

NORTHERN RAILWAY

Headquarters Office
Baroda House
New Delhi

P.S. No.15994/2025

No. 831-E/004/Policy/Pt.III/EIIBII

Dated: /07/2025

The General Manager(P)
Rail Coach Factory, Kapurthala
Diesel Locomotive Modernisation Workshop, Patiala

PS/DRM
28/7/25
Sr.DPO

The Director General
Research Design & Standard Organization

The Medical Director, Northern Railway, Central Hospital, Basant Lane, New Delhi.
DRMs /P-DLI, ~~FZR~~, LKO, MB & UMB.

Sub:- Syllabus for Selection for the post of Lab Superintendent/Level-6.

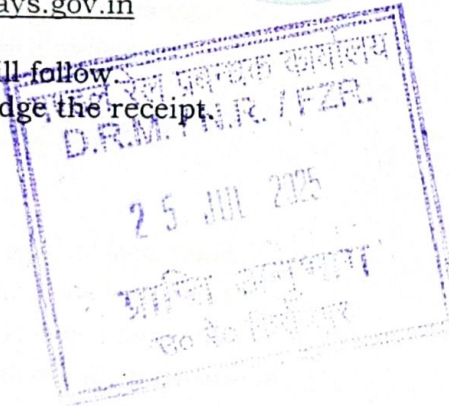
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2) Northern Railway's Medical Department No. 7-Med/E-3/QB-SY/Group-C dated 30.06.2025.

In reference to above subject, the syllabus for selection for the post of Lab Superintendent Level-6, is enclosed herewith for your information and necessary action please.

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(Signature)
(Udot Jha)
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SYLLABUS FOR LABORATORY SUPERINTENDENT

A. SUBJECT- RELATED TOPICS

PART A: FOUNDATION SUBJECTS

1. GENERAL PATHOLOGY

Basic Sciences Foundation:

- Cellular structure and function
- Tissue types and characteristics
- Organ systems overview
- Homeostatic mechanisms
- Systems Overview: Cardiovascular, Respiratory, Digestive, Urogenital, Nervous, Lymphatic & Immune Systems

Basic Pathological Processes:

- Cell injury and death mechanisms
- Inflammation: acute and chronic responses
- Healing and repair processes
- Thrombosis, embolism, and infarction

Disease Categories:

- Infectious diseases: bacterial, viral, fungal, parasitic
- Immune system disorders
- Neoplasia: benign and malignant characteristics
- Metabolic and nutritional disorders

2. LABORATORY FUNDAMENTALS & SAFETY

Core Concepts:

- Laboratory services and types of laboratories
- Infrastructure requirements and layout design
- Laboratory organization and medical laboratory technician roles
- Code of conduct for medical laboratory personnel

Safety & Quality Management:

- Universal precautions and laboratory safety protocols
- Bio-safety levels and hazard management (biological, chemical, fire)
- Laboratory accidents: prevention, emergency procedures, and first aid
- Biomedical waste management and disposal methods
- Standard Operating Procedures (SOPs)
- Internal quality control and external quality assessment

- Total Quality Management (TQM), Quality Assurance (QA), and Quality Control (QC)

Laboratory Materials & Techniques:

- Water purification, chemical storage, and reagent preparation
- Units of measurement and SI units
- Buffer systems and pH management
- Solution preparation (normal, molar, percentage w/v, v/v)
- Cleaning and maintenance of laboratory glassware and equipment
- Sterilization methods: autoclaves, hot air ovens, and other techniques

3. SPECIMEN MANAGEMENT & PHLEBOTOMY

Collection & Handling:

- Specimen collection, storage, and transportation protocols
- Blood collection techniques (venous and capillary puncture)
- Order of blood draw
- Preservation of blood sample; Changes during blood storage
- Materials required for blood collection
- Home collection procedures and preservation methods
- Anticoagulants: types, uses, and mechanisms of action
- Sample processing and analysis workflows

Sample Types:

- Blood specimens and components
- Urine collection and preservation
- Stool, semen, and sputum samples
- Body fluids (CSF, synovial, serous fluids)
- Tissue specimens for histopathology

4. LABORATORY APPARATUS & INSTRUMENTATION

Basic Equipment:

- Layout and organization of medical laboratories
- Glassware: beakers, flasks, pipettes, burettes, test tubes
- Specialized containers: reagent bottles, specimen bottles, cuvettes
- Flasks - different types (Volumetric, round bottom, Erlenmeyer conical)
- Funnels – different types (Conical, Buchner)
- Bottles – Reagent bottles – graduated and common, Wash bottles – different type
- Specimen bottles
- Measuring cylinders, Test tubes, centrifuge tubes, test tube, Wire gauze, Bunsen burner.
- Cuvette – Bottle, Test tube, Pipette Desiccator
- Measuring devices and calibration
- Reagent Preparation & Storage

Advanced Instrumentation:

- Microscopy: principles, types, and applications
- Analytical balances: operation and maintenance
- Centrifugation: principles, types, and applications
- Colorimetry and spectrophotometry
- Electrochemistry principles
- pH meters: calibration and maintenance
- Point of Care Testing (POCT) platforms
- Laboratory automation systems

