Mahatma Gandhi University
MEGHALAYA
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SYLLABUS MANUAL

PROFESSIONAL PROGRAMME
PROGRAMME CODE --- 102
Diploma in Science in Medical Lab Technology (DMLT)

SEMESTER I

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Detailed Syllabus

SEMESTER I

DMLT11 --- Biochemistry: Chemistry and techniques of Biochemistry
UNIT I: Introduction
Bioenergetics, Entropy, Enthalpy & their basic introduction, Concept of free energy, Thermodynamics 1st & 2nd Law.

UNIT II: Terms

UNIT III: Proteins
Proteins: Primary, Secondary, tertiary & quaternary (Overview).

UNIT IV: Lipids
Lipids; Structure, Classification & properties, Enzymes: Classification, enzyme action & their mechanism.

UNIT V: Carbohydrates
Carbohydrates intermediate metabolism, glycogens, glycogenolysis, gluconeogenesis & glycolysis. TCA, HMP, and its regulations Disorder of carbohydrates metabolism related to each cycle (inborn error of metabolism).

UNIT VI: Proteins
Different metabolic pathway of amino acid. The flow sheet of amino acids oxidation. Ransamination, oxidative deamination and pathways leading to acetyl co-A.

UNIT VII: Ammonia excretion
Decarboxylation of Amino acids, formation of nitrogenous excretion products. Urea cycle and ammonia excretion.

UNIT VIII: Biochemical aspects of Hormone
Hormone receptors and intracellular messengers, Adenylate cyclase, protein kinase and phosphodiesterase. Role of Insulin, glucagons, epinephrine and their mechanism. Various endocrine and regulatory systems mediated by cyclic AMP.

UNIT IX: Vitamin
Fat and Water soluble and their deficiency. Mineral metabolism Minor and Major (Cu, Fe, Ca, Mg & P) Inborn error of Nucleic acids metabolism.

UNIT X: Molarity
Molarity, Molality: volumetric apparatus, calibration of volumetric apparatus.

UNIT XI: Units of measurements
Units of measurements: S.I units: Definitions, conversions; Measurement of volume: Strength, Normality.

UNIT XII: Analytical balance

Reference Books:-
2. Basic Separation Techniques in Biochemistry by R O Okotore.
3. Modern physical methods in biochemistry by Albert Neuberger, Laurens L. M. van Deenen.
UNIT I: Classification of bacteria
On bacilli of differential staining Gram,s Stain .( its modification ) ZN .Stain ( its modification) On basis of their structure, Pre –remit of sample collections-general & disease specific their processing & storage.

UNIT II: Features of bacteria
Identification of bacteria on basis of cultural characteristics ,morphological , & serological features Staphylococcus & streptococcus including pneumonococci, Family Enterobacterical, Haemophilus bordetlla, Corynebacterium, Nessieria ,Treponema, Leptospira ,mycoplasma,chlamydia & Trieagents.

UNIT III: Identification of pathogenic & nonpathogenic fungi
(Morphologically,biochemically,Yeast,Dermatophytes,Cryptococci, Histoplasma,Nocardia,Common lab fungal contaminants.

UNIT IV: Characteristic diagnostic serological tests in diseases
Cholera,Typhoid, Tuberculosis ,VDRL,TPHA, Satellitism.ELISA, PCR.

UNIT V: Urology Viral genome

UNIT VI: Classification

UNIT VII: Antiseptics and disinfectants
Antiseptics and disinfectants ; Definition , types ,mode of action & properties Uses of disinfectant & antiseptics ,testing efficiency.

UNIT VIII: Glassware
Glassware : Description of glass ware ,its use ,handling and care,Decontamination and disposal of contaminated material.

UNIT IX: Virology
Introduction to virology, Physiochemical characteristics of viruses, Diseases caused by different viruses and mode of infection.

UNIT X: Parasitology
Introduction to medical parasitology and safety measures, General characters and classification of protozoa of Medical Importance.

