GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD, PAKISTAN

Scheme of Studies

BS (HONS) Medical Laboratory Technology

8 Semesters/4 Years Degree Program for the year 2016 and onwards

College of Allied Health Professionals
Directorate of Medical Sciences

Contents

Scheme of Studies 4
1st Year 5
1st Semester 5
Basic & Applied Anatomy 5
Basic & Applied Physiology 6
Social Psychology 8
English for Academic Purpose 9
Islamic Studies 10
2nd Semester 11
General Pathology 11
Introductory Pharmacology 12
Introductory Biochemistry 13
Computer Applications in Biology 14
Pakistan Studies 15
Fundamentals of Medical Lab Technology 16
2nd Year 17
3rd Semester 17
Community Medicine/Public Health 17
General Hematology 19
General Microbiology & Sterilization 18
Clinical Pathology 20
Clinical Lab Practice-II 21
4th Semester 22
Scientific Writing 22
Clinical Biochemistry (I&II) 23
Immunology & Serology 24
Histopathology and Histotechnology 25
Clinical Lab Practice-III 27
3rd Year 28
5th Semester 28
Clinical Parasitology 28
Immunohematology & Transfusion Medicine 29
Clinical Bacteriology 30

Biosafety and Biohazards 31
Medical Instrumentations & Software Applications 32
Clinical Lab Practice-IV 33
6th Semester 34
Cytology and Cytotechnology 34
Molecular Biology 35
Clinical Virology and Mycology 36
Advanced Hematology 37
Advanced Immunology 38
Clinical Lab Practice-IV 39
4th Year 40
7th Semester 40
Forensic Medicine 40
Biostatistics 41
Advanced Clinical Biochemistry 42
Advanced Clinical Microbiology 43
Advanced Molecular Biology 44
Advanced Diagnostic and Biomedical Techniques 45
Quality Assurance Management 46
Clinical Genetics 47
8th Semester 48
Epidemiology 48
Bioinformatics-I 49
Endocrinology 50
Clinical Laboratory Management 51
Research Project/Term paper 52

Scheme of Studies

Semester 1		
AHP-301	Basic and Applied Anatomy	4 (3-1)
AHP-303	Basic and Applied Physiology	4 (3-1)
PSY-407	Social Psychology	3 (3-0)
ENG-321	English for Academic Purpose	3 (3-0)
ISL-321	Islamic Studies	2 (2-0)
	Total	**16**
Semester 2		
AHP-302	General Pathology	4 (3-1)
AHP-304	Introductory Pharmacology	2 (2-0)
BCH-301	Introductory Biochemistry	4 (3-1)
CSI-421	Computer Applications in Biology	3 (2-1)
PST-321	Pakistan Studies	2 (2-0)
MLT-306	Fundamentals of Medical Lab Technology	2 (2-0)
	Total	**17**
Semester 3		
AHP-401	Community Medicine/ Public Health	3 (2-1)
MIC-321	General Microbiology & Sterilization	3 (2-1)
MLT-403	General Hematology	4 (3-1)
MLT-405	Clinical Pathology	3 (2-1)
MLT-407	Clinical Lab Practice-I	3 (0-3)
	Total	**16**
Semester 4		
AHP-402	Scientific Writing	2 (2-0)
MLT-404	Clinical Biochemistry (I & II)	4 (3-1)
MLT-406	Immunology & Serology	4 (3-1)
MLT-408	Histopathology & Histotechnology	4 (3-1)
MLT-410	Clinical Lab Practice-II	3 (0-3)
	Total	**17**

Semester 5		
MLT-501	Clinical Parasitology	3 (2-1)
MLT-503	Immunohematology &Transfusion Medicine	3 (2-1)
MLT-505	Clinical Bacteriology	4 (3-1)
MLT-507	Biosafety and Hazards	2 (2-0)
MLT-509	Medical Instrumentations & Software Applications	3 (3-0)
MLT-511	Clinical Lab Practice-III	3 (0-3)
	Total	**18**
Semester 6		
MLT-502	Cytology & Cytotechnology	3 (2-1)
BNB-321	Molecular Biology	3 (2-1)
MLT-504	Clinical Virology & Mycology	3 (2-1)
MLT-506	Advanced Hematology	3 (2-1)
MLT-508	Advanced Immunology	3 (2-1)
MLT-510	Clinical Lab Practice-IV	3 (0-3)
	Total	**18**
Semester 7		
AHP-601	Forensic Medicine	3 (3-0)
STAT-421	Biostatistics	3 (3-0)
MLT-603	Advanced Clinical Biochemistry*	4 (3-1)
MLT-605	Advanced Clinical Microbiology*	
MLT-607	Advanced Molecular Biology*	
MLT-609	Advanced Diagnostic & Biomedical Techniques	3 (2-1)
MLT-611	Quality Assurance Management	2 (2-0)
MLT-613	Clinical Genetics	3 (2-1)
	Total	**18**
* Student will opt any one from these elective subject		
Semester 8		
AHP-602	Epidemiology	3 (3-0)
BNB-402	Bioinformatics-I	3 (2-1)
PHS-503	Endocrinology	3 (2-1)
MLT-604	Clinical Laboratory Management	3 (3-0)
MLT-606	Research Project/Term Paper	3 (0-3)
	Total	**15**
Grand Total		**135**

1st Year

1st Semester

AHP-301	**Basic & Applied Anatomy**	4 (3-1)

Theory

Introduction to human anatomy: Branches, levels of body organization & systems, anatomical position, region names, planes, sections & body cavities, Cells and its structural components. Structure and types of different body tissues & membranes. Integumentary system: structures blood supply & development. Musculoskeletal System: structure, type and function of muscles, bones & joints. Components of the axial & appendicular skeletal system. The Nervous System: Central Nervous System. Peripheral Nervous System (Autonomic & somatic). Special Senses. Reflex arc and reflex action. Cerebrospinal fluid and its circulation. Cranial and spinal nerves. The Cardiovascular System; blood, Heart, and blood vessels, Pulmonary and systemic circulation, Lymphatic system & immunity. Respiratory System; The anatomy of the respiratory passages, lungs and pleural cavity. The Digestive System; organs of digestive tract (mouth, pharynx, esophagus, stomach, pancreas, liver and gall bladder, small & large intestine) Blood supply & lymphatic drainage. Genito-Urinary System; The structure of nephron and organs of the urinary system and its relations with other organs, Structures of Male & female reproductive system. Embryonic development.

Practical:

1. Labelling of various planes, sections & regions of human body
2. Identification of bones; compact, spongy, long, short, sesamoid bones
3. Identification of various types of muscles.
4. Identification of various organs of gastrointestinal system
5. Labelling of anatomical and functional regions of nervous system
6. Drawing and labelling of structures of genito- urinary tract system
7. Differentiation between arteries, veins and capillaries

Recommended Books:

1. Waugh A, Grant A. Ross & Wilson anatomy and physiology in health and illness. Elsevier Health Sciences; 2014.
2. Principles of Human Anatomy 12th Edition by Garad J. Tortora. John Wiley & Sons, Inc.
3. General Anatomy by Laiq Hussain Siddiqui.
4. Atlas of Human Anatomy 5th edition by Frank H. Netter
5. Simbryo: An Animated tour of Human development by Phllip M. Ecker, Grant M. Ecker, Lawrence H. Mathers

AHP-303	**Basic & Applied Physiology**	4 (3-1)

THEORY

Introduction to the human physiology; functional organization, relationship between structure and function of the human body. Homeostasis, importance negative and positive feedback mechanism. Integumentary system; Layers of skin and types of glands, Functions of the skin, hair and glands, diseases related to skin, Body temperature , its types and its regulation. The musculoskeletal system: Physiological anatomy of muscles and their types., Functional characteristics of skeletal muscle, smooth muscle and cardiac muscle, Properties of muscles , The events of muscle contraction and relaxation in response to an action potential in a motor neuron., Neuromuscular junction , Distinguish between aerobic and anaerobic muscle contraction., Muscle hypertrophy and atrophy. The nervous system; functional anatomy of nervous system, Functions of all the parts of central nervous system,, Functions of various cranial nerves., Division of peripheral nervous system (somatic and autonomic ns), The classification and function of neurons, neuroglial cells and their components. , Resting membrane potential and an action potential., Difference between sympathetic and para sympathetic ns, Difference between somatic and autonomic nervous system, The types and function of a synapse and reflex arc , Diseases related to nervous system. The functions of the specialized sense organs; Eye---- physiology of site, accommodation, optic nerve and optic chiasma, Ear---- functions of the internal, middle and external ear, Physiology of the hearing and balance, Smell---------- physiology of olfactory nerve, Taste ---------physiology of taste, Location of the taste buds, Physiology of speech. The endocrine system; Functions of the endocrine system, Chemical signals, receptors and hormones, the endocrine glands and their hormones, Other hormones. Blood; Composition of blood and plasma, Functions of blood, Formed elements , Stages of cell development, Blood grouping, Coagulation mechanism. The cardiovascular system; Functional anatomy cardiac system,, Functions of the heart , Electrical activity of the heart origin and propagation of cardiac impulse , Phases of the cardiac cycle , Heart sounds , Regulation of heart functions--- intrinsic and extrinsic, Functions of the peripheral circulation , The physiology of circulation , Pulmonary circulation , Cardiac circulation, Systemic circulation: arteries , Veins , Local control of blood vessels , Nervous control of blood vessels , Regulation of arterial blood pressure, The function of lymphatic system, tonsils, lymph nodes, the spleen and the thymus. Respiratory system; Functional anatomy of respiratory ns, Functions of the respiratory system beginning at the nose and ending with the alveoli., Ventilation and lung volumes , Pulmonary function tests, Gas exchange and gas transport in the blood , Diseases related to respiratory system. The digestive system; Functions of each organ of the digestive system including major salivary glands, Movements and secretions in each organ of the digestive system and their regulation, Physiology of digestion, absorption, and transport , Diseases related to digestive system. Excretory system; Functional anatomy of urinary system, Tubular system of kidney, Urine production, urine movement , Regulation of urine concentration and volume , Body fluid compartments , Regulation of extracellular fluid composition , Regulation of acid-base balance. Immunity; Define immunity, innate immunity, adaptive immunity , Antigens and antibodies, Primary and secondary responses to an antigen, Antibody-mediated immunity and cell-mediated immunity, Role of lymphocyte in immunity regulation,