PART B: CLINICAL DISCIPLINES

1. CLINICAL PATHOLOGY & BODY FLUID ANALYSIS

Urine Analysis:

- Collection methods (random, 24-hour, midstream)
- Physical examination: colour, clarity, specific gravity
- Chemical analysis: proteins, sugars, ketones, blood, bile
- Microscopic examination: cells, casts, crystals, parasites
- Clinical significance and interpretation

Other Body Fluids:

- **Cerebrospinal Fluid (CSF):** collection, processing, physical, and chemical analysis
- **Semen Analysis:** physical, chemical, and microscopic examination
- **Sputum Examination:** collection and analysis techniques
- **Synovial Fluid:** collection and clinical significance
- **Serous Fluids:** pleural, pericardial, peritoneal fluid analysis

Cytology:

- Specimen collection and processing techniques
- Exfoliative cytology and Fine Needle Aspiration Cytology (FNAC)
- Pap smear and cervical cytology
- Cytological stains: Giemsa, PAS, H&E, Ziehl-Nielsen
- Liquid-based cytology techniques

2. HEMATOLOGY

Basic Concepts:

- Haematopoiesis and bone marrow function
- Blood composition and cellular components
- Haemoglobin: structure, synthesis, and degradation
- Normal ranges for haematological parameters

Laboratory Procedures:

- Blood film preparation and staining
- Bleeding Time & Clotting Time
- Complete Blood Count (CBC) components
- Haemoglobin estimation methods (Sahli's, cyanmethemoglobin)
- Cell counts: RBC, WBC, platelet, reticulocyte
- Erythrocyte Sedimentation Rate (ESR)
- Packed Cell Volume (PCV) and haematocrit

Specialized Tests:

- Red cell indices and clinical significance
- Differential leucocyte count (DLC), AEC, ANC, IT Ratio
- Blood grouping and cross-matching
- Platelet Function Tests
- Coagulation studies: PT, APTT, bleeding time, clotting time
- Haemoglobin electrophoresis and variant detection
- Bone marrow slide preparation
- LE Cell Test
- Alkali Denaturation Test
- Sick Cell Preparation
- Supravital Stains
- Heinz Body, Pappenheimer Body

Investigation & Workup of Pathological Conditions:

- RBC, WBC, Platelet Disorders
- **Anaemia:** iron deficiency, megaloblastic, aplastic, haemolytic
- **Benign Lymphocyte Reactions:** Leucocytosis, Leukopenia, Neutrophilia, Lymphocytosis, Eosinophilia, Monocytosis
- **Leukemoid Reactions:** Myeloid, Lymphoid
- **Leukaemia:** AML, CML, ALL, CLL classification and diagnosis
- **Multiple Myeloma**
- **Bleeding Disorders:** platelet function tests, coagulation disorders
- **Hemoglobinopathies:** thalassemia, sickle cell disease
- **Parasitic Infections:** malaria, microfilaria identification, LD bodies

Instrumentation:

- Automated cell counters: principles and troubleshooting
- Hemacytometer usage and maintenance
- Haemoglobinometry: Methods, principle, procedure, application, and error analysis.
- Anticoagulants and preservatives: Mode of action, composition, merits and demerits of EDTA, citrate, oxalate, heparin. and sodium fluoride.
- Quality control in haematology

3. HISTOPATHOLOGY

Tissue Processing:

- Knowledge of material and equipment used
- Specimen collection, fixation, and labelling
- Grossing Methods
- Fixatives: types, composition, advantages/disadvantages
- Decalcification procedures for processing of bone tissue for histopathological studies
- Tissue processing: dehydration, clearing, embedding
- Microtomy: sectioning techniques, knife maintenance
- Mounting
- Processing of eyeball for histology

Staining Techniques:

- **Staining Procedures:** Theory & Types of Staining agents
- **Mordants & Differentiation**
- **Routine Stains:** Haematoxylin and Eosin (H&E) – Types & Preparation
- **Eosin Stock & Other Counterstains**
- **Metachromatic Dyes**
- **Special Stains:**
 - Connective tissue: collagen, reticulin, elastin
 - Carbohydrates: PAS, glycogen demonstration
 - Lipids and pigments: fat, iron, bile, melanin, lipofuscin
 - Amyloid, Mucin, Calcium, Iron, Copper
 - Microorganisms: Gram, acid-fast, silver stains
 - Demonstration of neuron, neuroglia, myelin, and axon

Advanced Techniques:

- Histochemistry principles and applications
- Immunohistochemistry principles
- Frozen section techniques

Record Keeping

- Preservation of specimens, blocks, reports
- Museum preparation and specimen preservation

4. CYTOPATHOLOGY

- Different types of techniques & equipment used to obtain materials, including various guided procedures.
- **Methods:** FNAC, imprint smear, pap smear, nipple discharge smear, vaginal smear, buccal smear, cytospin cytosmears
- Collection, preservation, transportation, and processing of cytological specimens (Sputum, Bronchial brush, Oesophageal and gastric brush, oral scraping, Breast aspiration)
- Cytological Stains: Introduction, Composition of Cytological Stains; Giemsa stain, Periodic Acid-Schiff (PAS) stain, Haematoxylin and eosin stain, Ziehl-Nielsen stain.
- Preparation of fluids for cytological examination
- Neubauer's Chamber

