

## Paper II: Technical Subject

### 1. Hematology

15 %

- 1.1 Formation, composition and function of blood
- 1.2 Collection and preservation of blood for various hematological investigations
- 1.3 Hemoglobinometry, various methods of estimation of hemoglobin, errors involved and standardization of instrument
- 1.4 Romanowsky dyes, preparation and staining procedures for all counts, visual as well as electronic method and errors involved, and means to minimize such errors in counting red blood cells, white blood cells and platelets.
- 1.5 Anemia: Definition, classification, and clinical features and causes of various types of anemia
- 1.6 Laboratory investigations for various types of anemia.
- 1.7 LE cell phenomenon and various methods of its demonstration
- 1.8 Principle procedure and interpretation of Coomb test.
- 1.9 Leukocyte abnormalities and pathological variations of white cell values
- 1.10 Leukemoid reactions and its importance.
- 1.11 Haemostatic mechanism and theories of blood coagulation.
- 1.12 Physico chemical properties of coagulation factors.
- 1.13 Routine test as well as the following Haematological tests and their Principle and interpretation of:
  - 1.13.1 Reticulocyte count
  - 1.13.2 Osmotic fragility test
  - 1.13.3 Foetal hemoglobin
  - 1.13.4 LE cell phenomenon
  - 1.13.5 Hb electrophoresis
  - 1.13.6 Serum Iron, Folic acid, Vit B<sub>12</sub>.
  - 1.13.7 Total Iron binding capacity
  - 1.13.8 Serum ferritin
  - 1.13.9 BT, CT, PT, APTT
  - 1.13.10 Factor VIII and IX
  - 1.13.11 Platelet function test
  - 1.13.12 Bence Jones protein
- 1.14 Classify Leukemia
- 1.15 Identify different types of leukemia and their morphological features

### 2. Microbiology

35%

- 2.1 Historical development of microbiology with reference to Anton Van Leuwenhoek, Louis Pasteur, Robert Koch, Joshep Lister, Edward Jenner
  - 2.1.1 Bacterial Classification, Morphology and Cell structure
  - 2.1.2 Laboratory contamination, and infection; Disposal of infectious material, laboratory safety measure, laboratory discipline and practices.
  - 2.1.3 Different ways of sterilization by Physical, chemical, radiation and filtration and its applications. Relationship between disinfectants and antiseptics, disinfection rate of microorganisms; and uses of ethylene oxide sterilizer
  - 2.1.4 Mechanism, functions, uses and the quality control of the laboratory equipments.

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- 2.1.5 Classify the types of antigen antibody reactions, hypersensitivity, immediate and delayed.
  - 2.1.6 Morphology, staining property, cultural characteristics, Biochemical reaction, Antigenic Characters, Pathogenicity, Laboratory diagnosis and the diseases caused by the followings:
    - 2.1.6.1 Gram positive cocci: Staphylococci, streptococci, Pneumococci, Micrococci
    - 2.1.6.2 Gram Positive bacilli: Corynebacteria, bacillus; clostridia
    - 2.1.6.3 Gram negative bacilli (Enterobacteriaceae): Escherichia coli, Klebsiella, Enterobacter, Citrobacter, Proteus, Providencia, Yersinia, Salmonella, Shigella, Arizona
    - 2.1.6.4 Gram negative cocci: Neiseria
    - 2.1.6.5 Curve Gram negative bacilli: Vibrio, Campylobacter, helicobacter
    - 2.1.6.6 Mycobacteria: Typical and Atypical mycobacteria, Leprosy
    - 2.1.6.7 Haemophilus: H. Influenzae and other species
    - 2.1.6.8 Non fermentative Gram negative bacilli: Pseudomonas, Acinetobacter, Moraxella
    - 2.1.6.9 Spirochaete; Treponema, Borrelia, Leptospira
    - 2.1.6.10 Miscellaneous fastidious organisms: Mycoplasma, Chlamydia, Rickettsia
  - 2.1.7 Antigen Antibody reaction; agglutination, precipitation flocculation, complement fixation and ELISA.
  - 2.1.8 Bacteriological examination: Water, milk, food, air and pharmaceutical products.
  - 2.1.9 Procedure of:
    - 2.1.9.1 Laboratory diagnosis of common Bacterial infection; Pyogenic Infection; Respiratory tract infection, urinary tract infection, sexually transmitted diseases, food poisoning, enteric fever, gastroenteritis, meningitis, diphtheria, tuberculosis, leprosy.
  - 2.1.10 Diagnostic procedure immunological/serological test; Widal tests; ASO titer; CRP, Rose – Walter test; Brucella agglutination; cold agglutination; VDRL, RPR, TPHA, ELISA, CFT.
  - 2.1.11 Methods of separation of T and B Cells
- 2.2 Bacteriology (procedure):
    - 2.2.1 Collection of specimens for bacteriological specimens
    - 2.2.2 Methods of culture techniques and organisms encountered in CSF, Blood culture, Sputum, Pus, Urine, Stool, Body fluid aspirate etc.
    - 2.2.3 Quality control in procedure, culture media, equipments
    - 2.2.4 Hospitals infection, Laboratory infection
    - 2.2.5 Infectious waste management
  - 2.3 General Virology:
    - 2.3.1 General properties of viruses and interferon
    - 2.3.2 Principle of viral isolation, embryonated egg and tissue culture
    - 2.3.3 Immunology of viral infection
  - 2.4 Mycology:
    - 2.4.1 Identification of superficial, deep and systemic mycosis
    - 2.4.2 Opportunistic mycosis
    - 2.4.3 Examination and identification by different method and culture
  - 2.5 Parasitology
    - 2.5.1 Classification of human and vectors