Practical

- Determination of human pulse rate
- Determination of blood pressure (by auscultatory and palpatory method)
- The effect of exercise and posture of b.p
- Determination of visual acuity for distant vision
- Determination of visual acuity test for near vision
- Determination of abo blood group system.
- Determination of rh blood group system
- To study hemocytometer
- Count the total number of rbcs/mm3 of your own blood
- Examination of cranial nerves

RECOMMENDED BOOKS

- Essentials of anatomy and physiology by seelay, stephens and tate. 4th edition
- Ross & wilson anatomy and physiology.
- Human physiology. Stuart ira fox. 7th edition
- Text book of medical physiology guyton
- Essential of medical physiology vol.i & ii by mushtaq ahmad.
- Lecture notes on human physiology by bray jj, cragg, pa macknight

PSY-407	**Social Psychology**	3 (3-0)

Introduction to Social Psychology; Nature and scope of social psychology, Social Perception Self in Social World, Attribution. Socialization; Nature: Perspectives of Socialization, Agents of Socialization, Process of Socialization, Socialization of Gender Roles. Attitudes; Nature &Structure Formation of attitude, Attitude Change, Attitude Predicts Behavior. Persuasion; Elements of Persuasion, Resistance in persuasion. Prejudice; Nature and power of power of prejudice, Sources of prejudice. Aggression; what is aggression? Theories of aggression, Influences on aggression, How can aggression be reduced? Social relations; Conformity, Altruism

Recommended Books:

1. Fisher, R. J. (1992). *Social psychology: An applied approach.* New York: St Martin Press.
2. Forsyth, D. F. (1987). *Social psychology.* California: Brooks Publishing Company.
3. Franzoi, S. L. (2006). *Social Psychology*. (7th Ed.). New York: McGraw Hill.
4. Myers, D. G. (2005). *Exploring social psychology.* (8th Ed.). New York: McGraw Hill.
5. Wayant, J. M. (1986). *Applied social psychology.* New York: Oxford University Press.

ENG-321	English for Academic Purpose	3 (3-0)

Course Contents

- Introducing ourselves
- Describing things
- Getting and giving information
- Recounting past events
- Talking about facts and opinions
- Agreeing and disagreeing
- Compare and Contrast
- Cause and effect
- Using your imagination
- Reporting
- Writing Essays
- Presentation skills
- Assessment

ISL-321	Islamic Studies	2 (2-0)

Introduction to Quranic Studies: Basic Concepts of Quran, History of Quran, Uloom-ul -Quran
Study of Selected Text of Holly Quran

- Verses of Surah Al-Baqra Related to Faith (Verse No-284-286)
- Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
- Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)
- Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6, 21, 40, 56, 57, 58.)
- Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- Verses of Surah As-Saf Related to Tafakar, Tadabar (Verse No-1,14)

Seerat of Holy Prophet (S.A.W) I: Life of Muhammad Bin Abdullah (Before Prophet Hood), Life of Holy Prophet (S.A.W) in Makkah, Important Lessons Derived from the life of Holy Prophet in Makkah
Seerat of Holy Prophet (S.A.W) II: Life of Holy Prophet (S.A.W) in Madina, Important Events of Life Holy Prophet in Madina, Important Lessons Derived from the life of Holy Prophet in Madina
Introduction to Sunnah; Basic Concepts of Hadith, History of Hadith, Kinds of Hadith, Uloom –ul-Hadith, Sunnah & Hadith, Legal Position of Sunnah, Selected Study from Text of Hadith
Introduction to Islamic Law & Jurisprudence: Basic Concepts of Islamic Law & Jurisprudence, History & Importance of Islamic Law & Jurisprudence, Sources of Islamic Law & Jurisprudence, Nature of Differences in Islamic Law, Islam and Sectarianism
Islamic Culture & Civilization: Basic Concepts of Islamic Culture & Civilization, Historical Development of Islamic Culture & Civilization, Characteristics of Islamic Culture & Civilization, Islamic Culture & Civilization and Contemporary Issues
Islam & Science: Basic Concepts of Islam & Science, Contributions of Muslims in the Development of Science, Quranic & Science
Islamic Economic System: Basic Concepts of Islamic Economic System, Means of Distribution of wealth in Islamic Economics, Islamic Concept of Riba, Islamic Ways of Trade & Commerce
Political System of Islam: Basic Concepts of Islamic Political System, Islamic Concept of Sovereignty, Basic Institutions of Govt. in Islam
Islamic History: Period of Khlaft-E-Rashida, Period of Ummayyads, Period of Abbasids
Social System of Islam: Basic Concepts of Social System of Islam, Elements of Family, Ethical Values of Islam

Recommended Books

1. Hameed ullah Muhammad, “Emergence of Islam” , IRI, Islamabad
2. Hussain Hamid Hassan, “An Introduction to the Study of Islamic Law” leaf Publication Islamabad, Pakistan.
3. Dr. Muhammad Zia-ul-Haq, “Introduction to Al Sharia Al Islamia” Allama Iqbal Open University, Islamabad (2001)

2nd Semester

AHP-302	General Pathology	4 (3-1)

Theory:

Cell Injury and adaptation; Cell Injury, Reversible and Irreversible Injury, Fatty change, Pigmentation, Pathologic calcification, Necrosis and Gangrene. Cellular adaptation; Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Aplasia. Inflammation; Acute inflammation --- vascular changes, Chemotaxis, Opsonization and Phagocytosis, cellular components and chemical mediators of acute inflammation, exudates and transudate, Chronic inflammation, Etiological factors, Granuloma. Cell repair and wound healing; Regeneration and Repair, Healing- steps of wound healing by first and second intention, Factors affecting healing, complications of wound healing. Hemodynamic disorders; Edema, Hemorrhage, Thrombosis, Embolism, Infarction & Hyperemia, Shock and its causes, compensatory mechanisms involved in shock, possible consequences of thrombosis, difference between arterial and venous emboli. Neoplasia; Dysplasia and Neoplasia, differences between benign and malignant neoplasms, common etiological factors for neoplasia, different modes of metastasis

Practical:

Types of Microscope. Necrosis and its types, Histopathological techniques, Study of inflammation, acute and chronic inflammation, coagulative necrosis, diagnostic laboratory tests, Liver function tests, Renal function tests, Complete Blood counts.

Recommended Books:

Kumar V, Abbas AK, Aster JC. Robbins basic pathology. Elsevier Health Sciences; 2012.

Strasinger SK, Di Lorenzo MS. Urinalysis and body fluids. FA Davis; 2014

Rosto E, editor. Pathophysiology Made Incredibly Easy!. Lippincott Williams & Wilkins; 2009.

Goljan EF. Rapid review pathology: with student consult online access. Elsevier Health Sciences; 2013 Jun 7.

MLT-304	Introductory Pharmacology	2 (2-0)

Introduction to Pharmacology, Pharmacokinetics: (Absorption, distribution, metabolism, excretion) Variable affecting the pharmacokinetics, Pharmacodynamics. Legal Policies and Responsibilities for Drug handling, Math Skills and Drug Calculations; (Addition, subtraction, multiplication and division), decimals, percentages, ratio, proportions. System of Measurements; metric system, international units, unit conversion, Calculations; ration system vs. formulas for drug calculations, calculation of solution strength (weight / volume and volume / volume, calculation of dosage by weight, Drug Label information; Drug identification, Rights of Medication Administration, Medicine Devices: syringes, needles, drug containers, Routes of medicine / drug administration; General Classification of drugs; Analeptics, analgesics, anesthetics, antibiotics, anticoagulants, anticonvulsants, antidiuretics, antiemetics, cardiac medications, CNS stimulants, coagulants, contrast media, diuretics, dyes, Emetics, gastric medications, Hemostatic agents, Hormones, irrigation solutions, narcotics antagonists, narcotics, neuromuscular blocking agents, obstetrical agents, ophthalmic medications, sedative / hypnotics agents and tranquilizers. Diagnostic Imaging agents

Recommended Books:

1. Lippincott's Illustrated Reviews Pharmacology 5th Edition. Lippincott's Williams & Wilkins
2. Chemical Calculations at a Glance by Paul Yates Blackwell Publishing
3. Medical Pharmacology at a Glance by Michael J. Neal. 4th Edition. Blackwell publishing

BCH-301	Introductory Biochemistry	4 (3-1)

Theory:

Foundation of Biochemistry; cellular foundation, isolation of eukaryotic cell, chemical foundation, Structure and function of cell membrane, movement of materials across cell membrane Carbohydrates; classification of carbohydrates. Regulation of blood glucose level, Glycolysis, Citric acid cycle, Glycogenolysis, Glycogenoses, Gluconeogenesis. Proteins and Amino Acids; Introduction, importance, classification and properties of proteins, Entry of amino acids into cells and peptide linkage, Special sources of proteins. Lipids; Introduction, Classification and Function of lipids, Biosynthesis of fatty acids, natural fats or triglycerides, Fatty acid oxidation. Vitamins and Minerals; Introduction, classification, Deficiency effects. Enzymes; Introduction, Classification, properties, the mechanism of enzyme reactions, Factors affecting the enzyme activity, Important coenzymes and their actions, Enzyme inhibitors and Regulatory enzymes. Nutrition and Dietetics; Balanced diet, Role of carbohydrates, fats and proteins, their dietary sources and uses in the body, Quantitative and qualitative daily requirements of carbohydrates, fats, proteins, vitamins and minerals. Physiochemical Principles; Acidity & Alkalinity, Osmosis & Osmotic pressure, Hydrogen ion conc. and pH notation, Indicators & Buffer solutions, pH.

Practical:

1. Measurement of pH of various biological fluids
2. Estimation of serum albumin
3. Estimation of blood glucose
4. Measurement of serum total protein level and A / G ratio
5. Measurement of blood cholesterol
6. Measurement of Triglycerides
7. Measurement of Urea
8. Measurement of serum Creatinine

Recommended Books:

1. Harper's Illustrated Biochemistry, 30th Edition MC Graw Hill.
2. Boyer RF. Modern experimental biochemistry. Benjamin/Cummings Pub. Co. 3rd Edition
3. Harvey RA, Ferrier DR. Lippincott's illustrated reviews: Biochemistry. 6th Edition by Kluwer, New York. 2011.
4. Nelson DL, Lehninger AL, Cox MM. Lehninger principles of biochemistry. 6th Edition Macmillan;

CSI-421	Computer Applications in Biology	3 (2-1)

Theory:

Generation of computer: 1st to 4th generation with their characteristics. Basic concept of computer: Introduction, different components of computer, basic design of computer. Introduction to operating system. Introduction to OS, different management (processor, memory, device, file), Processor management-Process concept, Threads, CPU Scheduling, Process scheduling, Deadlocks, Process synchronization. Memory management –Memory allocation rule, Swapping, Overlay, Paging, Demand paging, segmentation, virtual memory. Device management, File management.

