



STUDY GUIDE

FIRST YEAR BS MLT

MEDICAL LAB TECHNOLOGY



BS in Medical Lab Technology
(BS-MLT) 2023 Batch-VI



Message from the Desk of Principal
Bahria University Health Sciences Campus

PROFESSOR DR. AMBREEN USMANI
MBBS, PhD (Anatomy), MCPS (HPE), PGH
(Bioethics)
PRINCIPAL AND DEAN HEALTH SCIENCES



My Dear Students,

Welcome to Bahria University Health Sciences Campus, where you will spend four years of your life in pursuit of knowledge and become qualified medical lab technologists. We will facilitate you in converting the “information” given in “Books” to “knowledge” with “understanding” and how to use this knowledge ‘wisely’ for the benefit of humanity as health care provider.

This study guide will give you a road map for the forthcoming activities including the objectives, contents, learning strategies and assessment of your educational course; which we regard as essential. Use this study guide as a reference for your “Code of Conduct”. It gives policies and rules pertaining to examinations, electives, attendance and rotations etc. A competent team of experienced professional teaching faculty will guide you towards learning goals in different clinical settings through effective use of different tools of teaching and assessment. You will be encouraged to integrate your learning across the disciplines.

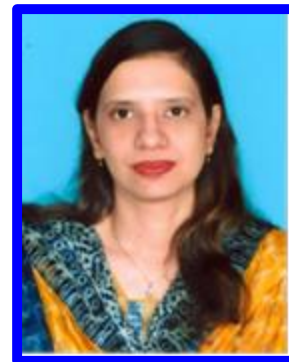
Advancements in medical technology have allowed physicians to better diagnose and treat their patients since the beginning of the professional practice of medicine. Thanks to the continuous development of technology in the medical field, countless lives have been saved and the overall quality of life continues to improve over time.

Your social and moral values should be explanatory. It is here where you change from a technical student to reliable, dependable professional medical technologists/ clinical laboratory scientists, who are empathetic and take responsibility for human lives very seriously and religiously. You as student are expected to demonstrate professional and responsible behavior towards your teachers, colleagues, health professionals and patients. Communication skills and professionalism will play a vital role in your development. You are an adult and adults are responsible for their actions. We use principles of adult learning here. Your teachers are here to guide you but you are the decision makers. Results will depend on how committed, honest and hard-working you are yourself.

I hope you will enjoy the co-curricular activities that are planned for you. Have fun but do not forget that you are here to become a doctor. I hope you will become the best medical lab technologist that you can. Dress up properly and always smile.

Message from the Desk of Principal
Bahria University College of Allied Health Sciences

ASSOCIATE PROFESSOR DR. MEHREEN LATEEF
BSc(H), MSc, MPhil, PhD (Biochemistry),
PRINCIPAL, BAHRIA UNIVERSITY COLLEGE OF ALLIED HEALTH
SCIENCES



Dear Students,

Heartiest congratulations and welcome to Bahria University College of Allied Health Sciences. Selection in medical lab technology department of the college is the evidence of sheer hard work, incessant struggle and relentless efforts towards achieving the goals. State of the art facilities and adroit faculty of this college will ensure smooth transition of a student to a highly trained practitioner. The logical convergence towards the aim will be explained stepwise in the study guide which includes forthcoming activities, content, and learning strategies.

The highly proficient teaching faculty will provide necessary guidance related to learning objectives, effective use of teaching tools and integrated teaching methods. The study programs also support social and moral development of a medical student besides achieving academic excellence. A team of highly trained and professional teachers act as mentors to guide students on social and academic related affairs.

The mandate of medical technology education is to equip laboratory professionals with requisite knowledge, skills and attitude. As a medical lab technology student it is expected of you to keep an exemplary character and honest morality. Plan and strive hard with full sincerity and devotion. This marks the beginning of your professional career where attitude defines your altitude and acts as a panacea in practical life.

INTRODUCTION TO BAHRIA UNIVERSITY HEALTH SCIENCES CAMPUS

Bahria University Health Sciences Campus was established in 2008 by Pakistan Navy under Bahria University and aligned with Higher Education Commission and Pakistan Medical & Dental Council. The University has a beautiful custom built basic sciences wing which also houses the Dental College, Physical Therapy School, an auditorium, a library, video link facilities, a skills laboratory and an advanced multi-disciplinary research laboratory.

The clinical teaching wing is PNS SHIFA, a tertiary care hospital, which takes care of Armed Forces Personnel, their families, parents and civilian patients. There are large variety of clinical cases for students to learn from. Emergency and intensive care facilities are available. About 1500 patients visit PNS Shifa daily. The outpatient departments in all disciplines are in full use and well organized. Where patients are seen promptly, investigations like laboratory tests, X rays and advanced imaging techniques are available on site. Doctors and medical technologists work as a team to ensure the best care of patient.

With its advanced facilities and successful programs of MBBS, BDS, DPT, BUHSC, also started Bachelors in Medical Lab Technology by providing excellent learning environment with modern techniques for medical

technologists to use it for patient diagnosis and treatment.



VISION STATEMENT

To become an internationally recognized university that contributes towards development of nation through excellence in education and research.

MISSION STATEMENT

To prepare allied health sciences professionals equipped with knowledge, skills, and innovative research expertise, attained in a collegiate environment supported through national and international linkages, for provision of high quality services in the health care system.

THE UNIVERSITY AIMS TO REALIZE THIS MISSION BY:

- Training the health sector workforce of the future
- Conducting research that creates new knowledge in the field of health sciences and reviews improvement in existing bodies of knowledge.
- Providing innovative, patient-oriented health care
- Contributing to the economic development and wellbeing of Pakistan through integrated programs in education, research and clinical care.

Why choose BU for this Degree Program

- *Among the top most universities of Pakistan.*
- *Aligned with the guidelines of HEC.*
- *PMDC accredited Medical and Dental College*
- *State of Art Multi-Disciplinary Laboratory with latest and advanced equipment for histopathology and molecular biology available at one place to learn.*
- *Foreign Qualified PhD Faculty*
- *Clinical labs of 700 bedded affiliated Hospital; PNS Shifa is available for students to do practice in final year.*

MEDICAL LAB TECHNOLOGY PROGRAM

MISSION:

The mission of the medical technology program is to prepare allied health sciences professionals equipped with knowledge, skills, and innovative research expertise, attained in a collegiate environment supported through national and international linkages, for provision of high quality services in the health care system.



PROGRAM EDUCATIONAL OBJECTIVES:

- To prepare a team of health technologists who can effectively assist senior health professionals in the delivery of quality health services.
- To prepare graduate medical technologists with the knowledge and abilities needed for

certification by nationally recognized professional agencies.

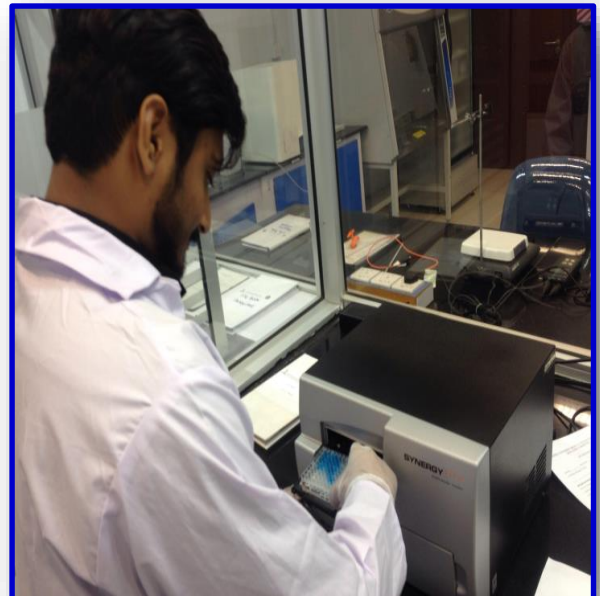
- To prepare paramedical workers for all levels of the health care delivery system from primary to tertiary level.
- To introduce and impart standard technical education with advanced techniques by replacing the conventional methods of pre-service training (certificate level).
- To provide paramedical workers a status and recognition in the health care delivery system through improving their capacity along with increasing awareness of their responsibilities, authority and job description.
- To facilitate paramedical staff with modern skills and techniques and latest technical knowledge of international level.

PROGRAM LEARNING OUTCOMES (PLOs)

- Graduates will be prepared as proficient medical professionals that work with physicians and other members of the healthcare team, preparing specimens and analyzing blood and other body fluids to diagnose and detect disease
- Graduates will be able to deliver the services in performing the full range of clinical laboratory tests in areas such as hematology, clinical chemistry, immunohematology, microbiology, serology/immunology, coagulation, molecular, and other emerging diagnostics.
- Graduates will have diverse responsibilities in areas of analysis and clinical decision-making, regulatory compliance with applicable regulations, education, and quality

assurance/performance improvement wherever laboratory testing is, developed or performed.

- Graduates will possess basic knowledge, skills, and relevant experiences in: C communication to enable consultative interactions with members of the healthcare team, external relations, customer service and patient education;
- Graduates will be able to deal efficiently with all departments including financial, operations, marketing, and human resource management of the clinical laboratory to enable cost-effective, high-quality, value-added laboratory service.
- Graduates will also be able to do effective, timely, accurate, and cost-effective reporting of laboratory-generated information, Research design/practice sufficient to evaluate published studies as an informed consumer.



RATIONALE

Medical technologists are vital members of the health care team. Doctors make many of their decisions about diagnosis and treatment of disease based on laboratory test results and about 70 percent of treatment decisions are based on these results.

By this, the graduate medical technologist will be prepared with the knowledge and abilities needed for certification by nationally recognized professional agencies. With the help of this undergraduate program, highly trained professionals will be developed who can utilize proven technology to provide life-saving medical information used to treat patients.

This program will provide excellent opportunity to technicians already working in clinical laboratories and hospitals to establish their career as medical technologist and can earn a respectable salary.

This program will provide a career path to the students and laboratory professionals with advanced research opportunities as scientists, which can boost their professional career and enhances the promotion chances up till senior and supervisor level.

This program will also enable the medical college to fully utilize its preexisting resources like multidisciplinary research laboratory in undergraduate teaching as well.

This programme will develop conscientious, caring, skilled professionals that are highly capable of comprehending, practicing

medical technology to meet challenges healthcare needs of the society.



FUTURE CARRER PROSPECTUS

- This program provides excellent career opportunities to students with a quality learning experience and development of expertise in technological practices required for professional clinical laboratory scientist.
- Upon completing the degree, graduates will be qualified to work as a medical technologist in
 - Hospitals
 - Diagnostic laboratories
 - Research laboratories
 - Physician's Office
 - Universities
- This program will provide a career path to the students and lab workers with advanced research opportunities as scientists, which can boost their professional career and enhances the promotion chances up to senior and supervisor level.
- This program will provide excellent opportunity to technicians already working in clinical laboratories and hospitals to

establish their career as medical technologist and can earn a decent salary.

CODE OF CONDUCT

The administration will oversee the code of conduct, discipline, dress code and educational performance. There is a Chairperson for Student Affairs and a Chairperson for Post-graduate students. The Associate Deans can be approached as appropriate regarding queries on educational matters, any breach of discipline, and referrals for electives, and advice about leave of absence or leave for medical reasons. All faculty members are also responsible for maintaining all aspects of discipline. Breaches of the university's code of conduct are routinely referred to the committee and disciplinary action is taken as it deems appropriate.

1. DRESS CODE:

MALE STUDENTS:

- Casual Trousers
- Jeans (Plain blue) without images, graphics and write ups
- Casual Shirts (Half/ Full sleeves)
- T Shirts without any messages, images, graphics and write ups
- Casual shoes or Joggers with socks
- ShalwarQameez with shoes (only on Friday)
- Suit/ Combination
- Coat/ Pullovers/ Sweaters/ Jackets in winter

FEMALE STUDENTS:

- ShalwarQameez
- Hijab, Abaya, Chaddaretc
- Full length Jeans with long shirt/ kurta (knee length)
- Light jewelry and light makeup
- Shoes, Sandals and Joggers
- Duppatta/ Scarf is compulsory with all dresses

NOTE: BUHSC students should wear white coat during classes, hospital rotations and other wise as appropriate.

Smoking & Drugs are strictly prohibited at campus.

2. Personal behavior

Your personal behavior at all times should reflect that you are an educated person who is aiming to develop good professional conduct. Please remember to greet your teachers and fellow students as is commensurate with religion and the norms dictated by our society. Politeness should be your mannerism. Tidiness and cleanliness must be adhered to at all times. Please do not litter the BUHSC premises. If you see any litter please pick it up and dispose it off in a litter bin. Rowdy and abusive behavior is to be avoided at all costs. Please report to the vice principal or your Mentor or a senior faculty member if you have experienced such behavior. Men and women will be working

closely together in BUHSC. Be polite and considerate. You should never use gender as basis for teasing or abuse. Violence against students, faculty and staff will be dealt with severely. Ethnic or religious intolerance will not be tolerated at all. Politeness towards auxiliary and support staff is expected at all times.



