۶۹،۶۰) ▪ التوبہ(۹۸،۲۳،۶۹،۲۳،۲۳،۶۰،۳) ▪ الاعراف(۱۷۲،۱۸۵،۵۷،۵۸،۱۹۳،۱۹۳،۱۶۰،۳۰،۱۳۳،۱۷۶،۱۶۶) ▪ الرعد(۱۷،۳) ▪ الطور(۴۴) ▪ الانعام(۵۹،۹۳،۱۴۱،۱۳۶،۳۸) ▪ الانفال(۲۸،۳۶،۳۱) ▪ الکہف(۵۱،۱۰۹،۲۷،۳۲،۴۵،۱۷،۴۵) ▪ الجاثیہ(۵) ▪ فاطر(۲۷،۱۲،۱۳) ▪ العنکبوت(۲۰،۶۳،۴۱) ▪ الروم(۵۰) ▪ الاسراء(۷۰،۹۹) ▪ الرعد(۲) ▪ النبا(۱۰،۳،۲۲) ▪ یونس(۸۸،۱۰۱،۲۳،۲۳،۵،۲۲) ▪ یوسف(۹۴،۱۳) ▪ الفرقان(۶۲،۵۳) ▪ لقمان(۲۹،۱۶) ▪ طہ(۱۱۴،۵۳) ▪ النحل(۷۵،۱۱،۶۱،۴۹،۷۹،۶۸،۶۸،۱۱۵،۸،۸) ▪ النمل(۶۳،۶۳،۸۸،۶۰،۸۲،۱۶،۱۷،۱۸) ▪ السجدہ(۲۷) ▪ الحدید(۶) ▪ ھود(۴۳،۶) ▪ یٰسین(۳۷،۴۱) ▪ الروم(۳۹،۳۹،۵۰،۱۹،۲۳،۳۶) ▪ فصلت(۳۹،۳۹) ▪ الحج(۶۱،۶۵،۲۲،۷۳) ▪ الحجر(۱۹،۲۲) ▪ الانبیاء(۳۱،۳۰،۴۷) ▪ الزاریات(۴۷) ▪ الزلزال(۱) ▪ القصص(۷۶،۷۹،۸۰،۸۱،۸۲) ▪ النور(۳۷،۲۲،۲۲،۴۰،۴۵،۴۳) ▪ الجمعہ(۱۱،۶۲،۱۰،۱۱،۵)

• القمر(۷) • الواقعہ(۶۹) • الفاطر(۲۰،۱۳) • الملک(۱۹) • الصف(۱۰) • الجن(۱۳) • الشوریٰ(۲۸) • الزخرف(۱۱) • الفیل(۱)	

EIGHTH SEMESTER

COURSE CODE	COURSE	CREDIT HOURS
MDLT-6235	CLINICAL LABORATORY MANAGEMENT AND SUPERVISION	3(2-1)
MDLT-6236	QUALITY ASSURANCE IN CLINICAL LABORATORY	2(2-0)
MDLT-6237	CLINICAL ENDOCRINOLOGY	3(2-1)
MDLT-6238	FORENSIC SCIENCE	2(2-0)
MDLT-6239	AI APPLICATIONS IN HEALTH CARE	2(2-0)
MDLT-6240	RESEARCH/ CAPSTONE PROJECT	6(0-6)

MDLT-6235 CLINICAL LABORATORY MANAGEMENT AND SUPERVISION CREDIT HOURS 3(2-1)

COURSE DESCRIPTION

A medical laboratory is a laboratory where clinical examinations are carried out on clinical specimens to obtain the information about patients health to aid in the diagnosis, treatment and prevention of diseases. In hospital and other patient care settings, laboratory medicine is provided by variety of medical laboratories working on multiple specialty areas of pathology. Credibility of medical laboratories is paramount to the health and safety of the patients relying on the clinical services provided by these laboratories. This course is designed with the main aims of providing the knowledge to medical lab sciences students in their undergraduate studies to understand the principles of establishing and working of medical laboratories providing the information about patient health. The core focus of this course is the leadership, management, laboratory design, service models and the strategies for establishing a medical laboratory in a specialty area. This course also describes the regulations, accreditation and legislation for the establishment of a medical laboratory to provide quality results about patient health. In this course, students will gain theoretical and practical knowledge about the standards of establishing and managing of medical laboratories.

