

**Syllabus For
B.Voc in
Medical Lab and Molecular Diagnostic Technology
2021 Onwards
Under
Choice Based Credit System (CBCS)**



**Centre for Vocational Studies
Islamic University of Science and Technology,
Awantipora, Pulwama, 192122**

SEMESTER-I

Course Type: Soft Skill
Course Title: English Communication Skills
Course Code: MLT101S

Credits: 04

M.M: 100

Course Learning Objectives: The objective of the course is to develop an effective understanding of the fundamentals of verbal/non-verbal communication and to build the communication skills of students through reading, comprehension, and listening.

Unit I: Fundamentals of Verbal Communication

Role and purpose of communication. Forms of communication. Barriers to effective communication

Unit II: Fundamentals of Non-verbal Communication

Relevance and effective use. Para language: Importance, Elements, Interpretation. Kinesis, Proxemics, Haptics, Chronemics, Occulesics. Cross-cultural non-verbal communication

Unit III: Effective Reading and Comprehension

Process and types of reading. Reading tactics and strategies. Skimming, Scanning, Intensive reading, Extensive reading. Reading business/technical press. News reading. Reading Comprehension

Unit IV: Listening Skills

Process, Importance and Types of Listening. Effective Listening: Principles and Barriers. Paraphrasing/Summarizing. Activities to enhance listening

Course Type: Soft Skill
Course Title: Ecology & Environment
Course Code: MLT102F

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to help the students better understand the surroundings, dynamics of atmospheric processes, which include its composition, meteorological phenomena, and atmospheric chemistry. Further, the course will also help students understand and evaluate the global scale of environmental problems and reflect critically on their roles, responsibilities, and identities as citizens, consumers, and environmental actors in a complex unified world. They will also develop an understanding of biomedical waste management and its impact on the environment

UNIT I: Ecology - I

(15 Lectures)

Ecology: definition, importance, and types (autecology and synecology). Ecosystem structure and functions. Types of ecosystems— aquatic and terrestrial. Biological communities and species interactions. Types of interactions between species. Ecological succession: types, causes, and process of succession. Biogeochemical cycles - nitrogen, carbon, phosphorus, and water.

UNIT II: Ecology – II

(15 Lectures)

Concept of species, population dynamics, and growth curves. Community structure and dynamics. Energy flow in an ecosystem. Food chain, food web, and ecological pyramids. Animal associations—Mutualism, Commensalism, Parasitism, competition, and predation ecological adaptations.

UNIT III: Environmental Pollution

(15 Lectures)

Environmental pollution – sources, effect, and control measures of air, water, soil, and noise pollution. Acid rains - sources and impact on biological systems. Greenhouse effect. Global warming and climate change. Ozone depletion-environment policy and agreements. Smog – types and processes; photochemical processes role of an individual to prevent pollution. Disaster management: floods, earthquakes, cyclones, and landslides.

UNIT IV: Biomedical Waste Management

(15 Lectures)

Present scenario of bio-medical waste (BMW)—concepts and perceptions, waste generation, segregation, and disposal. Planning and objectives of BWM management. Survey, policies, and perspectives of BMW management. Record keeping. Management of bio-medical waste. Technologies for treatment for BMW. Criteria for selecting appropriate medical waste technologies. Occupational safety and health issues. Legal aspects and environmental concerns. Implementation of the action plan. Approaches to a common regional facility.

Suggested Readings

- i. M. P. Arora, 'Ecology' Himalaya Publishing company.
- ii. P. D. Sharma, 'Environmental Biology'.
- iii. P. R. Trivedi and Gurdeep Raj. 'Environmental Ecology'
- iv. Buddhadeb Sarma and Tej Kumar, Indian Wildlife Threats and Preservation
- v. Chapman J.L. and Reiss M.J, Ecology Principles and Applications, Second Ed., Cambridge University Press, London.
- vi. Benny Joseph, Environmental Studies, TATA Mc Graw Hill Com., New Delhi.

Course Type: Aptitude Development
Course Title: Fundamentals of Biomolecules
Course Code: MLT103A

Credits: 04

M.M: 100

Course Learning Outcomes:

Students taking this course will be able to demonstrate an understanding of the fundamental biochemical principles, such as the structure & function of bio-molecules present within our body.

UNIT I: Carbohydrates

(15 Lectures)

Definition and classification of carbohydrates; classification based on functional groups and number of monomeric units. Ring structures and conformations of sugars. Glycosidic bonds. Monosaccharides, disaccharides, oligosaccharides, and polysaccharides. Complex polysaccharides—structural and storage polysaccharides. Dietary fibers; homo and hetero-polysaccharides, glycoproteins. Mutarotation, anomers, epimers, and enantiomers, biologically important sugar derivatives, reduction and oxidation of sugars and other important reactions. Introduction to carbohydrate metabolic disorders.

UNIT II: Lipids

(15 Lectures)

Lipids: definition, structure, classification and function of lipids; saturated & unsaturated fatty acids, nomenclature. Isomerism. Essential fatty acids, their biological functions, storage lipids- triacylglycerol and waxes. Structural lipids; phospholipids- glycerophospholipids, sphingolipids, glycolipids- glyceroglycolipids. Brief classification, structural and functional introduction to sterols, fat-soluble vitamins and eicosanoids. Introduction to lipid disorders (fatty liver and atherosclerosis)

UNIT III: Amino Acids & Introduction to Proteins

(15 Lectures)

Amino acids and peptide bonding: classification, structure stereoisomerism, and naming- RS system for designating optical isomers. Classification based on the nature of "R" groups. Amino acids present in proteins and non-protein amino acids. The specialized role of amino acids. Physical and chemical properties of amino acids—titration curve. Peptide- naming and formation of a peptide bond. Rigid and planar nature of a peptide bond. Proteins structure—hierarchical structures in proteins-primary structure, predominant secondary structures, tertiary and quaternary structures. Nature of non-covalent interactions and covalent bonds in protein folding. Chemical properties and denaturation of proteins.

UNIT IV: Nucleotides & Introduction to Nucleic Acids

(15 Lectures)

Structural chemistry of purines and pyrimidines, nomenclature of nucleosides and nucleotides. Structure of nucleic acids (DNA and RNA); stability of the nucleic acid structure (anti-parallel strands, stability-complementary base pairing, and stacking); the conformation of nucleic acids (a, b, z DNA, tRNA, mRNA); DNA Vs RNA. Physical and

chemical properties of nucleic acids. Denaturation of DNA. DNA and RNA as genetic material in viruses, bacteria, and eukaryotes. Historical experiments demonstrating DNA as a genetic material.

Suggested Readings:

- i. Lehninger: Principles of Biochemistry (2013) 6th Ed. 6 Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 /ISBN:10:1-4292-3414-8.
- ii. Harper's Illustrated Biochemistry Thirty-First Edition Paperback – Illustrated, 23 May 2018

Course Type: Core Course
Course Title: The Fundamentals of Anatomy & Physiology
Course Code: MLT104C

Credits: 04

M.M: 100

Course Learning Outcomes:

The prime objectives of this course are to make students aware of the terminology used in human anatomy and understand the function of all physiological systems. They will also develop the basic knowledge of body plan and organization of the human body, structure of cells, tissues, organs, organ systems, and their coordination with each other to yield integrated physiological response.

UNIT I: Skeletal System & Muscular System (15 Lectures)

Introduction to the human body: Introduction to Anatomy and Physiology. Elementary tissues of the body and their classification along with a brief description. Organ and systems. Cell as a basic unit of life. Cell cycle. Mitosis and meiosis. Skin (structure and functions). Regulation of body temperature. Physiology of pain.

Skeletal system: The Skeleton. Important bones and their brief description. Articulation of bones– joints. Classification of joints. Bones of the skull. Bones of the upper limb. Bones of the thorax. Bones of the pelvic girdle. Bones of lower limb.

Muscular system: Brief description of skeletal, smooth, and cardiac muscles. Muscles of head, face, neck. Muscles of shoulder girdle, upper limb. Muscles of thorax. Muscles of abdomen and back. Muscles of pelvis. Muscles of lower limb, buttock, thigh, leg and foot. Functions of muscles. Properties of muscle. The physiology of muscle contraction. Energy for muscle contraction

UNIT II: Digestive, Respiratory & Reproductive System (15 Lectures)

Digestive system: Various organs of digestion and their functions (stomach, small intestine) and accessory organs (liver, pancreas, and salivary glands). Process of digestion of food. Absorption and assimilation of food.

Respiratory system: Organs of respiration and their histology. Respiration (definition and mechanism). Mechanism of respiration. Regulation of respiration. Respiratory volumes. Gas exchange in the lungs. Basal metabolic rate.

Reproductive system: Male and female reproductive system. Structure and functions. Puberty. Menstrual cycle. Menopause. The ovarian cycle and ovulation. Fertilization.

UNIT III: Nervous System & Excretory System (15 Lectures)

Nervous system: Central nervous system (brain and spinal cord). Peripheral nervous system (cranial and spinal nerves). Autonomic nervous system. Sympathetic & parasympathetic. Reflex action. The sense organs (eye, ear, tongue and nose)—structure and functions. Mechanism of sight. Mechanism of hearing and equilibrium. Sensation of gustation. Sensation of olfaction.

Excretory system: Organs of excretion (kidneys, ureter, bladder). Functions of kidney.

Structure of nephron. Formation of urine and its composition.

UNIT IV: Circulatory System & Endocrine System

(15 Lectures)

Circulatory system: Composition and functions of blood. Anatomy and physiology of heart. Circulation of blood- systemic, pulmonary, coronary. Functions of heart. Cardiac cycle and conducting system of heart. Cardiac output. The blood pressure. Factors affecting blood pressure. Hypertension and hypotension. Arteries and veins. Disorders of blood vessels. Lymph and lymphatic system. Functions of lymphatic system. Spleen.

Endocrine system: Description of each endocrine gland (pituitary, thyroid, parathyroid, adrenal glands, pancreas, gonads)—their secretions and their effect on the body.

Course Type: Core Course
Course Title: The Fundamentals of Anatomy & Physiology Practical
Course Code: MLT105C

Credits: 04

M.M: 100

1. Identification and Description of various parts of body.
2. Identification and Description of tissues of body.
3. Identification and Description of various parts of skin (demonstration from models)
4. Identification and Description of various bones and joints.
5. Identification and Description of parts of digestive system.
6. Identification and Description of parts of respiratory system.
7. Identification and Description of parts of excretory system.
8. Study of various parts of nervous system (brain and spinal cord) (demonstration from model)
9. Study of structure of eye and ear (demonstration from models)
10. Study of structural differences between skeletal, smooth and cardiac muscles (permanent mounts) through demonstration.
11. Study of various parts of circulatory system through demonstration.
12. Examination of stained blood film for blood cells
13. Study of various parts of reproductive system (male and female demonstration from models and charts)
14. Measurement of Pulse, Blood Pressure.

Suggested Readings:

- i. Anatomy and Physiology in Health and Illness - Wilson Katheen, Anne Waugh; Churchill Living Stone.
- ii. Concise Medical Physiology- Sujit Chaudhari; Central.
- iii. Textbook of Medical Physiology- Arthur Guyton and Hall; W.B. Saunders.
- iv. Understanding Medical Physiology R. L. Bijlani, Jaypee
- v. Basic Anatomy and Physiology by N. Murgesh
- vi. Seeley's Anatomy & Physiology.
- vii. Essentials of Medical Physiology by K. Sembulingam

Course Type: Core Course
Course Title: General Pathology & General Microbiology
Course Code: MLT106C

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to develop a basic understanding of why and how diseases develop and the changes that occur at the macroscopic, tissue and cellular level. The student will become familiar with the terminology used in pathology, identify physiological changes that occur at the macroscopic and microscopic level, perform various basic clinical pathology tests. The students are also expected to be able to learn the morphology, staining, cultural characteristics and identification of bacteria.