- Liquid based Cytology
- Synovial Fluid Analysis

5. BIOCHEMISTRY

Basic Biochemistry:

- Principles of assay procedures
- Normal ranges in blood, serum, plasma, urine, and reference values
- pH: Definition, Henderson Hasselbach equation, Pka value, pH indicator, methods of measurement of pH, pH paper, pH meter.
- Volumetric Analysis: Normal & molar solutions, standard solutions
- Preparation of reagents and storage of chemicals
- Electrophoresis: working principles, applications, types – paper, agarose gel, cellulose acetate, PAGE
- Chromatography: working principles, applications, types – paper, TLC, ion exchange, affinity gel, filtration, gas chromatography & HPLC
- Working principles & applications of photometry, spectrophotometry, and colorimetry
- Carbohydrates: structure, classification, metabolism disorders
- Lipids: classification, lipoproteins, dyslipidemia
- Proteins: structure, plasma proteins, clinical significance
- Non-Protein Nitrogen Substances (NPN)
- Enzymes: classification, clinical enzymology, organ-specific markers
- Nucleic Acids: DNA/RNA structure and clinical applications
- Macro- & Micro- Nutrients: Vitamins & Minerals

Clinical Chemistry:

- Glucose Metabolism: diabetes diagnosis, glucose tolerance tests, HbA1c
- Lipid Profile: cholesterol, triglycerides, HDL, LDL, VLDL
- Liver Function Tests: bilirubin, aminotransferases, alkaline phosphatase
- Kidney Function: urea, creatinine, electrolytes
- Pancreatic Function: Amylase, Lipase
- Cardiac Markers: troponins, CK-MB, myoglobin
- Tumour Markers: PSA, CEA, AFP, CA 125
- Electrolytes & Blood Gases

Endocrinology:

- Current Concepts: RIA, ELISA, CLIA, ECLIA
- Physiological effects produced by normal and abnormal levels of various hormones
- Thyroid Function: T3, T4, TSH
- Reproductive Hormones: Testosterone, Oestrogen, Progesterone, LH, FSH
- Diabetes Markers: Insulin, C-Peptide, Glucagon
- Stress Hormones: Cortisol, ACTH

Specialized Areas:

- Therapeutic drug monitoring
- Toxicology and drug analysis

- Trace elements and vitamins
- Inborn errors of metabolism
- Study/ Estimation of sugar, protein, and chloride from Cerebro Spinal Fluid (CSF), pleural fluid, peritoneal fluid, amniotic fluid - foam test.
- Estimation of Ketone bodies in blood/ urine.
- Estimation of Vitamin A, C, E/ & Metabolites of Vitamins in serum /Urine (B complex)
- Methods for electrolyte estimation -Na/ K/ Cl/ Ca in serum/urine
- Porphyrins – Including appropriate specimen collection & preservation techniques
- Acid-base balance and blood gases
- Radio isotope techniques
- Calculi formation and analysis

6. MICROBIOLOGY

General Microbiology:

- Sample: Types and Procedures for collection
- General characteristics and classification & nomenclature systems of microbes
- Immunity, antigen, and antibody reactions
- Vaccines
- Serology & culture techniques
- Bacterial morphology and physiology
- Growth requirements and culture conditions
- Sterilization and disinfection methods
 - Physical agents: Dry heat (flaming, incineration, and hot air oven),
 - Moist heat (pasteurization, boiling, autoclaving and Tyndallisation), filtration and UV radiation.
 - Chemical agents: ethanol, phenol, and ethylene oxide.
- Disposal of used media and specimens
- Normal flora and pathogenicity
- Nosocomial Infections

Culture Techniques:

- **Media Preparation:** types and compositions
 - Basic: nutrient agar, nutrient broth
 - Enriched: blood agar, chocolate agar
 - Selective: MacConkey, DCA
 - Differential: specialized media for organism identification
 - Dorsett's egg media, Mac Conkey's media, Lowenstein-Jensen's media
- Pure culture techniques and preservation methods
- Anaerobic culture systems

Identification Methods:

- **Staining Techniques:** Gram, acid-fast, capsule, spore stains, India ink
- **Biochemical Tests:** catalase, coagulase, oxidase, IMViC
- **Antimicrobial Susceptibility:** disk diffusion, MIC determination

- **Rapid Identification:** automated systems, molecular methods

Systematic Bacteriology:

- Characterization of aerobic and anaerobic bacteria, including fastidious organisms
- Gram's staining method, Albert stain, AFB Stain, Capsular stain – reagents preparation & staining
- Principles, procedure, and interpretation of biochemical tests for identification of bacteria
- Antimicrobial agents and antimicrobial susceptibility test
- **Gram-positive:** Staphylococcus, Streptococcus, Bacillus, Clostridium
- Catalase Test, Coagulase Test
- **Gram-negative:** Enterobacteriaceae, Pseudomonas, Haemophilus
- Oxidase Test, IMViC Test, Sugar Fermentation Test
- **Acid-fast:** Mycobacterium species
- **Anaerobes:** identification and clinical significance

Mycology:

- Fungal morphology and classification
- Culture media and identification techniques
- Types of Media for fungus (Sabouraud's Dextrose Agar (SDA), Brain Heart Infusion (BHI), Potato Dextrose Agar (PDA))
- Sample collection and processing
- Techniques used for isolation of medically important fungi
- **Common Infections:** dermatophytosis, candidiasis, systemic mycoses
- Laboratory diagnostic methods
- Identification of yeast and moulds

Virology:

- Viral classification and characteristics – DNA/ RNA Viruses
- Sample collection and processing
- **Diagnostic Methods:** serology, ELISA, antigen detection, PCR
- **Important Viruses:** hepatitis, HIV, influenza, dengue
- Tests based on immunochromatography
- Maintenance of virology laboratory

Parasitology:

- Classification of parasites and vectors
- Collection, transportation, preservation of stool specimen for parasite examination
- **Stool Examination:** Ova & Cyst – Normal Saline and Lugol Iodine mounts
- **Protozoa:** Plasmodium, Entamoeba, Giardia, Leishmania
- **Helminths:** Ascaris, Taenia, Schistosoma, Ancylostoma
- **Arthropods:** mosquitoes, flies, ticks, mites
- Diagnostic techniques and life cycle studies (Pictorial Representation)

Applied Microbiology:

- Clinical specimen processing

- Infection control and nosocomial infections
- Food and water microbiology
- Biomedical waste management

Automation in Microbial Identification:

- Automation in Bacteriology – Blood Culture Systems
- Antimicrobial Sensitivity Tests – Disk Diffusion Test (Kirby Bauer) – MIC-E Test
- Automation in bacterial identification
- Principle of action of antibiotic agents
- Detection of Multi Drug Resistance (MDR) Bacteria – ESBL, MRSA, VRE, Mycobacterium
- Serological tests for antigen and antibody detection

7. IMMUNOHEMATOLOGY (BLOOD BANKING)

Blood Group Systems:

- ABO system: genetics, serology, variants
- Rh system: antigens, antibodies, clinical significance
- Other systems: Kell, Duffy, Kidd, MNS
- Antibody screening and identification

Blood Collection & Processing:

- Donor selection criteria and screening
- Blood collection procedures and equipment
- Component preparation and storage
- Quality control testing and labelling of Blood Bags
- Testing for Transfusion Transmitted Infections

Transfusion Medicine:

- Pre-transfusion testing: crossmatching, compatibility
- **Specialized Tests:** direct/indirect Coombs, antibody titration
- Transfusion reactions: recognition and investigation
- Problems & troubleshooting in Blood Grouping & Crossmatching
- Haemolytic disease of the newborn
- Therapeutic apheresis procedures
- Cryoprecipitate

Additional Aspects:

- Organization and operation of blood donation camp
- Quality control in blood banking
- Advances in transfusion medicine: Cord blood bank, Automation
- Obstetric and Paediatric Transfusion

8. MOLECULAR DIAGNOSTICS & ADVANCED TECHNIQUES

Sample: Collection, Transportation, Handling, Processing

Molecular Biology Techniques:

- DNA/RNA extraction and purification
- Polymerase Chain Reaction (PCR) and RT-PCR
- Gel electrophoresis and analysis
- Sequencing and genotyping methods
- NAAT

Immunological Techniques:

- ELISA: principles and applications
- Immunofluorescence assays
- Immunodiffusion
- Western blotting
- Flow cytometry concepts
- Radioimmunoassay (RIA)
- Chemiluminescence immunoassays (CLIA)

Fundamental Genetics:

- DNA structure and replication
- Mendelian inheritance patterns
- Chromosomal abnormalities
- Sex-linked inheritance

Applied Genomics:

- Human Genome Project implications
- Molecular diagnostics applications
- Genetic counseling basics
- Population genetics principles

Point-of-Care Testing:

1. Rapid diagnostic tests
2. Portable analyzers
3. Quality assurance for POCT

PART C: SUPPORT SUBJECTS

1. MEDICAL RECORDS & ETHICS

Documentation:

- Medical record forms and content requirements
- Utility & functions of Medical Records in Laboratories
- Laboratory information systems (LIMS, Apex LIS, eLAB)
- Report writing and data management
- Record maintenance and retrieval systems

Ethical Considerations:

- Basic principles of medical ethics
- Patient confidentiality and informed consent
- Patient rights and autonomy
- Professional conduct and malpractice prevention

2. BIOMEDICAL INSTRUMENTATION**Instrument Categories:**

- **Optical Instruments:** microscopes, spectrophotometers, colorimeters
- **Separation Techniques:** centrifuges, electrophoresis, chromatography
- **Measurement Devices:** pH meters, analytical balances, thermometers
- **Specialized Equipment:** autoclaves, incubators, laminar flow hoods

Maintenance & Troubleshooting:

- Preventive maintenance protocols
- Calibration procedures
- Common problems and solutions
- Safety protocols for instrument operation

3. COMPUTER APPLICATIONS & INFORMATION SYSTEMS**Basic Computer Skills:**

- Hardware and software concepts
- Operating systems and file management
- Internet applications and email

Laboratory Informatics:

- Laboratory Information Management Systems (LIMS)
- Electronic health records integration
- Data analysis and statistical software
- Report generation and transmission

Microsoft Office Applications:

- Word processing for documentation
- Excel for data analysis and calculations
- PowerPoint for presentations
- Database management basics

4. LABORATORY ACCREDITATION & QUALITY MANAGEMENT**Accreditation Standards:**

- NABL (National Accreditation Board) requirements
- ISO 15189 medical laboratory standards
- CAP (College of American Pathologists) guidelines
- Good Laboratory Practices (GLP)

Quality Systems:

- Document control and management
- Internal audit procedures
- Corrective and preventive actions
- Management review processes
- Continuous improvement strategies

5. COMMUNICATION SKILLS

Professional Communication:

- Verbal and non-verbal communication
- Patient interaction skills
- Telephone etiquette and email protocols
- Medical terminology usage

Presentation Skills:

- Public speaking and confidence building
- Visual aid preparation and use
- Group discussion participation
- Interview skills and resume writing

Healthcare Communication:

- Patient education techniques
- Interdisciplinary team communication
- Conflict resolution strategies
- Cultural sensitivity in healthcare settings

6. RESEARCH METHODOLOGY & BIOSTATISTICS

Research Fundamentals:

- Research design and methodology
- Literature review techniques
- Hypothesis formulation and testing
- Data collection methods

Statistical Analysis:

- Descriptive & Inferential Statistics
- Data presentation and interpretation
- Statistical software applications

PART D: RAJBHASHA

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SYLLABUS OF PHYSIOTHERAPIST**A. TOPIC**

Subject
Human Anatomy
Human Physiology
Biochemistry
Fundamentals of Exercise Modalities
Fundamentals of Electro Physical Agents
Psychology & Sociology
Fundamentals of Healthcare Delivery System
Information Technology
Clinical Orientation

Subject
Pathology & Microbiology
Pharmacology
Public Health & Health Promotion
Emergency Care and Life Support Skills
Exercise Therapy
Electrotherapy
Biomechanics & Kinesiology
Yoga and Systems of Medicine
Clinical Observation

Subject
General Medicine and Pediatrics
General Surgery
Orthopedics
Physiotherapy in Medical & Surgical Conditions
Physiotherapy in Orthopedic Conditions
Physical & Functional Diagnosis & Prescription
Research Methodology, Biostatistics & EBP
Clinical Education

Subject
Neurology, Psychiatry & Neurosurgery
Physiotherapy in Neurological Conditions
Cardiothoracic Diseases & Surgeries
Physiotherapy in Cardiothoracic Conditions
Sports Physiotherapy & Exercise Prescription
PT Ethics, Medico Legal & Admin
Community Based Rehabilitation
Women's Health & Geriatrics

B. Rajbhasha

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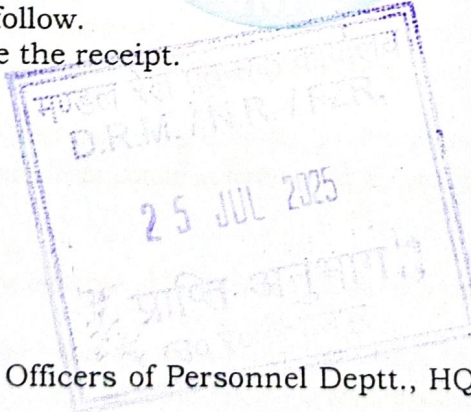
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ANNEXURE-IV

SYLLABUS OF RADIOGRAPHER/X-RAY TECHNICIAN

A. 1—Gross Radiological and surface Anatomy of human body.

Introduction of Anatomy as a whole, structure of human cells and tissue types, connective tissue—muscle tissue, nervous tissue, epithelial tissue, etc. Skeleton, bones and joints—formation of bone growth of skeleton. Centers of ossifications, types of the bones—types of joints. Thoracic contents and general location of the organs and vessels. Abdominal viscera and the location of major organs. Fracture and dislocations, Diseases of the bones and joints, Radiological Anatomy, Surface Anatomy.

2—Physiology in Radiography.

Blood—its composition and function—nerve tissue—muscular tissue and types. Abnormalities in tissue-ulceration-sepsis-asepsis and antiseptics the nature of neoplasm, common tumors-Malignant tumors-dissemination of malignancy, primary and secondary spread.

Respiratory system-Nasal passages and para nasal sinuses-Pharynx and larynx—Trachea, Bronchus and lungs-The pleura-nature and functions of respiration-common terms relating to diseases and conditions of this systems. Lymphatic system-Lymph and tissue fluid main glands and drainage areas in the lymphatic system-Lymphoid tissue and the tonsils.

Reticulo-endothelial system-Liver and spleen-Bone marrow, Life cycle of red and white corpuscles of the blood, Alimentary systems-function of mouth, tongue and teeth, salivary glands-Pharynx and oesophagus-Stomach-small intestine (jejunum)-Large intestine colon)-

Liver and biliary tract-pancreas-Functions of the alimentary system digestion and absorption of food-metabolism-common terms used in connection with abnormalities of this system.

Urinary tract-kidney, ureters and bladder-urethra-urinary excretion.

