परिशिष्ट (XIII)

SYLLABUS FOR LABORATORY TECHNICIAN

(A) Fundamentals of Physiology & Basics of Biochemistry

Fundamental of Physiology

General outline along with the functional anatomy of various body systems

1. Cell : Structure & function
2. Tissue : Epithelium, Connective, Sclerous, Muscular & Nervous
3. Blood : Blood cells, Hemoglobin, Blood groups, Coagulation Factors, Anemia & Immunoglobulins
4. Cardiovascular system: Heart rate, cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse, Measurement of pulse, blood pressure, Auscultation for Heart Sounds.
5. Respiratory System : Ventilation, Functions, Lungs Volumes and capacities
6. Gastrointestinal System : Process of digestion in various parts
7. Endocrinology: Endocrine Glands, Hormones - Their secretion and functions
8. Excretion system: Structure of nephron, Urine formation
9. Central Nervous System: Parts, Sliding Filament Theory, Neuromuscular Junction, Wallerian Degeneration, Motor Nervous system, Sensory nervous system, Sympathetic Nervous system, Parasympathetic nervous system
10. Reproductive System: Male and Female reproductive systems
11. Skin: Structure & Function
12. Muscular System : Classification of muscles & their functions
13. Special Senses : Eye & ear (in brief)

Basics of Biochemistry

1. Introduction to Apparatus, Chemical Balance: Different types, Principles and Practice.
2. Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards,
3. Atomic structure, Valence, Acids, Bases, Salts, & Indicators.
4. Chemistry of carbohydrates & their related metabolism: Introduction, definition, classification, biomedical importance & properties.
5. Brief outline of metabolism: Glycogenesis &glycogenolysis, Glycolysis, Citric acid cycle & its significance, HMP shunt & Gluconeogenesis, regulation of blood glucose level, Hyperglycemia & hypoglycemia, Diabetes mellitus - definition, types, features, gestational diabetes mellitus , glucose tolerance test, glycosurias, Hypoglycemia & its causes

6. Amino acids: Definition, classification, essential &non essential amino acids.
7. Chemistry of Proteins & their related metabolism: Introduction, definition, classification, biomedical importance.
8. Metabolism: Transamination, Decarboxylation, Ammonia formation & transport, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids especially Phenylalanine, Tyrosine & Tryptophan, Creatine, Creatinine, Proteinuria.
9. Chemistry of Lipids & their related metabolism: Introduction, definition, classification, biomedical importance, essential fatty acids.
10. Brief out line of metabolism: Beta oxidation of fatty acids, Fatty acid synthesis, Ketosis, Cholesterol & its clinical significance. Lipoproteins- composition & functions, Fatty liver & Atherosclerosis.
11. Chemistry of Nucleic acids: DNA Structure and function, RNA Types: Structure and function.
12. Vitamins: Fat & water soluble vitamins, sources, requirement, deficiency disorders & biochemical functions.
13. Enzymes: Introduction, definition, classification, coenzymes, isoenzymes, properties, factors affecting enzyme action, enzyme inhibition, diagnostic value of serum enzymes

(B) Hematology & Clinical Pathology

Hematological Disorders

1. Classification of Anemia (Morphological & etiological), Definition, causes, classification & lab findings of Iron Deficiency Anemia, Megaloblastic Anemia, Hemolytic Anemia
2. Bone Marrow : Cell composition of normal adult Bone marrow
3. Leukemia: Classification, Blood Picture, Differentiation of Blast Cells.

Basic Hematological Techniques

1. Blood collection
2. Anticoagulants used in Hematology
3. Normal values in Hematology
4. Basic Hematological Techniques: RBC count, Hemoglobin estimation, Packed cell volume.
5. Calculation of absolute indices: WBC counts-Total and differential, Absolute eosinophil count, Platelet count, Erythrocyte sedimentation rate, Reticulocyte count
6. Preparation of blood films
7. Stains used in Hematology
8. Morphology of red cells

9. Morphology of Leukocytes and platelets
10. Bone marrow: Techniques of aspiration, preparation and staining of films, Bone marrow biopsy
11. Laboratory methods used in the investigation of anemia.

Clinical Pathology

1. Urine examination: Physical, Chemical & Microscopic
2. Examination of body fluids, cell counts
3. Semen analysis
4. CSF (Cerebrospinal Fluid)
5. Stool Examination.

(C) General Microbiology

1. Introduction & History of Microbiology

Development of microbiology as a discipline, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner.