UNIT XI: Morphology
Morphology, Life cycle and laboratory diagnosis of Intestinal Protozoa- Amoebae and Giardia.

UNIT XII: Sterilization
Sterilization: Definition , Different methods and principles –Moist heat ,dry heat,Radiation &filtration Autoclave - its structure ,functioning , control & indicators.

Reference Books:-
1. General Microbiology by Hans Günter Schlegel, C. Zaborosch, M. Kogut.
2. General Microbiology by Roger Y. Stanier.

DMLT13 --- Basics of Haematology
UNIT I: Haematology
Introduction to haematology: Definition, importance, important equipment and chemicals, various tests performed, laboratory organization.

UNIT II: Red Blood Cells
Normal morphology count, isolation from whole blood & count, Effect on count & morphology of physiochemical parameters & the diseased state, Red cell anomalies & their relevance w.r.t normal & diseased state.

UNIT III: Blood Transfusion
Pre-requisitement & the complication of mis-matched transfusion, Methods of blood matching.

UNIT IV: White blood cells & platelets
Morphology count & methods of isolation, Effect on count & morphology of cell by the physiochemical parameters, diseased. State & the relevance of condition of the diseases.

UNIT V: Formation of blood
Formation of blood: Erythropoiesis, Leucopoiesis, Thrombopoiesis.

UNIT VI: Anaemia
Anaemia: Definition (in general) & courses, types of anaemia & their classification, Physiochemical, characteristic features & etiology of a plastic anaemia, haemolytic, megaloblastic, Clinical features & diagnosis.

UNIT VII: Leukaemia
Definition (in general) & their etiology, Classification of leukaemia, FAB classification, Etiologies, physiochemical features of different Type of leukaemias, with reference to clinical states, Diagnosis of different types of leukaemias.

UNIT VIII: Coagulation studies
General pathways (intrinsic & extrinsic), Properties (physiochemical) mode of action of coagulation factors, Platelet studies, platelet function tests (for different Coagulation factors), Effect of promoters & inhibitors at different steps in coagulation, their solution & mode of action, Diseases associated with coagulation disorders, their etiology & characteristics Features.

UNIT IX: Red Cell mass studies
Chemical method & radioactive methods, Red Cell function studies.

UNIT X: Anticoagulants
Anticoagulants: Definition, uses, different types, mode of action, their merits and demerits
Morphology of normal blood cells: Normal morphology, morphology in diseases.

UNIT XI: Blood film
Blood film: Different types, Methods of preparation, Staining.

UNIT XII: Romanwsky stains
Romanwsky stains: Principle of staining, Different stains, their composition and preparation, method of staining.

Reference Books:-
2. A beginner's guide to blood cells by Barbara J. Bain.
3. Diagnostic Hematology by Norman Beeck.

DMLT14 --- Anatomy and Histotechnology: Different Body Systems Of Human Being

UNIT I: Human Anatomy & Physiology
Cell structure, division & function, Cell organelles, Tissue: Types of tissues and their functions, Skeletal system.

UNIT II: Digestive system
Physiology and anatomy of mouth, stomach, intestine, Absorption of food and its excretion, Role of Bile in digestion and excretion, Liver function and a brief description of liver and biliary tree.

UNIT III: Respiratory system
Brief description of larynx, bronchi, lungs, Cardiovascular system: Anatomy and Physiology of heart, arteries and veins. Circulation: Systematic and pulmonary (in brief), Brief review of chamber.

UNIT IV: Urinary system
Structure and Function of the Kidney, uterus, bladder, urethra and nephron Give special emphasis on formation of Urine, Physiology and Anatomy of male and female reproductive organs, Endocrine: Pituitary, thyroid, parathyroid, thymus, adrenals and pancreas.

UNIT V: Central nervous system
Brain, spinal cord and meninges explain with its functions. Skins: Structure and Functions, Study and give small project on bones and cartilages, HLA system.