3. Punctuality

Please be prompt and punctual. Classes will start on time. A teacher may choose to mark you absent if you come late to class. Punctuality is also expected from you in the practical classes, demonstrations and ward clinics. If your teaching involves a patient then punctuality is very important because this patient, who is ill, has given you the favour of allowing you to learn from his/hersuffering. Punctuality also means being on time when using college transport. Do not keep other people waiting.

Punctuality also means that you return from holidays one day before the college re-opens so that you do not miss classes. At BUHSC education starts immediately after any holiday. There is no lag period after leave. You may have a quiz or exam on the day the college re-opens. There will be no relaxation for students who are absent. Please inform

your parents of this and make your travel arrangements accordingly. Avoid taking leave for personal reasons like weddings during the academic year.

4. Conduct in the hospital

When you are working in the hospital be quiet, avoid rowdiness and unnecessary laughter and chatter. Remember the patients need peace, quiet and their rest. You must always wear a white coat. Ladies will wear their dupattas inside the white coat and the gentlemen's ties must be tucked inside the shirt so that infection is not carried from one area to the next. Shoe covers, sterile aprons, caps and gowns must be worn where appropriate. Be polite to the patients, greet them appropriately and inquire after their health and wish them well. All nursing staff must be addressed appropriately and politely. Don't hang around once your work is done. Do not eat or drink inside the wards and treatment areas. Avoid making phone calls and put your phones on the silent mode.

5. Conduct in the library, cafeteria and common rooms

Whenever you are working or studying in the common areas or relaxing in the cafeteria your behavior should be polite, quiet and should not disrupt anybody else's work or study. Loud conversation, loud phone calls, shouting across the room are to be avoided. If you are listening to music, use headphones. Be polite to all the staff. Smoking is not permitted anywhere on BUMDC premises or the hospital.

COLLEGE DISCIPLINARY COMMITTEE

The College Disciplinary Committee deals with the maintenance of discipline on-campus. All cases of breach of discipline will be brought before this committee. The ruling of the committee cannot be challenged. The student will be dealt with accordingly.

Students are to avoid the following:-

- a) Unauthorized use of the University's name or logo that is the property of the University
- b) Harassment, sexual or otherwise, or intimidation of any member of the University community
- c) Coming late for classes. The student may be considered absent and marked accordingly.
- d) Improper/inappropriate dress
- e) Loud and disruptive or aggressive behavior in the Cafeteria or Common rooms or on the premises of BUHSC or PNS Shifa Hospital.
- f) Non clearance of bills/dues. The non-clearance of dues may cause a student to be with-held from a professional examination. The student may also be refused permission to attend classes.

ATTENDANCE POLICY FOR REGULAR STUDENTS

Bahria University rules for undergraduate degree programs will be applicable to medical technology program as per HEC Criteria.

The minimum attendance requirement is 75% in each subject: attendance is for lectures and practical session. No shortfall in attendance will be condoned in any case by any

authority. Attendance is maintained by the Department of Scholastic Records at BUHSC.

- Lecture Attendance is marked at the start of the class.
- Students who come more than 10 minutes late are marked absent.
- A random head count is done to ensure correct entry of attendance.
- The attendance sheet is signed by the teacher and sent to Scholastics Department.
- The attendance is entered into the spreadsheet as soon as possible on that day.
- No correction will be made later than 24 hours as the system is then locked.

The University rules permit a 25% short fall for genuine reasons of personal ill health of a life threatening nature or unavoidable circumstances such as death of a blood relative. This 25% relaxation is not so that you can take a holiday.

If you have less than 75% attendance even for reasons of health, you will be asked to repeat the year. Maintaining adequate attendance is your personal responsibility.

ATTENDANCE POLICY FOR STUDENTS REPEATING A YEAR.

- Students who have been asked to repeat the year either because of poor attendance or failure in the professional examination or supplementary examination will attend all the classes next year.

- Their previous years' attendance will not be counted again.
- If their attendance is less than 75% in their current class they will not be allowed to appear in the next examination.

ELIGIBILITY CRITERIA FOR APPEARING IN ANNUAL EXAMS

A student will be eligible to appear in the annual professional examination if he/she fulfills the following criteria including 75% attendance and must have cleared all financial dues.

BRIEF DESCRIPTION OF THE PROGRAMME:

Bahria University College of Allied Health Sciences is offering Bachelor of Science (BS) in Medical Technology in the field of Clinical Laboratory Science/Clinical Pathology/Clinical Chemistry / Medical Biochemistry. This is a Four-Year degree Program consisting of generalized, compulsory courses and specialized courses aligned with HEC semester rules and Bahria University rules. The program of study is as follows.

Course title	BS in MLT
Course duration	4 YEARS
Study system	SEMESTER SYSTEM Regular
semestersNo.	8
Semester Duration	16- 18 weeks
Total credit hours	130
Courses per semester	4-6
Course Load per Semester	15-18 credit hours

What will the student study in this program?

General Courses:

- English
- Pakistan Studies
- Islamiat
- Computer Skills

Basic Medical Courses:

- Anatomy
- Biochemistry
- Physiology
- Pharmacology
- Microbiology
- Pathology

Specialized Courses

- Histopathology
- Hematology
- Clinical Bacteriology
- Hematology
- Human Genetics
- Communication Skills
- Clinical Virology and Mycology
- Chemical Pathology
- WBCS and Platelets Disorders
- Bioinformatics
- Clinical Parasitology
- Clinical Pathology

**Within BUMDC & PNS
SHIFA always display
your BUMDC
Student Identity Card!**

SEMESTER SYSTEM

There will be two regular semesters (fall, spring) in an academic year. Fall/Spring semesters will spread over 16-18 weeks (inclusive of 1 – 2 weeks for exams).

Summer Semester will be offered to remove deficiencies. It comprises of 8 – 9 weeks of concentrated study for completing remedial course

SUBJECT DISTRIBUTION PER YEAR

Year	Semester	Course codes	Title of Course
1 st year	Spring Semester	MBC101	Medical Biochemistry -I
		HPH102	Human Physiology-I
		HAT103	Human Anatomy-I
		ENG104	English –I
		PKS 105	Pakistan Studies
		CSK 106	Computer Skills
	Fall Semester	MBC 107	Medical Biochemistry -II
		HPH 108	Human Physiology-II
		HAT 109	Human Anatomy -II
		ENG 110	General Pathology-I
		GPT 111	English -II
		IST 112	Islamic Studies

Year	Semester	Course codes	Title of Course
2 nd year	Spring Semester	GPH201	General Pharmacology-I
		HMT202	Hematology - I
		HGN 203	Human Genetics
		DMB 204	Diagnostic Microbiology-I
		GPT 205	General Pathology-II
	Fall Semester	DMB 207	Diagnostic Microbiology-II
		GPH 206	General Pharmacology-II
		HMT 208	Hematology -II
		CPT 209	Chemical Pathology
		CVM 210	Clinical Virology and Mycology
		BSC 211	Behavioral Sciences

Year	Semester	Course codes	Title of Course
3 rd year	Spring Semester	WPD 301	WBCS and Platelets Disorders
		HPT 302	Histopathology
		CPS 30	Clinical Parasitology
		CPT 304	Clinical Pathology
		BTC 305	Biotechnology
	Fall Semester	BSS 307	Biostatistics
		MLI 306	Medical Laboratory Instrumentation
		IAS 308	Immunology and serology
		RMT 309	Research Methodology
		BLB 310	Blood Banking

Year	Semester	Course codes	Title of Course
4 th year	Spring Semester	MLM401	Medical Laboratory Management Skills
		FIC 4032	Fundamentals of infection control
		MCB 403	Molecular Biology
		EPD 404	Epidemiology
		SDB 405	Systematic Diagnostic Bacteriology
		CAC 406	Cytology and Cytogenetics
	Fall Semester	RPT 407	Research Project
		SMR 408	Seminar
		MSC 409	Medical Sociology
		BIN 410	Bioinformatics
		CSK 411	Communication Skills

A weekly schedule will be placed on the notice board regarding the time table.

MODE OF ASSESSMENT AND EXAMINATION

Assessment and examination will be based on HEC and BU rules. In each semester, students

may be required to appear in quizzes, tests, midterms, final examinations, presentations (individual/group), group discussion, and submits projects/assignments/lab reports, etc. These assessment marks (to be determined by the teacher concerned) will have different weightage contributing towards the overall assessment in percent marks. This weightage may be determined on the basis of following guidelines:

Nature of Exam	Weightage
Quiz	5 - 10%
Mid Term	20 - 25%
Assignments/Presentations/ Practical	5 - 25%
Sessional Examination	10 - 15%
Final Examination	35 - 40%

There will be no Supplementary/Special Examination in a Semester System; if a student fails in a course, s/he is required to repeat it

STUDENTS' SUPPORT CENTRE

The Students Support Centre Affairs Office coordinates administrative co-curricular and extracurricular activities. Students are advised to approach the Manager, Students support centre for any academic or non-academic matter.

LIAISON WITH PARENTS

The Students Support Centre also serves as a bridge between the College Administration and parents.

Students' progress reports will be mailed to parents on request at the conclusion of every term and annual examination. Similarly, the

issue of short attendance, college discipline, and violation of college rules and regulations are handled by this Office.

CLUBS FOR EXTRACURRICULAR ACTIVITIES

Different clubs for extracurricular activities are established for students to participate.

1. Literary and debate society
2. Arts and dramatics society
3. Adventure club
4. Event club
5. Community support club
6. Sports club
7. Media club
8. Music club

WHOM TO CONTACT?

ADMINISTRATION BUCHS

- Professor Dr. Ambreen Usmani, Dean Health Sciences & Principal Medical BUHSC
- Sr. Associate Professor, Dr. Mehreen Lateef, Principal Bahria University College of Allied Health Sciences
- Ms. Ayesha Hilal, Sr. Clerk,
- Mr. M. Sameer, Clerk and PA to Principal

CODE OF CONDUCT FOR PROTECTION AGAINST HARASSMENT OF WOMAN AT THE WORK PLACE

1. An informal approach to resolve a complaint of harassment may be through mediation between the parties involved and by providing advice and counseling on a strictly confidential basis.
2. A complainant or a staff member designated by the complainant for the purpose may report an incident of harassment informally to her supervisor, or a member of the Inquiry committee, in which

case the supervisor or the committee member may address the issue at her discretion in the spirit of this Code. The request may be made orally or in writing.

3. If the incident or the case reported does constitute harassment of a higher degree and the officer or a member reviewing the case feel that its needs to be complainant, the case can be taken as a formal complaint.

4. A complainant does not necessarily have to take a complaint of harassment through the informal channel. She can launch a formal complaint at any time.

5. The harassment usually occurs between colleagues when they are alone, therefore usually it is difficult to produce evidence. It is strongly recommended that staff should report offensive behavior immediately to someone they trust, even if they do not wish to make a formal complaint at the time.

Harassment Complaint Cells . Focal Persons
at BUHSC (K) are as follows:

- (1) Prof. Dr. Khalid Mustafa
- (2) Prof. Dr. ShaziaShakoor

Inquiry Committee

3. Inquiry committee for sexual harassment at BUHSC (K) is as follows:

- (1) Prof. Dr. ShamaAsghar
- (2) Prof. Dr. Nasim Karim
- (3) Dr. AiniSamreen

MENTORING SYSTEM

BUMDC has student assisting programs such as mentoring. Mentors have been already assigned at the start of the teaching program in the first year. The students will meet the assigned mentor in the mentor's office to discuss academic, non-academic,

experiences, problems for advice and guidance.

Following students will be supervised by mentors as follows:

Mentor Supervisor: Dr. Mehreen Lateef

1. Dr. LaraibLiaquat, First Batch
2. Ms. ShafaqMahmod, Second Batch
3. Ms. HumairaGhauri, Third Batch
4. Ms. Shabana Nasir, Fourth Batch

Mentors will report to supervisors and then to in-charge mentor



MEDICAL LAB TECHNOLOGY

It comprises of well trained and experienced medical laboratorytechnologist as faculty members.

The Department of Medical Technology is developed under Multidisciplinary Research Laboratory at Bahria Medical and Dental College.

MDRL is located on the second floor of Bahria University Medical and Dental College with advanced research instruments. The main objective of MDRL is to strengthen research environment in medical college for faculty,

students and researchers (undergraduates and postgraduates) by providing scientific instrumentation and technical expertise under one umbrella. With the help of MDRL, clinicians, and scientists will be enabled to explore diagnostic and various treating ways in basic and clinical research and in this way overall health care system can be improved.

It comprises of well trained and experienced PhD faculty members.

Head of Department

- Dr. Mehreen Lateef, PhD
Associate Professor
- Dr. Laraib Liaquat, Assistant Professor
- Dr. Madiha Kanwal, Sr. Scientific Officer
- Ms. Humera Ghouri, Sr. Lecturer
- Ms. Shafaq Mehmood, Sr. Lecturer
- Ms. Syeda Shabana Nasir, Lecturer
- Ms. Hiba Saleem, Lecturer
- Ms. Minza Ahmed, Clinical Technologist

Senior professors and faculty members from Anatomy, Pharmacology, Physiology and Biochemistry and Pathology will be part of Medical Technology Department as shared faculty members and will deliver their expertise through lectures and demonstrations.