Reproductive system-Male genitalia-Female genitalia, Mammary glands-Menstruation, pregnancy and lactation-common terms related to abnormalities of this system.

Ductless glands (Endocrine system)-Anatomical location of pituitary, thyroid, parathyroid, adrenal, thymus, pancreas and gonads-their function & common term related to this system.

Nervous system-Main subdivisions, lobes and ventricles of the brain-Spinal cord meninges and cerebro-spinal fluid-common terms used in abnormalities of this system. Organs of sense-Structure and function of the eye-Structure and function of the ear. Surface landmarks and topography in relating to organs on the body for radiographic positioning-positional terms-anatomical terminology with regard to location.

3—Basic Electricity and magnetism and Radiation Physics.

Revision of mathematics related to radioigraphy, measurements and units of C.G. S. and M.K.S. system, Electrical charges, Potential difference, current and resistance. Ohm's law for electrical circuits, direct current. Conductor, insulators and semi-conductors. Electrical Power - ammeters and voltmeters. Electromagnetism, Electromagnetic induction self and mutual. Production of A.C., Generators, Transformers.

Thermionic emission, vacuum, diode-variation of tube current and anode voltage. The diode as rectifier and as an X-ray tube. Types of rectification and methods used in diagnostic, and therapy units H.T. Cables, Capacitor and capacitance, generation and property of X-rays, interaction of X-ray with matter.

X-ray tube-diagnostic type method of heat dissipation, failure, measurement in Radiation exposure, Scattered-Radiation anti methods to reduce it. Inverse square law etc.

4—Dark Room procedures.

Fundamental of photographic emulsion, light sensitive materials, construction and emulsion formation. Formation of latent image. Chemical development of the latent image. Storage of X-ray films & its transportation. Types of photography emulsions. Size of grain-speed of the films, Sensitometry-evaluation of emulsion characteristic-density, contrast and latitude - basic fog - characteristic curve - Luminiscence-fluorescence and phosphorescence. Fluorescent screens, types of intensifying screens, mechanism-care of intensifying screens and cassettes, intensification factor, size of crystals, reciprocity failure and test for it, Cassettes-test for cassettes for screen-contrast and light leakage. Construction & types of films (X-rays, material. Etc.). X-ray Developer-characteristics-possibility of retaining standard results with regeneration-low fog and staining properties, long active life. Developing agents-function and constituents of the developer-standardization by time and temperature-Process of development, latitude-exhaustion of developer-regeneration by replenishment. Types of developer used in radiography-powders & liquid concentrates-standard, high contrast and high energy developers-Ultrarapid development

methods-increased temperature, use of replenisher special ultrarapid developer, combined developer/fixer solutions. Fixation-fixing agents-constituents of radiographic fixer and function of the chemicals-fixation time-exhaustion of fixer-silver recovery combined with generation of fixer (electrolysis)-other silver recovery methods-rapid fixer. Film rinse-acid stop bath-washing of films static bath-water flow and rate of change-test for washing film during methods. Practical processing-preparation of solutions-water supply mixing vessels-order of mixing chemicals-stock solutions and storage-storage of dry chemicals and liquid concentrates. Processing apparatus-temperature control-immersion heaters-thermostat-ice cooling and refrigeration cooling. Theatre processing-ultra-rapid processing-- dish and small tank techniques-ultra-rapid processing-dish and small tank techniques-special theatres processors-types and care of hangers. Technical and processing faults-fog, static, pressure, screen artifacts. Chemical reduction of film density-farmers reducer preprational and selective techniques-local application. The X-ray Dark Room-minimum dimensions-services required-planned circulation and layout-light proofing-ventilation-radiation protection-dooration and chemical proof materials-Bench design, film holders, film makers, hanger location-Location of processing unit- pas-Box fixers or wash tanks-illumination and testing of illumination- separate drying room with drying cabinets-wet or dry viewing rooms following manual of automatic processing rapid drying apparatus-effects of circulation and layout planning on efficiency. The radiographic image effects of exposure factors on contrast, detail and image sharpness-relationship between kilo voltage & exposure time and tube current (mAs)-Effects of distance, filtration, collimation, screens, grids, film speed developers arid processing techniques. Presentation of the radiograph identification orientation-technical information for film making-actinic markers using radiation sources preparation of stereo radiographs for straight of mirror viewing- mounting of dental films-use of lead letters and numbers-embossing machine-inscribing materials. Accessories viewing boxes—magnifier—high intensity localized viewers—projectors and viewing screens for miniature and cineradiography---film tremors---corner cutters—dental mounts, films envelopes—filling system and units—Stores viewers. Fluorescent screen photography—photofluorography and cineradiography—optical principles lenses, speed, focal length, depth of field function of the diaphragm—focusing—Equipment for photofluorography (Radiophotography, miniature, radiography) - Conventional lens units—Mirror lens units—Cassettes types—film magazines—manual and automatic operation—Automatic exposure control—optical identification devices—Safety relays and interlocks, independent generators—design of Static and mobile units—Units for battery operation—Battery ("reservoir" units). Fluorescent screen types spectral emission for maximum photographic efficiency—lens resolution and color sensitivity—Ilalation, radiography technique and its role in preventive, epidemiological and diagnostic. System—Exposure techniques to ensure uniformity with and without automatic exposure control—Special protective measures—Viewing and projection—filling system—records—organization of surveys.