COURSE OBJECTIVES

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

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

COURSE CONTENTS

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

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

STRATEGIC PLANNING

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

REGULATIONS, ACCREDITATION AND LEGISLATION; Prospective Payment System, Deficit Reduction Act, Clinical Laboratory Improvement Act of 1988 (CLIA '88), Physician Self-referral Ban, Ergonomic Safety and Health Program Management Guidelines, Three-Day Rule, Occupational Exposure to Hazardous Chemicals in Laboratories, Occupational Exposure to Blood-Borne Pathogens, Health Insurance Portability and Accountability Act: OIG Compliance Guidelines, CMS National Coverage Determinations: Hazardous Material Regulations, Laboratory-Related Governmental Agencies, Safety, Biological Hazard, Chemical Hazard, Ergonomic Hazard, Waste Disposal.

INTRODUCTION TO PRINCIPLES OF GOOD LAB PRACTICE: Introduction, The fundamental points of good lab practice, The good lab practice principles, Internal Audit, External Audit, Proficiency testing, Accreditation, Lab Record Keeping, Laboratory information system, Optimizing Laboratory workflow and performance Procurements of Lab Consumables and instruments, Budgeting of Labs Inspections of Labs

RESOURCES; Management, Personnel, Facilities: buildings and equipment

CHARACTERIZATION & THE TEST ITEM: Date of dispatch, Number of containers or items, type of contents and quantity, identity of the test item, batch numbers, identity of the person responsible for the dispatch, Name of the transporter and type of carrier.

Practical

Recruitment of Staff
Documentation
Equipments
Test methods
Test Report design/ Certificates
Design of Lab

Size of Lab
Building requirement
Specified areas in lab
Safety
Hygiene
Disposal of Waste

RECOMMENDED BOOKS

1. *Bishop, M. L., Fody, E. P., & Schoeff, L. E. (Eds.). (2013). Clinical chemistry: principles, techniques, and correlations (7th ed.). Philadelphia: Lippincott Williams & Wilkins*
2. *Kumar, V., Abbas, A. K., Fausto, N., & Aster, J. C. (2014). Robbins and Cotran pathologic basis of disease (9th ed.). New York: Elsevier Health Sciences.*
3. *Anwar, M., Waqar, M. A., Khan, F. A., Tariq, W. U. Z., Ahmed, S., Mushtaq, S., ... & Dawood, M. M. (2005). Manual of laboratory medicine. Armed forces institute of pathology, Rawalpindi, Pakistan, 257-260.*
4. *McPherson, R. A., & Pincus, M. R. (2017). Henry's clinical diagnosis and management by laboratory methods (23rd ed.). New York: Elsevier Health Sciences.*
5. *Cheesbrough, M. (2006). District laboratory practice in tropical countries. Cambridge university press.*

MDLT-6236 QUALITY ASSURANCE IN CLINICAL LABORATORY CREDIT HOURS 2(2-0)

COURSE DESCRIPTION:

The course outlines of quality assurance will guide the students to understand the quality controls and how to manage the safety protocols and instruments. They will interpret the laboratory results, identify errors and how to manage laboratory services.

COURSE OBJECTIVES:

On the completion of this course students will be able to understand the:

- The student will be able to describe the fundamental principles of quality assurance in different sections of diagnostic and teaching laboratories.
- Laboratory safety protocols, how to identify the different errors in the processing of samples.
- To understand the requirements for international standard as applied to testing and calibration laboratories
- To provide guidance on implementation & improvement of quality system.
- To understand the requirements for accreditation.