UNIT VI: Cytology
Cytological Staining, Cytological preparation with special emphasis on MGG, Pap stains, Cytological Fixatives, Cytological Screening.

UNIT VII: Histopathology
Theory of Histopathology, Reception of specimens, Histopathology of Tumor cell, Histopathology of Liver, Kidney, Adrenal, Ovary, Testicles, Method of preparing stains & Fixatives.

UNIT VIII: Preparation
Preparation of smear for Fine needle aspiration cytology, Pap’s smear theory and identification of cells in a normal vaginal smear.

UNIT IX: Stool examination

UNIT X: Laboratory equipment
Laboratory equipment, its uses and maintenance, Laboratory hazards and safety precautions.

UNIT XI: Tissue processing
Theory of Tissue processing and embedding, Theory of H & E staining, Use of Microtome, Tissue section cutting, Embedding and preparation of blocks, Fixation of Tissue with DPX mount, Theory of frozen section preparation.

UNIT XII: Skeletal system
Skeletal system: Structure and function of all individual bones and joints, movement of joints, Skeletal muscles, Cardiac muscles, smooth muscles, muscles of upper arm & anterior, compartment of thigh (their name, attachments, functions and nerve supply).

Reference Books:
UNIT I: Introduction
Bioenergetics, Entropy, Enthalpy & their basic introduction, Concept of free energy, Thermodynamics 1st & 2nd Law.

UNIT II: Proteins
Proteins: Primary, Secondary, tertiary & quaternary (Overview).

UNIT III: Lipids
Lipids: Structure, Classification & properties, Enzymes: Classification, enzyme action & their mechanism.

UNIT IV: Carbohydrates
Carbohydrates intermediate metabolism, glycogenesis, glycogenolysis, gluconeogenesis & glycolysis. TCA, HMP, and its regulations Disorders of carbohydrates metabolism related to each cycle (inborn error of metabolism).

UNIT V: Ammonia excretion
Decarboxylation of Amino acids, formation of nitrogenous excretion products. Urea cycle and ammonia excretion.

UNIT VI: Biochemical aspects of Hormone
Hormone receptors and intracellular messengers, Adenylate cyclase, protein kinase and phosphodiesterase. Role of insulin, glucagon, epinephrine and their mechanism. Various endocrine and regulatory systems mediated by cyclic AMP.

UNIT VII: Vitamin
Fat and Water soluble and their deficiency. Mineral metabolism Minor and Major (Cu, Fe, Ca, Mg & P) Inborn error of Nucleic acids metabolism.

UNIT VIII: Analytical balance

SEMMESTER-II

DMLT21 --- Biochemistry: Techniques of Biochemistry

Unit I: Introduction
Bioenergetics, Entropy, Enthalpy & their basic introduction.

Unit II: Concept of free energy
Concept of free energy, Thermodynamics 1st & 2nd Law.

Unit III: Methods of tissue homogenization
(Potter-Elvejham, mechanical blender, sonicator and enzymatic). Principle and applications of centrifugation techniques - differential, density gradient.

Unit IV: Ultra - centrifugation
Ultra-centrifugation - preparative and analytical.

Unit V: Principle and applications of chromatographic techniques
Principle and applications of chromatographic techniques - paper, thin layer, gel filtration, ion exchange and affinity chromatography. Elementary treatment of an enzyme purification.

Unit VI: Electrophoresis
Electrophoresis - principles and applications of paper, polyacrylamide (native and SDS) and
agrose gel electrophoresis.

**Unit VII: Colorimetry and Spectrophotometry**

**Unit VIII: UV and visible absorption spectra**
UV and visible absorption spectra, molar extinction coefficient, biochemical applications of spectrophotometer.

**Unit IX: Tracer techniques**
Tracer techniques: Radio isotopes, units of radio activity, half life, $\beta$ and $\gamma$- emitters, use of radioactive isotopes in biolog.

**Unit X: Mineral metabolism Minor and Major**
Mineral metabolism Minor and Major (Cu, Fe, Ca, Mg & P) Inborn error of Nucleic acids metabolism.