Practical:

Usage of MS DOS commands: basic concept of internal & external commands, directory &file commands, copying, erasing, renaming, displaying files, introduction to pipes & filters, concept of batch file. Windows operation: Customizing the interface, windows explorer, computer upkeep & utilities. Office operation, Microsoft word:- concept of toolbar, character, paragraph& document formatting, drawing tool bar, header, footer, document editing, page setup, short cut keys, text & graphics. Microsoft excel:- concept of spread sheets, creating worksheet ,well formatted documents, concept of row, column, cell &formula bar, using function, using shortcuts, chart, conditional formatting, goal seek, validation rule. Microsoft power point: - slide presentation, slide layout & design, custom animation, image importing, slide transition.

PST-321	Pakistan Studies	2 (2-0)

1. ***Historical Perspective***

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

   b. Factors leading to Muslim separatism

   c. People and Land
      i. Indus Civilization
      ii. Muslim advent
      iii. Location and geo-physical features.

2. ***Government and Politics in Pakistan***

   Political and constitutional phases:

   a. 1947-58
   b. 1958-71
   c. 1971-77
   d. 1977-88
   e. 1988-99
   f. 1999 onward

3. ***Contemporary Pakistan***

   a. Economic institutions and issues
   b. Society and social structure
   c. Ethnicity
   d. Foreign policy of Pakistan and challenges
   e. Futuristic outlook of Pakistan

Books Recommended

1. Akbar, S. Zaidi. *Issue in Pakistan's Economy.* Karachi: Oxford University Press, 2000.
2. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press, 1993.
3. Mehmood, Safdar. *Pakistan Political Roots & Development.* Lahore, 1994.

MLT-306	Fundamentals of Medical Lab Technology	2 (2-0)

Theory:

Basic laboratory principles, Code of conduct of medical laboratory personnel, Organization of clinical laboratory and role of medical laboratory Technologist and technician, Safety measures, Medical laboratory professional - professionalism in laboratory workers, code of conduct, communication between physician and lab technician, Common glassware in clinical laboratory, Cleaning, care and maintenance of glassware, Calibration of pipettes and other volumetric apparatus. Laboratory instruments. Microscopes-Principles, parts, use, care and maintenance of Light microscope. Brief history of microscopy, Parts of a microscope, Types of microscope. Classification and their uses, Nature of light, Concepts of amplitude, Wavelength and Phase, Perception of color and brightness, Refraction, formation of images. Centrifuge. Water bath. Refrigerators. Autoclave. Hot air oven. Mixer. Water distillation apparatus. General approach to specimen collection, transport and disposal. Anticoagulants- E.D.T.A, Dipotassium salts of EDTA Double oxalate, single oxalate, sodium citrate. Sodium Fluoride. Preparation of solution: Normal solution, Buffer solution, Percent solution, normal saline, Molar solution. Preparation of Normal saline. Methods of measuring liquids, weighting solids.

Recommended Books:

Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006, Part I & II.

Ravel, R., Clinical laboratory medicine: clinical applications of laboratory data. Mosby Elsevier 6th Edition1995.

2nd Year

3rd Semester

AHP-401	Community Medicine/Public Health	3 (2-1)

Theory:

General concepts of health and diseases with reference to natural history of disease with pre-pathogenic and pathogenic phase. The role of socio-economic and cultural environment in health and diseases-Epidemiology and scope. Public health administration-An overall view of the health administration set up at center and state level. The National Health Programs- National Health programs including tuberculosis, malaria, MCH and HIV/AIDS. Health problems in vulnerable groups-Pregnant and lactating women and infants and school going children-occupational groups, geriatrics. Occupational Health- Definition, scope-Occupational diseases, prevention of occupational diseases and hazards. Social security and other measures for the protection of occupational hazards, accidents and disease. Details of compensation acts. Family planning objectives of National family planning methods. A general idea of advantages and disadvantages of the method. Mental Health-community aspects of mental health; role of physiotherapists, therapists in mental health problems such as mental retardation etc. Communicable disease; An overall view of the communicable disease. Classification according to the principal mode of transmission. Role of insects and their vectors. International health agencies.

Practical:

Contraceptive methods; intra-uterine devices, hormonal contraceptives, demographic studies and data collection, communication for health education, Human nutrition, Hospital and biomedical waste management, Arthropods of medical importance. Air pollution and fumigation. Extended Program for Immunization (EPI).

Recommended Books:

Park K. Park's textbook of preventive and social medicine. 2007.

Maxcy-Rosenau. Public health and preventive medicine. Appleton-century-crofts, 1986.

Ansari, IS, Public health and community medicine

MIC-321	General Microbiology & Sterilization	3 (2-1)

Theory:

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

Practical:

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

Recommended Books:

1. Kathleen P. T., and Arthur, T. 2001. Foundations in Microbiology: Basic Principles McGraw-Hill Companies
2. Tortora, G. J., Christine, L. Case, C. L., Funke, B. R., Funke, B., Case, C., 2006. Microbiology: An Introduction, Publisher: Pearson Education.
3. Alcamo, I. E., 2001. Fundamentals of Microbiology published by Jones and Bartlett Publishers, USA.
4. Black, J. G., 2005. Microbiology: principles and explorations, by 6th Edition, J. Wiley & Sons, USA.

MLT-403	General Hematology	4 (3-1)

Theory:

Blood and its constituents, Origin, Development, maturation and fate of blood cells. Collection of blood; capillary and venous blood collection, various anticoagulants and their uses, advantages and disadvantages. Different types of hemo-cytometers, their ruling and uses. Erythrocytes; morphology of RBC in health and disease, functions of RBC, RBC counting, diluting fluids used, erythrocyte indices. Leucocytes; structure, count, absolute eosinophil count, variation in WBC count. Platelets; Structure and function counting of platelets, diluting fluids, causes of thrombocytopenia/ thrombocytosis. Principles of staining- Romanowsky stains, Preparation of blood smear; Thin smear, thick smear, wet preparation and buffy coat preparation, Leishman staining differential leukocyte count (DLL) with recognition of abnormal blood cells. Quality control methods in cell counts. Automatic blood cell counter. Bone marrow aspiration; indications, aspiration, preparation of bone marrow smears, morphologic study of bone marrow films and its differential count. Identification of parasites in blood and bone marrow films. Supra-vital staining technique- principle and uses, demonstration and counting of reticulocytes, Principles and different methods of determining ESR and PCV, advantages and disadvantages, Clinical significance of ESR and PCV normal values. Hemoglobin; Structure and function, Estimation of hemoglobin principles, techniques, advantages and disadvantages methods of identification of abnormal hemoglobin, HB electrophoresis, Alkali denaturation tests and sickling phenomenon HB-F and its demonstration.

Practical:

1. Different methods of blood collection & Preparation of anticoagulant bottles.
2. CBC (Hemoglobin, TLC, RBC count, Platelet count, PCV)
3. ESR
4. Differential leukocyte count
5. Absolute eosinophil count
6. Reticulocyte count.
7. ABO grouping-Cell and serum grouping, Rh Grouping
8. Rh grouping
9. Test for Du antigen
10. Compatibility test-Major and Minor cross matching & Coombs cross matching

Recommended Books:

Ciesla B. Hematology in practice. FA Davis; 2011.

Mehta A, Hoffbrand V. Haematology at a Glance. John Wiley & Sons; 2009.

Mazza JJ, Manual of clinical hematology. Lippincott Williams & Wilkins; 2002.

Hoffbrand V, Moss P. Essential haematology. John Wiley & Sons; 2011.

MLT-405	Clinical Pathology	3 (2-1)

Theory:

Urinalysis; Collection of urine and its preservation, 24 hour urine collection for protein. Physical examination of urine – examination of urine for colors, cloudiness, specific gravity, reaction and pH. Chemical examination of urine. Microscopic examination of urine- Urine sediment preparation, types of sediments and its examination. Feces; Collection and preservation, examination of stool for color, mucus, consistency, ova, ameba, cysts, parasites, pus cells, RBC and crystals. Detection of occult blood in stool, concentration techniques. Sputum; Method of collection for various purposes including AFB fugal, malignant cells and others. Microscopic examination of sputum, sputum for AFB. Semen; method of collection examination of semen for time for liquefaction, volume, color, reaction pH, motility of spam, sperm count and other findings staining and morphological study of spermatozoa, semen fructose determination, anti-sperm antibodies CSF; General introduction method of CSF collection, Transport of CSF, examination of CSF, colour, turbidity and fibrin clot (Cobweb), total and differential leukocyte count. CSF examination by gram's staining and acid fast staining, biochemical tests, clinical significance of CSF analysis in various meningitis and encephalitis and interpretations. Other body fluids; Methods of collection, transport and macroscopic and microscopic examination of ascetic fluid, pleural fluid, pericardial fluid and synovial fluid. Pregnancy tests; Different methods of testing and chronic gonadotropin assay with urine

Practical:

(1) Urine-collection, processing, physical, chemical and microscopic examination.
(2) Collection, preservation and examination of stool
(3) Sputum collection and microscopic examination of sputum for AFB.
(4) Physical, chemistry and microscopic examination of semen
(5) Analysis of CSF, microscopic and chemical examination of CSF.
(6) Macroscopic and microscopic examination of ascitic fluid, Pleural fluid, pericardial fluid and synovial fluid

Recommended Books:

McPherson RA, Pincus MR. Henry's clinical diagnosis and management by laboratory methods. Elsevier Health Sciences; 2011.
Drew, P. and Andrew, K., Oxford handbook of clinical and laboratory investigation. 2010
Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006.
Ravel, R., Clinical laboratory medicine: clinical applications of laboratory data. Mosby Elsevier 6th Edition1995.