UNIT I: General Pathology

(15 Lectures)

Cell injury and cellular adaptations—Normal cell, Cell injury- types of cell injury, etiology of cell injury, morphology of cell injury, & cellular swelling. Cell death types—autolysis, necrosis, apoptosis & gangrene. Cellular adaptations—atrophy, hypertrophy, hyperplasia & dysplasia. Inflammation—acute inflammation, & chronic inflammation. Haemodynamic disorders—oedema, hyperemia, congestion, hemorrhage, circulatory disturbances, thrombosis, ischemia & infarction. Neoplasia and how does it differ from hyperplasia? Healing—definition, different phases of healing, factors influencing wound healing.

UNIT II: Clinical Pathology

(15 Lectures)

Urine analysis: composition of urine; collection and preservation of urine; physical and chemical examination of urine; microscopic examination of urine; clinical significance of urine analysis. Interpretative urinalysis.

CSF analysis: formation and normal composition of CSF, collection and preservation of CSF, physical and chemical examination of CSF; microscopic examination of CSF; clinical significance of CSF analysis.

Semen analysis: composition of semen, collection and preservation of semen, morphology of human spermatozoa. Physical and chemical examination of semen, microscopic examination of semen, clinical significance of semen analysis.

Sputum analysis: composition of sputum, collection and preservation of sputum, physical and chemical examination of sputum, microscopic examination of sputum, clinical significance of sputum analysis. Cavity fluids: transudates and exudates; pleural fluid. Synovial fluid analysis, peritoneal fluid analysis, pericardial fluid analysis.

UNIT III: General Microbiology—(Part I)

(15 Lectures)

General characters and classification of bacteria. Characteristics of bacteria morphology- shape, capsule, flagella, inclusion, granule, spore. Growth and maintenance of microbes. Bacterial division, batch culture, continuous culture, bacterial growth-total count, viable count, bacterial nutrition, oxygen requirement, CO₂ requirement, temperature, pH, light.

Sterilization and disinfection. Physical agents- sunlight, temperature less than 100°C, temperature at 100°C, steam at atmospheric pressure and steam under pressure, irradiation, filtration. Chemical agents- alcohol, aldehyde, dyes, halogens, phenols, ethylene oxide. Heat sterilization. Incineration.

UNIT IV: General Microbiology—(Part II)

(15 Lectures)

Culture media—Definition, uses, basic requirements, classification, agar, peptone, transport media, sugar media, anaerobic media, containers of media, forms of media. Staining methods: gram staining, Ziehl- Neelsen staining or AFB staining, negative impregnation. Collection and transportation of specimen: general principles, containers, rejection, samples—urine, feces, sputum, pus, body fluids, swab, blood. Disposal of laboratory/hospital waste: non-infectious waste, infected sharp waste disposal, infected non-sharp waste disposal.

Course Type: Core Course
Course Title: General Pathology & General Microbiology - Practical
Course Code: MLT107C

Credits: 04

M.M: 100

1. General Pathology

- (i) Components & Setting of the Compound Microscope.
- (ii) Focusing of Object.
- (iii) Use of Low & High-Power Objectives of Microscope.
- (iv) Use of Oil Immersion Lens.
- (v) Care and Maintenance of the Microscope.
- (vi) Different Types Microscopy: Dark Field Microscopy Fluorescence Microscopy.

2. General Microbiology

- (i) Preparation of Swabs/Sterile Tubes & Bottles.
- (ii) Preparation of Smear.
- (iii) Staining: Gram & Ziehl-Neilsen Staining.
- (iv) Preparation of Culture Media.
- (v) Identification and Study of Instruments.
- (vi) Identification of Common Microbes.

Suggested Readings:

- i. Textbook of Pathology - Harsh Mohan; Jaypee
- ii. Basic Pathology - V. Kumar, S. Robbins; Harcourt
- iii. Pathology - Emanuel Rubin; Lippincott
- iv. Pathology - Ian Cree; Chapanmann Hall
- v. Text Book of Microbiology - Pelczar, Chan, Kreig
- vi. Bacteriology - A.J. Salle

SEMESTER-II

Course Type: Aptitude Development
Course Title: General Chemistry
Course Code: MLT150F

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to help students understand and explain the differential behavior of organic compounds based on fundamental concepts learnt. Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved. Understand the concept of pH and its effect on the various physical and chemical properties of the compounds. Understand the fundamentals of functional group chemistry through the study of methods of preparation, properties, and chemical reactions with the underlying mechanism.

UNIT I: Chemical Thermodynamics

(15 Lectures)

Introduction and Importance. First Law of Thermodynamics, Work done in Isothermal and adiabatic conditions. Heat capacities, Relation between C_p and C_v relations, Second Law of Thermodynamics, Concept of Entropy, Carnot engine, Gibbs free energy. Free Energy Changes as Criteria of Reversible and Irreversible process, Gibbs Helmholtz's equation, Clausius-Clapeyron equation.

UNIT II: Fundamental Chemistry

(15 Lectures)

Molecular weight & Equivalent weight of elements and compounds. Normality, Molarity, Molality. Stock and working solutions. Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H_2SO_4 , H_3PO_4 , CH_3COOH , etc.); Preparation of percent solutions – w/w, v/v w/v (solids, liquids, and acids); Conversion of a percent solution into a molar solution; Saturated and supersaturated solutions; Standard solutions: Technique for preparation of standard solutions and Storage. e.g. glucose, albumin, etc.; Dilutions—Diluting Normal, Molar and percent solutions. Preparing working standard from stock standard; Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors.

UNIT III: Acid-Base Reactions

(15 Lectures)

Acid-Base concept: Arrhenius concept, theory of solvent system (in H_2O , NH_3 , SO_2 and HF), Bronsted-Lowry's concept, relative strength of acids, Pauling rules. Amphoterism. Lux-Flood concept, Lewis concept. Superacids, HSAB principle. Acid base equilibria in aqueous solution and pH. Acid-base neutralization curves; indicator, choice of indicators; Buffers used in biochemistry- near neutral, mid acidic, and mid basic buffers.

UNIT IV: Organic Chemistry

(15 Lectures)

Electronic Displacements: Application of Electronic Effects.

Reaction intermediates: Carbocations, Carbanions, and Free radicals. Aromaticity:

benzenoids and Huckel's rule.

Carbon in organic molecules: Formation of C–C, C=C, C=C, C–O, C=O bonds. Polar and non-polar character of carbon-carbon and carbon–hetero atom bonds. Application of dipole moment in aliphatic and aromatic compounds. Inter- and intra-molecular forces and their effects on physical and chemical properties of molecules.

Stereochemistry of carbon compounds: Isomerism, Enantiomers, and Diastereoisomers; Interchanging of Fischer, Sawhorse, and Newman Projection formulae of simple molecules containing one and two asymmetric carbon atom (s). Asymmetric carbon atom, chirality, optical activity. Nomenclature: E & Z, D & L for carbohydrates and amino acids only and R & S for one stereogenic center molecule.

Organic reaction mechanism: (i) classification of reagents: nucleophiles, electrophiles, free radicals; regioselectivity and chemoselective reactions.

Suggestive Readings:

- i. Lee., J. D.(2010), A new Concise Inorganic Chemistry, Pearson Education.
- ii. Huheey, J.E.; Keiter, E.; Keiter, R. (2009), Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
- iii. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A.(2010), Shriver and Atkin's Inorganic Chemistry, Oxford
- iv. Bahl, A; Bahl, B. S. (2012), Advanced Organic Chemistry, S. Chand.
- v. Practical: 1. Jeffery, G.H.; Bassett, J.; Mendham, J.; Pearson.

DISCIPLINE CENTRIC ELECTIVES: Aptitude Development
COURSE TITLE: Lab Management and Ethics
COURSE CODE: MLT151A

Credits: 02

M.M: 50

Course Learning Outcomes:

The main objective of this course is to identify and explain the role and responsibilities of a laboratory manager, including staff training and supervision, procurement, and finances. It will also help students develop work practices that demonstrate an understanding of the health and safety requirements, ethical conduct, risk management, and record-keeping in the context of medical science.

UNIT I: Introduction to Clinical Laboratory (15 Lectures)

Introduction, Layout, Facility of clinical Laboratory- Role of medical laboratory technology in total health care, principles of management, techniques of planning, physical facilities/equipment – layouts and design. Laboratory Organization and Layout- Laboratory organization, operation, job description, evaluation, performance. Layout of clinical laboratory. Lay out of Blood Bank. Material Required. Material management, procurement, financial resources, importing, inventory, control, and analysis, inspection, storage etc. Quality Assurance. Analytical control, Internal and external quality assurance in clinical laboratories, precision, accuracy, standard deviation as per national standards.

Safety Precautions Safety measures in clinical laboratories (microbiology, hematology, biochemistry, histopathology and cytology, transfusion medicine),

UNIT II: Ethical Principles in a Clinical Laboratory (15 Lectures)

Ethical principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, good laboratory practice (GLP), introduction to basics of GLP and accreditation, aims of GLP and accreditation, advantages of accreditation, brief knowledge about national and international agencies for clinical laboratory accreditation. Medical Ethics and Code of Conduct. Ethics and code of conduct - legal aspects – confidentiality malpractice/ negligence; legal implications, law suits, consumer protection and insurance for professional health hazards.

Suggested Readings:

- i. Acar, Sevil, and Erinc Yeldan, eds. *Handbook of Green Economics*. Academic Press, 2019.
- ii. Newton, Adrian C., and Elena Cantarello. *An introduction to the green economy: Science, systems and sustainability*. Routledge, 2014.
- iii. Barbier, E.B. and Markandya, A., 2013. *A new blueprint for a green economy*. Routledge.

- iv. Richardson, Robert B. *Building a green economy: perspectives from ecological economics*. Michigan State University Press, 2013.

Course Type: Aptitude Development

Course Title: Basic Medical Care

Course Code: MLT152A

Credits: 02

M.M: 50

Course Learning Outcomes:

- The main objective of this course is to help the student understand the general rules of first aid and treatment of minor ailments.

Unit I: Basic Medical Care & Treatment of Minor Ailments (15 Lectures)

Introduction—Principles of Medical care. Treatment of minor ailments. Lifesaving drugs. Home nursing. Hygiene of the patient. Observation of the patient-temperature, Measurement of pulse. Role and functions of the Healthcare Workers in the health sector. Role in accidents and diseases; management of accidents; management and care of the sick.

Signs, Symptoms and treatment of conditions affecting the:

- a. Skin—Itching, Rashes, Scabies, Ulcer, Boils, Urticaria, Frostbite.
- b. Eye and Ear—Earache, Discharging ear, Dry eyes, watering eyes, Red eyes.
- c. Skeleton—Joints pain, Dislocations. Sprains.
- d. Respiratory System—Nose Bleeding, Chest pain, Common Cold, Asphyxia.
- e. Digestive System—Diarrhoea, Constipation, Indigestion, Worms, Sores in the mouth, Bleeding gums, Blood in stool.
- f. Urinary System—Urine Retention, Enuresis, Incontinence.
- g. Neuromuscular System—Headache, Fever, Heat stroke, Convulsions. Unconsciousness.
- h. Reproductive system—Sores on the Genital area, Vaginal discharge, Abnormal menstruation, Prolapse, Breast lump.