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- 2.5.2 General characteristics of Protozoa, Helminthes, trematodes/ cestodes
- 2.5.3 Methods of collection, transportation and storage of different types of specimens
- 2.5.4 Methods of identification parasites from different types of clinical materials
- 2.6 Immunology
  - 2.6.1 Immune system and infectious diseases
  - 2.6.2 Structure, types and function of Immunoglobulin
  - 2.6.3 Toxin/ antitoxin and antibody/antigen reaction; and their various types
  - 2.6.4 Immunological reaction and their various types; agglutination, precipitation, complement fixation, ELISA
  - 2.6.5 Preparation, preservation and titration of complement
  - 2.6.6 T cells and B cells
  - 2.6.7 Monoclonal and polyclonal antibodies preparation
- 2.7 Systematic Bacteriology
  - 2.7.1 Properties, epidemiology, methods of isolation, differentiation, pathogenesis and Laboratory diagnosis of following bacterial infections:  
*Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacteria, Bacillus, Clostridium, nonsporing anaerobes, Enterobacteriaceae, Vibrio, Pseudomonas, Yersinia, Pasteurella, Francisella, Haemophilus, Bordetella, Mycobacterium, Spirochaetes, Mycoplasma, Actinomycetes, Rickettsia, Chlamydiae.*

## 3. Biochemistry

35%

- 3.1 Total Quality management in Laboratory Medicine
  - 3.1.1 Fundamental of Total Quality management
  - 3.1.2 Statistical process in quality control
  - 3.1.3 Method evaluation
  - 3.1.4 Element of quality assurance program
  - 3.1.5 Type of pre-analytical variables and its control
  - 3.1.6 Control of analytical variables
  - 3.1.7 Selection of QC materials
  - 3.1.8 Frequency of assay for QC materials
  - 3.1.9 Quality control chart-LJ Chart, operating specification chart, Cusum chart, shewhart chart
  - 3.1.10 Rule to evaluate QC results- Westgard multirule concept
  - 3.1.11 Post-analytical variables in laboratory
  - 3.1.12 Calibration issue in Quality control
  - 3.1.13 Quality control using patient data
  - 3.1.14 Standard operating procedure
  - 3.1.15 Monitoring Technical competence
  - 3.1.16 Errors and identification of the source of error in laboratory
  - 3.1.17 External quality control and proficiency testing (PT)
  - 3.1.18 Accreditation in laboratory medicine
- 3.2 Basic Biochemistry
  - 3.2.1 Principle of Biochemistry
  - 3.2.2 Buffer: Definition, types, composition of buffer present in body fluids
  - 3.2.3 Photometric measurement of light i.e. radiant energy, spectrum characteristics i.e. UV and IR, Beer's law and Lambert's law and their limitations and to select the multiple wave length i.e. single and double beams.

### 3.3 Metabolism

#### 3.3.1 Carbohydrate

- 3.3.1.1 Glycolysis
- 3.3.1.2 Glycogenesis
- 3.3.1.3 Glycogenolysis
- 3.3.1.4 Pentose phosphate pathway
- 3.3.1.5 Kreb's cycle
- 3.3.1.6 Gluconeogenesis
- 3.3.1.7 Electron transfer chain (Respiratory chain)

#### 3.3.2 Protein metabolisms

- 3.3.2.1 Transamination
- 3.3.2.2 Deamination
- 3.3.2.3 Urea cycle
- 3.3.2.4 Nitrogen balance
- 3.3.2.5 Creatinine and creatinine formation
- 3.3.2.6 Biochemical basis, investigation and interpretation of aromatic amino acid metabolism disorder

#### 3.3.3 Lipid metabolisms

- 3.3.3.1 Biochemical basis of formation of bile acid/bile salts.
- 3.3.3.2 Biosynthesis, biochemical effect of prostaglandin and other arachinodic acid metabolism
- 3.3.3.3 Use of prostaglandin and their inhibitors in medicine
- 3.3.3.4 Ketogenesis and its regulation and transportation
- 3.3.3.5 Biochemical changes leading to ketosis, utilization of ketone bodies.
- 3.3.3.6 Biosynthesis of cholesterol and triglyceride (TG)
- 3.3.3.7 Dyslipidemia and laboratory investigation
- 3.3.3.8 Introduction, classification, definition and types of lipoprotein