**Unit XI: Fat and Water soluble**
Fat and Water soluble and their deficiency.

**Unit XII: Insulin**
Role of Insulin, glucagons, epinephrine and their mechanism. Various endocrine and regulatory systems mediated by cyclic AMP.

**Reference Books:**
2. Basic Separation Techniques in Biochemistry by R O Okotore.
3. Modern physical methods in biochemistry by Albert Neuberger, Laurens L. M. van Deenen.

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**DMLT22 --- Microbiology: Techniques**

**UNIT I: Origin of Life**
Time scale of Chemical and Biological evolution, Chance and necessity considerations, Molecular ontogenesis, Working assumptions, cosmo-chemistry, synthesis and polymerisation of biopolymers.

**UNIT II: Review of important milestones in Microbiology and Immunology**
Review of important milestones in Microbiology and Immunology - Contributions of scientists during 1990 to update.

**UNIT III: Microscopy**
Electron microscopy and high voltage electron microscopy.

**UNIT IV: Principle and structure**
Greater resolution, and higher magnification of electron microscope.

**UNIT V: General Methodology**
Sample preparation (fixation, dehydration, embedding, etc).

**UNIT VI: Ultramicrotomy**
Ultramicrotomy (instrument knife, thickness of section, etc), section processing (transfer on grid, staining procedures, etc).

**UNIT VII: Special techniques related to microscopy**
freeze etching, freeze facturing and epoxy resins, shadow casting.

**UNIT VIII: Microscopy techniques**
Immunoelectron and flourecence microscopy techniques.

**UNIT IX: Applications**
Ultrastructure studies, localisation of enzymes and micromolecules.

**UNIT X: Pre - remit of sample collections**
UNIT XI: General morphology
General morphology & ultra structure of virus and growth cycles.

UNIT XII: Clinical diagnosis serological techniques
Clinical diagnosis serological techniques for identification of bacteria: TMV Bacteriophages.

Reference Books:-
1. General Microbiology by Hans Günter Schlegel, C. Zaborosch, M. Kogut.
2. General Microbiology by Roger Y. Stanier.

DMLT23--- Basic cellular Pathology

UNIT I: Study of Body Tissues
Epithelial Tissue : Simple epithelium, Compound epithelium.

UNIT II: Connective Tissue
Connective Tissue: Connective tissue Proper, Skeletal tissue, Vascular tissue.

UNIT III: Muscular Tissue
Muscular Tissue : Striated Muscles, Unstriated Muscles, Cardiac Muscles.

UNIT IV: Alimentary system
Alimentary system : Diseases of Mouth(Infiammatory & Infectious (conditions) , Diseases of Pharynx(Tonsilitis and diphtheria), diseases of Salivary Glands( Mumps, Calculus formation), Diseases of Oesophagus (Oesophageal varies, Inflammatoriy & infections condition).

UNIT V: Digestive System
Digestive System : Diseases of Stomach(Gastritis, Peptic Ulceration Tumours), Diseases of Intestine( Appendicitis, microbial diseases, typhod, food poisoning, cholera & desentry), bowel disease Tumours, Hernias, Intestinal, Obstruction & Malabsorption.

UNIT VI: Liver
Liver : Haepatits, Inflammation & Liver failure.

UNIT VII: Pancreas
Pancreas : Pancreatitis, Fibrosis & Tumour.

UNIT VIII: Gall Blader
Gall Blader : Gall Stones, Jaundice.

UNIT IX: Circulatory System

UNIT X: Diseases of Heart
Cardiac failure, disorders of heart valves, rheumatic heart disease, cardiac arrhythmias, heart block), Disorders of blood pressure(types & hypo tension).

UNIT XI: Respiratory system
Respiratory system : Disorders of upper Respiratory Tract( Infectious & inflammatory disorders common cold, sinusitis, tonsili pharyngitis, laryngitis,Dipheria, Hay fever).