Unit II: First Aid & Animal Bites

(15 Lectures)

First Aid and Emergency Care—General rules. First Aid Kit. Blood Pressure. First aid measures. Promoting safety consciousness. First aid in wounds and haemorrhage. First aid in unconsciousness. First aid treatment for critical burns, mild burns, scalds. First aid measures in Electric shock. Chemical injuries. Application of Bandages, Slings, Dressings, Splints. First Aid for Animal Bites—Dog, Rodents, Snakes, Scorpion. Wasp sting. Common bacteria involved in various animal bite wound infections. Immunization.

Suggested Readings:

- i. Thompson, Charlotte E. *101 Ways to the Best Medical Care*. Infinity Publishing, 2006.
- ii. Cole, Steven A., and Julian Bird. *The Medical Interview E-Book: The Three Function Approach*. Elsevier Health Sciences, 2013.
- iii. Bhushan, Vikas, Tao Le, Rohit Chandwani, and Ali Ozturk. *First Aid for the USMLE Step 1 2006*. McGraw-Hill, 2006.
- iv. Auerbach, Paul S. *Medicine for the Outdoors E-Book: The Essential Guide to First Aid and Medical Emergencies*. Elsevier Health Sciences, 2015.

Course Type: Aptitude Development
Course Title: Medical Genetics
Course Code: MLT153A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to demonstrate an understanding of the basis of heredity and variation in living organisms. They will also learn about how changes in the human genome result in disease and disability. The student will be able to draw a comprehensive family medical history and construct a pedigree and how to recognize medical history and features that suggest genetic disease.

UNIT I: Mendel's Laws of Inheritance

(15 Lectures)

Symbols and terminology, mendel's experiments, mendel's results. Principle of segregation, principle of independent assortment. Rules of probability. Monohybrid cross, dihybrid cross, test cross, back cross. Multiple alleles and iso-alleles, linkage, crossing over. Lethal and sub-lethal genes, dominance and recessive lethal's, incomplete dominance, co-dominance and epistasis

UNIT II: Chromosomes and Disorders

(15 Lectures)

Chromosome structure, human chromosomes. Specialized chromosomes lamp brush chromosomes, polytene chromosomes, super numerary chromosomes. Chromosome variation structural aberrations—duplications, deletions, inversions, and translocations with examples. Numerical aberrations—Aneuploidy, Euploidy, auto-polyploidy and allo polyplody with examples. Inborn errors of metabolism in humans—phenylketonuria, Alkaptonuria, Albinism, galactosemia, Hurler's syndrome, Wilson disease, familial hyper cholesterolemia.

UNIT III: Genetics of Sex Determination and Sex-Linked Inheritance (15 Lectures)

Primary and secondary sex determination. Mechanisms of sex determination in insects, birds, humans, bonellia. Sex-linked inheritance- color blindness, haemophilia, Duchenne muscular dystrophy, vitamin D resistant rickets, body color in drosophila. Y-linked inheritance holandric genes- hypertrichosis pinnae, SRY gene, partial sex linkage- bobbed bristles in drosophila, PAR region in man. Sex limited and sex-influenced characters with examples.

UNIT IV: Population Genetics, Prenatal Diagnosis of Genetic Diseases and Genetic Counselling (15 Lectures)

Gene pool and gene frequencies, equilibrium of gene frequencies and Hardy Weinberg law. Changes in gene frequencies – mutations, selection and migration, random drift. Indication for prenatal diagnosis, techniques for prenatal diagnosis—amniocentesis, fetoscopy, ultrasonography, fetal blood sampling, maternal serum screening, chorionic

villus bioscopy. Treatment of genetic diseases– prenatal treatment, postnatal treatment. Genetic counseling diagnosis and management of genetic disease, genetic counseling in disputed paternity, cousins marriage and genetic counseling, adoption and genetic counseling.

Suggested Readings:

- i. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
- ii. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley And Sons Inc.
- iii. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
- iv. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
- v. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction To Genetic Analysis. IX Edition. W. H. Freeman and Co.
- vi. Gupta P.K., 'Genetics'
- vii. Pal G.P., (2009). Medical Genetics. A.I.T.B.S. Publishers, India.

Course Type: Core Course
Course Title: Clinical Biochemistry & Bioinstrumentation
Course Code: MLT154C

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to obtain the basic knowledge of chemistry and metabolism of macromolecules and the integration of metabolism in the healthy and diseased state for diagnosis. Further, students will also learn to demonstrate safe handling of automatic instruments, apparatus, and equipment.

UNIT I: Bioinstrumentation

(15 Lectures)

Photometry- definition, laws of photometry, absorbance, transmittance, absorption maxima, instruments, parts of photometer. Types of photometry. Colorimeter, spectrophotometer (principal & working), flame photometer (principal & working), fluorometry, choice of appropriate filter, measurements of solution, calculation of formula, applications. Electrophoresis- principle, types & applications. Auto analysers- principle, types & applications. Laboratory instruments- principle and working of basic laboratory instruments. Autoclave, hot air oven, incubator, pH meter, water bath, centrifuge, refrigerator, balance, flame photometer, microscope (brief).

UNIT II: Organ Function Tests

(15 Lectures)

Liver functions & their assessment based on—carbohydrate metabolism, protein metabolism, lipid metabolism. Principle, procedure, reference values and clinical significance of the following—LP, SGOT, SGPT, Bilirubin (direct & indirect), Jaundice, its types and biomedical findings. Vanden Bergh reaction. KFT – introduction, tests principle and procedure of various estimation methods for serum creatinine, urea, uric acid, GFR. Urinary proteins. Creatinine estimation in 24 hrs urine. Reference values and clinical significance. Concept of clearance. Urea clearance test, creatinine clearance test and their clinical significance.

UNIT III: Cardiac Profile, Glucose & Cholesterol Estimation

(15 Lectures)

Cardiac profile (in brief)—hypertension, angina, myocardial infarction, pattern of cardiac enzymes in heart diseases. Different methods of glucose estimation: blood glucose-estimation, screening test. Metabolism of glucose. Reference values. Renal threshold. Significance and performance of ST/GTT. Glucose challenge test (GCT). Different methods of cholesterol estimation- principle, advantage, and disadvantage of different methods. Lipid profile- formation of cholesterol. High density and low-density cholesterol. Principles and procedures of estimation. Reference value. Clinical importance. Triglycerides, principle, and procedure of estimation.

UNIT IV: Minerals and Vitamins

(15 Lectures)

Water & Minerals—distribution of fluids in the body, ECF and ICF. Water metabolism,

dehydration. Mineral metabolism, macronutrients (principle mineral elements) & micronutrients (trace elements). Macronutrients—deficiency, disorders. Micronutrients—deficiency, disorders. Vitamins, Fat soluble vitamins, Water soluble vitamins, their sources, requirements, deficiency, disorders, and biochemical functions.

Course Type: Core Course

Course Title: Clinical Biochemistry & Bioinstrumentation Practical

Course Code: MLT155C

Credits: 04

M.M: 100

1. Cleaning of glass ware.
2. Handling and maintenance of Balance, Centrifuge, Colorimeter, and Glucometer.
3. Collection of blood by various methods including Vacutainer system.
4. Separation of serum and plasma.
5. Demonstration of various parts of centrifuge; its functioning and care.
6. Demonstration of various parts of microscope its functioning and care.
7. Preparation of various anticoagulants.
8. Collection of venous and capillary blood.
9. Preparation of the stains and other reagents.
10. Preparation of peripheral blood film (PBF)

Suggested Readings:

- i. Procedure Manual for Routine Diagnostic Tests Vol. I by KL Mukherjee; Tata McGraw Hill Publishers, New Delhi
- ii. Biochemistry Estimations by F.J.Baker Medical Laboratory Technology Vol. 1 by KL Mukherjee; Tata McGraw Hill Publishers, New Delhi
- iii. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworth Heinmann, Oxford
- iv. Medical Laboratory Manual for Tropical Countries by Monica Cheesbrough; Cambridge University Press, UK
- v. Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai.
- vi. Practical Haematology by JV Decei; ELBS with Curchill Living Stone; UK
- vii. Medical Laboratory Science Theory and Practical by J Ochei and A Kolhatkar, Tata McGraw Hill Publishing Company Ltd., New Delhi 2000 Ed.
- viii. Medical Lab. Technology by Satish Gupte, JP Publishers

Course Type: Core Course
Course Title: Clinical Hematology
Course Code: MLT156C

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to familiarize the students with the structure and function of blood and the techniques used to diagnose disease by studying the different components of blood in the laboratory. The students will be able to perform various basic hematological tests, correlate and compare the normal and abnormal values.

UNIT I: Introduction to Haematology

(15 Lectures)

Various glassware/plastic ware used in haematology labs. (Hb tube, Hb pipette, RBC pipette, WBC pipette). Different apparatus and instruments used in hematology lab. Blood cell counter, blood mixer. Basic steps for drawing blood by vein, capillary and artery puncture. Complications during and after blood collection specimen. Rejection criteria for blood. Hemopoiesis—Erythropoiesis, Leucopoiesis, Thrombopoiesis. Definition. Composition and functions of blood. Factor effecting/contributing hemopoiesis.

UNIT II: Anticoagulants

(15 Lectures)

Definition and various types of anticoagulants, their mode of action and their preparation, with merits and demerits of each. Collection and preservation of blood. Collection of blood; venous and capillary. Various equipment used for collection of blood samples. Safety measures at the time of sampling and collection. Preservation of processed blood samples in hematology. Diluting fluid (Hb, TLC, platelets, RBC count). Uses. Preparation and composition. Romanowsky stains. Theory and preparation. Choice of slide and spreader. Preparation of blood film. Characteristics of good film preparation. Staining procedure. Effects of pH on staining.

UNIT III: Haemoglobinometry

(15 Lectures)

Hemoglobin- structure, synthesis and degradation. Abnormal hemoglobin. Types of hemoglobin. Various methods of estimation with specific reference to cyanmethaemoglobin method. Haemocytometry: various counting chambers. Methods of counting of RBC, WBC and platelets. Their calculation and reference values. Errors involved in haemocytometry and means to minimize them. Test for sickle cell—demonstration of LE cell. Osmotic fragility test. Estimation of hemoglobin F (fetal hemoglobin). Detection of glucose 6-phosphate dehydrogenase (G6PD) deficiency.

UNIT IV: Haematological Disorders

(15 Lectures)

Preparation and staining of blood film. Performance of DLC. Normal values and significance of DLC. Blood cell morphology in health and disease (peripheral blood film). Haematological disorders- anemia. Classification of anemia: morphological & etiological. Iron deficiency anemia: distribution of body iron, iron absorption, causes of iron

deficiency. Lab findings. Megaloblastic anemia: causes, lab findings. Hemolytic anemia: definition, causes, classification & lab findings. Bone marrow: cell composition of normal adult bone marrow, aspiration, indication, preparation & staining, special stain for bone marrow- Periodic Acid Schiff, Sudan black, myeloperoxidase. Leukemia: classification, blood picture, differentiation of blast cells.