2. Microscopy

Study of compound microscope-magnification, numerical aperture, resolution and components of microscope, different types of microscopy-Bright field microscope, Dark field microscope, Phase contrast microscope, Electron Microscope-Transmission & Scanning Electron Micoscope, Precautions and care of microscope

Bacteria

1. General characters and classification.
2. Morphology: Shape, Capsule, Flagella, Inclusion, Granule, Spore.

Growth and Maintenance of Microbes

1. Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, Viable count, bacterial nutrition, oxygen requirement, CO_2 requirement, temperature, pH,light.

Sterilization and Disinfection

1. Physical agents- Sunlight, Temperature less than 1000C, Temperature at 1000C, steam at atmospheric pressure and steam under pressure, irradiation, filtration.
2. Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

Culture Media

1. Definition, uses, basic requirements, classification, Agar, Peptone, Transport
2. Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media

Staining Methods

1. Simple, Grams staining, Ziehl-Nelsen staining or AFB staining, Negative Impregnation

Collection and Transportation of Specimen

1. General Principles, Containers, Rejection, Samples- Urine, Feces, Sputum, Pus, body fluids, Swab, Blood.

Care and Handling of Laboratory Animals

1. Fluid, Diet, Cleanliness, Cages, ventilation, Temperature, Humidity, handling of animals, Prevention of disease.

Disposal of Laboratory/Hospital Waste

1. Non-infectious waste, infected sharp waste disposal, infected non-sharp waste disposal.

Nosocomial Infections/ Hospital Acquired Infections (HAI)

1. Causative methods, transmission methods, investigation, prevention and control of Hospital Infection

(D) Clinical Biochemistry

Photometry

1. Definition,
2. Laws of photometry, absorbance, transmittance, absorption maxima,
3. Instruments,
4. Parts of photometer, types of photometry–colorimetry, spectrophotometry,
5. Flame photometry,
6. Fluorometry, choice of appropriate filter,
7. Measurements of solution,
8. Calculation of formula, applications.

Water & Mineral Metabolism

1. Distribution of fluids in the body,
2. ECF & ICF,
3. Water metabolism, dehydration,
4. Mineral metabolism, macronutrients (principal mineral elements) & trace elements.

Acid base balance concepts & disorders

1. Concepts of Acid Base reaction and hydrogen ion concentration. pH meter & pH buffer.
2. pH, Buffers, Acidosis, Alkalosis

Organ Function Tests

1. Liver Function Tests, Renal Function Tests,
2. Thyroid function tests and Pancreatic Function tests

Cardiac Profile

1. Hypertension, Angina, Myocardial Infarction,
2. Pattern of Cardiac Enzymes in heart diseases.

Diabetic Profile

1. Regulation of Blood Glucose,
2. Glucose tolerance test,
3. Glycosylated Hemoglobin,
4. Microalbuminuria etc.

Endocrinology

1. Classification of hormones;
2. Regulation and general mechanism of action of hormones;
3. Pituitary gland & hypothalamus;
4. Hormones of the Anterior Pituitary, neurohypophysis,
5. Thyroid gland,
6. Adrenocortical hormones, Adrenal medulla,
7. Gonads & Pancreas.

(E) Histopathology & Cytology

1. Introduction to Histopathology, Exfoliative cytology.
2. Basic steps for Tissue Processing: Fixing, Embedding, Microtomy, Staining, Mounting, methods of decalcification.
3. Laboratory requirements for Histopathology & Cytology: Chemicals & Reagents
4. Equipments - Microscope, Microtome: Types, Uses, Parts, different types of microtome knives, care & maintenance. Automated tissue processor - components, working & precautions during use, Tissue floating bath.
5. Staining Methods
    a) Hematoxylin & Eosin stain,
    b) Reticulin stain
    c) PAP staining
6. Museum Techniques

a) The mounting of pathological specimens: Introduction, Preparation of specimen, Fixation of specimen

b) Precaution taken for the Fixation of Specimens.

c) Storage of Specimens.

d) Mounting of Museum Specimens.

e) Routine Mounting of Specimens.

f) Filling and Scaling.

(F) Immunology, Serology & Parasitology

Immunology & Serology

1. Immunity - Definition and classification, General Principles of Innate & Acquired Immunity.
2. Immune Response - Humoral immunity & cell mediated immunity.
3. Antigen - Definition, classes, properties.
4. Antibodies/ Immunoglobulins - Definition, Properties, Sub types of Immunoglobulins, Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody
5. Antigen/Antibody Reaction/ Serological Refractions

6. Features of antigen/antibody Reaction- Precipitation, Agglutination, ELISA, RIA, Complement fixation test, Neutralization, Opsonization, Immune adherence, Immuno fluorescence, Immuno electron microscopic test
7. Structure and functions of Immune System
   a) Parts of Immune system
   b) T/B cells, Natural Killer cells, other cells & their functions
8. Hyper sensitivity Reactions
   a) General Principles of different types of hypersensitive reactions i.e., type 1, 2, 3, 4.
   b) Auto immune disorders
9. ELISA
10. Vaccination- Immunoprophylaxis schedule in neonates, children and in pregnancy

