SANJAY GANDHI POSTGRADUATE INSTITUTE OF MEDICAL SCIENCES

Raebareli Road, Lucknow-226014 (U.P.)

Syllabus for the post of Medical Lab Technologist (Core Subject)
Advt No. I/10/5/Rectt/2026-27

(Syllabus is only Indicative. The questions can assess any aspect of knowledge, aptitude, attitude and practical skills, which is expected from a trained person to work efficiently at the advertised post)

Anatomy & Physiology

a. Musculo skeletal system: Bones – Types, structure and functions
b. Digestive system: Gross anatomy of digestive organs, Physiology of Digestion, Digestive juices – secretion, composition and functions
c. Respiratory system: Gross anatomy of respiratory organs, physiology of respiration, oxygen and carbon dioxide transport
d. Cardiovascular System: Gross anatomy of heart & vessels
e. Excretory System: Gross anatomy of excretory organs, function of kidneys, mechanism of urine formation, structure and function of Kidney
f. Reproductive System: Gross anatomy of Male & Female reproductive organs, Physiology of menstruation
g. CerebroSpinal Fluid: Formation, composition of CSF
h. Endocrine System: Gross anatomy of endocrine organs; Brief description of endocrine hormone and their functions

Biochemistry

a. Introduction and scope of Biochemistry, cleaning and care of laboratory glass ware and equipments, preparation and storage of distilled water, analytical balance, calorimeter, spectrometer, pH meter, flame photometer, S.I unit of measurement, preservation and disposal of biological sample, basic statistics – mean, median, modes, SD, CV, normal reference ranges. Acid and base, pH, buffer solution, indicator, standard solution, storage of chemicals, water, electrolytes, acid base balance
b. Carbohydrate, lipids, proteins – Classification, properties, Biological importance, functions.
c. Amino acids, nucleic acid, Enzymes, co-enzymes – definition, classifications, Biological role/importance.
d. Glycolysis, TCA cycle, Electron transport chain, Pentose phosphate pathway, Glyconeogenesis, Gluconeogenesis, cori-cycle, Blood sugar and its regulation.
e. Amino acids, vitamins, mineral – classification, Biological role, deficiency state. Transamination, Deamination, Biological importance of catecholamine, GABA, serotonin, Histamine, Melanin.
f. Tumour markers: Brief history, classifications, clinical applications.
g. Laboratory Test (AFP, CEA, PSA);
    - Liver function test, renal function test
    - Thyroid function test, Enzymes and co-enzymes in diagnosis of the diseases, Hormone analysis
    - Cardiac function test

- Qualitative test for Carbohydrates, lipids, proteins, Bence Jones Protein.
- Estimation of serum electrolytes, and bicarbonates Blood sugar
- Quantitative test for organic constituent (Urea, uric acid, creatinine) inorganic constituent (Sodium, potassium, calcium, ammonia, chloride, phosphate, bicarbonate and sulphate in urine with clinical significance and study of abnormal constituent of urine – Glucose, Protein, ketone bodies, blood, bile salt, bile pigments).
- Radio Immunoassay (RIA)
- Enzyme link Immuno sorbent Assay (ELISA)
- Chromatography (thin layer, paper, gas, liquid); Electrophoresis (gel electrophoresis, liquid electrophoresis)

Microbiology

a. Introduction, brief history of Microbiology, origin of microbial life – theory of spontaneous generation.

   Safety Measures in Microbiology.

   - Classifications and nomenclature of bacteria (five kingdom concepts).
   - Sterilization – principle, methods, antiseptic, disinfectants.
   - General characteristics of bacteria, anatomy of bacteria (shape, size, components).
   - Growth and nutrition of bacteria, classification of bacteria on the basis of nutritional requirements, measurement of cell mass and factor affecting growth.
   - Cultivation of Microbes (Bacteria);
   - Culture technique (media preparation and inoculation)
   - Isolation of pure cultures (streak plate, spread plate, pour plate and serial dilution)
   - Identification of microbes by colony morphology.

b. Bacteriology, Normal Micro flora of human body, Germ theory of diseases, microbial infection (types, sources and transmission.

   - Bacterial Toxin (Endotoxin & exotoxin)
   - Bacterial Morphology, isolation, identification, Pathogenecity, lab diagnosis of staphylococcus, streptococcus, Neisseria Gonorrhea, N. Meningitidis, clostridium tetani & C. perfringens
   - E. coli, vibrio cholera, salmonella typhi, shigella, Mycobacterium tuberculosis, spirochetes – Treponema pallidum.
   - Collection, preservation, transportation of clinical specimens for microbial investigation.
   - Bacteriological methods: examination of blood, faeces, pus, sputum, throat swab and urine.
   - Antibiotic sensitivity test (Disc diffusion and broth dilution methods).
   - Hospital acquired infections and their control.
   - Waste disposal and management.

c. Instruments & Glassware:

- Autoclave, Incubator, Laminar Airflow,
- Hot air oven, water bath, vortex shaker.
- Petridish, test tube, screw cap tube, glass spreader/L-rods, Pasteur pipettes.

d. Medical Mycology:
   - Classification and nomenclature of fungi
   - General characteristics, structures, reproduction, cultivation
   - Medically important division of fungi
   - Morphology, culture characteristics, Pathogenecity, Lab diagnosis of common pathogenic fungi (Aspergillus sp., Candida Sp., Dermatophytes, Penicillum Sp.)

e. Immunology:
   - Introduction, Antigens (Types and properties) Antibodies/Immunoglobulin types and properties
   - Antigen-antibody reactions and their application (Agglutination, precipitation, complement fixation and neutralization tests)
   - Immunity (Innate and Acquired)
   - Hypersensitivity
   - Immunodeficiency diseases.

f. Serology:
   - Quality control measures in serology
   - Common serological technique and their applications (VDRL, Widal, RA test, ASO, Pregnancy test, HbsAg and HCV, HIV, Mantoux test).

g. Medical Virology:
   - Classification, nomenclature, general characteristics (Morphology, Chemical, biological properties and multiplication)
   - Cultivation of viruses (chick embryo, cell culture and animals)
   - Bacteriophages (lytic and lysogenic cycles)
   - Morphology, cultural characterstics, Pathogenecity and laboratory diagnosis of Poliomyelitis, Mumps, Measles, Hepatitis A,B,C, Cytomegalovirus, Rabies, HIV/AIDS.

h. Molecular Biology:
   - Introduction
   - DNA & RNA
   - Isolation of DNA (Genomic & Plasmid)
   - Plasmids (types & importance).

i. Principles, methods and application of ELISA, Immunofluorescence test, Western Blot, PCR.

Parasitology

a. Introduction, classification, characteristics of human parasites.
   - Collection, storage and transportation of specimens, preservation of parasites.

- Morphology, transmission, life cycle, Pathogenecity and lab. Diagnosis of: Entamoeba histolytica, Giardia Lamblia, Trichomonas vaginalis, Leishmania donovani and L. tropica, Plasmodia species, Toxoplasma gondii, nematodes, Intestinal flukes, lung flukes, liver fluke.
- Common vectors of human diseases (mosquito, flies, ticks and fleas)

Pathology and Clinical Pathology, Basic Lab. Techniques and Instruments

a. Pathology – definition, Branches
   - Acute and chronic Inflammation (definition, characteristics)
   - Sub acute, granulomatous inflammation
   - Changes in Inflammation
   - Chemical mediators of Inflammation.

b. Cell Injury – Definition, causes, Ischemia, Necrosis, Apoptosis, degeneration, dehydration.

c. Cellular adaptation of growth & differentiation (Atrophy, Hypertrophy, Hyperplasia, metaplasia, Dysplasia, Anaplasia).

d. Neoplasia (Benign and Malignant, definition, characteristics, etiology, spread).

e. Cell of Immune system (B & T lymphocytes, macrophage, dendritic and Langerhan's cells, NK cells).

f. Laboratory organization, role of laboratory technicians and responsibilities, safety measures, instruments, reporting and recording, common laboratory accidents and its preventions, handling of infectious materials, prevention and disposal, reagents and its storage.

g. Types of solution (isotonic, hypotonic, hypertonic); quality control – Principles & Types.

h. Routine examination and clinical significance of: Urine, Stool, Body Fluids (Ascitic fluid, pleural fluids, pericardial fluids, synovial fluids, CSF, seminal fluids, sputum); Medico legal importance of semen analysis and abnormal morphology of sperm.

Hematology

a. Blood – Components, collection, anticoagulants, preparation of smears and quality. Haemoglobin, TLC, DLC with absolute count, WBC, Red cell Indices, Reticulocytes (methods of estimation, clinical significance). Erythropoiesis, Granulopoiesis, Megakaryopoiesis (normal, abnormal & clinical significance). Blood parasites, bone marrow smears.
   - Haemoglobin (normal and abnormal, Biosynthesis, Haemoglobinopathies and its investigation)
   - RBC – structure, erythropoietin, functions
   - WBC – Physiology, pathological variation
   - Platelets – functions, purpuras, investigation of disorders, thrombocytosis, thrombocytopenia.
   - Haemostasis (Coagulation) – Normal mechanism, abnormal, investigation of abnormal haemostasis
   - Thrombosis – definition, causes.