Course Type: Core Course
Course Title: Clinical Haematology Practicals
Course Code: MLT157C

Credits: 04

M.M: 100

1. To stain a peripheral blood film by Romanowsky stain.
2. Preparation and standardization of stains (leishman and giemsa).
3. Preparation of thick and thin blood smear.
4. Haemoglobin Estimation by Sahli's method, Oxy-Haemoglobin and Cyanmethaemoglobin method.
5. Counting of RBC
6. Counting of WBC
7. Platelet counting.
8. Absolute eosinophil counting.
9. Study of morphology of normal RBC and WBC with the help of stained slide.
10. To study abnormal morphology of RBC with the help of stained slide.
11. To study abnormal morphology of WBC with the help of stained slide.
12. To study abnormal morphology of platelet with the help of stained slide.
13. Determination of bleeding time by Ivy's and Dukes method.
14. Determination of clotting time by Lee and white and capillary method.
15. Determination of prothrombin time.
16. ESR estimations (wintrobe and westergren) in blood sample.
17. Determination of PCV (wintrobe and capillary) in blood.

Suggested Readings:

- i. Medical Laboratory Technology Vol. 1 by KL Mukherjee; Tata McGraw Hill Publishers, New Delhi
- ii. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworth Heinmann, Oxford
- iii. Medical Laboratory Manual for Tropical Countries by Monica Cheesbrough; Cambridge University Press, UK
- iv. Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai
- v. Practical Haematology by JV Decei; ELBS with Curchill Living Stone; UK
- vi. Medical Laboratory Science Theory and Practical by J Ochei and A Kolhatkar, Tata McGraw Hill Publishing Company Ltd., New Delhi 2000 Ed.
- vii. Medical Lab. Technology by Satish Gupte, JP Publishers.

SEMESTER-III

Course Type: Soft Skill
Course Title: English Communication Skills
Course Code: MLT201S

Credits: 04

M.M: 100

Course Learning Outcomes:

The objective of the course is to help students learn and practice effective spoken and written communication strategies necessary in their day-to-day communication and eventually in their professional field.

Unit I: Introduction to Speaking Skills (15 Lectures)

Effective Speaking Skills. Accurate pronunciation, stress, and intonation. Idiomatic English associated with effective speaking. Jargons, Terminology, Colloquialism

Unit II: Introduction to Public Speaking (15 Lectures)

Effective Public Speaking. Art of Persuasion. Context-based speaking, speaking in general situation, Speaking in professional situation

Unit III: Introduction to Writing Skills (15 Lectures)

Effective Writing Skills. Avoiding Common Errors. Paragraph Writing. Note Taking

Unit IV: Letter/Report Writing and other Correspondence (15 Lectures)

Letter Writing: Types and Format. Report Writing: Purpose, Scope and Fundamental Principles. Resume Writing. Official Correspondence: Memo, Notice, Circulars, Agenda, Minutes

Course Type: Soft Skill
Course Title: Computer Applications
Course Code: MLT202S

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to develop a basic understanding of the computers and their role in the practice of modern medicine. Students will be able to demonstrate a basic understanding of computer hardware and software, programming languages, networking and applications in a clinical setting.

UNIT I: Computer Fundamentals

(15 Lectures)

Evolution of Computers. Basics of computers and its operation. Functional components and their interconnections. Hardware and Software Relationship between Hardware and Software. Concept of Booting. Installation of applications. Software Concepts: Types of Software- System Software, Utility Software and Application Software. System Software: Operating System. Compiler, Interpreter and Assembler.

UNIT II: Computer Appreciation

(15 Lectures)

Operating System: Need for Operating System. Functions of Operating System. Types of Operating System. Interactive, Time Sharing, Real Time and Distributed. Uses and functions of Operating System. Disk Operating System- Simple Dos Commands. Simple file operations. Directory related commands. Characteristics of Computers- Input, Output, Storage Units. CPU. Computer system. Input devices- Keyboard, Mouse, Scanner, OMR, Bar-code reader, Card reader, Video cameras, Web Cam. Output devices- Monitors, Printers (Dot-matrix, Inkjet), Multi-media projector.

UNIT III: Computer System Organization

(15 Lectures)

Multimedia: Text, Graphics, Animation, Multimedia application in education, Entertainment, Marketing. Number System: Binary, Decimal, Octal, Hexadecimal. Conversion between two different number systems. Microprocessor- Basic Concepts. 16-bit, 32-bit, 64-bit. Types of memory: Cache, RAM (DRAM, SDRAM, RDRAM, DDRAM). Secondary Storage Devices.

UNIT IV: Operating Microsoft Office

(15 Lectures)

Brief Introduction to:

Microsoft Word: using Word interface. Creating a document. Typing and editing a document. Opening an existing document. Saving a document. Printing a document. Using shortcut keys. Undo and redo commands. Manipulating window. Using Go-To feature. Using find and replace. Spell checker. Text-formatting. Document formatting. Creating tables and charts in word. Working with mail-merge, graphics and web pages.

Microsoft Excel: working on workbook—creating, opening, saving, and closing a workbook. Use of shortcut keys. Entering and editing data in Excel. Entering date and time. Using auto-fill. Moving and copying cell contents. Deleting or inserting cells, rows,

and columns. Formatting a worksheet. Working with formulas. Functions in Excel. Creating a chart- column, bar, pie. Printing an excel worksheet.

Microsoft PowerPoint: creating PowerPoint presentation. PowerPoint views. Saving the presentation. Editing text on a slide. Formatting text. Inserting a table slide. Creating charts. Using clipart gallery. Changing background color. Designing templates. Printing presentation. Assigning slide transitions. Using preset animations. Running a slideshow.

Suggested Readings:

- i. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
- ii. Information Technology for Management by Henery Lucas, 7th edition, Tata Mc Graw Hills, New Delhi
- iii. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
- iv. Computers Today by SK Basandara, Galgotia publication Pvtltd. Daryaganj, New Delhi.
- v. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

Course Type: Aptitude Development

Course Title: Cell Biology

Course Code: MLT203A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of the course is to develop an understanding of the structure and function of cells, cell organelles, and their life processes. Further, students will be familiarized with how cells communicate and divide in healthy and diseased conditions.

UNIT I: Introduction to the Cell

(15 Lectures)

Cell as a fundamental unit of life. The cell theory. Basic properties of cell. Classification of cell types and their characteristics. Microscopic techniques for the study of cell—Light microscopy, Bright and Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy. Electron microscopy. Cell fractionation.

UNIT II: Bio-Membranes

(15 Lectures)

Composition of Biological Membranes. Functions of cell membrane. Structural organization of cell membrane—Fluid Mosaic Model. Membrane permeability. Membrane dynamics. Membrane fluidity, Factors affecting membrane fluidity. Membrane transport—passive and active transport.

UNIT III: Cell Organelles

(15 Lectures)

Ribosomes—structure, composition, types, and role in Protein Synthesis. Endoplasmic Reticulum—structure, composition, and functions. Golgi complex—structure and functions. Lysosomes—structure and function. Cytoskeleton—composition and Functions of Microtubules, Microfilaments, and Intermediate filaments. Mitochondria—structure, composition, and its functions. Nucleus—structure and function. Extracellular matrix.

UNIT IV: Cell Cycle and Cancer

(15 Lectures)

Eukaryotic Cell Cycle-G, S and M Phase. Cell Division—Mitosis and Meiosis. Regulation of cell cycle. Cell death. Basic aspects of intercellular communication- Autocrine, Endocrine and Paracrine signaling. Cancer—properties of cancer cells. Proto oncogenes. Tumor suppressor genes.

Suggested Readings:

- i. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons.Inc.
- ii. De Robertis, E.D.P. And De Robertis, E.M.F. 2006.Cell and Molecular Biology.8th Edition. Lippincott Williams and Wilkins, Philadelphia.
- iii. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th Edition. Asmpress &Sunderland, Washington, D.C.; Sinauer Associates, MA.

Course Type: Aptitude Development
Course Title: Clinical Pharmacology
Course Code: MLT204A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of the course is to familiarize students with how drugs and medicines work at cellular and sub-cellular levels to produce useful and sometimes harmful effects.

UNIT I: Introduction & Pharmacokinetics (15 Lectures)

Standard features of lab design, lab space. Lab ventilation. Store of different lab chemicals. Sterilization methods. Carcinogens (in brief). Classification of drugs. Nomenclature of drugs. Routes of administration. Introduction to drug development. Clinical trials (conduction in different phases). Ethical aspects of clinical trials.

UNIT II: Pharmacokinetics & Pharmacodynamics (15 Lectures)

Pharmacokinetics (brief introduction). Absorption of drugs, distribution, biotransformation, and elimination of drugs. Factors affecting drug action and absorption. Elimination of drugs—Zero order elimination, first order elimination. Pharmacodynamics (brief introduction). Agonist and antagonist. Pharmacology of receptors. Drug abuse and drugs of abuse. Bioavailability of drugs. Pharmacodynamics, Volume of distribution. Drug interaction and adverse drug reactions.

UNIT III: Experimental Pharmacology (15 Lectures)

Introduction to experimental pharmacology and equipment. Different types of experimental animals used. Animal house anesthetic used in experimental animals. Euthanasia. Ethical aspects of experimental pharmacology. Different physiological solutions and their significance. Bioassay—method, principle, and application. Isolated tissues, intact tissues, and their significance. Dose response curve LD50, ED50. Pyrogen testing.

UNIT IV: Instruments and Testing (15 Lectures)

Therapeutic drug monitoring. Principle and application of colorimeter: spectrophotometer and flame photometer. Chromatography techniques. Estimation of drugs by high pressure liquid chromatography (HPLC). Drug Act and Drug Control (various schedules). Antibiotics, antiseptics, and disinfectants. Lifesaving drugs. Dissolution testing. Disintegration testing. Some common evaluation techniques

Suggested Readings:

- i. Pharmacology for Medical Graduates 4th Edition by *Tara V Shanbhag & Smita Shenoy*
- ii. Fundamentals of Experimental Pharmacology. 7th edition by *M. N. Ghosh*

- iii. Basic and Clinical Pharmacology 14th Edition (A & L LANGE SERIES) by *Bertram G. Katzun*
- iv. Rang & Dale's Pharmacology. 9th Edition by *James Ritter*
- v. Lippincott Illustrated Reviews: Pharmacology 6th edition by *Karen Whalen*
- vi. Practical Manual of Experimental and Clinical Pharmacology by *Bikash Medhi, Ajay Prakash.*

Course Type: Core Course
Course Title: Systemic Bacteriology, Virology & Mycology
Course Code: MLT205C

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to teach students the knowledge of basic morphological features of various pathogens, their staining characteristics, sterilization methods, and biochemical and other tests for the identification of the pathogen. At the end of the course, the student will be able to collect microbiological samples, set up culture & antimicrobial sensitivity test, and identify the causative organisms using various culture media.

UNIT I: Systemic Bacteriology

(15 Lectures)

Morphology, Cultural Characteristics, Biochemical Reaction. Pathogenesis/Disease Caused. Lab Diagnosis of—*Staphylococcus*, *Streptococcus*, *Pneumococcus*, *Neisseria gonorrhoea*, *Neisseria meningitis*, *Corynebacterium diphtheriae*, *Mycobacterium*, *Clostridium*, *Escherichia coli*, *Klebsiella*, *Salmonella*, *Proteus*, *Pseudomonas*, *Vibrio* and *Spirochaetes*.

UNIT II: Mycology

(15 Lectures)

Morphology and Structure of Fungi. Classification of Fungi. Nutrition and Cultivation of Fungus. Cutaneous, Sub Cutaneous and Systemic Mycosis (In Brief). Lab Diagnosis of Fungal Infections, Opportunistic Fungal Infections.

UNIT III: Virology

(15 Lectures)

General Characters of Viruses. Lab Diagnosis of Viral Infections, Bacteriophages. Retro Viruses- HIV, Hepatitis Virus, Pox Virus. Picorna Virus - Polio Orthomyxo Virus – Influenza, Arbo Virus– Chikungunya, Dengue Herpes, and Adeno Virus.