Prof. Dr. Ambreen Usmani HOD Anatomy

Prof. Dr. Yasmeen Taj HOD Pathology

Prof. Dr. Nasim Karim HOD Pharmacology

Prof. Dr. Shazia Shakoor HOD Physiology

Prof. Dr. Hassan Ali, HOD Biochemistry

Prof. Dr. Khalid Mustafa, Pharmacology

FIRST YEAR BS MLT

SEMESTER I COURSES

1. MBC-101 Medical Biochemistry -I
2. HPH-102 Human Physiology-I
3. HAT-103 Human Anatomy-I
4. ENG-104 English-I
5. PKS-105 Pakistan Studies
6. CSK-10 Computer Skills

MBC-101 MEDICALBIOCHEMISTRY-I

Course learning objectives (CLOs):

- To identify the chemical composition, biochemical role, digestion and absorption of macro and micro molecules of the cell.
- To recognize different biochemical reactions in cell.
- To explain the mechanism of action of hormones.

Course contents:

Biochemical composition and functions of the cell membrane; Chemistry of signals and receptors; Structure and function of Carbohydrates, Proteins and lipids; biochemical functions of vitamins; biochemical function of Sodium, potassium, chloride, calcium, phosphorus, magnesium, sulfur, iodine and fluoride; Composition and function of saliva, gastric juice, gastric acid (HCL), pancreatic juice, bile and intestinal secretion; Digestion and absorption of proteins, carbohydrates, lipids, vitamins and minerals; Body buffers and their mechanism of action; Acid base regulation in human body; Biochemical mechanisms for control of water and electrolyte balance; Mechanism of action of hormones.

Practicals:

- Good laboratory Practices
- Preparation of Solutions
- Principles of Biochemistry analyzers (spectrophotometer, flame photometer)

- Determination of Cholesterol, TG, HDL, LDL, sugar, calcium and phosphorus in blood
- SOP of centrifuge, water bath and microscope

Course Outcomes:

After completion of the course students are expected to be able to:

- Explain the synthesis of carbohydrates and their role in metabolic pathway with their regulation.
- Explain the synthesis of proteins and their role in metabolic pathways along with their regulation.
- Describe the synthesis of lipids and their role in metabolic pathways along with their regulation.
- Describe the synthesis of nucleic acids and their role in metabolic pathways along with their regulation.
- Describe the acid-base balance, electrolytes balance.

Recommended Books

- Harper's Biochemistry Robert K. Murray, Daryl K. Granner 28th edition 2009
- Medical Biochemistry Mushtaq Ahmad vol. I and II 8th edition 2013

HPH-102 HUMAN PHYSIOLOGY**Course learning objectives (CLOs):**

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

Course Contents:

Functional organization of human body, Mechanism of Homeostasis, Cell structure and its function, function of different Tissue, Functions of the skin, , Types and function of

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

Practicals:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Have an enhanced knowledge and appreciation of human physiology, understand the functions of important physiological systems including the cardio-respiratory, renal, reproductive and metabolic systems.
- Understand how these separate systems interact to yield integrated physiological responses to challenges such as exercise, fasting and ascent to high altitude, and how they can sometimes fail.
- Be able to perform, analyze and report on experiments and observations in physiology.
- Be able to recognize and identify principal tissue structures.

Recommended Books:

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

HAT-103 HUMAN ANATOMY-I**Course learning objectives (CLOs):**

- To definethe basic concepts of anatomy beginning from the cell organization to organ system function
- To explain the basic concepts of general anatomy including skeleton and musculo skeleton.
- To describe the anatomy of Thorax Abdomen and pelvis

Course contents:

Musculo skeletal system(Axial and Appendicular),Axial Skeleton, Different bones of human body, Axial and Appendicular Skeleton, Classification on the basis of development, region and function, General concept of ossification of bones, parts young bone, Blood supply of long bones. Joints Structural Regional and functional classification of joints,Characteristics of synovial joints, Classification of synovial joints, Movements of synovial joints. Muscular System Parts of muscle Classification of muscles (skeletal, Cardiac, smooth) Thoracic wall: Muscles of thorax, Surface Anatomy, Trachea, lungs, pleura, mammary glands (breast), Heart and thoracic vessels. Thoracic cavity: Mediastinum, Lungs, bronchi, blood supply and lymphatic

Abdominal wall: Skin, nerve and blood supply, Muscles of anterior abdominal wall. Abdominal cavity: General Arrangement of the Abdominal Viscera, Peritoneum, Omenta, mesenteries, Stomach, blood, nerve, lymphatic supply, Small intestine, blood, nervous and lymphatic supply, Large intestine: blood nerve and lymphatic supply. The pelvic wall: Anterior, posterior wall, diaphragm. Pelvic cavity: Ureters, urinary bladder Male genital organs, Female genital organs, Muscles of pelvic region, blood supply, nerve supply, Special Senses.

Practicals:

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

Course outcomes:

After completion of the course students are expected to be able to:

- Explain the basic knowledge of human anatomy and physiology, defines anatomy.
- Define the main structures composing human body, relates structure and functions of tissue.
- Explain structure of skeletal system, lists tissues of skeletal system.
- Defines structure and functions of joints, explains properties of bone tissue.
- Describe nervous system and sense organs, categorizes nervous system, and recognizes cells of nervous system.
- Explains structure and functions of sense organs, explain endocrine system, categorizes endocrine organs.
- Describe the properties of circulatory and respiratory systems, lists organs of

circulatory system, and explains structure and functions of heart, lists of types of vessel.

- Explains importance of respiratory system, structure and functions of lungs.
- Explain properties of digestive and excretory systems, lists organs of digestive system, importance of excretory system, and recognizes organs of excretory system.
- Recognize organs of reproductive system, explains structure of female reproductive organ, structure of male reproductive organ.

Recommended Books:

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

Reference Books:

- Netter Atlas of human anatomy 5th Edition Saunders.
- Gray's Anatomy for students 2nd Edition Drake VogalMitcell.

ENG-104 ENGLISH –I

Course Learning Objective (CLOs):

- To enable the students to meet their real life communication needs
- To enhance language skills and develop critical thinking

Course Contents:

Vocabulary Building Skills: Antonyms, Synonyms, Homonyms, One word Substitute, Prefixes and suffixes, Idioms and phrasal verbs, Logical connectors, Check spellings, Practical Grammar & Writing Skill: Parts of Speech, Tenses, Paragraph writing: Practice in writing a good, unified and coherent paragraph, Précis writing and comprehension, Translation skills: Urdu to

English, Reading skills: Skimming and scanning, intensive and extensive, and speed reading, summary and comprehension Paragraphs, Presentation skills: Developing, Oral Presentation skill, Personality development (emphasis on content, style and pronunciation).

Course Outcomes:

After completion of the course students are expected to be able to:

- Heighten their awareness of correct usage of English grammar in writing and speaking
- Improve their speaking ability in English both in terms of fluency and comprehensibility.
- Give oral presentations and receive feedback on their performance
- Improve their reading fluency skills through extensive reading.
- Strengthen their ability to write academic papers, essays and summaries using the process approach.

Recommended books:

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

PKS-105 PAKISTAN STUDIES

Course Learning Objective (CLOs):

- To develop vision of Historical Perspective, Government, Politics, Contemporary Pakistan, ideological background of Pakistan.
- To study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Contents:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Scholarly treat the historical perspective of Pakistan and its contemporary issues.
- Have sufficient knowledge about National Ethics (Culture and Civil Rights (Constitution of Pakistan) and Codes of Ethics and Codes of Conduct (provided by Pakistan Engineering Council).
- Have an in-depth understanding about the working and impacts of a few major civil engineering projects in Pakistan.

Books Recommended:

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

CSK-106 COMPUTER SKILLS

Course Learning Objective (CLOs):

- To explain the basic of computer
- To utilize the MS office, internet and email

Course Contents:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Set up logical storage locations on hard drive so that can easily store and retrieve information.
- Manage MS Outlook files by using tools such as archiving, storage folders and message rules.
- Create a word document and navigate way around the basic applications.
- Create an excel workbook and navigate way around the basic applications.
- Create a professional email signature and learn how to edit and update it with important and timely company information.
- Create and present a basic PowerPoint presentation complete with headings, bullet points and pictures.

Recommended Books:

- Computer science by Muhammad Ashraf, edition 1st 2010

SEMESTER II COURSES

1. MBC-107 Medical Biochemistry -II
2. HPH-108 Human Physiology-II
3. HAT-109 Human Anatomy -II
4. ENG-110 English
5. GPT- 111 General Pathology-I
6. IST-112 Islamic Studies

MBC-107 MEDICAL BIOCHEMISTRY-II

Course Learning Objective (CLOs):

- To describe the metabolism of carbohydrates, lipids and proteins.
- To identify clinical role of enzymes in human being.
- To recognize the facts about nutrition.

Course Contents:

Balance food, Major food groups, Nutritional status of Pakistani nation, Metabolic changes in starvation, Protein energy malnutrition, Regulation of food intake, Obesity; metabolism of carbohydrates (Citric Acid Cycle, Glycolysis, Pentose Phosphate Pathway), proteins (urea and corie cycle), nucleotides (uric acid formation) and lipids (beta oxidation); Respiratory chain and oxidative phosphorylation, components of respiratory chain, electron carriers, ATP synthesis coupled with electron flow, phosphorylation of ADP coupled to electron transfer; clinical diagnostic enzymology: clinical significance of ALT, AST, ALP, LDH, CK, CKMB, Pancreatic lipase and amylase, cholinesterase, G6PD, GGT.

Practicals:

- Determination of liver, cardiac, pancreatic enzymes
- Determination of urea and uric acid.

Course Outcomes:

After completion of the course students are expected to be able to:

- Identify the structural elements of proteins, the basic features of enzyme catalysis and regulation, and the function of hemoglobin in oxygen binding and transport.
- Describe the basic structural features of nucleic acids, the mechanisms by which DNA is transcribed, replicated, and repaired, and how proteins are

encoded in mRNA and synthesized by translation.

- Describe the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways along with their regulation at the epigenetic, transcriptional, translational, and post-translational levels including RNA and protein folding, modification, and degradation.
- Understand the concept of Biochemistry regarding Biomolecules Carbohydrates, proteins, lipids, Nucleic acids, Enzymes, Minerals.
- Have knowledge of intermediary metabolism & regulation of individual metabolism.
- Possess the knowledge of the impairment of metabolism including inborn errors of metabolism.
- Understand the role of nutrition in health & disease.
- Apply biochemical knowledge in normal & diseased states.
- Have knowledge regarding the analysis of biological fluids for its chemical constituents & correlating the same in health & diseases.

Recommended Books:

- Harper's Biochemistry Robert K. Murray, Daryl K. Granner 28th edition 2009
- Medical Biochemistry Mushtaq Ahmad vol. I and II 8th edition 2013

HPH-108 HUMAN PHYSIOLOGY-II

Course Learning Objective (CLOs):

- To recognize the basic concepts of physiology beginning from the organization of the systems to their role in the body.
- Describe the organization and function of various systems

- Explain the physiology of Blood, CVS, Nervous System and special senses
- Students will be able to define immunity, its types and immune reactions

Course Contents:

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

Practicals

Spirometry
Electrocardiography
Blood Pressure Measurement
Normal and abnormal ECG interpretation
Pulse rate measurement
Heart sounds

Course Outcomes:

After completion of the course students are expected to be able to:

- Have an enhanced knowledge and appreciation of mammalian physiology.
- Understand the functions of important physiological systems including the cardio-respiratory, nervous system, cardiovascular system and immunity systems.
- Understand how these separate systems interact to yield integrated physiological responses to challenges such as exercise, fasting and ascent to high altitude, and how they can sometimes fail.
- Be able to perform, analyze and report on experiments and observations in physiology.
- Be able to recognize and identify principal tissue structures.
- Describe the structure of major human organs and explain their role in the maintenance of healthy individuals.
- Explain the interplay between different organ systems and how organs and cells interact to maintain biological equilibria in the face of a variable and changing environment.

Recommended Books

- Essentials of Medical Physiology K Sembulingam, Prema Sembulingam Sixth Edition 2013
- Guyton And Hall Textbook Of Medical Physiology John E. Hall, Arthur C. Guyton Professor and Chair 2006
- Ross and Wilson Anatomy and Physiology in Health And Illness 11th Edition Anne Waugh, Allison Grant 2010

HAT-109 HUMAN ANATOMY-II

Course Learning Objective (CLOs):

- To recognize the basic concepts of anatomy beginning from the cell organization to organ system function
- To describe the anatomy of upper limb, lower limb and head and neck.
- To describe the anatomy and the knowledge about endocrine system

Course contents:

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

Practicals:

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

- Human Models
- Video demonstration
- Study radiographs of upper and lower limb.

Course Outcomes:

After completion of the course students are expected to be able to:

- Describe the upper limb bones of shoulder girdle and arm, muscles, axilla, brachial plexus, cubital fossa, the forearm and hand bones.
- Understand the mechanism of blood supply, nerve supply and lymphatic circulation to lower limb fascia, bones, muscles, femoral triangle, head and neck skull, mandible, cranial nerves, cranial cavity, meninges, brain, orbit, neck.