5—Hospital practice and care of the patients.

Hospital staffing and administration records—professional ethics in attitudes to patients, Cooperation with other staff and depts. Departmental organization. Handling of the patients—moving of injured patient. Normal pulse, temperature and respiration. Preparation of the patients for general and special examination. Supervision of patients undergoing special examinations. Supervision of patients undergoing special examination. Administration of enemas, aseptic and sterile procedures. Use of opaque media. Trolley setting for special X-ray examinations.

6--- Apparatus for Radiography.

Basic circuits of X-ray machine, construction and functioning of each part, component. Construction and function of Imaging equipment like X Rays, Ultrasound, C.T. scan and MRI etc.

7—Radiographic Techniques of Bones & Joints.

Individual bones of skeletal system of human body & its different projections. Special projection, whenever required & indicated as in skull including petrous, temporal, mastoids, accessory nasal arches, nasal bone, maxilla, mandible, temporomandibular joint, optic foramina, teeth, intra-oral and extra-oral projection-occlusal view. Projections of scaphoid, shoulder joint, sternum, SI joint, hip joint, Patella, Calcaneum, lordotic view, chest apicogram.

8—Radiographic Techniques (Special).

Salivary glands-routine projections for calculi, - sialography with opaque media, macro-radiography, general & selective, angiography, peripheral angiography, cerebral angiography, venography with Valsalva.

Respiratory system-upper respiratory tract-nasopharynx-larynx-trachea-barium swallow. Thyroid & parathyroid glands-bronchus-tomographic techniques. Lungs-routine projections-evaluation of unilateral density, exposure on inspiration & expiration, Valsalva & Muller's maneuver, pleural techniques to demonstrate fluid levels, effusions &

adhesions-oblique, lordotic & decubitus AP and Lateral projections-pneumothorax, expiration & inspiration. Diaphragmatic excursion-double exposure technique-fluoroscopy, mediastinum-routine projections.

Bronchography-dangers of anesthesia of larynx-inhibition of coughing-methods of introduction of opaque media-positioning and technique during introduction of media.

Genito-urinary system- Plain film examination of K.U.B. _ Differentiation of opacities especially in right hypochondrium. Erect, lateral, double exposure on inspiration and expiration. Excretory pyelography- intravenous pyelography (I.V.P.) - Drip infusion pyelography- pyelography in children.

Use or non -use of compression- Trendelenburg's position, High doss technique - appreciation of factors causing variation in concentration of media, contrast media to be used and quantities to be injected-supplementary techniques. Retrograde pyelography-position and identification of ureteric catheters.

Cystography- Introduction of the media-exposure in relaxed and straining micturition -control by image intensifier and cineradiography- demonstration of fistulae, post micturition radiographs-urethrography-excretory or retrograde technique.

Radiography of exposed kidney during surgical operation- Renal angiography during selective aortography-retroperitoneal and perinephric gas insufflation techniques.

Obstetrics and gynaecology- Pregnancy-techniques for evaluation of foetal development, maturity , abnormality, position and multiplicity-placentography- Use of compensating, filters-contrast media and soft tissue techniques-cystography and arteriography- pelvimetry- Consideration of radiation hazard- Cephalometry- Hystero-salpingography- Preparation of patient- Alternative injection procedures - Radiation hazard in Obstetrics and gynaecological radiography.

Central Nervous System- Routine projection of skull and spine-ventriculography and encephalography- Injection of contrast media- Film series to cover all ventricular outlines- Cerebral angiography- Myelography- Methods of contrast injection.

Alimentary system- Barium swallow- Pharynx and oesophagus- contrast technique with Valsalva maneuver – fistula – Barium meal- Procedure for fluoroscopic examination of stomach, Jejunum and colon appropriate timing- Diaphragmatic hernia-Post-operative examinations – the Barium meal follow through- Plain film, erect, P.A., decubitus for abdominal obstruction. Barium enema- Preparation of the patient – Administration of the opaque medium- routine projections under fluoroscopic control, special techniques in colostomy, Hirschsprung's disease- double contrast enema with insufflation technique – Intussusception.

Biliary system- Routine projections for plain film- differentiation of opacities in Right hypochondrium (see Genito-Urinary system) - respiratory movements. Oral cholecystography- projection of the patient- advice on taking of oral opaque medium- reasons for nonappearance of opaque medium in system- Intravenous cholecystography (I.V.C.) Action of fatty meal- Direct and indirect cholangiography- Demonstration of hepatic ducts.

Liver and spleen- Pneumoperitoneum – Fluoroscopy and radiography of diaphragmatic excursion- Selective Aortogram- splenohepatic venography.

Salivary glands- routine projections- sialography.

Arthrography= Media for visualizing joint space – asepsis, special projections.

Sinography- tracing of fistulae and inflammatory conditions by opaque media and fluoroscopic control.

Lymphatic system- soft tissue differentiation for regions concerned – calcification of glands- technique for lymphography with colour tracer and opaque media.