UNIT IV: Clinical Microbiology

(15 Lectures)

Normal microflora of human body. Sore throat and fever of unknown origin UTI, Diarrheal disease Bacteremia, septicemia and infective endocarditis. Sexually Transmitted Diseases

Course Type: Core Course
Course Title: Systemic Bacteriology, Virology & Mycology Practical
Course Code: MLT206C

Credits: 04

M.M: 100

Systemic Bacteriology

1. Culture Techniques.
2. Culture Methods & Identification of Common Bacteria on Media.
3. Antibiotic Sensitivity Testing.
4. To Perform Biochemical Test:
 - a) Imvic Test
 - b) Catalase Test
 - c) Coagulase Test
 - d) Oxidase Test
 - e) Gelatin Liquefaction Test
 - f) Urease Test.
5. Identification of Organism from Urine, Pus and Blood Samples.
6. Bacteriology of air water and milk.

Mycology and Virology

1. Culture Media Used for Fungus.
2. Fungal Culture.
3. Methods of Lab Diagnosis of Virus.

Suggested Readings:

1. Text Book of Medical Laboratory Technology by Prafulgodkar; Bhalani
2. Text Book of Microbiology by Ananthnarayan and Paniker.
3. Medical Microbiology by Davis and Dulbacco
4. Microbiology by C.P. Baveja
5. Microbiology by Prescott

Course Type: Core Course
Course Title: Immunology, Serology & Diagnosis of Immune Disorders
Course Code: MLT207C

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to learn the basics of immunity, antigens, antibodies & Immunoglobulin, cells and organs of the immune system, Humoral & Cellular immune response. The students will also be able to perform serological tests and correlate their results with disease conditions.

UNIT I: Basics of Immunology

(15 Lectures)

Immunity- Definition and classification. Historical background. General concepts of the immune system. Active and passive Immunity. Primary and secondary immune response. General principles of innate and acquired immunity. Humoral immunity and cell mediated immunity. Antigen—definition, classes, properties, Haptens, Adjuvants. Antibodies/Immunoglobulins-definition, properties, Sub types of Immunoglobulins

UNIT II: Immune System

(15 Lectures)

Structure and functions of immune system—parts of Immune System—Primary and Secondary Lymphoid Organs. T Cells, B Cells, other cells of the Immune System, and their functions. Hyper sensitivity Reactions—General principles of different types of hypersensitive reactions i.e., Type I, II, III and IV. Skin tuberculin test. Auto immune disorders. Vaccines, classification and applications. Active and passive immunization. Immunoprophylaxis schedule in Neonates, Children and in pregnancy.

UNIT III: Humoral & Cell Mediated Immunity

(15 Lectures)

Mechanism of Humoral and Cell mediated immune response. Antigen presenting cells, Antigen processing and presentation. Complement System. Introduction of Hybridoma Technology. Monoclonal Antibodies & Polyclonal Antibodies.

UNIT IV: Serology

(15 Lectures)

General Terminologies of Serology. General features of Antigen- Antibody reactions. Types of Antigen-Antibody reactions—Precipitation, Agglutination, Complement Fixation Test, Neutralization, Opsonization. Immune Adherence. Immunofluorescence, Immuno Electron Microscopic Test. Principles, types & applications of Immuno-diffusion Techniques, Radioimmunoassay & ELISA.

Course Type: Core Course
Course Title: Immunology & Serology Practicals
Course Code: MLT208C

Credits: 04

M.M: 100

Immunological Techniques

1. WIDAL Test
2. VDRL Test
3. RA Test
4. CRP Test
5. Pregnancy Test
6. Immunodiffusion
7. Qualitative Test for ABO Grouping with Antisera
8. Qualitative Test for Determination of D (Rho) Antigen on Human Red Blood Cells.
9. To Perform Direct Coomb's Test
10. Determination of Anti-Streptolysin O (ASO)
11. To Perform C-Reactive Protein Test (CRP)
12. Tuberculin Test
13. HIV Test
14. ELISA Test

Suggested Readings:

- i. Text Book of Medical Laboratory Technology by Praful Godkar; Bhalani.
- ii. Essential Haematology by A. V. Hoffbrand; Black Well.
- iii. Immunology by Kuby
- iv. Immunology and Serology by Joshi
- v. Immunology by I. Kannan. MJP Publishers

SEMESTER IV

Course Type: Soft Skill Development
Course Title: Leadership and Personality Development
Course Code: MLT250S

Credits: 04

M.M: 100

Course Learning Objectives:

The main objective of the course is to develop and exhibit a proper sense of professional and personal goals, values, and ideals, nurture a deep understanding of personal motivation, practice personal and professional responsibility. The course will further refine and nurture leadership strategies drive organizational change, prepare for the future and maintain team performance

UNIT I: Introduction to personality development (15 Lectures)

Personality: Concept and Definition, Determinants of personality, Personality traits, Personality characteristics in organizations: Self-evaluation, Locus of control, Self-efficacy, Self-esteem, Self-monitoring: Positive and negative Impact.

UNIT II: Attitude, Motivation (15 Lectures)

Attitude and concept. Significance and factors affecting attitudes. Positive attitude and advantages. Negative attitude and disadvantages. Ways to develop positive attitude. Differences between personalities having positive and negative attitude. Concept of motivation. Significance. Internal and external motives. Importance of self-motivation. Factors leading to de-motivation.

UNIT III: Leadership-I (15 Lectures)

Leadership: Definition and meaning, Importance, Leadership and Management, Leader vs Manager, Essential qualities of an effective leader. Theories of Leadership: Trait theory, Behavioral theories, Contingency theory.

UNIT IV: Leadership-II (15 Lectures)

Types of Leaders, Leadership styles: Traditional, Transactional, Transformational, Inspirational and servant leadership and Emerging issues in leadership: Emotional Intelligence and leadership, Trust as a factor, Gender and Leadership. Organizational Context of Leadership and Personality, Contemporary Business Leaders.

Suggested Readings:

- i. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
- ii. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition: Prentice Hall.
- iii. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
- iv. Heller, Robert.Effective leadership. Essential Manager series. Dk Publishing, 2002
- v. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003

Course Type: Aptitude Development
Course Title: Parasitology & Vector Borne Diseases
Course Code: MLT251A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objectives of the course are to identify, describe and contrast unicellular parasites and parasitic worms and describe specific human vector-borne diseases.

UNIT I: Parasitology – Protozoan Parasites (15 Lectures)

Definition- Parasitism, Host. Classification of Parasites. Phylum Protozoa: General Pathogenic and Non-Pathogenic Protozoa. Phylum Nematelminthes/Round Worms (Nematoda). Phylum Platyhelminthes; Class- Cestoda, Class- Trematoda. Lab Diagnosis of Parasitic Infections. Protozoa: *Entamoeba Histolytica*: Life Cycle, Morphology, and Disease & Lab diagnosis. *Giardia Lamblia*: Life Cycle, Morphology, Disease & Lab Diagnosis. *Trichomonas Vaginalis*: Life Cycle, Morphology, Disease & Lab Diagnosis. *Plasmodium vivax*: Life Cycle, Morphology, Disease & Lab Diagnosis. Differences between *P. Vivax*, *P. Malaria*, *P. Falciparum* & *P. Ovale*.

UNIT II: Helminth Parasites of Humans (15 Lectures)

Phylum Platyhelminthes. Cestodes- *Taenia Solium*, *Taenia Saginata* & *Echinococcus Granulosus*: Life Cycle, Morphology, Disease & Lab Diagnosis. Trematodes - *Schistosoma Haematobium* & *Fasciola Hepatica*: Life Cycle, Morphology, Disease & Lab Diagnosis. Phylum Nematoda: *Ascaris* - Life Cycle, Morphology, Disease & Lab Diagnosis. *Enterobius Vermicularis* (Thread Worm) and *Encyclostoma Duodenale* (Hook Worm): Life Cycle, Morphology, Disease & Lab Diagnosis. Tissue Nematode: *Wuchereria Bancrofti*- Life Cycle, Morphology, Disease & Lab Diagnosis.

UNIT III: Introduction to Insects as Vectors (15 Lectures)

General Features of Insects; Mouth Parts w.r.t Feeding Habits. General Features of Insects as Vectors– Orders: Diptera, Siphonaptera, Siphunculata, Hemiptera. Brief Introduction of Carrier and Vectors (Mechanical and Biological Vector), Reservoirs, Host-Vector Relationship, Vectorial Capacity. Adaptations of Vectors. Host Specificity. Order Dipteran and Siphonaptera as Important Insect Vectors– Mosquitoes, Sand Fly, Houseflies, Fleas. Order Siphunculata and Hemiptera as Disease Vectors- Human Louse (Head, Body and Pubic Louse) as Important Insect Vectors.

UNIT IV: Important Vector-Borne Diseases of Humans (15 Lectures)

Study of Mosquito-Borne Diseases– Malaria, Dengue, Chikungunya, Viral Encephalitis, Filariasis; Control of Mosquitoes. Study of Sand Fly- Borne Diseases– Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus Fever; Control of Sand Fly. Study of House Fly as Important Mechanical Vector, Myiasis, Control of House Fly. Fleas as Important Insect Vectors; Study of Flea-Borne Diseases– Plague, Typhus Fever; Control of Fleas. Study of Louse Borne Diseases– Typhus Fever, Relapsing Fever, Trench

Fever, Vagabond's Disease, Phthiriasis; Control of Human Louse. Bugs as Insect Vectors; Blood-Sucking Bugs; Chagas Disease, Bed Bugs as Mechanical Vectors, Control and Prevention Measures.

Suggested Readings:

- i. Text Book of Medical Laboratory Technology by Prafulgodkar; Bhalani.
- ii. Parasitology by D.C. Chatterjee.
- iii. Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications and Distributors.
- iv. Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK.
- v. Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and other Insect Vector Borne Diseases. Wiley-Blackwell.
- vi. Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall
- vii. Srivastava, P. 2005. Textbook of Applied Entomology, Vol.1& 2. Kalyani Publishers
- viii. Tembhare, D. B. Modern Entomology, Himalaya Publishing House, 2019 Edition.

Course Type: Aptitude Development
Course Title: Molecular Biology
Course Code: MLT252A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to gain insight into the structure and function of genes and the organization of the human genome.

UNIT I: DNA Replication and Repair

(15 Lectures)

Structural Organization of DNA. Semi-Conservative nature of Replication. Experimental Evidence. DNA Replication in Prokaryotes- DNA polymerase. Replication fork. Origin of replication. Enzymes and proteins involved in replication. Replication in Eukaryotes. Comparison of replication in Prokaryotes and Eukaryotes. DNA Repair-an overview.

UNIT II: Transcription

(15 Lectures)

Biosynthesis of RNA. Transcription in Prokaryotes- Initiation, Elongation and Termination. Role of enzymes and factors in Transcription-RNA polymerase, Sigma Factor. Role of promoters. Transcription in Eukaryotes. Inhibitors of Transcription. RNA Processing-Brief Idea. Reverse Transcription.

UNIT III: Translation

(15 Lectures)

From RNA to Proteins Genetic Code- Basic Features and Significance. Wobble Hypothesis. Ribosome Structure-A, P and E Site. Mechanism of Translation in Prokaryotes- Initiation, Elongation and Termination. Regulation of Translation. Translation in Eukaryotes-Brief overview. Translation Inhibitors—role of Antibiotics. Post Translational Modifications.