- Acquire knowledge of endocrine system, classification of endocrine glands, pituitary glands, thyroid Glands, adrenal gland and differences between the cortex and medulla.

Recommended Books:

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

Reference books

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

GPT-111 GENERAL PATHOLOGY-I

Course Learning Objective (CLOs):

- To recognize different pathological processes
- To compare the processes of blood coagulation and embolism
- To understand the mechanism of wound healing and regeneration

Course Contents:

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

Practicals:

- Estimation of Prothrombin Time
- Estimation of Clotting Time

- Estimation of Bleeding Time
- Estimation of Activated Partial Tromboplastin Time

Course Outcomes:

After completion of the course students are expected to be able to:

- Identify the fundamental causes and mechanisms of disease, and the associated alterations in the structure and function of cells, tissues, organs and systems.
- Describe basic mechanisms of cellular pathology, including cell injury, necrosis, and cellular adaptations.
- Describe the etiology and classification of inflammatory responses, and the mechanisms involved in healing and repair.

Recommended Books:

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

ENG-110ENGLISH –II**Course Learning Objective (CLOs):**

- To enhance students writing, reading and listening skills.
- To enhance language skills and develop critical thinking.

Course contents:

Writing Skill: CV and job application, Technical Report writing, Writing styles, Changing narration: Converting a dialogue into a report, Converting a story into a news report, Converting a graph or picture into a short report or story, Active and Passive voice, Letter / memo writing and minutes of

the meeting, use of library and internet resources, Essay writing, Phrases - Types and functions, Clauses - Types and functions, Punctuation: Tenses - Types, Structure, Function, Conversion into negative and interrogative. Speaking Skill: Group Discussion (Various topics given by the teacher), Presentation by the students (individually), Role Play Activities for improving Speaking. Listening Skill: Listening Various Documentaries, Movies, and online listening activities to improve the listening as well as pronunciation of the words.

Course Outcomes:

After completion of the course students are expected to be able to:

- Interpret texts with attention to ambiguity, complexity, and aesthetic value.
- Practice a deliberate writing process with emphasis on inquiry, audience, research, and revision.
- Evaluate genres of writing and write in appropriate genres and modes for a variety of purposes and audiences.
- Read diverse texts within their historical and cultural contexts, developing a critical understanding of how literature can both uphold and resist existing structures of power.
- Deploy ideas from works of criticism and theory in their own reading and writing.
- Identify topics and formulate questions, identify appropriate methods and sources for research, and engage ethically with sources.
- Participate in critical conversations and prepare, organize, and deliver their work to the public.

Recommended Books:

- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492.
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
- Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
- Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

IST-112 ISLAMIC STUDIES

Course Learning Objective (CLOs):

- To learn about Islam and its application in day to day life.
- To provide Basic information about Islamic Studies
- To enhance understanding of the students regarding Islamic Civilization
- To improve Students skill to perform prayers and other worships
- To enhance the skill of the students for understanding of issues related to faith and religious life.

Course contents:

Fundamental beliefs of Islam, Belief of Tawheed, Belief in Prophet hood, Belief in the Day of Judgment, Worships, Salaat / Prayer, Zakat /Obligatory Charity, Saum / Fasting, Hajj / Pilgrimage, Jihad, Importance of Paramedics In Islam, Ethics, Religion and Ethics, Higher Intentions / Objectives of Islamic

Sharia and Human Health, Importance and Virtues of Medical Profession, Contribution and Achievements of Muslim Doctors, Knowledge of the Rights, Wisdom and Prudence, Sympathy /Empathy, Responsible Life, Patience, Humbleness, Self Respect, Forgiveness, Kindhearted, Beneficence, Self Confidence, Observing Promise, Equality, Relation among the Doctors, Jealousy, Backbiting, Envy, Etiquettes of Gathering, Relation between a Doctor and a Patient, Gentle Speaking, Mercy and Affection, Consoling the Patient, To inquire the health of Patient, Character building of the Patient, Responsibilities of a Doctor,

Course Outcomes:

After completion of the course students are expected to be able to:

- Understand basic concept of Islam (faith, pillars and systems etc.) and express their impact on society.
- Present Islam as complete code of life and demonstrate understanding of Islamic Ethics.
- Demonstrate the difference between religion, shahri'ah and fiqh.

Recommended Books:

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

SECOND YEAR BS MLT SEMESTER III COURSES

1. GPH-201 General Pharmacology-I
2. HMT-202 Hematology - I
3. HGN-203 Human Genetics
4. DMB-204 Diagnostic Microbiology-I
5. GPT-205 General Pathology-II

GPH-201 GENERAL PHARMACOLOGY-I

Course Learning Objective (CLOs):

- 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.
- To provide quality patient care in routine as well as advanced procedures.
- To describe the mechanism of drug action at molecular as well as cellular level, both desirable and adverse.
- To explain the principles of pharmacokinetics i.e. drug absorption, distribution, metabolism and excretion and be able to apply these principles in therapeutic practice.

Course Contents:

Definitions of a drug pharmacology, clinical pharmacology, therapeutics, pharmacogenetics, therapeutic index, Pharmacokinetics: 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.

Practicals:

1. Routes of drug administration
2. Dose-Response Curves
3. Effect of adrenaline on pulse rate
4. Effect of beta blockers on heart rate after exercise
5. Source of drug and identification of some raw materials that are source of drug
6. Weight conversions and measurements

Course Outcomes:

After completion of the course students are expected to be able to:

- Demonstrate an understanding of basic pharmacological principles and mechanism of action and classification of drugs.
- Familiar with the therapeutic effects, efficacies, side effects, toxicities and drug interactions.
- Describe the core principles of drug action in terms of bioavailability, pharmacokinetics, pharmacodynamics and mechanism of action of drugs in the treatment of diseases.
- Understand drug efficacy, side effects, toxicities, drug interactions and special emphasis on dosage concerns in special populations such as the young, pregnant women and in the elderly.
- Describe the basic scientific concepts and principles that serve as the foundational underpinnings of the pharmacological sciences including pharmacokinetics, pharmacodynamics, drug metabolism and drug-drug interactions.

- Describe the specific pharmacology of the major drugs and drug classes currently used in medical practice
- Explain the physiological, pharmacological, and psychological effects of acute and chronic exposure of individuals to drugs of abuse.

Recommended Books:

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

HMT-202 HEMATOLOGY-I**Course Learning Objective (CLOs):**

- To introduce the students about the basic concepts in Hematology and acquire skill in practical work to produce students steeped in knowledge of Hematology.
- To equip students with latest advancements in the field of hematology.

Course Outlines:

Introduction to hematology, physiology of blood and composition, introduction to bone marrow, structure and function of bone marrow, blood formation in the body (Intra-uterine and extra-uterine), factors governing hematopoiesis, erythropoiesis, different stages and factor effecting on erythropoiesis, granulopoiesis, different stages and factor effecting on granulopoiesis, megakariopoiesis, different stages and factor effecting on megakariopoiesis, introduction to hemoglobin structure, synthesis and function, complete blood count and its importance, morphology of red blood cells and white blood cells, introduction to anemia and classification of anemia, introduction to hemolysis (physiological and pathological), introduction to WBC disorders, introduction to leukemia, etiology, pathogenesis and its classification, leukocytosis,

leukopenia, neutrophilia, condition related to neutrophilia, neutropenia, condition related to neutropenia, eosinophilia, condition related to eosinophilia, eosinopenia, condition related to eosinopenia, monocytosis, condition related to monocytosis, monocytopenia, condition related to monocytopenia, lymphocytosis, condition related to lymphocytosis, lymphopenia, condition related to lymphopenia, basophilia, condition related to basophillia, introduction to hemostasis, mechanism of hemostasis, function of platelets and coagulation factors, coagulation cascade, quantitative disorder of platelets, , qualitative disorder of platelets. leucopoiesis, introduction to WBC,s disorders, investigations towards WBC,s disorders, introduction to leukemia, causes, classification and diagnosis, introduction to acute leukemia, classification, diagnosis, introduction to acute lymphoblastic leukemia, diagnosis, acute myeloid leukemia, classification and diagnosis, chronic leukemia, classification and diagnosis, chronic myeloid leukemia, pathogenesis, diagnosis and differential diagnosis of chronic myeloid leukemia, chronic lymphocytic leukemia, classification, diagnosis and differential diagnosis, myeloproliferative disorders, introduction to plasma cell dyscrasias, classification, multiple myeloma, lymphoma classification.

Practical:

1. Collection of blood sample
2. Preparation and staining of peripheral blood smear
3. Total leucocyte count, RBC count
4. Determination of absolute values
5. Differential leucocyte count; platelets count and reticulocytes countto determine the ESR
6. Determine bleeding time; prothrombin time; activated partial thromboplastin time
7. Morphology of leukemic slides
8. Automated differential count
9. Flow cytometry
10. Sudan Black B

11. Myeloperoxidase stain
12. Periodic acid shift
13. Esterase stain
14. Leukocytes alkaline phosphatase Score

Course Outcomes:

After completion of the course students are expected to be able to:

- Describe the stages in red blood cell, white blood cells and platelets maturation from stem cell to maturity.
- Recall the structure and function of the red blood cell, the synthesis of haemoglobin and the normal breakdown and recycling of components.
- Define anaemia and give the classification of anaemia based on the size of the red blood cells and the etiology.
- Describe the investigative approach and management of a patient with anaemia.
- Outline the nutritional and metabolic aspects of iron metabolism, including dietary iron, iron absorption, body iron distribution and transport, sign & symptoms, cause of IDA, and lab diagnosis of IDA
- Differentiate, by laboratory tests, anaemia due to iron deficiency from other causes of microcytic anaemia.
- Outline the genetics of alpha and beta Thalassaemia, Discuss how genetic alterations affect the normal physiology of Haemoglobin and the RBCs.
- Describe the clinical consequences of alpha and beta Thalassaemia, Outline the laboratory diagnosis of alpha and beta Thalassaemia

- Define sickle cell disease and sickle cell trait, Outline the genetics of sickle cell disease, clinical consequences and laboratory diagnosis of sickle cell disease
- Define and recognize the Howell Jolly bodies and discuss the mechanism of production and their significance.

Recommended Books:

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

HGN-203 HUMAN GENETICS**Course Learning Objective (CLOs):**

- To memorize basic concept of human genetics
- To demonstrate instrumentation involved in human genetics

Course Contents:

Cell cycle, Introduction to Gene, Locus, Allele, Genotype, Phenotype, Homozygote, Dominant, Recessive, Mutations: Missense, Nonsense, Deletion, Insertion, Frame Shift/in-frame, Loss of function, Gain of Function, Pedigree Nomenclature, Modes of Inheritance-Dominant, Recessive, Autosomal, X-Linked, Mitochondrial, Recurrence Risk, Obligate carriers. X chromosome inactivation and formation of Bar Bodies, Variable expression, Population Genetics- Genotype Frequency, Allele Frequency, Restriction length polymorphism, Factors causing Genetic variation in Population, Genetic Drift, Cytogenetic analysis, Polymorphism Markers, Gene Map, linkage analysis, Genetic diagnosis and its applications.

Practical:

1. Extraction of DNA and RNA
2. PCR amplification of genes
3. Use of Gel documentation
4. Preparation of pedigree

Course Outcomes:

After completion of the course students are expected to be able to:

- Understand and describe the mechanisms that underpin human inheritance.
- Be able to describe the structure, function and replication of DNA as the genetic material.
- Describe gene structure, expression and regulation.
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis.
- Describe modes of inheritance.
- Be aware of the possibility of heterogeneity in a genetic disease and the potential impact on diagnosis.
- Be able to describe clinical features of common chromosomal disorders.
- Be familiar with the aims, methods and practice of genetic counselling.
- Be aware of the differences and similarities between diagnostic, predictive and carrier genetic testing.

Recommended Books:

- Human genetics By Robertson, 2007, edition 4th.
- Human Genetics concepts and application By Ricki Lewis, edition 5th
- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
- Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford

Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

- Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

DMB-204 DIAGNOSTIC MICROBIOLOGY-I**Course Learning Objective (CLOs):**

- To identify basic concepts in bacteriology and mycology.
- To list common bacterial and fungal infections.
- To list diagnosis of common bacterial and fungal infections.
- To recognize basic concepts in diagnostic bacteriology.
- To perform laboratory procedure used in diagnostic bacteriology.
- To introduce the students with basic and differential diagnosis of bacterial infections.
- To introduce the students with technical skills used in diagnostic bacteriology.

Course contents:

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

Introduction to diagnostic bacteriology, Collection, preservation, transport and

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

Practical:

1. Different methods & interpretation of antibiotic sensitivity testing and minimal inhibitory concentration.
2. MTB culture by concentration method.
3. Biochemical tests used for the identification of bacteria.
4. Inoculation and isolation of pure and mixed bacterial culture.
5. Identification of medically important bacteria from pure culture.
6. Special stains used in bacteriology
7. Inoculation and isolation of pure bacterial culture and its antibiotic susceptibility testing.
8. Detection of motility: Hanging drop examinations with motile bacteria, non-motile bacteria.
9. Simple staining methods of pure culture and mixed culture.
10. Gram's staining of pure culture and mixed culture.