MLT-407	Clinical Lab Practice-I	3 (0-3)

Point-of-Care Testing (POCT), Urinalysis, Hemoglobin & Hematocrit, Coagulation (e.g., PT) Basic Chemistry (e.g., glucose, total protein, albumin, electrolytes) Non-Blood Specimens (Urine, Stool, Other) Patient Preparation, sample Collection, Processing and Handling, Terminology, Different methods of blood collection & Preparation of anticoagulant bottles. Different methods of Hemoglobin estimation, Blood smear formation, smear Staining (Giemsa), Identification of RBCs, WBCs and Platelets in peripheral films. Identification of malarial parasites. TLC by Hemocytometer, Red Blood Cell count, Platelet count, Erythrocyte Sedimentation rate, Pack cell volume, Mean cell volume, mean cell hemoglobin, mean cell hemoglobin concentration, Differential leukocyte count. Eosinophil count, reticulocyte count. ABO grouping-Cell and serum grouping, Rh grouping, Test for Du antigen, Compatibility test-Major and Minor cross matching & Coombs cross matching, Coombs test-Direct and Indirect. Screening of blood for infectious agents-HIV test, HBV, HCV, V.D.R.L, malaria.

Recommended Books:

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

4th Semester

AHP-402	Scientific Writing	2 (2-0)

PART I:

Introduction; principles of effective writing, Crafting better sentences and paragraphs, Orthography and Punctuation, Correct Spelling, Spell Checkers, Consistent Spelling: American English versus British English, Punctuation, Proper use of punctuation marks. Parentheses and Brackets, Apostrophes in Contractions, Nonbreaking Spaces and Hyphens, Shortened Word Forms in Scientific Writing, Sentence formation: Grammar, the Tenses in Scientific Reporting, Joining Statements, Nonparallel Verbs, Subject-Verb Agreement, Using the Correct Verb Forms. Organization; and streamlining the writing process.

PART II:

The format of an original manuscript, reviews, commentaries, and opinion. Writing a scientific paper; selection of title for the paper, writing the abstract, key words, Introduction, Methods, Results, Discussion, Conclusion, and Acknowledgement. References (Citation and Bibliography), different citation styles. Dissertation/thesis writing. The publication process, Issues in scientific writing (plagiarism, authorship, reproducible research). Reference management softwares. EndNote.

Recommended Books:

1. Taylor R. Clinician's guide to medical writing. Springer Science & Business Media; 2006.
2. Lebrun JL. Scientific writing: a reader and writer's guide. World Scientific; 2007.
3. Matthews JR, Matthews RW. Successful scientific writing: a step-by-step guide for the biological and medical sciences. Cambridge University Press; 2014.
4. Fathalla MF, Fathalla MM. A practical guide for health researchers. World Health Organization, Regional Office for the Eastern Mediterranean; 2004.
5. Taylor RB. Medical writing: a guide for clinicians, educators, and researchers. Springer Science; 2011.
6. Hartley J. Academic writing and publishing: A practical handbook. Routledge; 2008.

MLT-404	Clinical Biochemistry (I&II)	4 (3-1)

Theory:

Carbohydrates; Blood sugar and its types, diabetes mellitus, complications of diabetes mellitus, test for blood sugar carbohydrates digestion and absorption. Lipids; Digestion and absorption, Metabolism- synthesis of fatty acids, oxidation of fatty acids, cholesterol biosynthesis and regulation, biologically important compounds synthesized from cholesterol, lipotropic factor and laboratory tests for cholesterol. Proteins; Digestion and absorption metabolism, synthesis and degradation of amino acids. Liver function tests; Bile pigment metabolism, jaundice and its type, tests for liver function. Renal function tests; Functions of Kidney, disease of kidney, Renal Function Tests. Gastric function tests; Functions of stomach, tests for gastric function. Hormones; Introduction, classification, chemistry and function. Hemoglobin; Chemistry, properties and synthesis, metabolism of pigments Hb- derivatives – abnormal hemoglobin, Hb electrophoresis Porphyrins and disorders of porphyrins metabolism, chemistry of porphyrins metabolism, chemistry of porphyrins, primary disorders of haem synthesis, secondary disorders, Analytical procedures. Water and mineral metabolism; General consideration, Regulation of water. Phenomenon of thirst, mineral Metabolism (Ca, Na, Cl, K, P). Cardiac profile tests; Introduction, Heart diseases, Laboratory tests for heart diseases. Troponin TM, qualitative and quantitative. Urinalysis; 24 hour urine sample collection and assays for proteins, Sodium, Ca, P, urea, creatinine, uric acid.

Practical:

Estimation of bilirubin, SGPT, SGOT, ALP, GGT, Uric acid, Serum sodium & potassium, calcium, acid phosphatases, Amylase,

Recommended Books:

Harper's illustrated biochemistry. New York: McGraw-Hill Medical, 2012.

Harvey RA, Ferrier DR. Lippincott's illustrated reviews: Biochemistry. Edition by Kluwer, New York. 2011.

Ahmad N, Clinical Biochemistry, Oxford University Press, UK, 2011.

MLT-406	Immunology & Serology	4 (3-1)

Theory:

Immunity-definition, innate immunity, acquired immunity (humoral and Cell mediated immunity). Active and passive immunity and vaccination. Antigens and immunogens; types, characteristics, adjuvants. Cellular basis of immune response; T-cells and subtypes, B cells, antigen presenting cells, Activation of T-cells and B-cells, memory cells. Immunoglobulin; Structure, types, classes, isotypes, allotypes, idiotypes, monoclonal antibodies and Hybridoma technology. Humoral immune response, primary and secondary immune response, Major Histocompatibility Complex and its types and role in transplantation and allograft rejection. Complement; pathways and activation, biological effects and clinical manifestations. Antigen-antibody reactions; precipitations, agglutination, Radioimmunoassay, ELISA, Complement Fixation assays, hem agglutination, neutralization assays, antiglobulin (Coombs) test. ABO, Rh antigen and antibodies. Hypersensitivity (Allergy), Types of hypersensitivity reactions, tolerance; B-cell and T-cell tolerance. Autoimmune disorders and its associated factors. Immunodeficiency; congenital and acquired immunodeficiencies.

Practical:

1. Serological diagnosis of microbial diseases
2. Widal test
3. ASO titer
4. CRP titer
5. RA factor
6. VDRL
7. RPR
8. ELISA for HBV and HCV

Recommended Books:

(1) Owen, Judith A., Jenni Punt, and Sharon A. Stranford. ***Kuby immunology***. New York: WH Freeman, 2013.

(2) Review of Medical Microbiology and Immunology, 12th Edition, Mc Graw Hill Medical, New York

MLT-408	Histopathology and Histotechnology	4 (3-1)

Theory:

Introduction to Basic Histology, Classification of Tissue, Epithelium, Connective tissue, Muscular tissue, Nervous tissue. Introduction to surgical specimens and biopsy, Merits and demerits of different types of biopsies, Fixation methods with salient gross and microscopic morphological changes in common diseases of Gastrointestinal Tract, Genitourinary System (Male and Female), Respiratory tract, Brain and spinal cord, Skin and subcutaneous tissues, Heart and blood vessels, Lymphatic system including tonsils, lymph nodes, the spleen and thymus. Histological Techniques: General organization and basic requirements of histopathological lab. Supravital staining. Fixation, Tissue Processing Basic steps, fixation, dehydration, clearing (Aim of cleaning, different cleaning agents), impregnation, embedding, and techniques of casting Blocking, microtomy, staining, and mounting of histological preparations. Mounting- Different mounting media and mounting techniques. Fixation and fixatives- Aim of fixation, classification of fixation, classification of fixatives, Different fixatives used for the histological techniques, its advantages and disadvantages. Advantages and disadvantages of the paraffin method. Infiltration with paraffin. Paraffin block making. Section cutting with a rotary microtome. Microtome and Microtome Knives: Principles, operation, parts and use of automatic tissue processors. Types of microtomes. Frozen sections- Principles, methods used, staining of frozen sections and application of frozen sections advantages and disadvantages and common techniques. Decalcification- techniques, aim, agents used. Museum techniques- organization of museum, Mounting of museum specimens in the preservative fluids like Kaiserling Solution I, II & III. Stains: Principles, Classification, Acids and basic dyes, Basophilic and acidophilic tissue components. Routine Hematoxylin-Eosin staining of paraffin Sections. Special Staining Techniques, GMS, Mucicarmine and Alcian Blue, Mallory's connective tissue stain, Toluidine blue staining of mast cells, Von- Geison, Masson's Trichome, Nissel Stain for Nervous Tissues. Staining for frozen section, The PAS Technique and staining. Immunohistochemistry; Introduction, significance, Methods - Direct and Indirect, PAP / Avidin Biotin method, Steps involved, Antigen retrieval methods, Types of fixatives, buffering media, enzyme labels and chromogens used in Immunohistochemistry. List of commonly used tumor markers in different diseases and their clinical utility.

Practical:

1. Basic steps of tissue processing.
2. Preparation of fixatives and fixation.
3. Embedding.
4. Microtomy
5. Staining. (H & E)
6. Mounting.
7. Various methods of preparation of tissue sections (Grossing).
8. Paraffin section, celloidin embedding, frozen section.
9. Decalcification
10. Demonstration of an Automated Tissue processing.

Recommended Books:

Culling, Charles Frederick Albert. Handbook of histopathological and histochemical techniques: including museum techniques. Butterworth-Heinemann, 2013.

Suvarna, S. Kim, Christopher Layton, and John D. Bancroft. Bancroft's Theory and Practice of Histological Techniques, Expert Consult: Online and Print

Bancroft's Theory and Practice of Histological Techniques. Elsevier Health Sciences, 2013.

MLT-410	Clinical Lab Practice-II	3 (0-3)

General Histopathology; Introduction to Basic Histology, Introduction to surgical specimens and biopsy, Merits and demerits of different types of biopsies, Introduction to common Histological Techniques, Tissue Processing; Basic steps in tissue processing fixation, dehydration, clearing (Aim of cleaning, different cleaning agents), impregnation, embedding, techniques of casting Blocking, microtome, staining, mounting of histological preparations. Mounting- Different mounting media and mounting techniques. fixation and fixatives, The Paraffin method of sectioning tissue, Microtome and Microtome Knives, Decalcification, Routine Hematoxylin-Eosin staining of paraffin Sections, Special Staining Techniques; GMS, Mucicarmine and Alcian Blue. The PAS Technique: Estimation of blood glucose, serum creatinine, bilirubin, albumin, triglycerides, cholesterol, HDL and LDL cholesterol, uric acid, alkaline phosphatase, SGPT, SGOT, acid phosphatases, serum Amylase, serum inorganic phosphorous, serum sodium, serum Potassium, urinary calcium, pH of water, Demonstration of equipment used in Bacteriology. Identification of unknown bacteria. Study of cultural characteristics, Biochemical reactions and antibiotic sensitivity of the medically important bacteria Staphylococcus, Streptococcus, E. coli, Salmonella, Shigella, Pseudomonas, Klebsiella, Proteus, and Vibrio. Serology; Widal test, VDRL test, RPR, Anti-streptolysin O test, CRP.