COURSE CONTENTS:

Quality control introduction, concept and costs, The quality management system model, History of laboratory quality management, international laboratory standards, Importance of laboratory quality control in each department of clinical lab requirements, quality policy and objectives, Good documentation practice, Quality Manual and procedures. Document control Client requirements and subcontracting, Purchasing Improvement elements, Records and management of records Internal audits and management, review Staff issues and managing change, Facilities and safety Equipment Purchasing and inventory, Process control sample management, Process control introduction to quality control, Calibration and measurement traceability, Assessment—audits Assessment external quality, assessment norms and accreditation,

Personnel Customer service Occurrence management, Process improvement. Documents and records Information management Organization, Computer issues, Sampling and sample management, Records and management of records, Qualities of lab manager, Cost managements, Staff issues and managing change, Laboratory facilities, Test methods, Equipment management. Computer issues, Quality control and Proficiency Testing programs,

QUALITY ASSURANCE: Protocol (or study plan) review, SOP review, Planning (master schedule, inspection plan), Audits and inspections, Quality assurance statement, QA inspections of suppliers and contractors, Issuing and archiving of QA files and reports.

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

PRACTICALS:

- Western guard graph preparation
- Log sheet preparation
- EOPS Preparations
- SOPs Preparation
- Record Keeping and Maintenance
- Training on ISO certification
- Inventory Maintenance

RECOMMENDED BOOKS:

1. Laboratory quality management system: handbook. World Health Organization
2. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics, 7th edition
3. Laboratory Management: Principles and Processes 2nd Edition by Denise M. Harmening

MDLT-6237 CLINICAL ENDOCRINOLOGY CREDIT HOURS 3(2-1)

Course Description:

This course provides the foundation of skills and knowledge required for the understanding of clinical endocrinology. Topics covered include an overview of endocrinology include the various classes of hormones, sources of hormones, principles of the production and synthesis of hormones, receptors and target tissues, mechanisms of action and regulation, and methods used in endocrinology.

Learning Objectives

Upon completion of this course students should have the:

- Knowledge about how changes to the normal physiology of cells and systems can underlie human diseases and disorders.
- Knowledge primarily of endocrinology in humans.
- Capable of effectively communicating how endocrine systems function.

- Ability to integrate across multiple endocrine systems to better understand the complexity of endocrine-related disorders.

Course contents

1. **Clinical Endocrinology**

   Introduction: Endocrine Glands, Functional anatomy of different endocrine glands,
   General account of chemical nature and biosynthesis of hormones,
   Transport of hormones to the site of action.
   Mechanism of Hormone Action: Hormonal signaling and its role in coordination of molecular, cellular and tissue functions; conceptual account of different types of signaling and transductions,
   Hormone Functions: physiological actions of the hormones of hypothalamus, pituitary, thyroid, parathyroid, endocrine pancreas, adrenal cortex, adrenal medulla, gonads, corpus luteum, pineal, thymus. Endocrine secretions of heart, kidney and adipose tissue.
   Invertebrate hormones. Hormones involved in molting and metamorphosis.
   Control of Hormonal Secretion: Negative and positive feedback regulation.
   The study of hormones, and their diagnostic value in endocrine disorders

2. **Hypothalamus and pituitary:**

   physiology and disorders of the gonadotrophs, prolactin, growth hormone and the hypothalamo-pituitary-adrenal axis, as well as disorders of the posterior pituitary and structural disorders of the pituitary. Myxedema,Hypo & hyperpituitarism, Diabetes inspidus, Amenorrhea.

3. **Thyroid hormones and Parathyroid Hormones**

   Anatomy, physiology and disorders such as hypothyroidism, hyperthyroidism, goitre, thyroid nodules and thyroid cancers. Thyroid function tests, effects of thyroid hormones on metabolism,
   Anatomy, physiology and disorders such as hyperparathyroidism, hypercalcaemia of malignancy, hypocalcaemia, osteomalacia and osteoporosis. Parathyroid effects on Calcium and phosphorus metabolism.

4. **Reproductive, pregnancy and Paediatric Endocrinology**

   Normal growth and development and the physiology of puberty, disorders of growth, development and puberty. Menstrual disorders, hirsutism, fertility, contraception, male and female gonadal dysfunction and endocrinology in gender dysphoria. Endocrinology of normal pregnancy and the management of endocrinopathy in pregnancy.

5. **Pancreatic hormones** and diabetes mellitus

6. **Adrenal cortex and medulla:**

   Anatomy, physiology, adrenal development, homeostatic control, the glucocorticoid receptor and the use of steroid therapy in replacement as well as adrenal investigations. Disorders such as Conn's syndrome, Cushings syndrome, congenital adrenal hyperplasia and phaeochromocytoma.