11. AFB staining of Normal smear, AFB positive smear.
12. KOH preparation for fungal hyphae.
13. Germ tube test for yeast identification.
14. Gram stain for candida.

Course Outcomes:

After completion of the course students are expected to be able to:

- Demonstrate how to properly use the compound light microscope, as well as know its parts, their functions, how to safely transport and clean it.
- Determine etiologic agent and identify disease given a series of original infectious diseases case studies.
- Describe the structures/functions of external and internal components of both prokaryotic and eukaryotic cells.
- Draw standard growth curves for bacterial cultures and explain factors affecting bacterial growth.
- Outline the physiology and genetic processes of microorganisms.
- Explain the dynamics of host-parasite interaction.
- Explore the characteristics of selected pathogens, and the diseases caused by each.
- Interrogate the role of genes, chromosomes, mutations and human manipulation in heredity of prokaryotic cells.
- Evaluate the best method to control microbes in various settings (chemical, physical or chemotherapeutic agents).
- Demonstrate aseptic technique and safe handling of microbial cultures.
- Prepare smears, perform staining procedures and record microscopic observations

Recommended books:

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

GPT-205 GENERAL PATHOLOGY-II**Course Learning Objective (CLOs):**

- To explain different environmental hazards
- To explain basic systemic diseases

Course contents:

Health effects of climate change, toxicity of chemical and physical agents, environmental pollution, effect of tobacco, effect of alcohol, injury by therapeutic drugs and drugs of abuse, general principles of microbial pathogenesis, special techniques for identifying infectious agents, agents of bioterrorism, heart failure, congenital heart diseases, ischemic heart diseases, hypertensive heart diseases, arrhythmias, atelectasis, chronic obstructive pulmonary disease, asthma, bronchiectasis, pneumonias, pneumothorax, hemothorax, nephrotic syndrome, renal stone,

hydronephrosis, aphthous ulcer, gastritis, peptic ulcer, hemorrhoid, jaundice, liver cirrhosis, viral hepatitis, cholecystitis, urinary tract infections, arthritis, facial palsy

Practicals:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Identify the fundamental causes and mechanisms of disease, and the associated alterations in the structure and function of cells, tissues, organs and systems.
- Describe basic mechanisms of cellular pathology, including cell injury, necrosis, and cellular adaptations.
- Demonstrate the effects of toxicity of chemical and physical agents, environmental pollution, tobacco, alcohol, injury by therapeutic drugs and drugs of abuse.
- Describe the etiology and classification of inflammatory responses, and the mechanisms involved in healing and repair.
- Have knowledge of general principles of microbial pathogenesis, special techniques for identifying infectious agents.

Recommended Books:

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

4TH SEMESTER COURSES

1. GPH-206 General Pharmacology-II
2. DMB-207 Diagnostic Microbiology-II
3. HMT-208 Hematology -II
4. CPT-209 Chemical Pathology
5. CVM-210 Clinical Virology and Mycology
6. BSC-211 Behavioral Sciences

GPH-206 GENERAL PHARMACOLOGY-II

Course Learning Objective (CLOs):

- To provide quality patient care in routine as well as advanced procedures.
- To describe the mechanism of drug action at molecular as well as cellular level, both desirable and adverse.
- To explain the principles of pharmacokinetics i.e. drug absorption, distribution, metabolism and excretion and be able to apply these principles in therapeutic practice.

Course contents:

Drugs acting on cardiovascular system; Drugs for heart failure, anti hypertensive drugs, anti arrhythmic drugs, antianginal drugs, Anti Hyperlipidemic drugs, Blood drugs, Diuretics, Insulin and glucose lowering drugs, Chemotherapeutic drugs, Antibiotics, Drugs acting on Respiratory system, Anesthetics.

Practical:

1. Weight conversions and measurements
2. Preparation Sulfur ointment
3. Preparation of pilocarpine drops
4. Prescription writing

Course Outcomes:

After completion of the course students are expected to be able to:

- Acquire knowledge of the mechanisms responsible for the absorption, distribution, metabolism and excretion of pharmacologically

active molecules, either natural or synthetic.

- Have knowledge of the main pharmacokinetic parameters.
- Have knowledge of the main classes of pharmacological targets, with a specific focus on membrane and intracellular receptors.
- Evaluate the behavior of a pharmacologically active compound based on its pharmacokinetic and pharmacodynamic characteristics.
- Have knowledge of the pharmacologically active compounds and therapeutic activities of medicinal drugs/botanicals belonging to different chemical or therapeutic classes.

Recommended Books:

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

DMB-207 DIAGNOSTIC MICROBIOLOGY-II

Course Learning Objective (CLOs):

- To recognize basic concepts in clinical mycology and virology.
- To describe epidemiology and pathology of fungal and viral infections.
- To list differential diagnosis of fungal and viral infections.
- To perform technical skills used in clinical mycology and virology.
- To recognize basic concepts in clinical parasitology.
- To describe epidemiology and pathology of parasitic infections.

- To list differential diagnosis of parasitic infections.
- To demonstrate technical skills used in clinical parasitology

Course contents:

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

Practical:

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

9. Macroscopic and microscopic examination of stool for adult worms, ova, cysts, larvae.
10. Concentration techniques for intestinal parasites in stool.
11. Collection of blood and preparation of thick & thin smears.
12. Staining of blood smears for blood parasites.
13. Examination of blood smears for malaria & microfilaria and their identification.
14. Microscopic examination of urine for trichomonas vaginalis and shistosoma egg

Course Outcomes:

After completion of the course students are expected to be able to:

- Explain the basic features of every group of microorganisms.
- Diagnose specific diseases on the basis of symptoms and laboratory test results.
- Perform basic microbiology lab procedures using appropriate PPE required for this laboratory course.
- Demonstrate safe handling and proper hazardous waste disposal procedures for microorganisms and chemicals used.
- Perform aseptic transfer techniques and interpretations of laboratory results.
- Identify an unknown bacterial organism based on results of lab procedures performed and through a miniaturized multi-test system; compare findings of these two methods.
- Evaluate physical, chemical and chemotherapeutic agents.

- Perform quantitative plating and turbidity measures to determine the number of bacteria present in a culture sample.
- Prepare smears, perform staining procedures and record microscopic observations.

Recommended Books:

- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006.
- Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3rd ed. MedMaster, 2004.
- Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12th ed. Elsevier Mosby, 2007.
- Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005
- Review of Medical Microbiology and Immunology. Levinson, W., 10th ed. McGraw Hill Professional, 2008.
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26th ed. McGraw-Hill Medical, 2012.

HMT-208 HEMATOLOGY II**Course Learning Objective (CLOs):**

- To introduce the students about the basic concepts in Hematology and acquire skill in practical work to produce a team of Medical Technologists steeped in knowledge of Pathology.

- To equip Medical Technologists with latest advancements in the field of hematology.

Course Outlines:

Iron metabolism, introduction to iron deficiency anemia, different stages and diagnosis, introduction to thalassemia, classification, pathophysiology and its diagnosis, introduction to Sideroblastic anemia, etiology and diagnosis, folate and vitamin B12 metabolism, introduction to megaloblastic anemia, etiology and diagnosis, introduction to G6PD deficiency anemia, pathophysiology and diagnosis, introduction to sickle cell anemia, pathophysiology and diagnosis, introduction to hereditary spherocytosis, pathophysiology and diagnosis, introduction to hemolytic anemia, Immune hemolytic anemia, non immune hemolytic anemia, aplastic anemia, etiology and diagnosis.

ABO and Rh D group system, Kell blood group system, Duffy blood group system, Kidd blood group system, donor selection criteria, phlebotomy of donor, blood products, preparation, storage and its importance, hemovigilance in blood bank, cross match, types of cross match, procedure and its importance, blood grouping and its importance, Coombs test, types and importance, introduction to hemolytic disease of newborn, types, pathophysiology, diagnosis and management, hemolytic transfusion reactions and management.

Introduction to hemostasis, primary hemostasis, secondary hemostasis, coagulation, coagulation factors, inhibitors of coagulation, fibrinolytic system, introduction to hemophilia, classification, diagnosis, thrombotic thrombocytopenic purpura, pathogenesis, and diagnosis, hemolytic uremic syndrome, pathogenesis, diagnosis, von Willebrand diseases, classification and diagnosis, glanzmann thrombasthenia,

barnadsoliar syndrome, immune thrombocytopenic purpura Correction Studies.

Practical:

1. ABO blood grouping (Forward and Reverse grouping)
2. Rh Blood grouping
3. Antibodies screening
4. Cross matching (Major and Minor)
5. Coombs tests (Direct and Indirect)
6. Separation of different blood components
7. Du Test
8. Automated differential count
9. Prothrombin Time
10. Partial Thromboplastin time
11. Fibrinogen Assay
12. FDP's and D-Dimer
13. Clot solubility test for factor XIII
14. Hess's test

Course Outcomes:

After completion of the course students are expected to be able to:

- Describe the common causes of macrocytic anaemia and macrocytosis without anaemia.
- Outline the nutritional and metabolic aspects of vitamin B12 and folate metabolism including dietary aspects, absorption, body distribution and transport.
- Describe the concept of megaloblastic anaemia and the effect of vitamin B12 and folate deficiency on inhibition of DNA synthesis. Compare megaloblastic to non-megaloblastic anaemia.
- Describe the difference between B12 and folate deficiency with respect to underlying causes, time of development of clinical deficiency state and clinical manifestations.

- Describe the signs and symptoms and laboratory diagnosis of macrocytic anaemia and lab diagnosis of vitamin B12 and folate deficiency.
- Outline a simplified classification for the haemolytic anaemias, clinical signs.
- Describe the mechanism involved in the development of anaemia in congenital spherocytosis and in G6PD.
- Describe the mechanism involved in anaemia in PNH and give the three different forms of the disease (haemolytic anaemia, Thrombosis, aplastic anaemia).
- Demonstrate the pathological mechanism that leads to autoimmune haemolytic anemia and discuss warm and cold haemolytic anaemia
- Outline the clinical consequences of Haemolysis, and laboratory diagnosis of a haemolytic anaemias.

Recommended books

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

CPT-209 CHEMICAL PATHOLOGY

Course Learning Objective (CLOs):

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

Course Contents:

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

Practicals:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Demonstrate a capacity to analyse and problem-solve in chemical pathology including the principle and rationale of various analytes that are estimated, the pre-analytical factors that may impact result integrity.
- Apply knowledge and understanding of the clinical tests associated with various pathologies and perform the measurement of a broad range of using a variety of techniques and instrumentation as per established protocols.
- Describe inborn errors metabolism, metabolic defects, lab diagnosis of various metabolic disorders.
- Describe Hormones, synthesis, secretion, function and importance in various biological processes.

- Describe lab diagnosis of hormonal imbalance and abnormal levels.
- Describe bone disorders, vitamin-D synthesis, function and deficiency.

Recommended Books:

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

CMV-210 CLINICAL MYCOLOGY & VIROLOGY**Course Learning Objective (CLOs):**

- To recognize basic concepts in clinical mycology and virology.
- To describe the epidemiology and pathology of fungal and viral infections.
- To list the differential diagnosis of fungal and viral infections.
- To demonstrate technical skills used in clinical mycology and virology.

Course contents:

Introduction to clinical mycology, introduction to fungi, fungal characteristic, morphology, structure, replication and classification, mechanism of fungal pathogenesis, growth and isolation of fungi, laboratory approaches to diagnose fungal infection, clinical categorization of fungal infections, superficial mycoses, cutaneous mycosis, subcutaneous mycoses, systemic mycoses and opportunistic fungi, introduction to clinical virology, Viral morphology, structure, replication and classification, general properties of virus, pathogenesis and control of virus, DNA

viruses (envelop and nonenvelop), RNA viruses (envelop and non envelop), Hepatitis viruses, Arboviruses, tumor viruses, slow viruses and Prions, minor viral pathogens.

Practical:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Outline the general characteristics of viruses, prions, and viroids.
- Follow good laboratory and safety protocols.
- Produce realistic learning objectives and work schedules.
- Recognize the role played by each professional in the laboratory, and work cooperatively as a team.
- Perform a molecular separation technique (gel electrophoresis) and identify a DNA source using DNA fingerprinting.
- Observe bacterial transformation by plasmid DNA and describe an acquired phenotypic trait of the transformed cells.
- Apply immunochromatographic technique procedure (ICT) to detect a

positive HBsAg, HCV, H.pylori, dengue, HIV reaction.

- Apply immunology procedure (ELISA) to detect a positive HBsAg, HCV, H.pylori, HIV reaction in a simulation

Demonstrate aseptic techniques that are appropriate for the allied health fields.

Recommended Books:

- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006.
- Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3rd ed. MedMaster, 2004.
- Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D., A., Weissfeld, A., S., & Bailey, W., R., 12th ed. Elsevier Mosby, 2007.
- Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005
- Review of Medical Microbiology and Immunology. Levinson, W., 10th ed. McGraw Hill Professional, 2008.
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26th ed. McGraw-Hill Medical, 2012.