Recommended Books:

Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006, Part I & II.

Lieseke CL, Zeibig, EA. Essentials of Medical Laboratory Practice. F.A. Davis Company, Philadelphia, 2012

Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.

Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010

3rd Year

5th Semester

MLT-501	Clinical Parasitology	3 (2-1)

Theory

Introduction to parasitology, Taxonomy and classification of parasites, Quality control of Stool examination, Entameba histolytica, Other Entamoeba species (comparative study), Giardia lamblia, (Naegleria fowleri and Acanthamoeba), Trichomonas vaginalis, Cryptosporidium, Blood Flagellates; Trypanosomiasis; African Trypanosomiasis, American Trypanosomiasis, Leishmania: Introduction and classification, Cutaneous, mucocutaneous and Visceral leishmaniasis, Blood Sporozoa: Plasmodium Species, Pathology and Pathogenesis, Epidemiology, Tissue Sporozoa: Toxoplasma gondii, Intestinal helminthic infections; Enterobius vermicularis, Trichuris trichiura, Ascaris lumbricoides, Ancylostoma duodenale, Strongyloides stercoralis, Taenia saginata, Taenia solium, Blood and tissue helminthic infections; Schistosoma species, Taenia solium, Echinococcus granulosus,

Practical

(1) Identification of Equipment used in parasitology laboratory - Principles, Uses , maintenance
(2) demonstration & visual presentation of protozoan
(3) Stool examination
(4) Detection and identification of Entamoeba histolytica
(5) Detection and identification of other Entamoeba species (Microscopy and visual presentation)
(6) Detection and identification of Giardia lamblia
(7) Detection and identification of malarial parasites

Recommended Books:

Jawetz, Melnick, & Adelberg. Medical Microbiology. 26th edition. Mc Graw Hill Medical, New York.

Levinson, W. Review of Medical Microbiology and Immunology, 12th Edition, Mc Graw Hill Medical, New York.

MLT-503	Immunohematology & Transfusion Medicine	3 (2-1)

Theory:

General Introduction to Immunohematology & blood banking, Antigen-Antibody Concept, precipitation, flocculation, General management and essential components of blood bank. ABO blood group system, Inheritance, distribution antibodies in ABO system, Subgroups, ABO grouping methods and factors influencing RH Blood group system, Inheritance and distribution, antibodies, Hemolytic disease of newborn, RH typing methods. Other blood group systems NS blood group, P Blood Group Lutheran Blood group, Kell blood group, Lewis blood group, Duffy blood group, Kid blood group, Bombay blood group, Blood transfusion, Donor screening, collection of blood. Screening of blood, Anticoagulants used in blood bank, storage of blood. Transfusion reaction, Principles and methods of investigating Transfusion reactions, diseases transmitted by blood transfusion, Component therapy – preparation and transfusion of leucocytes poor blood, RBC concentrate platelet rich plasma, platelet concentrate factor VIII, Transfusion of plasma, components and preparation of cryoprecipitate, its use and advantages.

Practical:

1. ABO grouping-Cell and serum grouping
2. Rh grouping
3. Test for Du antigen
4. Compatibility test-Major and Minor cross matching & Coombs cross matching
5. Coombs test-Direct and Indirect.
6. Screening of blood for infectious agents-HIV test, HBV, HCV, V.D.R.L, malaria etc

Recommended Books:

Quinley. Immunohematology: principles and practice. Philadelphia: Lippincott; 1998 Jan.

Klein HG, Anstee DJ. Mollison's blood transfusion in clinical medicine. John Wiley & Sons; 2008.

Harmening DM. Modern blood banking and transfusion practices. FA Davis; 2012.

Hillyer C, Hillyer KL, Strobl F, Jefferies L, Silberstein L, editors. Handbook of transfusion medicine. Academic Press; 2001.

MLT-505	Clinical Bacteriology	4 (3-1)

Theory:

Pathogenicity, Clinical features and Laboratory diagnosis of Medically Important Bacteria including *Staphylococcus aureus*, Coagulase-negative Staphylococci, Beta-hemolytic Streptococci, Alpha-hemolytic Streptococcus and *Streptococcus pneumoniae*, Enterococci, Bacillus Species (*B. anthracis, B. cereus*), Clostridium species (*C. tetani, C. botulinum, C. perfringens. C. difficile*) *Corynebacterium diphtheriae*, *Listeria monocytogenes,* Neisseria species (*N. meningitidis, N. gonorrhoeae*), *Escherichia coli*, Klebsiella species, Enterobacter species, Citrobacter species, Salmonella, Shigella, Proteus, Campylobacter, Helicobacter, Vibrio, Haemophilus, Bordetella, Legionella, Brucella, Francisella, Pasteurella, Pseudomonas, Rickettsia, Chlamydia trachomatis Bacteroides, Mycobacteria, *Treponema pallidum*, Leptospira, Borrelia and Mycoplasma. Molecular and Immunological Methods to study bacteria and bacterial infections. Antibacterial drugs; mode of action. Antimicrobial resistance.

Practical:

Identification of unknown microorganisms, Identification of Staphylococci, Streptococci, Enterobacteriaceae, Pseudomonas, Vibrio. Biochemical test including, Catalase, Coagulate, DNAse, Citrate Utilization, Glucose fermentation, Lactose and Sucrose fermentation, methyl red, urease, Voges Proskauer. Multiple Test Systems including 20E.

Recommended Books:

Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006

Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.

Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010.

Gillespie S, Hawkey PM, editors. Principles and practice of clinical bacteriology. John Wiley & Sons; 2006.

Leboffe MJ, Pierce BE. Microbiology: laboratory theory and application. Morton Publishing Company; 2012.

MLT-507	Biosafety and Biohazards	2 (2-0)

Theory:

Introduction to biosafety and biohazards. Hazard Criteria and Categorization of Microbes. Classification Systems, general and specific containment principles, Biosafety level I-IV laboratories, designs and specialized features. Personal Protective equipment (PPE); Routes of microbial entry and types and use of PPE, Disinfection and Decontamination; including physical (Heat, radiations) and chemical disinfection/decontamination, factor affecting disinfection/decontamination. Fumigation of spaces; process and practices, validation, post fumigation steps. Risk Assessment Procedures; timings, qualitative risk assessments and systematic documentation. Biosafety and biosecurity: Biological risk management plan, physical security and access control, biological waste management. Transfer of biological material. Biohazards; history modern day biological risks, bioterrorism, biohazards accidents and incidents, biological safety programs management.

Recommended Books:

Fleming DO, Hunt DL. Biological safety: principles and practices. 4th edition ASM Press Washington, USA

Wilson DE, Chosewood LC. Biosafety in microbiological and biomedical laboratories. 5th Edition. US Government Printing Office, Washington, DC

Grady SM, Tabak J. Biohazards: Humanity's battle with Infectious Disease (Science and Technology in Focus) Facts On File, Inc. Infobase Publishing, New York.

MLT-509	Medical Instrumentations & Software Applications	3 (3-0)

Fundamentals of medical instrumentation systems, sensors, and biomedical signal processing and electrical safety requirements. Example instruments for hematology, clinical chemistry and immunochemistry. Clinical laboratory measurements, POCT devices, chemical biosensors. Demonstration of common analytical instruments; the theory and applications of various analytical instruments including various types of Microscope, incubators, electrophoresis, spectrophotometry, chromatography, and centrifugation; and lab safety practice. Manual and automated methods for the biochemical analysis of blood and body fluids; principles of operation, maintenance, and troubleshooting of laboratory instruments. Various aspects of the medical laboratory including disciplines, automation, use of computers and software and Lab information system. Safe work practices, quality assurance features and the analytical principles of common clinical laboratory methods. Fundamentals of Software interface applications, user defined functions, user input from keyboard and mouse, text inputs, use of bar codes. Statistics and quality control/assessment in clinical chemistry, Routine operation and daily maintenance of automated equipment and supervised evaluation and reporting of results.

Recommended Books:

1. Tietz, Norbert W., ed. Textbook of clinical chemistry. Vol. 486. Philadelphia et al.: Saunders, 1986.
2. Webster, John. Medical instrumentation: application and design. John Wiley & Sons, 2009.

MLT-511	Clinical Lab Practice-III	3 (0-3)

Preparation of culture media; Blood agar, Chocolate agar, MacConkey agar and broth, CLED agar, SS agar, Nutrient agar and broth, Mueller Hinton agar and broth, Inoculation and isolation techniques; culture of bacteria on liquid and solid media, streaking plate method, Biochemical tests for identification of bacteria; Catalase test, coagulate test, DNAse test, hemolysis on blood agar to differentiate between Streptococci, Oxidase test, Urease test, Triple Sugar Iron (TSI) agar, Antimicrobial susceptibility testing by disc diffusion method, Measurement of Minimum Inhibitory Concentration (MIC) and Minimum bactericidal concentration (MBC), Parasitological examination of Stool, Parasitological examination of Urine, Parasitological examination of Blood

Recommended Books:

Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006, Part I & II.

Lieseke CL, Zeibig, EA. Essentials of Medical Laboratory Practice. F.A. Davis Company, Philadelphia, 2012

Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.

Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010

6th Semester

MLT-502	Cytology and Cytotechnology	3 (2-1)

Theory:

Cell morphology and physiology, Cell structure and functions –lining membrane epithelia, stratified squamous epithelia, columnar epithelia, epithelia serving reproductive function and miscellaneous epithelia. Various cells seen in cytological preparations. Body fluids**:** method of collection transport and macroscopic and microscopic of Ascitic fluid, pleural fluid, and synovial fluid with special reference to cytology. Genitourinary cytology (including normal and abnormal) Histology and cytology of epithelia of female genital tract during the child bearing age. Cells originating from the normal squamous epithelium of cervix vagina. Squamocolumnar junction/Transformation zone. Endocervical epithelium ciliary tuft. Cells originating from normal Endometrial, cells other than epithelia in normal smears, normal vaginal floras. Cyclic changes in vaginal smears. Various devices and techniques for Vaginal smear. Excretory system: Cytology in the absence of cancer, cytology of normal urine- voided urine and catheterized urine. Inflammatory process with in the lower urinary tract. Bacterial fungal (Monilia) and viral infections and associated changes. Cytology of urinary tract in inflammation and malignancy. Respiratory Tract: Cytology in the absence of cancer. The squamous epithelium and Respiratory epithelium and their cytology, Non – epithelial cells of respiratory tract. Foreign materials in sputum. Benign abnormalities of respiratory epithelium, squamous epithelium and squamous metaplasia cytology in malignant condition. Cancer cells: Morphologic characters of cancer cells. Morphologic difference between normal cells and cancer cells. Fine Needle Aspiration Cytology (FNAC). Clinical procedures: Preparation and fixation of smears and fluid specimens. Collection, fixation and transport of cervical smears and vaginal smears for hormonal studies. Standards of adequacy of cytology examination of female genital tract. Collection of urine, bladder irrigation, urine collection after prostatic massage, screening of urinary sediment, GIT Brushing and lavage, Cytological sampling from esophagus, stomach and duodenum. Occult blood in stool. Collection of body fluids and anticoagulants used.

Practical:

1. Collection of samples and processing.
2. Cytological fixatives and fixation.
3. Collection and preparation of fluid sediment for cytological examination.
4. Preparation and fixation of sputum smears for cytology and preparation.
5. Preparation and fixation of vaginal and cervical smears for cytology.
6. Hormonal evaluation of vaginal smears.
7. Papanicolaou staining-principles and staining procedures.
8. Maygrunwarld staining-principles and staining procedures.
9. Identification of cells.
10. Differentiation between malignant and benign cells.

Recommended Books:

Diagnostic cytology and its Histopathological Basis-Vol-1-E.G.Koss

Suvarna SK, Layton C, Bancroft JD. Bancroft's Theory and Practice of Histological Techniques, Expert Consult: Online and Print, 7: Bancroft's Theory and Practice of Histological Techniques. Elsevier Health Sciences; 2013.

BNB-321	Molecular Biology	3 (2-1)

Theory

Overview of molecular biology, Advances in molecular biology, Central dogma of molecular biology, important definitions related to central dogma, Chemical structures of the major classes of macromolecules. DNA replication, Transcription, RNA processing, Genetic code, Translation, Post translational modifications. Gene regulation in prokaryotes, Gene regulation in eukaryotes. Phages. Transposable elements and its mechanism, DNA damage (Mutations) and DNA repair mechanisms (Nucleotide and base excision repair, mismatch repair, double strand break repair, Translation DNA synthesis). Genetic engineering.

Practical:

Isolation and purification of DNA, Detection and quantitative determination of chromosomal DNA and RNA. Simple cloning experiments using *Escherichia coli* as a host, Isolation and qualitative and quantitative detection of plasmid DNA (mini prep). Digestion of DNA with restriction enzymes and separation of different sized fragments on agarose gel, Study of transformed bacteria on the basis of antibiotic resistance.

Recommended Books:

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

MLT-504	Clinical Virology and Mycology	3 (2-1)

Virus; structure, classification, Replication of viruses (RNA & DNA), Principles of viral diagnostic procedures. Bacterial viruses, Prion and viroid. DNA Enveloped Viruses; Herpes simplex virus, Varicella Zoster virus, cytomegalovirus, Epstein-Barr virus (EBV), small pox virus, DNA non-enveloped Viruses; Adeno virus, Human papillomavirus; RNA Enveloped Viruses: Influenza virus, Measles virus, Rubella virus, Rabies virus, RNA non-enveloped Viruses; polio virus, Rota virus, Hepatitis Viruses; Hepatitis A virus, Hepatitis B virus, Hepatitis C viruses, Hepatitis D virus, Hepatitis E virus, Tumor Viruses, Slow Viruses & Prions, Human Immunodeficiency Virus, Introduction to mycology, structure, growth. Pathogenesis, fungal toxins and allergies, laboratory diagnosis, pathogenesis, clinical finding, diagnosis, treatment and prevention of cutaneous, subcutaneous, systemic, and opportunistic mycosis. Antifungal therapy.

Practical:

Hemagglutination assays for viral diseases.

ELISA for HBsAg and Anti-HCV

Molecular methods for diction of viral infections

Sample collection for fungal diseases.

Fungal culture media.

Determination of antifungal activity of (nystatin, amphotericin B etc.)

Recommended Books:

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

MLT-506	Advanced Hematology	3 (2-1)

Theory:

Mechanism of blood coagulation, laboratory tests used in investigation of coagulation disorders Assay of coagulation factors, Hemophilia and its laboratory parameters, Measurement of life span of platelets. Cytochemistry – Peroxidase, Sudan block, and Esterases, Perl's staining and estimation of Iron content in bone marrow smears and its significance. Thalassemia and hemoglobinopathies (in brief) Definition, Classification, Laboratory diagnosis of various types of anemia, polycythaemica Vera, leukocytosis, leucopenia, lymphopenia, monocytosis, neutropenia and Agranulocytosis, infectious mono-nucleosis. Definition and FAB/ WHO-2008 classification of leukemia, Acute and Chronic leukemia blood and bone marrow findings in acute myeloid Leukemia (AML), acute lymphoid leukemia (ALL) chronic myeloid leukemia (CML),chronic lymphatic leukemia,(CLL), Erythroleukemia, Eosinophilic Leukemia, megakaryocytic leukemia, Leukemoid blood reactions, FAB classification, Multiple Myeloma (in brief) Systemic methods of examination of blood film (blood Picture) and reporting, LE cell phenomenon and demonstration of LE cells, principle, method and significance of osmotic fragility test, Acid hemolysis (ham's test), G6PD estimation and its significance. Automation and recent advances in hematological techniques.

Practical:

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

Recommended Books:

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

MLT-508	Advanced Immunology	3 (2-1)

Theory

Introduction to the immune response, Specific immune response, Recognition by antibody – antigens and epitopes, Antibody structure, various classes of antibodies. T lymphocyte subsets, structure of T cell receptor, major histocompatibility complex (MHC), class 1 and 2 MHC molecules. Antigen recognition, processing and presentation by MHC molecules, Gene and protein structure of immunoglobulin and T cell receptors, Rearrangement of receptor genes in B and T cells, Additional mechanisms for the generation of immune diversity, somatic mutations antibodies class switching. Autoimmune disease, Classification of autoimmune diseases, genetic and environmental features of immunological disorders. Immunological memory, Vaccines, Properties of an ideal vaccine, current available vaccines, Recombinant vector vaccines, DNA vaccines, Peptide vaccines. Transplantation, Transplantation antigens, the immune response against transplants, Immunosuppressive drugs. Tumor immunology, Immunological approaches for cancer therapy, tumor vaccines.

Practical

1. Immunofluorescence Assays
2. ELISA technique for the estimation of viral antigens and antiviral antibodies
3. ELISpot
4. Immuno-blotting
5. Nephelometry for the estimation of serum complements (C3, C4) and immunoglobulins (IgG, IgM, IgA, IgE
6. Flow cytometry; technique and applications in immunology
7. Enumeration of lymphocytes substets using Flow cytometry
8. HLA Typing (Serological and Molecular)

Recommended Books:

(1) Owen, Judith A., Jenni Punt, and Sharon A. Stranford. *Kuby immunology*. New York: WH Freeman, 2013.

(2) Wood, Peter. *Understanding Immunology 2nd edition*. Benjamin Cummings, 2006.

(3) Rabson, Arthur, Ivan Maurice Roitt, and Peter J. Delves. *Really essential medical immunology*. Blackwell Pub., 2005.

(4) Abbas AK, Lichtman AHH, Pillai S. *Cellular and Molecular Immunology* Elsevier Health Sciences, 2014.

MLT-510	Clinical Lab Practice-IV	3 (0-3)

Tuberculin skin test for the diagnosis of tuberculosis, Skin prick testing for allergic diseases, Immunological tests for immunological disorders (ANA, anti-dsDNA), Polymerase chain reaction (PCR) for the detection of infectious diseases like HBV, HCV, Malaria, Typhoid Fever, Polymerase chain reaction (PCR) for the diagnosis of leukemia and lymphomas, Quantitative PCR for the quantification of viral load and therapeutic response, Fine needle aspiration (FNA) cytology, Collection and processing of FNA, Sample collection and smear preparation techniques for specimens from the Female genital tract, Respiratory tract, Body cavities and urinary tract. Staining of smears; including PAP, Wright, and Romanowsky stains, Processing of clots and sediments from fluids, Cytological features of normal cellular constituents, Common changes shown in cells in relation to disease and associated malignancy, Role and limitations of cytology in diagnostic pathology. Basic cytological identifications of benign and malignant cells. Demonstration of slides of various disorders of anemia and leukemia, Malarial Parasite identification and reporting, LE cell phenomenon.

Recommended Books:

Cheesbrough M. District laboratory practice in tropical countries. Cambridge university press; 2006, Part I & II.

Lieseke CL, Zeibig, EA. Essentials of Medical Laboratory Practice. F.A. Davis Company, Philadelphia, 2012

Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.

Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010

4th Year

7th Semester

AHP-601	Forensic Medicine	3 (3-0)

Introduction to forensic toxicology; Medical Jurisprudence, Legal prudence, Inquest, Courts, Procedure in court, Role of Consent in medical practice

Death: definition, phases of death, Signs of death; cadaveric lividly, Rigor Mortis, Putrefaction, Saponification, Mummification, Cadaveric spasm, Manners of death; Natural (causes of sudden natural death), accidental, suicidal, Intraoperative, homicidal & undetermined. Factors used in estimating time of death.

Evidence; Evidence and type of evidence, Dying declaration and dying deposition, Physical evidence & types, recovery and preservation of physical evidence, procedure for collection of biological and non-biological evidences. Asphyxia; suffocation, strangulation, chemical asphyxiant & neck holds

Injuries & Wounds; blunt force, sharps, gunshot, burns,

Autopsy; External and Internal examination; microscopic examination, findings, opinion & reporting

Forensic Toxicology: Poison & their Classification, Routes of Administration and Elimination of Poison, Factors modifying the effects/action of poison, Diagnosis, tissue & specimen collection, routine testing, drug screening; methods of analysis.