UNIT IV: Regulation of Gene Expression

(15 Lectures)

Control of gene expression in prokaryotes. Operon concept- Lactose Operon, Tryptophan Operon. Negative and positive regulation. Role of activators and repressors in regulation of gene expression. Regulation of gene expression in eukaryotes- a brief overview. Hetero-chromatin, Euchromatin and Chromatin remodeling.

Course Type: Core Course
Course Title: Endocrinology & Cancer Markers
Course Code: MLT253C

Credits: 04

M.M: 100

Course Learning Outcomes:

The major objective of the course is to describe the organization and structure of the endocrine systems and their relation to other organ systems for the maintenance of homeostasis & growth. Students should also be able to describe and quantify substances released in body fluids as an indication of cancer progression.

UNIT I: Endocrinology-I

(15 Lectures)

Introduction: Difference between hormones and enzymes. Classification of hormones. Regulation of hormones. General mechanism of action of hormones. Pituitary gland and hypothalamus. Hormones of the anterior pituitary- growth hormone, Prolactin (PRL), gonadotropin, follicle-stimulating hormone (FSH), luteinizing hormone (LH), thyroid-stimulating hormone (TSH), adrenocorticotrophic hormone (ACTH). Hormones of neurohypophysis- oxytocin, antidiuretic hormone (ADH)

UNIT II: Endocrinology-II

(15 Lectures)

Hormones of the thyroid gland- chemistry and normal physiology. Thyroid disorders- goiter, myxedema, autoimmune thyroiditis, tumors of the thyroid gland, hyperthyroidism, Grave's disease. Calcitonin, parathyroid hormone (PTH). Adrenocortical hormones- synthesis and secretion, aldosterone and its function, Addison's disease, glucocorticoids and functions, mineralocorticoids and functions, cortisol and functions, Cushing's syndrome, Conn's syndrome. Adrenal medulla- metabolism of catecholamines. Hormones of the gonads- testosterone, estrogens, progesterone. Their synthesis and functions. Human chorionic gonadotropin (hCG) hormone, menstrual cycle, menopause. Hormone of pancreas—insulin- its metabolic effects on carbohydrates, fats and protein, control of insulin secretion, glucagon—functions, and metabolic effects. Blood glucose regulation, diabetes mellitus, and somatostatin. Hormones of kidney- renin

UNIT III: Tumor & Cancer Markers-I

(15 Lectures)

Introduction. The carcinogens- definition. Oncogene: definition- mechanism of action of oncogenes (outline) characteristics of growing tumor cells- general and morphological changes, biochemical changes. Tumor markers- introduction and definition. Clinical applications of tumor markers. Enzymes as tumor markers- alkaline phosphatase (ALP), creatine kinase (CK), lactate dehydrogenase (LDH), prostatic acid phosphatase (PAP), prostate specific antigens (PSA).

UNIT IV: Tumor & Cancer Markers-II

(15 Lectures)

Hormones as tumor markers (introduction of each type in brief). Onco fetal antigens:

alpha-feto protein (AFP), carcino embryonic antigen (CEA). Squamous cell carcinoma (SCC) antigen. Carbohydrate markers (brief introduction of each type): CA15-3, CA-125 blood group antigen (brief introduction of each type) CA19-9, CA50, CA72-4, CA24-2 bladder cancer markers (introduction in brief)- bladder tumor antigen (BTA) fibrin-fibrinogen degradation product (FDP). Nuclear matrix protein (NMP22). Biomarkers still in research (introduction in brief)-telomeres, Trap assay, Hyaluronic acid and Hyaluronidase.

Course Type: Core Course
Course Title: Endocrinology & Cancer Markers Practical
Course Code: MLT254C

Credits: 04

M.M: 100

1. Blood Grouping and Cross Matching.
2. Estimation of T3.
3. Estimation of T4
4. Estimation of TSH
5. Estimation of FSH
6. Estimation of LH
7. Estimation of hCG
8. Estimation of Cortisol
9. Estimation of Progesterone
10. Estimation of Testosterone
11. Estimation of Alpha Feto Proteins (AFP)
12. Estimation of CarcinoEmbryonic Antigen (CEA)
13. Estimation of CA- 125
14. Estimation of Prostate Specific Antigen (PSA). Other ELISA Test
15. Test for HIV
16. Test for Hepatitis B (HbSAg)
17. Test for Hepatitis (HCV)
18. Malaria Antigen
19. Tuberculosis-IgG/IgM

Suggested Readings:

1. Manual of Endocrinology and Metabolism by Norman Levin
2. Endocrinology by Headley Ongenomics Handbook edited by William J. Rochelle and Richard A. Shimkets
3. Human Press Cancer Systems Biology edited by Edwin Wang, CRC Press.

Course Type: Core Course
Course Title: Transfusion Medicine
Course Code: MLT255C

Credits: 04

M.M: 100

Course Learning Outcomes:

The major objectives of the course are to equip students with the knowledge to perform the basic techniques in blood donation, component preparation, blood banking as well as pretransfusion testing, and resolution of post-transfusion problems. The course ensures students are competent in evaluating clinical cases and solving problems related to blood/plasma transfusion.

UNIT I: Historical Introduction to Transfusion Medicine (15 Lectures)

Antigen and Antibody. Definition of Antigen and Antibody. Classification of Antigens and Antibodies. ABO Blood Group System. H Substance and Bombay Group. Antigens and Antibodies involved. Principle and Procedure of ABO Blood Grouping. Various Blood Sub Groups (A1, A2, A1B, A2B). The Rh Blood Group System. Antigen and Antibody involved. Principle and Procedure of Rh Grouping. Variant of D Antigen (Du).

UNIT II: Composition of Blood (15 Lectures)

Erythrocytes-Structure and Functions. Leucocytes-Types, Structure, and Functions. Platelets- Structure and Functions. Blood Groups. Anticoagulants used in Blood Bank. Types and Composition of Various Anticoagulants. Advantages and Disadvantages of Various anticoagulants. Hemostasis and Fibrinolysis. Coagulation. Coagulation Factors. Disorders of Blood Coagulation. Hemophilia A. Hemophilia B. DIC (Disseminated Intravascular Coagulation). Thrombocytopenia. Tests for Coagulation Function- Bleeding Time (BT), Clotting Time (CT), Prothrombin Time (PT), Activated Partial Thromboplastin Time (APTT).

UNIT III: Criteria for Selection of Donor (15 Lectures)

Pre-Transfusion Tests on Donor's Blood. Blood Collection and Storage. Screening of Blood Donor and Characteristics of Ideal Blood Donor. Blood Collection Procedure. Transportation and Storage. Screening of Blood Donors For: Malarial Parasite, VDRL, HIV, HbSag, and HCV. Cross Matching. Types of Cross Matching. Various Methods and Their Procedures. Preparation of Red Cell Suspension. Reaction of Antisera with Red Cells. Uses of Blood Components, Fractions and Derivatives.

UNIT IV: Coomb's Test (15 Lectures)

Direct Coomb's Test (Principle, Procedure, Importance and Application). Indirect Coomb's Test (Principle, Procedure, Importance and Application). Various Blood Components {Packed Cells, Fresh frozen plasma, Cryoprecipitate, PRP (Platelet Rich Plasma)}. Preparation. Preservation. Uses. Blood Transfusion Reactions. Haemolytic Disease of New Born. Major Histocompatibility Complex (MHC) and HLA System.

Course Type: Core Course
Course Title: Transfusion Medicine
Course Code: MLT256C

Credits: 04

M.M: 100

1. Performing ABO blood grouping by following method:
 - Direct
 - Tube Test
 - Indirect (reverse)
 - Subgroup
2. Performing-Rh grouping by following techniques:
 - Slide
 - Tube technique
3. Performance of Coombs Test
 - Direct
 - Indirect
4. Cross Matching (compatibility testing)
 - Major
 - Minor
5. Preparation of anticoagulants
 - ACD (Acid Citrate Dextrose)
 - CPD (Citrate Phosphate Dextrose)
 - CPDA (Citrate Phosphate Dextrose Adenine)
6. Malarial Parasite test by thick and thin smear preparation
7. VDRL Test
8. HIV Test
9. HbsAg Test
- 10.HCV Test
- 11.Preparation of platelet rich plasma and platelet poor plasma.

Suggested Readings:

1. Introduction to Modern Lab Technology by FJ Baker, Butterworth, Heinemann Publishers Oxford
2. Text book of Modern Lab Technology by Praful and Godker, Bhalani Publisher, Mumbai
3. Modern Lab Technology – A Procedure Manual for Routine Diagnostic Test by Kanai L. Mukerjee, Volume 1, Tata McGraw Hill Publishing, New Delhi.
4. Modern Blood Banking and Transfusion Practices by Denise M Harmering, Jay Pee Brothers, New Delhi

SEMESTER V

Course Type: Soft Skill
Course Title: Employability Skills and Workplace Communication
Course Code: MLT301S

Credits: 04

M.M: 100

Course Learning Outcomes:

The objective of the course is to empower students with employability skills by enabling them to speak with confidence in interviews and while making their presentations. The course also aims to hone their communication and professional skills through the use of electronic channels.

Unit I: Interviews

Types and Styles. Facing Interviews: Fundamentals and Practice Sessions. Conducting Interviews: Fundamentals and Practice Sessions. Group Discussion: Introduction and Guidelines. Methodology of Group Discussions

Unit II: Business Etiquette

Introduction. Dressing up. Exchanging Business Card. Shaking Hands. Dining Etiquette

Unit III: Communication through Electronic Channels

Introduction. Technology-based Communication Tools. Video Conferencing. Web Conferencing. Email and email writing. Fax, Telephone Skills

Unit IV: Presentations

Audience Analysis. Preparing Effective PowerPoint Presentation. Delivery of Presentation. Handling Questions

Course Type: Aptitude Development
Course Title: Entrepreneurship Development & Biostatistics
Course Code: MLT302A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to equip students with knowledge on entrepreneurial development, creativity, and skills essential for business plan development. Students will learn to analyze statistical data graphically using frequency distributions and cumulative frequency distributions or by using measures of central tendency & dispersion.

UNIT I: Entrepreneurship (15 Lectures)

Entrepreneurship—concept, characteristics; prerequisites. Classification of Entrepreneurship, Entrepreneurial skills. Factors underlying the success and reasons for the failure of entrepreneurship. Role of entrepreneurship in economic development. Challenges in starting a new venture. Creativity and innovation. Developing ideas and business opportunities – methods of generating new ideas, Market analysis, and feasibility planning. Writing and presentation of the business plan.

UNIT II: Entrepreneurial Skill Development Programme (15 Lectures)

Financing the venture-early-stage financing and growth funding. Entrepreneurial support system e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), Intellectual property (Patents, trademarks & Copyrights). Intellectual property infringement. Harvesting and exiting the venture – exit strategies, mergers, and acquisitions. How to start a small-scale industry in India

UNIT III: Basics Biostatistics (15 Lectures)

Data and its types. Application and uses of biostatistics. Central Tendency- Mean, Median, Mode. Measure of Dispersion- Range. Variance. Standard deviation. Standard error. Uses of Standard Deviation.

UNIT IV: Tests in Biostatistics (15 Lectures)

Data Distribution. Types of Data Distribution. Statistical Analysis (Null Hypothesis). Simple Test of Significance. Sampling Error. Student's T-Test. Analysis of Variance (ANOVA). Correlation. Regression. Chi-Square (X^2).