BSC-211 BEHAVIORAL SCIENCES**Course Learning Objective (CLOs):**

- Organized diagnostic interviews
- Stated diagnostic findings and treatment recommendations
- Outline evaluation and treatment procedures, involving duties such as recording results of diagnostic interviews, lab studies, and/or treatment plans in a

timely way according to the medical records protocols of the rotation site

Course Contents:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Assess the major concepts, theoretical perspectives, empirical findings, and historical trends in behavioral sciences.
- Explain the basic research methods in the behavioral sciences
- Utilize the scientific approach to solve problems related to behavioral sciences
- Define principles and terminology in the behavioral sciences to understand problems related to behavior and mental processes.
- Critical Analysis: Critically analyze existing literature of a topic in psychology.
- Research Design and Statistics: Design research studies, including the application of statistical procedures.

- Written and Oral Communication: Demonstrate written and oral communication skills, especially the ability to write in APA (American Psychological Association) style.
- Application and Social Issues: Articulate how psychological principles can be used to explain social issues, address pressing societal needs, and/or inform public policy.

Recommended Books:

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

5TH SEMESTER COURSES

- 1.WPD-301 WBCs&Plateletes Disorders
2. HPT-302 Histopathology
3. CPS-303 Clinical Parasitology
4. CPT-304 Clinical Pathology
5. BTC-305 Biotechnology

WPD-301 WBC AND PLATELETS DISORDERS

Course Learning Objective (CLOs):

- To explain the concepts in Hematology and perform skills in practical work to produce a team of Medical Technologists steeped in knowledge of Pathology.
- To recognize latest advancement in the field of Pathology.

Course contents:

leucopoiesis, introduction to WBC,s disorders, investigations towards WBC,s

disorders, introduction to leukemia, causes, classification and diagnosis, introduction to acute leukemia, classification, diagnosis, introduction to acute lymphoblastic leukemia, diagnosis, acute myeloid leukemia, classification and diagnosis, chronic leukemia, classification and diagnosis, chronic myeloid leukemia, pathogenesis, diagnosis and differential diagnosis of chronic myeloid leukemia, chronic lymphocytic leukemia, classification, diagnosis and differential diagnosis, myeloproliferative disorders, introduction to plasma cell dyscrasias, classification, multiple myeloma, lymphoma classification, introduction to hemostasis, primary hemostasis, secondary hemostasis, coagulation, coagulation factors, inhibitors of coagulation, fibrinolytic system, introduction to hemophilia, classification, diagnosis, thrombotic thrombocytopenic purpura, pathogenesis, and diagnosis, hemolytic uremic syndrome, pathogenesis, diagnosis, von Willebrand diseases, classification and diagnosis, TTP, HUS, Bernard-Soulier syndrome, immune thrombocytopenic purpura Correction Studies.

Practical:

1. Morphology of leukemic slides
2. Automated differential count
3. Flowcytometry
4. Sudan Black B
5. Myeloperoxidase stain
6. Periodic acid shift
7. Esterase stain
8. Leukocytes alkaline phosphatase Score
9. Prothrombin Time
10. Partial Thromboplastin time
11. Fibrinogen Assay
12. FDP,s and D-Dimer
13. Clot solubility test for factor XIII
14. Hess's test

Course Outcomes:

After completion of the course students are expected to be able to:

- Define WBCs formation and maturation, leucocytosis and leukemoid reaction and compare leukemoid reaction with leukaemia.
- Describe the nature of the malignant process and the concept of clonality; relate this to haematological malignancy –abnormal growth, differentiation and apoptosis.
- Define leukaemia and classify leukaemia into acute (AML and ALL) and chronic (CML and CLL) based on clinical and laboratory findings.
- Compare and contrast the main differences between acute and chronic leukaemia.
- Describe the classification of Acute Myeloblastic Leukaemia based on FAB and WHO classifications.
- Describe the diagnostic pathway required to confirm the diagnosis of leukaemia and describe the prognostic factors that influence the treatment pathway.
- Explain the pathology and clinical manifestations of multiple myeloma, staging and lab diagnosis of multiple myeloma
- Define solitary plasmacytoma, Lymphoplasmacytic lymphoma (Macroglobulinaemia Waldenström) and describe its clinical manifestation
- Define the term lymphoma, clinical manifestations and lab investigation of a patient with lymphoma.
- Construct a simplified classification of Non-Hodgkin's lymphoma based on the cell size, cell type, pattern of growth and grade of malignancy, staging of lymphoma and list the criteria used for staging.

- Define the process of haemostasis, key elements of the haemostatic mechanism (primary and secondary haemostasis).
- Outline the cascade of coagulation and explain the function of each coagulation factor, describe the relationships among platelet function, von Willebrand factor, fibrinogen and explain their impact on haemostasis.

Recommended Books:

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

HPT-302 HISTOPATHOLOGY**Course Learning Objective (CLOs):**

- To recognize basic concepts in Histopathology and acquire skill in practical work.
- To produce a team of Medical Technologists steeped in knowledge of Pathology.
- To demonstrate latest advances in techniques in the field of Pathology.

Course Contents:

Reception and Fixation of Biopsy, Fixatives: Purpose, types and preparation of fixatives, Qualities of good fixative, factors affecting fixation, Gross examination, Processing of tissues: manual and automation, Steps in processing: dehydration, clearing and impregnation, Embedding and cutting of sections, Microtome & tissue sectioning techniques, Floating water bath, Decalcification of bone, Knife sharpener, H and E staining, frozen sections: Procedure and importance, cryostat, PAS: stain, Congo red stain, oil red stain, ZeihlNeelsen, giemsa and reticulocytes stain.

Practicals:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Recognize and describe the fundamental classes of tissues and distinguish between tissue types within each class.
- Describe the structure of organs at the histological level.
- Locate and describe the major organs of the mammalian body.
- Review the organization of each organ system and describe and define its components.
- Identify bone markings and their normal variations on human specimens.
- Identify the steps in tissue processing that all tissue specimens undergo from arrival in the laboratory to the completed report.
- List the equipment and reagents needed to process routine tissue specimens.
- Identify the role of the histotechnologist in tissue sample preparation in clinical, research, veterinary, and other histology laboratories.
- Acquire the internet to locate histotechnology journals, newsletters, conferences, and support resources to be used in subsequent courses and future careers.

Describe regulatory and accrediting agencies that set standards for histotechnology laboratories

Recommended Books:

- Manual of Laboratory Medicines AFIP, 3rd Edition 2005 Publication Armed Forces Institute of Pathology, Rawalpindi, Pakistan
- Wheater's Functional Histology by Paul R. Wheater 3rd Edition 1995 ELBS with Churchill Livingstone UK 6th edition 2013

CPS-303 CLINICAL PARASITOLOGY

Course Learning Objective (CLOs):

- To recognize basic concepts in clinical parasitology.
- To describe epidemiology and pathology of parasitic infections.
- To list differential diagnosis of parasitic infections.
- To perform technical skills used in clinical parasitology.

Course Contents:

Introduction to clinical parasitology, Parasite (protozoan and metazoan) morphology and classification, general principal of pathogenesis, immunology and diagnosis of parasitic infection, Protozoan: Sporozoa (Plasmodium, Toxoplasma, Cryptosporidium, Isospora), Rhizopods (Entamoeba histolytica, Naegleria, Acanthamoeba, Balantidium coli), Flagellates (Giardia lamblia, Trichomonas vaginalis, Leishmania, Trypanosoma), Metazoan: Intestinal nematodes (Enterobius vermicularis, Trichuris trichiura, Ascaris lumbricoides, Nectar americanus, Ancylostoma duodenale, Strongyloides stercoralis), Tissue nematode (Wuchereria bancrofti, Brugia malayi, Onchocerca volvulus, Loa loa, Dracunculus medinensis), Cestode (Taenia saginata & solium, Diphylobothrium latum, Hymenolepis nana, Echinococcus) and Trematode (Paragonimus, Clonorchis, Schistosoma, Fasciola species).

Practical:

1. Identification of parasites of Medical importance dealt in the theory.
2. Macroscopic and microscopic examination of stool for adult worms, ova, cysts, larvae.
3. Concentration techniques for intestinal parasites in stool.
4. Collection of blood and preparation of thick & thin smears.
5. Staining of blood smears for blood parasites.
6. Examination of blood smears for malaria & microfilaria and their identification.
7. Microscopic examination of urine for trichomonas vaginalis and schistosoma egg.

Course Outcomes:

After completion of the course students are expected to be able to:

- Distinguish the individual parasitic infectious diseases.
- Recognize the protozoan infectious diseases.
- Explain the methods used for diagnosis and treatment of protozoan infectious diseases.
- Recognize the protozoan infectious agents of individual flora regions of human body.
- Distinguish the individual helminthic infectious disease.
- Recognize the helminthic agents.
- Explain the methods used for diagnosis and treatment of nematodal infectious diseases.
- Distinguish the methods used for protection of parasitic infectious disease.

Recommended Books:

- Sherris Medical Microbiology: An Introduction to Infectious Diseases.

Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003.

- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006.
- Clinical Microbiology Made Ridiculously Simple. Gladwin, M., & Trattler, B., 3rd ed. MedMaster, 2004.
- Medical Microbiology, Kayser, F., H., & Bienz, K., A., Thieme, 2005
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26th ed. McGraw-Hill Medical, 2012.

CPT-304 CLINICAL PATHOLOGY

Course Learning Objective (CLOs):

- To recognize basic concepts in clinical pathology and acquire skill in practical work to produce a team of Medical Technologists steeped in knowledge of Pathology.
- To demonstrate latest advancement in the field of Pathology

Course Contents:

Urine: Physical, chemical and microscopic composition of urine. Faeces: Physical, chemical and microscopic composition of faeces, Cerebrospinal fluid: Physical, chemical and microscopic composition of CSF. Aspiration fluids: Physical, chemical and microscopic composition of ascetic, pleural, pericardial and synovial fluids. Semen analysis: Physical, chemical and microscopic composition of seminal fluid, Urinary Calculi.

Practicals:

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

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Describe urine formation, excretion, abnormal volumes of urine in different disorders
- Explain principles of each test included in a routine urine physical, chemical and microscopic examination
- Explain principles of each test included in a routine faeces physical, chemical and microscopic examination
- Describe the composition, formation and function of selected body fluids, explain the functions of the different body fluids
- Evaluate and correlate body fluid laboratory results for the differential diagnosis of various disorders

Recommended Books

- Manual of Laboratory medicines AFIP, Third Edition 2005 Publication Armed Forces Institute of Pathology Rawalpindi Pakistan.
- District laboratory practice in tropical countries Vol. 1 & 2 Monica Cheesbrough Cambridge University Press Low Price Edition 2000.

- Clinical chemistry: principles, methods & interpretation 2nd Edition by Prof. Dr. Abdus Salam Khan Gandapur 2003. Tahir Instruments Ltd Singapura Road Lahore-Pakistan.

BTC-305 BIOTECHNOLOGY

Course Learning Objective (CLOs):

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

Course Contents:

Introduction and scope, Green revolution, Restriction and modification system, Properties of restriction endonucleases, their occurrence and recognition sequences, Practical uses of endonucleases, DNA sequencing, PCR: its application and primer designing, Labeling methods of probes, Construction of genomic libraries, important enzymes production, vaccine production, Genetic engineering for better animal production, cloning, herbicide resistant crops, petiole plants, Bioremediation.

Practicals:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Apply biotechnological methods to investigate the treatment strategies against new and old disease.

- Establish modern strategies using genetic engineering and tools to harness microorganisms for production of high value fine chemicals and pharmaceuticals.
- Explore the methods to improve food quality, quantity and processing.
- Introduce innovative approaches with respect to vaccine production.
- Design and initiate research in the field of biotechnology by linking PCR and its application, DNA sequencing and genetic engineering

Recommended Books:

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

6TH SEMESTER COURSES

1. MLI-306 Medical Laboratory Instrumentation
2. BSS-307 Biostatistics
3. IAS-308 Immunology and Serology
4. RMT-309 Research Methodology
5. BLB-310 Blood Banking

MLI-306 MEDICAL LABORATORY INSTRUMENTATION

Course Learning Objective (CLOs):

- To demonstrate all instruments used in pathology laboratory.

Course Contents:

Principle, procedure, calibration and maintenance of microscope, colorimeter, photometer, flame photometer, water bath, centrifuge, balance, incubator, pH meter, vortex mixer, oven, water still, deionizer, safety cabinet, electrophoresis assembly, thermo-cycler, chromatography,

spectroscopy, flowcytometry, hematology analyzer, blood bank instruments and radiometric system.

Practicals:

Practical demonstration of

1. Microscope
2. Colorimeter
3. Photometer
4. Flame photometer
5. Water bath
6. Centrifuge
7. Balance
8. Incubator
9. pH meter
10. Vertex mixer
11. Oven
12. Water still
13. Deionizer
14. Safety cabinet, electrophoresis assembly, thermo-cycler, chromatography, spectroscopy and hematology analyzer

Course Outcomes:

After completion of the course students are expected to be able to:

- Demonstrate conceptual knowledge and application of medical laboratory Instruments.
- Describe methods, calibration and maintenance of all equipment's present in Laboratory.
- Recognize factors that affect laboratory procedures and results within predetermined limits, when indicated for resolution.
- Comply laboratory Instruments with safety regulations and universal precautions.
- Monitor quality control within predetermined limits.
- Demonstrate measuring of basic medical parameters of the equipment for using in diagnostic lab.