Recommended books:

1. DiMaio VJ, Dana SE. Handbook of forensic pathology. CRC Press; 2006.

2. Adelman HC. Forensic Medicine. Infobase Publishing; 2007.

3. Sharma RK. Concise textbook of forensic medicine and toxicology. Global Education Consultants. 2005

4. McLay WD. Clinical forensic medicine. Cambridge University Press; 2009 Mar 12.

STAT-421	Biostatistics	3 (3-0)

Introduction to Biostatistics and its scope in Microbiology. Collection of Primary and Secondary data. Editing of data. Presentation of data: Tabulation, Classification, Visual Presentation (Diagrams and Graphs). Measures of Central Tendency: Arithmetic Mean by direct and short-cut method, Geometric Mean, Harmonic Mean, Mode, Median, ED_{50} (LD_{50} in detail), Quantile. Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation by direct and short-cut method, Variance, and their Coefficient. Correlation: Simple Correlation Table, Rank Correlation, Partial and Multiple Correlations. Regression and method of least square. Probability: Concept of Probability, Laws of Probability. Permutation and Combination. Probability distributions: Binomial distribution, Poisson distribution and their fitting to observed data, Normal distribution. Sampling and Basic Design. Hypothesis Testing. Chi-square test, Student's t-test, Analysis of variance. Laboratory Experiments pertaining to the course.

Recommended Books:

1. Stanton, A.G., 2001. Primer of Biostatistics. McGraw Hill.
2. Jekel, J., Elmore, J.G., Katz, D.L., 2001. Epidemiology, biostatistics and preventive medicine. W. B. Saunders.
3. Quinn, G., 2002. Experimental Design and Data Analysis for Biologists. CMICROridge University Press.
4. Fernholz, L.T, Morgenlhaler, S., Stahel, W., 2000. Statistics in Genetics and in Environmental Sciences, Birkhauser Verlag.
5. Kuzma, J. W. and Bohnenblust, S. E. 2001, Basis Statistics for the Health Sciences, McGraw-Hill International Education.

MLT-603	Advanced Clinical Biochemistry	4 (3-1)

Theory:

Biochemical investigations and quality control, Modern clinical biochemistry laboratories, Evaluation of a clinical method, Quality control and audit, General automated chemistry systems, automated immunochemistry analyzers. Clinical enzymology and biomarkers; Biomarkers, Cardiac biomarkers in clinical practice. Abnormalities of lipid metabolism; Hypercholesterolemia, Hypocholesterolemia, Hypertriglyceridemia, Measurement of lipids in clinical samples, Assessment of cardiovascular risk. Endocrine system and hormone analysis, Disorders of pituitary function, Disorders of thyroid function, Insulin, glucagon, and the counter-regulatory hormones; diabetes mellitus, Specific protein markers; Plasma proteins, albumin, Alpha 1-antitrypsin, haptoglobin, Caeruloplasmin, transferrin, C-reactive protein, Cancer biochemistry and tumor markers, The present and future of clinical biochemistry in cancer diagnostics. Drug administration, distribution, and elimination: Types of poisons and poisoning, Biochemical features of poisoning, Laboratory investigation of poisoning, Toxicology of specific compounds.

Practical:

1. Measurement of plasma proteins.
2. Methods for the measurement of tumor markers.
3. Measurement of Thyroid function (T3, T4, and TSH)
4. Measurement of FSH, LH and Prolactin.
5. Measurement of immunosuppressive drugs in the body.
6. Measurement of cardiac biomarkers.

Recommended Books:

(1) Ahmad N, Clinical Biochemistry, Oxford University Press, UK, 2011.

(2) Burtis CA, Ashwood ER, Bruns DE. Tietz textbook of clinical chemistry and molecular diagnostics. Elsevier Health Sciences; 2012

(3) Tietz NW, editor. Textbook of clinical chemistry. Philadelphia et al.: Saunders; 1986.

MLT-605	Advanced Clinical Microbiology	4 (3-1)

Theory:

Classification and pathogenicity of microbes, factors affecting the virulence and spread of microbes. Use of microbiological laboratory-principles, collection of clinically relevant specimens, provision of essential clinical information. Collection of good quality specimens, transport and processing of specimens, Applications of molecular biology to clinical microbiology and infectious diseases. Antimicrobial chemotherapy; spectrum of activity, factors affecting antimicrobial chemotherapy, antibiotic prophylaxis, resistance to antimicrobial drugs, antibiotic policies. Septicemia; clinical features, microbiological investigations and treatment. Infections of Central Nervous System; meningitis, encephalitis, Rabies, cerebral abscesses. ENT and eye infections, Infections of the lower respiratory tract; acute and chronic bronchitis, pneumonia, influenza, para-influenza, cystic fibrosis, lungs abscess, empyema. Infections of the gastrointestinal tract; enteric fever, gastroenteritis and food poisoning, diarrhea and dysentery, Cholera. Infections of the urinary tract; significant bacteriuria, pathogenesis and predisposing features. Sexually transmitted diseases; bacterial, viral, fungal and protozoa infections. Nosocomial infections.

Practical:

1. Species level identification of staphylococci
2. Species level identification of streptococci
3. Identification of enterobacteriaceae
4. API 20E, API 20NE, API AUX
5. Media and reagent for the isolation and identification of bacterial pathogen from clinical specimens.
6. Instrumented Blood Culture Systems (BACTEC)
7. Automated Microbiology Systems

Recommended Books:

(1) Ryan KJ, Ray CG. Sherris medical microbiology: McGraw-Hill Medical Publishing. 6th Edition. 2014

(2) Shanson DC. Microbiology in clinical practice. Butterworth-Heinemann; 3rd Edition 1999

(3) Lee G, Bishop P. Microbiology and infection control for health professionals. Pearson Higher Education. 5th Edition. 2013

(4) Engelkirk PG, Duben-Engelkirk JL, Burton GR. Burton's microbiology for the health sciences. Lippincott Williams & Wilkins; 2011.

MLT-607	Advanced Molecular Biology	4 (3-1)

Theory:

Introduction; central dogma of biology, Prokaryotic & eukaryotic gene organization, Review of DNA cloning techniques, plasmid biology, vectors, bacterial genetics related to DNA cloning methods, Clone verification and blotting methods, DNA sequencing and PCR, Agarose gel electrophoresis safety, principles & practice , Restriction endonucleases, other molecular biology enzymes, Nucleic acid purification, quantification methods, Polymerase Chain Reaction and other DNA amplification methods, Animal genetic engineering and cloning, Hormones, receptors and signal transduction, Detection and Identification of Microorganisms; specimen collection, sample preparation, Selection of Sequence Targets for Detection of Microorganisms, Molecular Detection of Bacteria, Molecular mechanisms of resistance to Antimicrobial Agents, Molecular Detection of Resistance, Molecular Strain Typing Methods for Epidemiological Studies. Molecular basis of cancer, analytical targets of molecular testing, Gene and Chromosomal Mutations in Solid Tumors, Microsatellite Instability, Loss of Heterozygosity, Quality Assurance and Quality Control in the Molecular Laboratory

Practical:

1. Safety, basic techniques: pipetting, sterile technique, bacterial culture
2. Agarose gel electrophoresis
3. SDS-PAGE
4. PCR
5. PCR-RFLP
6. Purification and Characterization of Plasmid DNA

Recommended Books:

(1) Lodish H. Molecular cell biology. Macmillan; 7th Edition. 2013.
(2) Buckingham L. Molecular diagnostics: fundamentals, methods and clinical applications. FA Davis; 2011.
(3) Clark DP, Pazdernik NJ, Molecular Biology, Elsevier, 2013 Science
(4) Ream W, Field KG. Molecular biology techniques: an intensive laboratory course. Academic Press; 1998

MLT-609	Advanced Diagnostic and Biomedical Techniques	3 (2-1)

Theory:

Methods of qualitative analysis, Principles of automated blood cell counters; Introduction, Hb measurement, Red cell measurements, Reticulocyte and nucleated RBC measurement, White cell measurements. Ion-selective electrodes; Introduction, Specificity---how electrodes are made selective, Electrochemical reactions, Glucose electrodes, Electrochemical detectors, Complex electrodes, other complex enzyme-mediated electrodes. Light absorption, scatter and luminescence techniques in clinical biochemistry: Light absorption techniques, Turbidimetry and nephelometry, Luminescence. Analytical atomic spectrometry; Introduction, Principles, Instrumentation and Applications. Dry reagent chemistry techniques; Introduction and Principles of Methodology. Separation techniques in clinical laboratory; Chromatography, Thin-layer chromatography (TLC), High-performance liquid chromatography (HPLC), Gas chromatography (GC), Electrophoresis, Real-time PCR chemistries; TaqMan PCR chemistry, TaqMan primer and probe design, Amplicon detection, TaqMan real-time detection, Absolute and Relative quantitation. Background to CGH and array CGH, Overview of comparative genomic hybridization, Microarrays, Clinical applications. DNA sequencing, Chemical sequencing of DNA, The dideoxy method of DNA sequencing, Application of DNA sequencing. Fluorescence in situ hybridization, Choice of probe, Labelling of probes, Hybridization, Detection of hybridized probe, Applications in basic research, Applications in medical genetics, Applications in cancer diagnosis and research

Practical:

Automated blood cell counters; principle and procedures

Ion selective electrodes; principle and procedures

Principle and procedure of SDS-PAGE

Western blotting for the detection of proteins

Southern blotting: principle and procedures

Recommended Books:

Ream W, Field KG. Molecular biology techniques: an intensive laboratory course. Academic Press; 1998 Nov 17.

Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.

Bishop ML, Fody EP, Schoeff LE, editors. Clinical Chemistry: Principles, Techniques, and Correlations. Lippincott Williams & Wilkins; 2013 Feb 20.