UNIT XII: Disorders of lungs
Disorders of lungs-Pneumonia, Lung abscess, tuberculosis, Bronchial carcinoma, lung collapse.

Reference Books:
DMLT24 --- Human Anatomy & Physiology

UNIT I: Introduction Human Body
Overview of organ systems, Directional and regional terms, Cavities and planes, Homeostasis and negative and positive feedback systems, Life processes.

UNIT II: Tissues and Integumentary System
Cell membranes, transport and junctions, Structure, function and locations of epithelial, connective, muscle and nerve tissues, Microscopic identification of tissue types, Structure and function of skin, (layers and accessory organs).

UNIT III: Skeletal System
Functions of skeletal system, Anatomy of long bone, Bone histology, Naming all bones of axial and appendicular skeleton, Formation, growth and repair, Structural and functional classification of joints, Types of movement Calcium homeostasis.

UNIT IV: Muscular System
Functions of muscular system, Names of all major muscles, Origin, insertion and action, Sliding Filament Model, Neuromuscular junction, Structure (gross and microscopic), Physiology of muscle contraction, Muscle metabolism (ATP), Fiber types.

UNIT V: Cardiovascular System
Functions of circulatory system, Heart structures (chambers, valves, vessels), Circulatory routes (systemic, pulmonary, coronary and hepatic portal), Blood vessels and pressure, Blood components, function and typing Blood clotting, Regulation and conduction (EKG).

UNIT VI: Lymphatic/Immune System
Functions of lymphatic system, Structures (vessels, nodes, cells), Lines of defense, Humoral immune response, Cell mediated immune response, Immune cell types, Disease/AIDS.

UNIT VII: Digestion and Nutrition
Functions of digestive organs, Modes of mechanical digestion, Chemical digestion (hormones, enzymes, pH), Absorption and elimination, Name parts of GI Tract and accessory organs, Nutrition and metabolism (production of ATP), Biological polymers.

UNIT VIII: Excretory System
Functions of urinary system, Kidney, ureter, bladder, urethra, Microanatomy and function of nephron.

UNIT IX: Respiratory System
Functions of respiratory system, Anatomy of respiratory tract, Mechanics and regulation of breathing, Gas exchange and gas laws.

UNIT X: Nervous System
Functions of nervous system, Nerve cell anatomy, Neural physiology (action potential, synaptic transmission, Na/K pump), Brain anatomy and hemispheres, Spinal cord anatomy, reflex arc, PNS (autonomic and somatic), Sensory motor nerve functions, Sensory organs.

UNIT XI: Endocrine System
Functions of endocrine system, Naming organs/glands/cells and their hormones, Hormone types and target cells, Homeostasis and feedback loops, Chemical messengers.

UNIT XII: Reproductive System
Functions reproductive systems, Male and female anatomy, Menstrual cycle, Meiosis/gamete production.
Reference Books:-

DMLT25P --- Microbiology: Techniques Practical

UNIT I: Microbiology laboratory
To demonstrate safe code of practice for a microbiology laboratory, To prepare cleaning agents and to study the technique of cleaning of glassware.

UNIT II: Compound microscope
To study the working and handling of compound microscope, To study the method of sterilization by Autoclave.

UNIT III: Method of sterilization
To study the method of sterilization by Hot Air Oven, To study the method of sterilization of media/solutions by filtration.

UNIT IV: Nutrient Agar
To prepare Nutrient Agar in laboratory, To prepare Blood Agar in Laboratory.

UNIT V: Plates and agar slants
To prepare culture plates and agar slants, To perform inoculation of culture media (plates, slants and culture media).

UNIT VI: Antimicrobial susceptibility
To test the antimicrobial susceptibility of given bacterial culture on nutrient agar plates by Disc Diffusion Method.

UNIT VII: Morphology of giardia lambia
To study the morphology of giardia lambia from permanent slides.

UNIT VIII: Entamoeba histolytica
To study the morphology of Entamoeba histolytica from permanent slides.

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