- Basic knowledge to perform preventive and corrective maintenance of laboratory Instruments or refer to appropriate source for repairs in case of troubleshooting.
- Apply safety standards and safety procedures for all lab equipment's.
- Utilize computer technology in clinical laboratory data processing, data reporting, and information retrieval.
- Recognize and participate in activities which will provide current knowledge and upgrading of skills in laboratory medicine.

Recommended Books:

- Medical instrumentation By Kaplin, edition 5th .

BSS-307 BIOSTATISTICS**Course Learning Objective (CLOs):**

To introduce the student with the significance of bio-statistics, statistics means basic concept, describing and exploring data, normal distribution, sapling distribution and hypothesis testing, basic concept of probability and application of statistics and social research.

Course Contents:

Topics in univariate statistics: basic, Introduction, important terms, senses, method uses for taking sensus, information collection during sensus, method of estimating the population of any year, measurement scale, describing and exploring data, measures of central tendency and variability, health statistics, percentiles, quartiles and deciles, normal distribution, the standard normal distribution SND, using tables of SND, measures related to 'Z' scores, sampling distribution and hypothesis testing, basic concepts of probability, data collection (purpose and technique), categorical data

and neumerical data, application of statistics in social research, percentages, measure of central tendencies, means, Meidan, Mode, Quatile, decile and percentile

Course Outcomes:

After completion of the course students are expected to be able to:

- Student will be able to understand the role of biostatistics in public health.
- Understand the basic concept of data and types.
- Understand the measurement of scales.
- Able to understand the concept of mean, median, mode, standard deviation
- Understand the statistical test such as correlation, regression, t test, Annova, Chi square test compute them.
- Able to interpret the findings of statistical results.
- Able how to use statistical software to analyze the data.
- Able to understand the sampling and its types.

Able to understand how to calculate sample size through formula or using software

Recommended Books:

- Statistical methods for psychology by howell DC in 7th edition 2013.
- A guide to research methodology, biostatistics and medical writing by college of physicians and surgeons Pakistan by WHO collaboration center
- Reading understanding multivanant statistics giimm LG Yard AD PR, in 1995 publisher American Psychological association
- Ilyas Ansari's community medicine (Text Book) by Ilyas and Ansari 2003 published by Medical division Urdu Bazzar Karachi.

IAS-308 IMMUNOLOGY AND SEROLOGY

Course Learning Objective (CLOs):

- To identifybasic concepts in immunology and serology.
- To demonstrate diagnostic techniques in immunology and serology.
- To list immunodiagnosis and serodiagnosis of infectious diseases.
- To performtechnical skills used in immunology and serology.

Course contents:

Introduction to immunity, cellular basis of the immune response, antibodies, humoral immunity, cell-mediated immunity, major histocompatibility complex & transplantation, complement, antigen–antibody reactions in the laboratory, hypersensitivity (Allergy), tolerance & autoimmune disease, tumor Immunity, immunodeficiency, introduction to serology, introduction to serology, reactions in serology, serology of bacterial, viral, fungal and parasitic infections.

Practical:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Demonstrate conceptual knowledge and application of Immunology and serology.
- Explain immunity and serology theory supporting test principles.
- Apply the basic principles of antigen-antibody reactions in the performance of serological tests.
- Explain with diagnostic techniques in immunology and serology.
- Describe purpose of serological tests, types of serological tests and their role and applications in diagnostic lab.
- Read and interpret serologic results of test performed in lab.
- Make a differential diagnosis between and among the many diseases that could be detected by the various serologic tests.
- Explain the concepts of quality control in serology laboratory.
- Appreciate the importance of the diagnostic immunology diagnosis and treatment of diseases.

Recommended Books:

- Clinical Immunology and Serology. Stevens, C., D., 3rd ed. F.A. Davis Company, 2009
- Color Atlas of Immunology. Burmester, G., R., & Pezzutto, A., Thieme, 2003. □ Medical Immunology. Virella, G., 6th ed. CRC press, 2007.
- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006.
- Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D.,

A., Weissfeld, A., S., & Bailey, W., R., 12th ed. Elsevier Mosby, 2007.

- Review of Medical Microbiology and Immunology. Levinson, W., 10th ed. McGraw Hill Professional, 2008.
- Jawetz, Melnick, & Adelberg's Medical Microbiology. Brooks, G., Carroll, K., C., Butel, J., & Morse, S., 26th ed. McGraw-Hill Medical, 2012.

RMT-309 RESEARCH METHODOLOGY**Course Learning Objective (CLOs):**

- To describe the significance of research methodology foundation, concept of measurement, design clinical research and health system research to the students.

Course contents:

Introduction to research (in simple term and a scientific term), concept of research, why do need research, advantage of research, identification of research need and its qualities, component of research, ethical and legal aspect of research and objective of research (definition, purpose, structure) Relevance, Avoidance of duplication, Physibility, Political acceptability, Applicability, Cost efficiencies, work plan, budget required for research work, literature searching, statistical help, material, type of manuscript, printing of manuscript for submission and postage, Principles and reliability of measurement, errors and sources of measurement, types of measurement, measure of disease frequency and screening (introduction, validity and screening test) Studies design (introduction, selection of design), research questionnaire, validity and reliability of research finding, confounding factors, strategies to deal with threats to validity, hypothesis testing, sampling, collect data, data collection procedure, step and data collection survey questionnaire, starting questionnaire

Course Outcomes:

After completion of the course students are expected to be able to:

- Be able to understand basic concept of research and different types.
- Able to understand the study designs cross-sectional, cohort, case-control, and experimental (intervention) studies-and compare their strengths and weaknesses.
- Able to understand how to calculate basic measures of study design.
- Able to apply study design in different research project.
- Be able to understand the concept of systematic error, bias, the types of bias-selection, and confounding and methods of bias control.
- Be familiar with the ethical issues pertinent to epidemiological studies.
- Understand the concept of prevalence, incidence, mortality, attack rate, morbidity, rate, and ratio.
- Understand the concept of hypothesis testing in research study.
- Understand the basic concept of literature searching, topic selection

Recommended Books:

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

BLB-310 BLOOD BANKING

Course Learning Objective (CLOs):

- To distinguish basic concepts in blood banking and transfusion medicine & acquire skill in practical work.
- To produce a team of Medical Technologists steeped in knowledge of Blood banking and transfusion medicine.
- To perform latest advance techniques in the field of transfusion medicines. To establish safe blood transfusion practice.

Course Contents:

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

Practicals:

1. ABO blood grouping (Forward and Reverse grouping)
2. Rh Blood grouping
3. Antibodies screening

4. Cross matching (Major and Minor)
5. Coombs tests (Direct and Indirect)
6. Separation of different blood components

Course Outcomes:

After completion of the course students are expected to be able to:

- Describe the structure and function of immunoglobulins.
- Describe the standard blood bank requirements, protocols, applications in various sittings.
- Describe the ABO and Rh blood groups, recognise the importance of the Blood Transfusion Service and describe the blood donor screening criteria.
- Describe the most important blood groups and their associated antibodies and antigens and their clinical importance.
- Describe the precautions and testing that takes place to donated blood,
- Identify the various blood components available for transfusion and their clinical indications, safe blood transfusion practice.
- Discuss the risks associated with transfusion.
- Describe the common minor blood groups, genetics, applications and identification methods.
- Describe the genetic and pathological basis of transfusion reactions, Describe and compare TRALI (Transfusion Related Acute Lung Injury) and TACO (Transfusion Associated Circulatory Overload).
- Develop a plan to investigate and manage a patient suspected of receiving an incompatible transfusion.
- Describe and explain the risks, adverse effects, interactions and monitoring when using: whole blood; packed red cells; platelet concentrate; fresh frozen plasma;

cryoprecipitate; human albumin solution; clotting factor concentrates; immunoglobulins.

Recommended Books:

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

7TH SEMESTER COURSES

1. MLM-401 Medical Laboratory Management Skills
2. FIC-402 Fundamental Of Infection Control
3. MCB-403 Molecular Biology
4. EPD-404 Epidemiology
5. SDB-405 Systemic Diagnostic Bacteriology
6. CAC-406 Cytology And Cytogenetics

MLM-401 MEDICAL LABORATORY MANAGEMENT SKILLS

Course Learning Objective (CLOs):

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

Course Contents:

Introduction to quality, The quality management system model, Laboratory design, Safety management programme, Personal protective equipment, Equipment Selecting and acquiring equipment, Implementing an equipment maintenance programme, Equipment maintenance documentation, Purchasing and inventory, Implementing an inventory management programme, Forms and logs, Receipt and storage of supplies, sample management, The laboratory handbook, Collection and preservation, Sample storage, retention and disposal, Sample transport, Control materials, Establishing the value range for the control material, Graphically representing control ranges, Interpreting quality control data,

Using quality control information, audits, External audit, Internal audit, external quality assessment, International standards and standardization bodies, Certification and accreditation, Personnel, Recruitment and orientation, Competency and competency assessment, Training and continuing education, Employee performance appraisal, Personnel records, Customer service, Customer satisfaction surveys, Occurrence management, Quality indicators, Documents and records, Standard operating procedures (SOPs), Computerized laboratory information systems, Organizational requirements for a quality management system

Course Outcomes:

After completion of the course students are expected to be able to:

- Clear understanding of the role of the laboratory within the overall vision and mission of the organization.
- Gain knowledge of core team skills required to effectively manage a team in a laboratory, the stages of team development, team composition and process elements required for an effective team.
- Gain knowledge of core management skills required to effectively manage change in a laboratory and lead a team, leadership, potential development areas of a leader, coaching and mentoring in the performance management process
- Gain knowledge of basic financial activities to participate in financial management to do financial forecasts for the laboratory.
- Gain knowledge of the skills to manage and improve the quality of laboratory processes and systems.

Recommended Books

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

FIC-402 FUNDAMENTAL OF INFECTION CONTROL**Course Learning Objective (CLOs):**

- To recognize basic concepts in infection control.
- To indicate infection control principles and practices.
- To describe importance of immunization and hand hygiene in infection control.
- To explain the role of clinical laboratory in infection control.

Course contents:

Introduction to infection control, principle of infection control, source and transmission of infection, infection in the hospital environment, immunization prophylaxes, exposure prophylaxes, sterilization, disinfection and antisepsis, practical disinfection, epidemiology of infectious disease, antimicrobial agents, antibiotic and their uses (prophylactic, empirical , and therapeutic), antibiotic resistance and policy, principles of laboratory diagnosis of infectious diseases, biomedical waste management, biosafety levels, hand hygiene, standard precautions and PPE. Historical review and scope of microbiology, sterilization, disinfection and antisepsis, structure and function of prokaryotic cell, difference between prokaryotic and eukaryotic cell, bacterial growth and metabolism, bacterial classification, normal microbial flora of human body, mechanism of bacterial pathogenesis, host parasite interaction, Immune response to infection, common bacterial pathogen prevailing in Pakistan, introduction to fungi, fungal

characteristic, morphology, structure, replication and classification, mechanism of fungal pathogenesis, common fungal pathogen prevailing in Pakistan

Practical:

1. Introduction and demonstration of Laboratory Equipments used in Microbiology.
2. Inoculation and isolation of pure bacterial culture and its antibiotic susceptibility testing.
3. Demonstration of different types of physical and chemical methods of sterilization, and disinfection.
4. Students should be thorough to work with compound microscope.
5. Detection of motility: Hanging drop examinations with motile bacteria, non-motile bacteria.
6. Simple staining methods of pure culture and mixed culture.
7. Gram's staining of pure culture and mixed culture.
8. AFB staining of Normal smear, AFB positive smear.
9. KOH preparation for fungal hyphae.
10. Germ tube test for yeast identification.
11. Gram stain for candida
12. Demonstration of hand washing and hand rubbing technique.
13. Preparation of different disinfection and antiseptic solutions.
14. Demonstration of biomedical waste managements in hospitals.
15. Demonstration of cleaning and disinfection of working premises.
16. Demonstration of how to handle spills and aseptic handling.
17. Demonstration of standard precautions and PPE.

Course Outcomes:

- Understand the rationale for and develop policies and practices (i.e., an office infection control/exposure

control protocol) intended to prevent or minimize healthcare-associated infections in the oral healthcare setting.

- Understand the role of and implement vaccination strategies intended to reduce the risk of vaccine preventable diseases in the oral healthcare setting.
- Understand the role of and implement the use of personal protective equipment to prevent or reduce the risk of occupational exposure in the oral healthcare setting.
- Understand the role and implement appropriate hand hygiene.
- Understand the role of and incorporate engineering and work practice controls to eliminate or isolate the hazard in the workplace.
- Understand the role of and implement environmental infection control to provide a safer work environment.
- Understand the importance of post-exposure follow-up and associated policies and practices to reduce the risk of post-exposure infection.
- Understand the principles of and implement transmission-based precautions to prevent the potential spread of specific diseases (e.g., TB disease).
- Understand the principles of and implement respiratory hygiene/cough etiquette, i.e., basic source control measures with patients, visitors, and oral health care personnel with signs and symptoms of respiratory tract infection.
- Understand the principles of administrative controls and establish

exclusion policies from work and patient contact.