7. **Endocrine Oncology and genetics**:

   Brief overview of the inherited aspects of endocrine disorders, multiple endocrine neoplasias and inherited disorders of hormone resistance

Practical

- Learn the practical use of scientific equipments used for the determination of various hormones,
- To demonstrate the position of various endocrine glands
- **Endocrine tests:** Cortical hormone, Male and female reproductive hormones and sex hormone (estrogen, testosterone, and progesterone), Adrenal hormones (Aldosterone, Cortisol), Anterior and posterior pituitary hormones [Growth hormone, Prolactin, Thyroid stimulating hormone (TSH),

Adrenocorticotropic hormone (ACTH), Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), Antidiuretic hormone (ADH), Oxytocin], Abnormal values and their clinical significance.

- Experiments to reveal the roles of endocrine glands and their hormones in physiological functions
- To determine the effect of cortisol on biochemical parameters (glucose/protein)
- To determine the effect of MSH on skin pigmentation.

RECOMMENDED TEXTBOOKS

1. *Clinical Chemistry techniques, principles, correlations sixth edition Michael L. Bishop.*
2. *Introduction to Medical Laboratory Technology Seventh Edition by F.J Baker.*
3. *Clinical Chemistry In Practical Medicine by Stewart And Dunlopp*
4. *DeMan, J.M. 2007. Principles of clinical chemistry. Springer Verlag, Heidelberg, Germany.*
5. *A Manual Of Laboratory And Diagnostic Tests By Francis Talaska*
6. *Text Book Of Clinical Chemistrty by Zilva Pannel*
7. *Marks Basic Medical Biochemistry, A Clinical Approach By Colleen Smith, Allan D. Marks. Michael Lieberman.*

MDLT-6238 FORENSIC SCIENCE CREDIT HOURS 2(2-0)

COURSE DESCRIPTION

Forensic science is the study and application of science to the investigation of criminal and civil cases in the criminal justice system. This course introduces students to the scientific method and to the use of applied science from biological and chemical disciplines to benefit legal processes and investigations.

COURSE OBJECTIVES

On the completion of this course, students will be able to understand the:

- The student will be able to describe the fundamental principles and functions of forensic science and its significance to human society.
- Basic knowledge about the forensic science and their applications in crime scene, death investigation and forensic toxicology.
- Molecular aspects for disorders and disease diagnosis with the clear understanding of the molecular components i.e., DNA and its profiling.

Contents:

A. Introduction to Forensic Science

a. Applying Science and the Scientific Method to Legal Investigations
b. The Role of Forensic Science in Legal Processes
c. Working with Law Enforcement
d. The History of Forensic Science
e. Ethics and Responsibilities

B. The Crime Scene

a. Crime Scene Processing
b. Legal Considerations

C. Physical Evidence

a. Common Types of Physical Evidence
b. The Significance of Physical Evidence
c. Evidence Collection and Preservation

D. Crime Scene Reconstruction and Analysis

a. Crime Scene Reconstruction
b. The Physics of Bloodstain Pattern Analysis
c. General Features of Bloodstain Formation

E. Death Investigation

a. Cause, Manner and Mechanism of Death
b. Forensic Pathology
c. Forensic Anthropology
d. Forensic Entomology
e. Forensic Odontology

F. Forensic Toxicology

a. Role of Forensic Toxicology
b. Chemistry and Toxicology
c. Alcohol and Drugs
d. Poisons
e. Tests

G. Fingerprints

a. History of Fingerprinting
b. Fundamentals of Fingerprints
c. Development of Prints
d. Print Analysis

H. Firearms, Tools and Other Impressions

a. Class Vs. Individual Characteristics
b. Types of Firearms
c. Bullet and Cartridge Comparisons
d. Firing Distance
e. Tool Mark Investigation
f. Casting and Comparison
g. Microscopic Analysis

I. DNA and Serology

a. What is DNA
b. DNA Profiling
c. Short Tandem Repeats
d. Sequencing
e. The Nature of Blood

J. Cultural and Psychological Components of Criminal Behaviour

a. The History of Profiling
b. The Limitations of Profiling
c. Cultural, Psychological, and Sociological Aspects of Crime