MLT-611	Quality Assurance Management	2 (2-0)

Theory:

Introduction to Quality management, Quality Assurance in the Medical Laboratory, Personnel Qualifications and Proficiency Testing. Quality Improvement and Effective Quality Assurance Programs; internal and external quality controls. Spectrophotometry for QC, QC Terminology, Quality Control Concepts. Random Error, Standard Deviation (SD), Spread of Data on the Scale, calculation of Variance, Standard Deviation, Equation for Calculating a Standard Deviation and a Coefficient of Variation. Analyzing Quality Control Results. Out of Range results management. Sequential Steps for Out-of-Range Controls, Rejection and acceptance of tests/controls. Comparison of Precision, Reproducibility and Accuracy, Normal Reference Ranges and associated problems. Erroneous Samples, Effects of Position on Laboratory Values, Factors Affecting Laboratory Values, Types and Characteristics of Samples, Categories of Errors Pre-analytical, Analytical, Post-analytical, Interpretation of Results, Clinical versus Statistical Significance, Specificity and Sensitivity, Efficiency, Reporting of Results, Computer Processes within the Clinical Laboratory, Central Computer Memory, Software for Mechanical Functions and Calculation of Results, Administrative Functions and Related Personnel Tasks.

Recommended Books:

Crocker J, Burnett D, The Science of laboratory diagnosis. John Wiley & Sons; 2005.

Bishop ML, Fody EP, Schoeff LE, editors. Clinical Chemistry: Principles, Techniques, and Correlations. Lippincott Williams & Wilkins; 2013 Feb

MLT-613	Clinical Genetics	3 (2-1)

Theory:

Genetics and genomics in medicines, The human genome and chromosomal basis of Heredity, Medical relevance of mitosis and meiosis, Karyotype and chromosome analysis, common chromosomal disorders, Molecular basis of mutations and methods of mutation detection, Mendalian inheritance in man, Mitochondrial disorders, Inherited disorders running in families, Pedigree analysis, risk assessment in Mendalian disorders, Polymorphism, LOH assay, Tools of clinical genetics: analysis of individual DNA and RNA sequences, Methods of nucleic acid analysis, The polymerase Chain Reaction, Western Blot Analysis of Proteins, cytogenetic analysis in cancer, prenatal diagnosis, personalized genetic medicines, genetic screening in population, Screening of genetic susceptibility to disease, Ethical issues in Medical Genetics

Practical:

1. DNA extraction from blood and Saliva and Quantification
2. RNA extraction from human blood
3. Pedigree drawing and Haplotype analysis for carrier status
4. Internet and Human Genetics
5. Primer Designing and PCR
6. Agarose Gel Electrophoresis
7. Polyacrylamide Gel Electrophoresis
8. Gene expression analysis

Recommended Books:

1- Nussbaum R, McInnes RR, Willard HF. Thompson & Thompson genetics in medicine. Elsevier Health Sciences; 8th Edition

2- Read AP, Donnai D. New clinical genetics. Bloxham/Oxfordshire: Scion; 2007. 3rd Edition

3- Strachan T, Read A, Human Molecular Genetics 4th Edition

8th Semester

AHP-602	Epidemiology	3 (3-0)

Epidemiology, the historical contest, definition and scope of epidemiology, Measuring health and disease; definition of health and disease, measurement of disease frequency, prevalence and incidence rate, cumulative incidence rate, case fatality, use of available information, mortality, mortality before or after birth, life expectancy, morbidity, disability. Types of epidemiological studies; Observational studies including descriptive, ecological, cross sectional, case control, cohort studies. Experimental epidemiology including randomized clinical trials, field trails, community trials. Potential errors and bias in epidemiological studies. Ethical issues in epidemiological studies. Epidemiology and prevention; levels of prevention including primordial, primary, secondary and tertiary. Diseases screening programs. Communicable disease epidemiology; epidemic and endemic diseases, the infection chain, investigation and control of communicable disease epidemics, clinical epidemiology, normality and abnormality, diagnostic and prognostic tests. Prevention. Environmental and occupational epidemiology, health services and health policy.

Recommended books:

Bonita R, Beaglehole R, Kjellström T. Basic epidemiology. World Health Organization; 2006.

Salyers, A. A. and Whitt, D. D., 2002. Microbiology: Diversity, Disease, and the Environment. John-Wiley and Son Limited.

Ziegler, A., and Koenig, I. R., 2006. A Statistical Approach to Genetic Epidemiology: Concepts and Applications. John-Wiley and Son Limited.

Haines, J. L., Pericak-Vance, M. A., 2006. Genetic Analysis of Complex disease. Wiley, John and Sons Incorporated.

Adami, H.O., Hunter, D., Trichopoulos D., 2002. Textbook of Cancer Epidemiology. Oxford Press. Seedhouse, D., 2003. Health Promotion: Philosophy, Prejudice and Practice, 2nd Edition. John Wiley and Sons limited.

BNB-402	Bioinformatics	3 (2-1)

Theory:

Introduction and Importance of Bioinformatics; Internet Basics; World Wide Web and Web Browsers; Important Glossary of Bioinformatics; Biological Databases; Data Annotation and Redundancy; Entrez; Introduction to National Center for Biotechnology Information (NCBI); GENBANK Sequence Database; European Bioinformatics Institute (EBI); DNA Data Bank of Japan (DDBJ); Protein Sequence Primary Databases; Secondary Databases; Protein Pattern Databases; Structure Classification Databases; Analysis of Protein Sequences; Genome Organization and Resources; Genome Maps; Genome Projects; Human Genome Project.

Practical:

Internet browsers and bioinformatics, Primary databases for literature survey, Primary databases for DNA and Protein sequences, Searching and retrieval of DNA and Protein sequences, Navigating genome browsers for assessing and interpreting the data, Databases of online tools for DNA and Protein sequence analysis, DNA and Protein sequence analysis using online tools, Primer designing and calculation of primer parameters.

Recommended Books:

1. Baxevanis, A. D. and Ouellette, B.F.F. (2004) *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*. A John Wiley and Sons, Inc. Publication, New York.
2. Baxevanis, A. D. *et al*., (2013) *Current Protocols in Bioinformatics*. Wiley Publishers (Online Library).
3. Claverie, J.M. and Notredame, C. (2007) *Bioinformatics for Dummies*. Wiley Publishing Inc., Indianapolis, Indiana.
4. Ye, S.Q. (2008) *Bioinformatics: A practical Approach.* Chapman and Hall/CRC Publishers, Taylor and Francis Group, London, UK.
5. Xiong, J. (2006) *Essential Bioinformatics*. Cambridge University Press, Cambridge, UK.
6. Orengo, C.A., Jones, D.T. and Thornton, J.M. (2007) *Bioinformatics: Genes, Proteins, and Computers*. BIOS Scientific Publishers Ltd, Oxford, UK.
7. Ignacimuthu, S. (2005) *Basic Bioinformatics*. Narosa Publishing House, New Delhi, India.
8. Srinivas, V.R. (2005) *Bioinformatics - A Modern Approach*. Pentice Hall of India (PHI), New Delhi, India.

PHS-503	Endocrinology	3 (2-1)

Theory:

Introduction: Endocrine Glands, Functional anatomy of different endocrine glands, General account of chemical nature and biosynthesis of hormones, Transport of hormones to the site of action

Mechanism of Hormone Action: Hormonal signaling and its role in coordination of molecular, cellular and tissue functions; conceptual account of different types of signaling and transductions,

Hormone Functions: physiological actions of the hormones of hypothalamus, pituitary, thyroid, parathyroid, endocrine pancreas, adrenal cortex, adrenal medulla, gonads, corpus luteum, pineal, thymus. Endocrine secretions of heart, kidney and adipose tissue.

Invertebrate hormones. Hormones involved in molting and metamorphosis.

Control of Hormonal Secretion: Negative and positive feedback regulation.

Practical:

1. To demonstrate the position of various endocrine glands
2. Experiments to reveal the roles of endocrine glands and their hormones in physiological functions
3. The effect of insulin on glycemic level.
4. To determine the random and fasting blood glucose level.
5. To perform oral glucose tolerance test in human/animals.
6. To determine the effect of cortisol on biochemical parameters (glucose/protein)
7. To determine the effect of MSH on skin pigmentation.

Recommended Books:

Greenspan, F. S. and Strewler, G. J. Basic and Clinical Endocrinology. Prentice-Hall, New York, 2004. (Recommended Textbook).

Guyton, A. C. and Hall, J. E. Textbook of Medical Physiology. 12th ed. W. B Saunder, 2005.

Molina, P. E. Endocrine Physiology. McGraw-Hill, Boston, 2003.

Kacsoh, B.. Endocrine Physiology. McGraw-Hill, Boston. 2000.

Wilson, J. D., Foster, D. W., Larsen, P. R and Kronenberg, H. Williams Textbook of Endocrinology. W. B. Saunders, Philadelphia. 2002.

Ganong, W. F. Review of Medical Physiology. 24th ed. McGraw-Hill. 2005.

Gerald D. Tharp, David A. Woodman Experiments in physiology. 10th Edition.

MLT-604	Clinical Laboratory Management	3 (3-0)

Early History and Birth of a Profession, Timeline for Evolution of the Clinical Laboratory, Recognition of MLT as a Profession, Official Regulation of Medical Laboratories and Workers, Credentialing and Certification of Medical Laboratory Technical Workers. Clinical and Anatomic Pathologist/Director, Doctor of Laboratory Medicine (D.L.M.), Clinical Sciences Specialist, Laboratory Manager, Clinical Laboratory Scientist/Medical Technologist, Technician-Level Medical Laboratory Worker, Phlebotomists. Laboratory Accreditation, Facility and Departmental Licensure and Accreditation, Personnel Certification or Licensure, Specialty Designation for Categories of Clinical Laboratory Scientists. Legal, Moral, and Ethical Concerns. Patient Expectations and Rights. Medical Law and Privacy of medical information. Hospital and Laboratory Organization. Departments including Hematology, Coagulation, Immunohematology (Blood Banking), Clinical Chemistry, Serology (Immunology), Microbiology. Laboratory Design Laboratory-Specific Economics, Reference Laboratories, Elements Involved in Calculating the Costs of Performing Tests, Screening Tests, Contracts for Services, Equipment, and Supplies, Laboratory safety and hazards. Infection control. Laboratory management; business plan, technology, staff, services, threats, cost analysis. Laboratory Information system; from sample collection to reporting. Total quality management and accreditation. Laboratory management training. Management of laboratory Resources; Management of time, space, equipment and supplies

Recommended books:

Ridley J. Essentials of Clinical Laboratory Science. Delmar Cengage Learning; 2010.
De Kieviet W, Frank E, Stekel H. Essentials of clinical laboratory management in developing regions. IFCC Series. 2009.
Mekonnen E. Health Laboratory Management and Quality Assurance.

MLT-606	**Research Project/Term paper**	**3 (0-3)**