Recommended Books:

- Fundamentals of Infection Prevention and Control: Theory and Practice. Weston, D., Wiley-Blackwell, 2013.
- Sherris Medical Microbiology: An Introduction to Infectious Diseases. Ryan, K. J., Ray, C. G., 4th ed. McGraw-Hill, 2003.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006.
- Medical Microbiology and Infection at a Glance. Gillespie, S., H., Bamford, K., B., 4th ed. Wiley-Blackwell, 2012.

MCB-403 MOLECULAR BIOLOGY**Course Learning Objective (CLOs):**

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

Course Contents:

Central dogma of Molecular Biology, DNA as genetic Material Double Helical Structure of DNA, Nucleotides, Nucleosides, Nitrogenous bases, DNA replication; Origin of replication, replication Mechanism, enzymes involved in replication, differences in replication of Prokaryotic and Eukaryotic genomes, Concept of Gene; Genes, Allels, One gene on Enzyme theory, Introduction to RNA; mRNA, rRNA, tRNA, siRNA, Transcription; Transcription in Prokaryotes, Transcription in Eukaryotes, Translation; Translation in Prokaryotes, Translation in Eukaryotes, DNA repair.

Practicals:

1. Instrumentation of PCR
2. Instrumentation of Gel Electrophoresis
3. Instrumentation of Western Blotting, Northern Blotting, Southern Blotting

Course Outcomes:

After completion of the course students are expected to be able to:

After completion of the course students are expected to be able to:

- Understand and appreciate the diversity of life as it evolved over time by processes of mutation, selection and genetic change.
- Illustrate that fundamental structural units define the function of all living things.
- Explain that the growth, development, and behavior of organisms are activated through the expression of genetic information in context.
- Summarize that biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of physics.
- Illustrate that living systems are interconnected and interacting across scales of space and time.
- Design a scientific process and employ the scientific method, demonstrating that biology is evidence based and grounded in the formal practices of observation, experimentation, and hypothesis testing.
- Execute quantitative analysis to interpret biological data.
- Construct and utilize predictive models to study and describe complex biological systems.
- Apply concepts from other sciences in order to interpret biological phenomena.
- Communicate biological concepts and understanding to members of a diverse scientific community as well as to the general public.

- Identify social and historical dimensions of biological investigation.

Recommended Books:

Cell and molecular Biology By Gerald Karp, 5th edition 2005.

Molecular Biology By Robert F. Weaver 3rd edition 2010

EPD-404 EPIDEMIOLOGY**Course Learning Objective (CLOs):**

To explain to the students the know-how of the subject of epidemiology in order to apply the knowledge of the subject regarding the community and community related disease.

Course Contents:

Introduction to epidemiology, Determinants: Primary and Secondary, Clinical epidemiology, Occupational epidemiology, Importance of epidemiology, Definitions of common terms related to epidemiology, Health indication

Course Outcomes:

After completion of the course students are expected to be able to:

- Understand the basic concept of epidemiology.
- Understand the role of epidemiologist in public health.
- Understand the concept of public health screening programs.
- Describe a public health problem in terms of magnitude, person, time and place.
- Able to understand the study designs cross-sectional, cohort, case-control, and experimental (intervention) studies and compare their strengths and weaknesses.
- Able to understand how to calculate basic epidemiology measures.
- Be familiar with the ethical issues pertinent to epidemiological studies.

- Understand the field method in epidemiology like survey, sampling.

- Understand the concept of systematic error, bias, the types of bias-selection, and confounding and methods of bias control.

Recommended Books:

- Public Health by Ilyas Ansari
- Public Health by J Park

SDB-405 SYSTEMIC DIAGNOSTIC BACTERIOLOGY**Course Learning Objective (CLOs):**

- To recognize basic concepts in diagnostic bacteriology.
- To perform laboratory procedure used in diagnostic bacteriology.
- To list differential diagnosis of bacterial infections.
- To perform technical skills used in diagnostic bacteriology.

Course content:

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

plated media, anaerobic culture methods with recent advance.

Practical:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Recognize the Gram-negative bacteriological infections and their effects occurring in the human body.
- Use advanced and state of the art equipment for analyzing the microbiological specimens and bacteria.
- Perform personal integrity, respect, honesty, and Islamic ethical behavior when dealing with colleagues, patients, community members, and the hospital staff.
- Use accurately advance and smart devices for analyzing the clinical specimens.
- Perform personal integrity, respect, honesty and ethical behavior when dealing with patients, Community members and the healthcare team.

Recommended Books:

- Bailey & Scott's Diagnostic Microbiology. Forbes, B., A., Sahm, D.,

A., Weissfeld, A., S., & Bailey, W., R., 12th ed. Elsevier Mosby, 2007.

- A Photographic Atlas for the Microbiology Laboratory. Leboffe, M., J., & Pierce, B., E., 4th ed. Douglas N. Morton, 2010.
- Principles and Practice of Clinical Bacteriology. Gillespie, S., H., & Hawkey, P., M., 2nd ed. Wiley-Blackwell, 2005.
- District Laboratory Practice in Tropical Countries, Part1 & Part 2. Cheesbrough, M., 2nd ed. Cambridge University Press, 2006.

CAC-406 CYTOLOGY AND CYTOGENETICS

Course Learning Objective (CLOs):

- To recognize basic concept of cytology and cytogenetics
- To perform techniques involved in cytology and cytogenetics

Course content:

Morphology and physiology of cell, cytology of: female genital tract, urinary tract, gastrointestinal tract, respiratory tract, effusions, miscellaneous fluids, collection, preservation, fixation and processing of various cytological specimen, preparation and quality control of various stains and reagents used in cytology, all routine and special staining techniques in cytology, FNAC, immunocytochemistry, flowcytometry, automation in Cytology Cytogenetic Structure and molecular organization of chromosomes, identification of human chromosomes, karyotyping, direct chromosome preparation of Bone Marrow cells, culture techniques, banding techniques, sex Chromatin bodies, autoradiography of human chromosomes, chromosome Identification by image analysis and Quantitative cytochemistry, clinical Manifestations of chromosome disorders

Practicals:

1. Morphology of normal and abnormal cells
2. Karyotyping technique
3. Immuno-histochemistry techniques
4. FNAC technique

Course Outcomes:

After completion of the course students are expected to be able to:

- Be able to explain the evaluation of cell and the variety of cells occurring in this progression, relate evaluation and progress of cells structures.
- Compare cells according to their structural and functional characteristics and distinguish differences, categorize of cell types.
- Explain normal and abnormal human cell, tissue and organ structure
- Explain the basic protocols for fixing and staining organs and tissues for cytological examination using light microscopy
- Identify normal, abnormal cells of different sites, female reproductive organs, tissues and body fluids
- Be able to list and define chemical and biological components of cell contents, compare to apical, lateral and basal surface of the cell, distinguish organelles having one layer and two layer membrane, compare the structural functions of all of the cell organelles.
- Relate to cell skeleton and cell division, define the structure and function of cell skeleton, explain and distinguish phases of cell division.
- Outline safe laboratory practices as well as the professional and ethical responsibilities

associated with working in a clinical histology or cytology laboratory

Books Recommended:

- Lynch's Medical Laboratory Technology
- Diagnostic Cytology Koss. Volume I & II
- Henry's Clinical Diagnosis & Management by Laboratory method.
- Basic Histopathology – Stevens.
- Practical Cytology – Astarita.
- Hand book of Medical Laboratory Technology – Robert H. Carman

8TH SEMESTER COURSES

1. RPT-407 Research Project
2. SMR-408 Seminar
3. MSC-409 Medical Sociology
4. BIN-410 Bioinformatics
5. CSK-411 Communication Skills

RPT-407 RESEARCH PROJECT

Course Learning Objective (CLOs):

- Students will learn some basic research methodology and gain knowledge about research.
- It will hopefully result in some of presentation or publication for the students and will provide a research oriented environment

Course contents:

During last year each student should select a topic of research report with consultation of his/her supervisor and shall prepare and submit research report to Khyber Medical University by the end of last year.

Practical:

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Carry out a substantial research-based project.
- Demonstrate capacity to improve student achievement, engagement and retention.
- Demonstrate capacity to lead and manage change through collaboration with others.
- Demonstrate an understanding of the ethical issues associated with practitioner research.
- Analyse data and synthesize research findings.
- Report research findings in written and verbal forms.
- Use research findings to advance education theory and practice

SMR-408 SEMINAR

Course Learning Objective (CLOs):

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Illustrate the ability to perform close and critical readings.
- Demonstrate the ability to consider critically the motives and methods of scholarship and the relationship between them.
- Demonstrate the ability to distinguish opinions and beliefs from researched claims and evidence and recognize that kinds of evidence will vary from subject to subject.
- Display the ability to ask disciplinarily appropriate questions of the material and recognize when lines of inquiry fall outside of disciplinary boundaries.
- Show the ability to evaluate, credit, and synthesize sources.

- Exhibit the ability to follow discussions, oral arguments, and presentations, noting main points or evidence and tracking threads through different comments. Further, students will be able to challenge and offer substantive replies to others' arguments, comments, and questions, while remaining sensitive to the original speaker and the classroom audience.
- Establish the ability to speak and debate with an appreciation for complex social and cultural sensibilities.
- Have the ability to offer compelling, articulate oral arguments, showing an understanding of the unique demands of oral presentation as opposed to writing.

MSC-409 MEDICAL SOCIOLOGY

Course Objectives:

- To explain knowledge about the significance and scope of sociology as a science, their relation with other sciences.

Course Contents:

Definition and scope of sociology, sociology is a science, Islamic Sociology, medical Sociology, introduction contribution of sociology to medicine, health and disease, social definition of illness, social and emotional component of illness, patient and paramedic, paramedics view of disease and patient, psychology of patient / paramedic relationship, mental illness sociological perspective, social implication of mental illness, rehabilitation, physical, mental handicap, method in rehabilitation: Guidance counseling and vocational training, social disorganization, the concept and factor of social organization, family, group and community disorganization, problem of community problem of crime, method of treatment and preventative measure, educational problems, deterioration of education standard in school, college and

university, health problems, illness behavior, delivery and utilization of health services, introduction to applied sociology, definition of applied sociology, nature and causative analysis of social problem and the role of sociologist in solving social problems, application of social research in social problems social servu and social research, nature purpose and function

Course Outcomes:

After completion of the course students are expected to be able to:

- Outline socio-economic explanations for health inequalities in morbidity and mortality and describe how social divisions (including gender, diversity, disability, sexuality) more generally influence health and health outcomes.
- Provide a basic account of sociological theories of deviance as applied to the doctor-patient relationship, violence and critical approaches to health behaviours.
- Discuss critical approaches to healthcare organisation drawing on a range of theoretical models, including medical imperialism, managerialism, consumerism and how such challenges have affected medical practice in various settings.
- Consider migration in the context of globalisation and its implications for models of health in rich and poor settings, with worked examples such as medical tourism and the spread of new pathogens (such as swine and bird flu).
- Assess critically the usefulness of social theory in published research that investigates a health problem using both quantitative and qualitative analytic approaches.

Recommended Books:

- Medical sociology by William C Cuckerham in 1978 printed by USA Health education by Lurna Robinson Wesley F Alles in 1994 by Times Mirror

/Mosby College Publishing ST LioisToronto

- Social psychology of health by ShirlynnSpacapan Stuart Oskanp Edition by SAGE publication New Delhi, New York, in 1987

BIN-410 BIOINFORMATICS

Course Learning Objective (CLOs):

- To analyze genetics data for research.

Course Contents:

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

Practicals:

1. Use of Bioinformatics software for data analysis

Course Outcomes:

After completion of the course students are expected to be able to:

- Implement solutions to basic bioinformatics problems, discuss the use of bioinformatics in addressing a range of biological questions
- Describe how bioinformatics methods can be used to relate sequence, structure and function
- Discuss the technologies for modern high-throughput DNAsequencing and their applications
- Practice / Use and describe some central bioinformatics data andinformation resources

- Describe principles and algorithms of pairwise and multiple alignments, and sequence database searching
- Perform pattern matching in bimolecular sequences, describe how evolutionary relationships can be inferred from sequences (phylogenetics)
- Describe the most important principles in gene prediction methods
- Describe basic principles of hidden Markov models and their application in sequence analysis.

Recommended Books:

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

CSK-411 COMMUNICATION SKILLS

• Course Learning Objective (CLOs):

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

Course contents:

Introduction to Communication , Meaning and definition of Communication, The process of communication, Models of communication, Effective Communications in Business, Importance and Benefits of effective communication, Components of Communication, Communication barriers,

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

Course Outcomes:

After completion of the course students are expected to be able to:

- Understand and apply knowledge of human communication and language processes as they occur across various contexts, e.g., interpersonal, intrapersonal, small group, organizational, media, gender, family, intercultural communication, technologically mediated communication, etc. from multiple perspectives.
- Understand and evaluate key theoretical approaches used in the interdisciplinary field of communication.
- Understand the research methods associated with the study of human communication, and apply at least one of those approaches to the analysis and evaluation of human communication.
- Find, use, and evaluate primary academic writing associated with the communication discipline.

- Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others.
- Communicate effectively orally and in writing.

Recommended Books:

- Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
- Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