K. Fire Arson and Explosion Investigation

a. Forensic Investigation of Fire
b. Chemistry of Fire
c. Collection and Preservation of Arson Evidence
d. Flammable Residues
e. Explosions and Explosives

Recommended Textbooks

1. *Saferstein, Richard. Criminalistics: An Introduction to Forensic Science, 12th Edition, Pearson.*
2. *White, P.C. Crime Scene to Court: The essentials of Forensic Science, 2nd Edition, Royal Society of*

Chemistry.
3. *Buchanan"s Text book of Forensic Medicine and Toxicology by Buchanan, 9th ed., Livingstone.*
4. *G. Principles and Practice of Forensic Medicine by Prof. Nasib R. Awan.*
5. *Medical Jurisprudence and Toxicology by Dr. Siddique Hussain.*
6. *Textbook of Forensic Medicine & Toxicology Krishan Vij (4th Edition)*

MDLT-6239 ARTIFICIAL INTELLIGENCE (AI) APPLICATIONS IN HEALTH CARE CREDIT HOURS 2(2-0)

Course Outcomes:

After completion of this course students should be able to:

- Understand what is Artificial Intelligence (AI) and Machine learning (ML)
- Understand the concept of Internet of Things (IoT) and its applications in healthcare
- Analyze the healthcare data and process it using data analysis and statistical tools
- Explore the applications of AI and ML with respect to healthcare domain

Course content

Introduction to **Artificial Intelligence (AI) and Machine learning (ML)**

- Importance and Applications of AI and ML in Healthcare

Types of Machine Learning and its classification

- Decision Tree, Bayesian Classifier, Regression

Neural Networks, their types, and processing

- Neural Networks – learning Models.
- Deep Neural Network, Convolution Neural Networks & Recurrent Neural Networks
- Natural Language Processing
- Commonly Used and Advanced Neural Network architectures
- Computer Vision

Internet of Things (IoT)

- Introduction
- Process flow and Tools
- Use Cases
- Remote Patient Monitoring

Data Representation:

- Introduction to data, data frames
- Data standardization
- Dealing with noise and missing values
- Transforming and normalizing data

Data Analytics:

- Overview of tools like R, Python
- Statistical and Visualization tools

Healthcare data Analysis:

- Sources of the healthcare data
- Pre-processing of the healthcare data

- Handling of the healthcare data
- Creation of analysis-ready datasets

Healthcare datasets – Examples and Case studies
Case studies and Future trends in AI Healthcare

References:

1. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence 3.
2. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press.
3. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning, Springer
4. Adam Gibson, Josh Patterson, Deep Learning, O'Reilly Media, Inc.
5. Guoguang Rong, Arnaldo Mendez, Elie Bou Assi, Bo Zhao, Mohamad Sawan, Artificial Intelligence in Healthcare: Review and Prediction Case Studies, Engineering, Volume 6, Issue 3, 2020, Pages 291-301, ISSN 2095-8099, https://doi.org/10.1016/j.eng.2019.08.015.

MDLT-6240 RESEARCH/ CAPSTONE PROJECT CREDIT HOURS 6 (0-6)

RESEARCH PROJECT

In the finalSemester/ year, a project will be allocated to a single or group of students, depending on available facilitie-s. The In charge / chairperson of the concerned department/institute shall allot a supervisor. Every student shall be evaluated keeping in view their contribution, thorough understanding of work done and comprehensive presentation. The details of the report are given below.

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

Abstract

A maximum of one page (200-250 words) on the work performed and your main conclusions. Abstract should be structured with subheadings background, objective, material and methods, results and conclusion.

Chapter 1. Introduction

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

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

Chapter 2. Literature Review

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

Chapter 3. Methodology

i) Participant Selection (Including ethical considerations)

ii) Experimental Design

iii) Measurement Procedures

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

iv) Analysis of Data

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

Chapter 4. A Results

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

Chapter 5. Discussion

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

Chapter 6. Conclusion

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

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

References:

A list of references must be included at the end of the project document and appropriately referenced within the text according to Harvard reference style by using endnote or any other reference management tool.

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