### 3.4 Liver Function Test

- 3.4.1 Function of liver and bilirubin metabolism
- 3.4.2 Liver function test and their list with principle, procedures and interpretations
- 3.4.3 Biochemical investigation in acute and chronic liver disease

### 3.5 Kidney function test

- 3.5.1 Anatomy and physiology of kidney
- 3.5.2 Function of kidney i.e. excretory, Secretion, re-absorption
- 3.5.3 Renal function test, their list with principle, procedure and interpretation
- 3.5.4 Biochemical investigation in acute and kidney disease, nephritic syndrome
- 3.5.6 Creatinine clearance test (principle procedure and interpretation).

### 3.6 Pancreatic Function test

- 3.6.1 Anatomy and physiology of pancreas
- 3.6.2 Pancreatic function test, their list and clinical significance of - Serum amylase, Urine amylase, Serum lipase, Serum trypsin, Phospholipase, Hyperglycaemia, Hypoglycaemia

### 3.7 Cardiac Function test

- 3.7.1 Biochemical basis, investigation and interpretation of myocardial infraction (MI)
- 3.7.2 Estimation and interpretation of

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- 3.7.2.1 LDH
- 3.7.2.2 CPK
- 3.7.2.3 GOT
- 3.7.2.4 Troponin
- 3.7.2.5 CPK MB
- 3.8 Acid base and Electrolyte
  - 3.8.1 ph, buffer and blood gas analysis and interpretation
  - 3.8.2 Acid base regulation and its disorders
  - 3.8.3 Water and electrolyte Imbalance and measurement of electrolytes
- 3.9 Endocrinology
  - 3.9.1 Thyroid Function Tests,
  - 3.9.2 Pituitary Function Test and
  - 3.9.3 Reproductive Hormone Test and investigation in infertility
  - 3.9.4 Hormonal regulation of calcium and phosphorous metabolism
  - 3.9.5 Hormonal regulation of blood glucose level
  - 3.9.6 Laboratory investigation in Diabetes mellitus
  - 3.9.7 Adrenal Function test
- 3.10 Tumor Marker
  - 3.10.1 Estimation and interpretation of AFP, B-hCG, CEA, CA-125, CA 19-9, CA 15-3, PSA
- 3.11 Enzyme
  - 3.11.1 Definition, classification and properties of enzyme
  - 3.11.2 Factor affecting enzymatic activity
  - 3.11.3 Mechanism of enzymatic activity
  - 3.11.4 Regulation of enzymatic activity
  - 3.11.5 Isoenzyme and clinical application of enzyme assessment
  - 3.11.6 Clinical importance and estimation of (SGPT, SGOT, ALP, GGT, ACP, CK, CK-MB, LDH, Amylase, Lipase.
- 3.12 Serum Protein, Lipoprotein and Hemoglobin Electrophoresis
- 3.13 Recent advances in clinical biochemistry.
- 3.14 Management of Biochemistry Laboratory

**4. Histopathology and Cytology 15%**

- 4.1 Fixatives and preservatives, their types, composition and methods of preparations
- 4.2 Different types of decalcifying agents, their principle and mode of decalcification
- 4.3 Special histological stains, their composition and principle of Haematoxylin, eosin and special stain for connective tissue, protein, amyloid, carbohydrate, lipid and pigments
- 4.4 Principle and application of immunohistochemistry
- 4.5 Immunofluorescence technique
- 4.6 Electron Microscopic and its applications
- 4.7 Safety measures and quality assurance in Histopathology Laboratory
- 4.8 Cytology of the respiratory tract: Introduction to respiratory tract, various methods of sample collection, different methods of staining the collected samples and special stains used in the diagnosis of the diseases.
- 4.9 Gynecological cytology: Introduction to the female genital tract, various methods of sample collection and different methods of staining. Features of various malignant, benign and infective specimens, stains and special stains used.

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- 4.10 Cytology of body fluids and urine: Introduction, methods of sample collection, various methods of staining body fluid samples and urinary cytology.
- 4.11 Cerebrospinal fluid (CSF): Introduction, staining, cytological study and its applications.
- 4.12 Sex chromatin, Chromosomal Analysis and Karyotyping: Introduction, methods of staining and its applications.
- 4.13 Uses of Cytogenetics, Flowcytometry, and Polarized microscopy in cytological study
- 4.14 Role of automation in cytology
- 4.15 Method of project writing and its importance

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द्वितीय पत्रको **Part II: Technical subject** का एकाईहरूबाट निम्नानुसार प्रश्नहरू सोधीनेछ ।

द्वितीय पत्र Part II का एकाई	1 Hematology (15%)	2 Microbiology (35%)		3 Biochemistry (35%)		4 Histopathology and Cytology (15%)
प्रश्न संख्या	1	1	1	1	1	1
अंक भार	15	15	20	15	20	15