- Leukemia – definition, classification (FAB), Acute & Chronic leukemia, lab features (AML, ALL, CML, CLL), Aleukemia, Leukaemoid reaction, Myelodysplastic syndrome.
- Anemias (Normochromic, Normocytic, Megaloblastic, Microcytic hypochromic, Anaemia of infections, Haemolytic Anaemias) – Definition, classification, causes, laboratory features and investigations.
- Thalassaemia (Trait, Minor, Major), Sideroblastic anaemia, Pancytopaenia, Aplastic Anaemias, Pure red cells aplasia.
- Coagulation disorders, lab diagnosis, causes, haemophilia, DIC.
- Lymphoma, definition, causes, classification, lab features/diagnosis
- Myeloma, definition, causes, classification, lab features/diagnosis
- Polycythaemia, definition, causes, classification, lab features/diagnosis
- Purpuras – definition, causes, classification, lab features/diagnosis.
- Staining – Leishman's stain, MGG, Giemsa's, PAS, Sudan B-Black, Iron, NAP, Acid phosphate, esterase (Principle, composition, methods & results).

(ii) Blood Banking & Immuno Haematology

a. Blood bank organisation, equipment, donor registration. Blood Groups – Types, technique of grouping. Donor's selection, collection of blood. Preservatives (storage), Laboratory screening of blood for transfusion.
b. Cross matching, compatibility testing, Coomb's Test, Transfusion reaction, Antigens, Antibodies (properties, production), Complements, sensitization, Agglutination, Haemolysis, Neutralization, Precipitation, Complement fixation, Immune response.
c. Diseases transmitted through blood and their screening, Haemolytic diseases of new born.
d. Blood component preparation and its uses, Haemapheresis, Massive transfusion, Autologous transfusion, exchange transfusion.

(iii) Histopathology – Basic & Technique

a. Cells & tissues – definition, cells and its organelles, function, cell cycle, mitosis, meiosis, epithelial cells, definition, classification & functions. Connective tissues (Bone & cartilage) Muscle tissues, Nerve tissues.
b. Histology of different systems and organs – Respiratory system, Alimentary system, excretory systems, reproductive system (male & female), endocrine system.
c. Histopathology technique –
    - Sample reception, registering, labelling
    - Fixative & fixation; Decalcification
    - Grossing(definition, Material required)
    - Processing of tissues (manual & automatic)
    - Waxes (Types of waxes)
    - Microtomies (Types, Knives, Honing & Stropping)
    - Dehydration, clearing, impregnation, embedding or blocking
    - Section cutting, mounting, labelling.
d. Demonstration of staining –
    - Nucleic acids

- Lipids
- Proteins
- Nerve cells
- Muscles
- Bone
- Carbohydrates
- Amyloid
- Pigments
- Micro organism & Parasites.

e. Biopsies of – Renal, Lymph node, Liver, muscle, Kidneys, nerve fibres, skin (Processing, fixation, blocking, staining).
f. Museum technique. Immunohistochemistry (definition, Purposes).
g. Staining – H & E stain, MGG Stain, connective tissue stains, Giemsa's stain, mucicarmine stains, Z.N stain, PAS Stain.

(iv) Cytology (Basic, Technique)

a. Definition of cytology, material for operation and establishment of cytology laboratory, role of cytology in the diagnosis, branches of cytology.
b. Reception, registration, numbering and supply of material for collecting specimens.
    - Preparations of Cytological smears.
    - Cytological fixation- aims and objects, chemical use for cytological fixation and methods of fixation.
    - Progressive changes of the cells. Nuclear criteria of Malignancy.
c. Exfoliative cytology – definition, source of samples
    - Body cavity fluid (pleural effusion, Pericardial effusion, Ascitic fluids, sputum, urine, synovial fluids, CSF, Pus and Abscess)
    - Methods of collection, fixation, methods of cyto preparations & staining.
    - Clotted blood fluidsm(methods of cytopreprations)
    - Cellular components in benign and malignant effusion, acute and chronic inflammation.
d. Interventional cytology (FNAC) – definition, Application, Methods
    - Role of FNAC
    - Common Sites
    - Advantage and disadvantage, limitations
    - Complications, precautions & contraindications
    - Preparation of smears
    - General properties of wet & dry smears
    - Imprint, crush smears, biopsy sediments, cell block preparations.
e. Aspiration of specific lesion e.g.: cyst, thyroid, lung, peritoneum, prostate, testis, radiological imaging aids of FNAC.

f. Methods of collection, fixation and cytoprepration of samples from – Female genital tracts, respiratory tracts, gastro-intestinal tracts, urinary tracts etc.

g. Staining
   - Pap's Stain
     - Chemical Requirement, preprations of various chemicals for PAP stain.
     - Various psp's stain methods
     - Types of haematoxylene and its prepration
     - Stain maintainance
     - Prepration of Graded Alcohols (50%, 60%, 70%, 80%, 85%)
     - Prepration of 0.5% HCL, lithium carbonate, EA modified, 0.2% hcl, 1% ammonium hydroxide in 70% ethanol, Orange G-6
   - Bismark be=rown, EA-50, EA-36
     - Procedures of PAP's Stain
   - MGG Stain
     - Giemsa's stain
     - Modified pap's stain
     - PAS stain, Alcian blue staining
     - Mayers & south gate Mucicarmine stain
     - Gram's stain
     - ZN stain
   - Quality controls (Internal & External) – definition, methods, advantage.