Suggested Readings:

- i. Agarwal, Vinod K, Initiative enterprise and economic choice in a study of the patters of entrepreneurship. Munshiram Manohar Lal, New Delhi.
- ii. Clifton, Davis S and F Y Fir, David E, project feasibility analysis, John Willey, New York.

- iii. David H Holt, Entrepreneurship: New Venture creation, Prentice Hall.
- iv. Deasi Vasant, Entrepreneurial Development, Himalayas publishing house.
- v. Druker peter, Innovation and Entrepreneurship, Heinemann London.
- vi. Kumar S.A., Entrepreneurship in small industry, Discovery publishers New Delhi.
- vii. Pareek Vdaina Venkateshwara Rao T: Developing Entrepreneurship: A handbook of learning system, New Delhi.
- viii. Biostatistics by Khan and Khanum.
- ix. Biostatistics by N. Gurumani.

Course Type: Aptitude Development
Course Title: Ability & Quantitative Aptitude
Course Code: MLT303A

Credits: 04

M.M: 100

Course Learning Outcomes:

Students will be expected to actively do mathematics—such as analyzing data, constructing hypotheses, solving problems, reflecting on their work, and making connections. Demonstrate procedural fluency with real number arithmetic operations and use those operations to represent real-world scenarios and to solve stated problems. The other major objective is to determine when approximations are appropriate and when exact calculations are necessary

Unit I: Verbal Aptitude

(15 Lectures)

Basic English grammar; Tenses; Articles; Adjectives; Prepositions; Conjunctions; Conjunctions; Verb-noun agreement and other parts of speech; Basic vocabulary; Words; Idioms; Phrases in context; Reading and comprehension; Narrative sequencing

Unit II: Analytical Aptitude

(15 Lectures)

Logic—deduction and induction; Analogy; Numerical relations and reasoning. Spatial Aptitude—transformation of shapes, Translation, Rotation, Scaling, Mirroring. Grouping—Paper folding, Cutting, Patterns in 2 and 3 dimensions. Analytical Reasoning (based on Logic)—the basics of logic, Informal tips, Assumptions, Forcefulness of arguments, evaluating inferences, Evaluating given course of action, data sufficiency, punch line. Strengthening and weakening arguments; cause and effects.

Unit III: Quantitative Aptitude—I

(15 Lectures)

Data interpretation—Data graphs (bar graphs, pie charts, and other graphs representing data); 2- and 3-dimensional plots, Maps, Tables. Numerical computation and estimation. Ratios, Percentages, Powers, Exponents and logarithms. Permutations and combinations, Series, Mensuration and geometry; Elementary statistics and Probability.

Unit IV: Quantitative Aptitude—II

(15 Lectures)

Simplification. Powers & Roots, Square, Cube, Indices, Surds, Squaring, LCM & HCF. Ratio & Proportion. Partnership. Percentage. Average and Age related problems. Profit & Loss. Compound Interest. Alligation or Mixture. Time & Work. Time & Distance. Streams. Races & Games. Approximate values. Data Interpretation.

Course Type: Aptitude Development
Course Title: Advanced Medical Diagnostics
Course Code: MLT304A

Credits: 04

M.M: 100

Course Learning Outcomes:

By the end of this course, students will be able to demonstrate knowledge of a range of diseases and drug abuses prevalent in our society. They should also be able to explain the physical principles relevant to a variety of advanced medical imaging and therapy techniques; evaluate when they should be applied, and their relevance in the planning and execution of therapy.

UNIT I: Genetic Disorders, Diagnosis and Treatment (15 Lecture)

Disorders of carbohydrate metabolism: Diabetes Mellitus, glycohemoglobins, hypoglycemias, galactosemia and ketone bodies. Glycogen storage diseases.

Disorders of lipids/lipoproteins. Lipidosis. Clinical inter-relationships of lipids (sphingolipidosis and multiple sclerosis), lipoproteins and apolipoproteins. Diagnostic tests for HDL - cholesterol, LDL - cholesterol and triglyceride disorders.

Inborn errors of amino acid metabolism:

- a. Disorders of amino acid metabolism- phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and aminoacidurias.
- b. Disorders of nucleic acid metabolism- disorders in purine/pyrimidine metabolism.

UNIT II: Disorders Prevalent in the Society & Treatment (15 Lecture)

Malnutrition in society. Nutritional deficiencies in children. Management of life style diseases including hypertension. Gastroenteritis. Celiac disease, gastroesophageal reflux disease (GERD). Malaria, cholera. Tuberculosis, lower respiratory tract infection. Diarrheal diseases and neonatal syndromes (preterm birth complications, neonatal encephalopathy, neonatal sepsis, and other neonatal disorders) in children. Coronary heart disease, stroke, diabetes, obesity. Chronic obstructive pulmonary disease (COPD/Asthma).

UNIT III: Environmental & Mental Health Diseases Disorders (15 Lecture)

Environmental pollution, air pollution, tobacco smoking, chemical and drug injury. Alcohol, lead, and carbon monoxide poisoning. Drug abuse; allergens; injury by physical agents, thermal and electrical injury, injury by radiation. Characteristics of mentally healthy person. Warning signals of poor mental health. Types and causes of mental illness. Depression: causes and its treatments. Substance abuse (drugs, cigarette, alcohol) de-addiction and rehabilitation

UNIT IV: Diagnostic Tools and Applications in Diagnosis (15 Lecture)

Advanced diagnostic tools- principles and importance in disease diagnosis with examples: X-ray, magnetic resonance imaging (M, positron emission tomography (PET) scan, CT/CAT scan/ ECG, EEG, and blood gas apparatus.

Imaging techniques: angiocardiology, angiography-cerebral angiography; brain

scanning. Echoencephalography, magnetoencephalography and pneumoencephalography, cholecystography, echocardiography. Endoscopic retrograde, cardiac magnetic resonance imaging, functional magnetic resonance imaging and magnetic resonance spectroscopy, computed tomography, single photon emission computed tomography, ultrasound, and urography.

Suggested Readings:

- i. Marshall, W.J., Lapsley, M., Day, A. and Ayling, R., 2014. Clinical Biochemistry E-Book: Metabolic and Clinical Aspects. Elsevier Health Sciences.
- ii. Mütze, Ulrike. "Jean-Marie Saudubray, Matthias R. Baumgartner, John Walter (Eds.). Inborn Metabolic Diseases: Diagnosis and Treatment." (2017): 165-165.
- iii. Nyhan, William L., and Georg F. Hoffmann. Atlas of Inherited Metabolic Diseases. CRC Press, 2020
- iv. Blau, N., Duran, M., Gibson, K.M. and Dionisi-Vici, C. Eds., 2014. Physician's Guide to the Diagnosis, Treatment, and Follow-Up of Inherited Metabolic Diseases (Pp. 247-264). Heidelberg: Springer.
- v. Suetens, P., 2017. Fundamentals of Medical Imaging. Cambridge University Press

Course Type: Aptitude Development

Course Title: Diet & Nutrition

Course Code: MLT305A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to familiarize students with basic human nutritional needs throughout life and utilize basic nutrition knowledge and the dietary guidelines for making food choices that will promote optimal health. They will also understand the basic processes involved in the preparation, transformation, and conservation of foods.

Unit I: Introduction

(15 Lectures)

Relation of nutrition to health; relation of other factors, importance to nutritional status and health, e.g., infections. Classification and functions of foods -body building, energy yielding, and protective foods. Nutrients - carbohydrates, proteins, fats, vitamins, mineral functions, sources, and daily requirements of each; color requirements; water and cellulose. Nutritive value of foodstuffs Cereals Pulses Fats & oils Vegetables Milk & milk products Sugar Fruits, Eggs, Meat & fish Condiments Spices Beverages Enriching subsistence diets with locally available foodstuffs. Scope of Nutrition. Classification of Food, Classification of Nutrients; Dietary Fiber-Classification, sources, composition, properties & nutritional significance.

Unit II: Balanced Diet

(15 Lectures)

The balanced diet Definition; factors to be considered in planning meals; improvement of diets; selection of foods; cultural factors; nutritional requirement for special groups; vulnerable groups; improving maternal nutrition and child nutrition. Modified diets-liquid, bland, soft, full. Idea of Energy and its unit, Energy Balance, Assessment of Energy Requirements—deficiency and excess, Determination of Energy in food, B.M.R. and its regulation, S.D.A.

Unit III: Malnutrition

(15 Lectures)

Malnutrition, under nutrition; causes; inter-relationship of facto leading to malnutrition, e.g., infections, worm infestations. Deficiency diseases in the country including vitamin deficiency protein-energy malnutrition, goitre. Importance of Nutrition for ensuring adequate development.

Unit IV: Food Preservation & Guttural Factors

(15 Lectures)

Preparation and preservation of foods General principles of cooking; methods of cooking; effects cooking on nutrients and common foodstuffs. Preservation of foods-household methods. Food hygiene-simple household measures. Guttural factors in nutrition foods fads, food habits. Food adulteration practices injurious to health. Nutrition education - principles of imparting nutrition knowledge. Dietary survey.

Suggested Readings:

- i. Schlenker, Eleanor, and Joyce Ann Gilbert. *Williams' Essentials of Nutrition and Diet Therapy-E-Book*. Elsevier Health Sciences, 2018.
- ii. Rattan, Suresh IS, and Gurcharan Kaur. "Nutrition, Food and Diet: Recapitulation, Conclusions and Suggestions." In *Nutrition, Food and Diet in Ageing and Longevity*, pp. 633-640. Springer, Cham, 2021.
- iii. Zhong, Jian, and Xichang Wang, eds. *Evaluation Technologies for Food Quality*. Woodhead Publishing, 2019.
- iv. Jones-Smith, Jessica, ed. *Public Health Nutrition: Essentials for Practitioners*. Johns Hopkins University Press, 2020.
- v. Whelan, Kevin. *Advanced nutrition and dietetics in obesity*. John Wiley & Sons, 2018.
- vi. Webster-Gandy, Joan, Angela Madden, and Michelle Holdsworth, eds. *Oxford Handbook of Nutrition and Dietetics 3e*. Oxford University Press, 2020.

Course Type: Core Course
Course Title: Molecular Diagnostic Techniques
Course Code: MLT306C

Credits: 04

M.M: 100

Course Learning Objectives:

At the end of the semester, the students will develop an insight into the molecular diagnostic techniques used in the detection of infectious diseases, cancers, genetic disorders, and forensic testing.

UNIT I: Recombinant DNA Technology

(15 Lectures)

Introduction and Application of rDNA Technology. Steps Involved in rDNA Technology. Isolation of DNA from different sources. Concept of Restriction Modification. Restriction Endonucleases. Introduction of Vector and Host. Introduction to Generation of Genomic and cDNA Libraries. Improvement of Plant, Animals and Microbes. Gene Therapy, Pharmaceutical Products and Molecular Diagnostics, Molecular Pharming. Metagenomics, Metabolic Engineering.

UNIT II: Polymerase Chain Reaction

(15 Lectures)

Polymerase Chain Reaction- Principle, Methodology. Gene Amplification through PCR and Types. Primer Designing, Types of Polymerase and Factors affecting PCR. Advantages, Limitations and Application of PCR. Variants of PCR. Reverse Transcriptase PCR, Real-Time PCR, Inverse PCR. Anchored PCR, Nested PCR, Hot Start PCR, Multiplex PCR, Touchdown PCR, ARMS (Amplification Refractive Mutation System) PCR. DNA Fingerprinting. Methods- Methodology and Application of DNA fingerprinting Methods (RFLP with Probe Introduction, RAPD, AFLP, SSR, SCAR, DGGE). Applications of Molecular diagnostics-Diagnosis of cancer by using molecular techniques, Molecular diagnosis of genetic diseases and infectious disease

UNIT III: Forensic Sciences-I

(15 Lectures)

Definition- Scope and Need of Forensic Science. Tools and Techniques of Forensic Science. General Methods of Investigation: Narcoanalysis—history, Importance as an investigative tool. Methods as use of drugs, hypnosis etc. Limitations and legal aspects. Brain fingerprinting: Concepts, history, significance, method, Future perspective of the technique and limitations.