Parasitology

1. Definition - parasitism, Host, Vectors etc.
2. Classification of Parasites.
3. Lab diagnosis of parasitic infections.

Protozoa: Life cycle, Morphology, Disease & Lab Diagnosis

1. Intestinal Amoebae: E. histolytica, E. coli
2. Flagellates of intestine/genitalia: Giardia lamblia, Trichomonas vaginalis
3. Malarial Parasite: Plasmodium vivax ; Differences between P. vivax, P. malaria, P. falciparum & P. ovale.

Nematodes: Intestinal Nematodes:

1. Ascaris: Life cycle, Morphology, disease & lab diagnosis
2. Enterobiusvermicularis (Thread worm) and Ancylostomaduodenale (Hook worm) (inbrief)
3. Tissue Nematodes: W. bancrofti - Life cycle, Morphology, Disease & Lab Diagnosis

Phylum Platyhelminths

1. Cestodes - T. solium, T. saginata & E. granulosus.
2. Trematodes - S. haematobium& F. hepatica

(G) Coagulation studies & Blood Bank procedures

Coagulation studies

1. Hemostasis: Definition, Basic concept and principle, Basic steps involved in Hemastosis.
2. Coagulation:
   a) Basic Physiology, coagulation factors.
   b) Mechanism of blood coagulation.
   c) Extrinsic Pathway.
   d) Intrinsic Pathway.
   e) Regulators of blood coagulation.
3. Testing of blood coagulation:
   a) Bleeding Time, Duke's method.
   b) Clotting Time- Capillary tube method & Lee white's method.
   c) PT, APTT
   d) Clot retraction time
   e) Determination of fibrinogen.
4. Quality Assurance for routine Heamostasis Laboratory:
   a) Introduction.
   b) Sample collection technique (Phlebotomy)
   c) Sample preparation, Anticoagulant used, Importance of use of Sodium Citrate.

5. Role in Diseases, Bleeding disorders
    a) Platelet disorder - Thrombocytopenia - causes including aplastic anemia
    b) Hemophilia

Blood Bank Procedures

1. Principles and practice of:
    a) Blood Grouping
    b) Blood Transfusion
    c) Blood Donation
    d) Blood Collection
    e) Storage & Transport
    f) Maintenance of Blood Bank Records
    g) Compatibility Testing
    h) Blood Components
    i) Blood Transfusion Reactions

(H) Systematic Bacteriology, Mycology & Virology

Systematic Bacteriology

1. Morphology, cultural characteristics,
2. Biochemical reaction,
3. Pathogenesis/ disease caused & lab diagnosis of:
    a) Staphylococcus,
    b) Streptococcus,
    c) Pneumococcus,
    d) Neisseria gonorrhoeae,
    e) Neisseria
    f) meningitidis,
    g) Corynebacteriumdiptheriae,
    h) Mycobaterium,
    I) Clostridium,
    j) E.coli,
    k) Klebsiella,
    l) Salmonella,

m) Proteus,

n) Pseudomonas,

o) Vibrio

p) Spirochaetes.

4. Molecular techniques in diagnostic microbiology -PCR, DNA hybridization Mycology

a) Morphology and Structure of fungi

b) Classification of fungi

c) Nutrition and cultivation of fungus

d) Cutaneous, Subcutaneous and Systemic Mycosis

e) Lab diagnosis of fungal Infections

f) Opportunistic fungal infections

Virology

1. General characters of viruses
2. Classification of viruses
3. Structure of Viruses: Capsid symmetry, enveloped and non-enveloped viruses
4. Lab diagnosis of viral infections

5. Cultivation of viruses
6. Bacteriophages.
7. Retro viruses - HIV, Hepatitis virus, Pox virus
8. Picorna virus - Polio
9. Orthomyxo virus - Influenza
10. Arbo virus - Chikungunya, Dengue
11. Herpes and Adeno virus

Syllabus for X-Ray Technician

1. Human Anatomy & Physiology

Scope of Anatomy and Physiology - Definitions and Terms in Anatomy and Physiology- Structure and function of human cell - Elementary tissues of human body- Brief account on Composition of Blood - functions of blood elements - Blood Group and coagulation ofblood.

(i) Cardio Vascular System (Structure and functions of various parts of the heart, arterial and venous system, briefaccount on common cardiovascular disorders).

(ii) Respiratory System (various parts of respiratory system and their functions,