UNIT IV: Forensic Sciences-II

(15 Lectures)

Criminal profiling: introduction, importance, profile of the victim and culprit. Investigative strategy, crime scene characteristics, limitations. DNA profiling: introduction- history of DNA typing. DNA typing systems- RFLP analysis. PCR amplifications, sequence polymorphism. Analysis of SNP, y-STR. Mitochondrial DNA, allele frequency determination, match probability- database. Quality control, certification and accreditation. Forensic significance of DNA profiling-applications in disputed paternity cases. Child swapping, missing person's identity. Status of

development of DNA profiling in India and abroad. New and future technologies: DNA chips. Limitations of DNA profiling. Biologic evidence– importance, nature, location, collection, evaluation and tests for identification of hair and fibres, saliva, sweat, urine, blood, fecal matter, vaginal secretions and tests for their identification. Blood grouping from stains of blood, semen, saliva and other body fluids by absorption inhibition. Absorption- elution and mixed agglutination techniques. Determination of secretor/non-secretor status. Emerging forensic techniques. Terminal restriction fragment length polymorphism (TRFLP), amplified fragment length. Polymorphism (AFLP), single stranded conformation polymorphism analysis (SSCP), thermal and denaturing gradient gel electrophoresis (TGGE, DGGE).

Course Type: Core Course
Course Title: Molecular Diagnostic Techniques Practicals
Course Code: MLT307C

Credits: 04

M.M: 100

1. PCR
2. Isolation of Genomic and Plasmid DNA
3. Restriction Digestion
4. Western Blotting
5. Gradient Gel Electrophoresis
6. Single Strand Conformation Polymorphism
7. FISH

Suggested Readings:

- i. Gene VIII (2004) and Gene IX (2008).B. Lewin Oxford
- ii. Molecular Biology of the Cell Alberts Et Al. Garland Science
- iii. Cell and Molecular Biology, Concepts and Experiments Gerald Karp Wiley
- iv. Lehninger Principles of Biochemistry Nelson LD and Cox WH Freeman
- v. Molecular Biology of the Cell Lodish Et. Al., WH Freeman
- vi. Principle of Gene Manipulation old and Primerose Blackwell
- vii. Gene Cloning T.A. Brown Nelson Thornes
- viii. Recombinant DNA Watson Et. Al. WH Freeman
- ix. Methods of Forensic Science Curry, A. S. Interscience, New York
- x. Forensic Biology Chowdhari, S. B P R &D, Govt of India
- xi. Forensic Science Hand Book Richard Saferstein Prentice Hall

Course Type: Core Course
Course Title: Histopathology
Course Code: MLT308C

Credits: 04

M.M: 100

Course Learning Outcomes:

This course is intended for introducing the students to the various types of tissue preparations and developing expertise in cutting very thin tissue sections from tissue blocks and facilitating visualization using various stains and dyes. At the end of the semester, the student will be able to perform sample handling, preservation, tissue processing, routine, and special staining procedures.

UNIT I: Introduction

(15 Lectures)

Histology- definition. Histopathology: biopsy, autopsy, autolysis. Putrefaction. Preparation of tissue (different methods of preparation of tissue). Unfixed tissue preparations. Imprint methods. Impression smears. Teased preparation. Squashed preparation. Frozen section. Fixed tissue preparations (introduction only)- paraffin embedding. Celloidin embedding. Gelatin embedding. Reception of specimen. Reception, recording, labeling and preservation of histological specimen. Fixation (histological specimens). Classification of fixatives. Composition of various fixatives. Advantages and disadvantages. Processing (by paraffin technique). Dehydration. Clearing/ de-alcoholization. Infiltration and impregnation. Paraffin embedding.

UNIT II: Microtomy

(15 Lectures)

Microtome. Types. Advantages and disadvantages. Working principle, care and maintenance. Microtome knives. Various types of knives. Sharpening of knives- honing technique. Stropping technique. Section cutting. Rough cutting. Fine cutting. Use of tissue floatation bath. Use of various adhesive. Media and lifting of sections to the slide. Errors/cutting faults in sections and their remedies. Theory of staining (routine)- principle and mechanism of routine stain (Haematoxylin and Eosin). Various steps of staining. Deparaffinization, hydration, nuclear staining, differentiation, blueing, counterstaining. Dehydration. Clearing and mounting. Results. Mountants. Various types of mounting media (aqueous, resinous). Advantages and disadvantages. Various terms associated with staining. Mordants. Metachromasia. Accelerators. Progressive and regressive staining. Use of controls in staining and their significance. Automation: histokinete (automatic tissue processor)- its types, working, care and maintenance. Use of automatic stainer and coverslipper. Automatic knife sharpener- uses, care and maintenance- uses of abrasives and lubricants. Introduction to disposable blades- their advantages and disadvantages.

UNIT III: Light Microscope

(15 Lectures)

Principles of light microscope. Various parts of microscope. Uses of microscope. Cleaning and maintenance of microscope. Various attachments of light microscope introduction only- polarizing, dark field, phase contrast, fluorescent, electron. Special

stains. Principle, significance and interpretation of different types of stains. PAS (periodic acid schiff's reagent)- carbohydrates, silver impregnation stain- reticulin fibre, Ziehl-Nelson's- for AFB and leprae, masson's trichrome stain- connective tissue, oil red O- fat, gram's stain- gram positive and gram negative.

UNIT IV: Decalcification

(15 Lectures)

Process of decalcification. Various types of decalcifying methods. Their mechanism, advantage, disadvantage and applications. Assessment of decalcification. Handling of fresh histological tissues (frozen section). Reception and processing of frozen tissue. Freezing microtome and cryostat. Advantages and disadvantages of freezing microtome and cryostat. Working, care, maintenance of freezing microtome and cryostat. Frozen section cutting. Staining: rapid H&E, fat stain. Mounting of frozen section. Museum techniques. Introduction to museum with emphasis on the importance of museum. Reception, fixation and processing of various museum specimens. Cataloguing of museum specimen. Autopsy: Introduction to autopsy technique (care and maintenance of autopsy area, autopsy instruments, handling of dead bodies). Use of autopsy.

Course Type: Core Course
Course Title: Histopathology Practicals
Course Code: MLT309C

Credits: 04

M.M:100

1. Reception of specimen, labelling and preserving the specimen.
2. Preparation of various smears by unfixed methods - Imprint smears - Teased smears - Squashed smears.
3. Preparation of different fixatives with special emphasis on preparation of formalin-based fixatives.
4. Preparation of paraffin blocks from various tissue pieces and labelling with emphasis on orientation.
5. Handling of microtome.
6. Sharpening of microtome knives.
7. Preparation of blocks for fine cutting - Rough cutting - Trimming.
8. Practice of fine section cutting.
9. Practice of lifting of sections on the slides.
10. Performing H&E staining on sections.
11. Mounting and labelling of tissue section using various mounting medias.
12. Demonstration of cell.
13. Processing of urine samples for malignant cells.
14. Processing of sputum sample for malignant cytology.
15. To perform PAP stain on given smear.
16. To perform MGG stain on given smear.
17. To perform H&E on given smear.
18. To demonstrate various automation by use of brochures, charts etc.
19. Demonstration of various parts of light microscope (Mechanical & Optical).
20. Demonstration of cryostat (brochures and charts can be used)
21. Processing of tissue for frozen section.
22. Staining and mounting of frozen section using H&E stain (rapid method), Oil Red "O".
23. Preparation of various mounting reagents for museum specimens.
24. Demonstration and care of autopsy instruments.
25. Demonstration of malignant cell.
26. Preparation of dry smear and wet smear.
27. To perform Pap stain.
28. Fixation of smears and staining with MGG

Suggested Readings:

- i. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Scientific, London
- ii. Carleton's Histological Technique by RAB, Drury, MADM (OXON), FRC Path, Northwick Paru Hospital, Harrow, Middlesex

- iii. Theory and Practice of Histological Technique by John D. Bancroft, Churchill Livingstone, London
- iv. Cellular Pathology Techniques by CFA Culling, Butterworths, London

SEMESTER-VI

Course Type: Aptitude Development
Course Title: Critical Thinking & Reasoning
Course Code: MLT350A

Credits: 04

M.M: 100

Course Learning Outcomes:

The main objective of this course is to understand and explain the importance of critical thinking. Identify the core skills associated with critical thinking. And demonstrate the difference between deductive and inductive reasoning. Construct a logically sound and well-reasoned argument.

UNIT I Critical Thinking (15 Lectures)

Basic definitions and key concepts; Conclusions and Decisions, Beliefs and Claims, Evidence – finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self-assessment.

UNIT II Design Thinking (15 Lectures)

Introduction, Need of Design Thinking, problem to the question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stakeholder assessment, design thinking for manufacturers, smart Idea to implementation.

UNIT III Problem Solving (15 Lectures)

Problem definition, problem solving methods, selecting and using information, data processing, solution methods, solving problems by searching, recognizing patterns, spatial reasoning, necessity, and sufficiency, choosing and using models, making choices and decisions. Computational problem solving; interpersonal problem solving, advanced problem solving

UNIT IV Reasoning (15 Lectures)

Verbal Reasoning: Decision Making, Drawing Inference, Drawing Conclusions, Interpretation of Data, Drawing assumptions, Verification of the statements, Logical Diagrams, Problems on Alphabet and Numbers, Coding Decoding, Analogy, Calendar and Clock, Classification, Ranking, Relationship, Distinguishing arguments. Non-Verbal Reasoning: Type I to Type X

Course Type: MOOCS Course **Credits: 04**
Course Title: (Any Online Course) **M.M: 100**
Course Code: MLT351M

Hospital Internship Skill Based Core Course – I **Credits: 10**
Course Title: Project Work **M.M: 250**
Course Code: MLT352C

Hospital Internship Skill Based Vocational Course – II **Credits: 08**
Course Title: Project Seminar **M.M: 200**
Course Code: MLT353C

The objective of the Professional Training:

The objective of providing professional training is to:

1. Provide real life experience by creating necessary awareness regarding use of various types of diagnostic equipment, particularly sophisticated ones which are used in the field of medical laboratory technology.
2. Create confidence among students to work in hospitals by developing practical skills pertaining to laboratory management and diagnostic skills in the field of clinical haematology, transfusion medicine blood banking, clinical biochemistry, clinical microbiology, histopathology, and cytology and ensuring laboratory safety and quality assurance.
3. Develop appreciation regarding size and scale of operations, environment, and other related aspects like value of team work, interpersonal relations, and professional ethics in the field of medical laboratory technology.
4. Develop necessary traits for starting small clinical laboratories as per requirements.

Selection of Training Places

The institute offering BVOC programme in Medical Laboratory & Molecular Diagnostic Technology should establish rapport by personal visit to the following types of organizations:

- a) Medical Colleges/Research institutions
- b) Civil Hospitals at District Headquarters having well-equipped laboratory.
- c) Hospitals in private sector.

d) Well established clinical laboratories being run by a qualified person.

The students are expected to learn various tests being conducted at the training centre, where ever they are undergoing training.