Tomography- Advantages of various movements, Linear, circular elliptical, hypocycloidal- Basic of tomographic principles – effects of operational angle, F.F.D., vibration blur, magnification- Estimation of relevant layer of thicknesses and localization of required area by plain films and fluoroscopy- sequential tomography- Horizontal tomography- simultaneous multi-section tomography.

Fluoroscopy- general considerations of the role of the radiographer- dose hazard-limitation of K.V.,mA, Focus –skin distance- fluoroscopic time- Radiation protection to staff during fluoroscopy and associated examinations.

Stereography- Principles involved- Tube shift in relation to patient – Stereoscopic apparatus for viewing and orientation of films in relation to viewing methods correct making of stereographs.

Soft tissue techniques- Non-screen techniques – simultaneous screen and non-screen technique – Mammography.

High voltage technique- General principles- Relationship to patient dose-change in contrast, range and detail-elimination of scatter- Accessories for H.V techniques- Radiographic factors.

Localization of foreign bodies – Necessity for removal of all clothing and other opaque objects from the region to be examined- Anatomical location by projections at right angles- Fluoroscopic control for alimentary tract- Principles of geometrical localization.

Techniques for intra ocular F.B. – Technique for swallowed bones and obstruction to Barium swallow- technique to locate non opaque F.B. - Technique for inhaled F.B.

9. Recent advances in Imaging and contrast media:

Radio Nuclide, scintigraphy, C.T. Scanning, Ultrasound, NMR, Digital radiography contrast Media types, Properties, reactions and commonly used in diagnostic radiology.

10. Radiation hazards and its protections and planning of the department:

Introduction , Hazard, protections, units, aims and objectives, principles and methods, diagnostic X- Ray methods, design locations, layout, room size, shielding, illumination, control panels, waiting area, choice of equipment.

Wards mobile and domiciliary Radiography- Electrical supply- Radiation protection- cooperation with staff and care of ill patients- special considerations of patients having radioactive sources in the body.

Operating theatre techniques- revision of procedure in collaboration with theatre staff- Checking of mains supply and function of apparatus and selection of exposure factors prior to examination- Explosive risks- Asepsis in technique- Protection- rapid processing techniques.

Planning in Radiology Department, rating of X-Ray tubes.

B. Rajbhasha

4021
 (B)
 Northern Railway
 P.6
 30/7/25

Headquarters Office
 Baroda House
 New Delhi

P.S. No. 15997/2025

No. 831-E/004/Policy/Pt.III/EIIBII

Dated: /07/2025

The General Manager(P)
 Rail Coach Factory, Kapurthala
 Diesel Locomotive Modernisation Workshop, Patiala

The Director General
 Research Design & Standard Organization

The Medical Director, Northern Railway, Central Hospital, Basant Lane, New Delhi.
 DRMs /P-DLI, FZR, LKO, MB & UMB.

Sub:- Syllabus for Selection for the post of Lab Assistant Gr-II/Level-3.

Ref:- 1) PCPO/NR letter no. PCPO/Sel./2025 dated 15.05.2025.
 2) Northern Railway's Medical Department No. 7-Med/E-3/QB-SY/Group-C dated 30.06.2025.

In reference to above subject, the syllabus for selection for the post of Lab Assistant Gr-II Level-3, is enclosed herewith for your information and necessary action please.

The above PS No. is available on the website given as under:-
<https://nr.indianrailways.gov.in>

Hindi Version will follow.
 Please acknowledge the receipt.

DA. As above.

(Udot Jha)
 For General Manager (P)

Copy to for information:

1. All PHODs and All Officers of Personnel Deptt., HQ Office, Baroda House, New Delhi.
2. Genl. Secy./NRMU, 12 Chelmsford Road, New Delhi.
3. Genl. Secy./URMU, 166/2, P.K.Road, New Delhi.
4. Genl. Secy./AIOBC Rly Emp. Asso. 171/A3, Basant Lane, New Delhi.
5. Zonal. Secy. All India SC/ST Rly Emp. Asso. North Zone Office, Baroda House, New Delhi.
6. Genl. Secy. NRPOA Room No.301, HQ Office, Baroda House, New Delhi.
7. Dy.CPO/IT, HQs Office, Baroda House, NDLS for uploading on the website.

SYLLABUS FOR LABORATORY ASSISTANT GRADE II

A.

PART A: FOUNDATION SUBJECTS

1. GENERAL PATHOLOGY

Basic Sciences Foundation:

- Cellular structure and function
- Tissue types and characteristics
- Organ systems overview
- Homeostatic mechanisms
- Systems Overview: Cardiovascular, Respiratory, Digestive, Urogenital, Nervous, Lymphatic & Immune Systems

Basic Pathological Processes:

- Cell injury and death mechanisms
- Inflammation: acute and chronic responses
- Healing and repair processes
- Thrombosis, embolism, and infarction

Disease Categories:

- Infectious diseases: bacterial, viral, fungal, parasitic
- Immune system disorders
- Neoplasia: benign and malignant characteristics
- Metabolic and nutritional disorders

2. LABORATORY FUNDAMENTALS & SAFETY

Core Concepts:

- Laboratory services and types of laboratories
- Infrastructure requirements and layout design
- Laboratory organization and medical laboratory technician roles
- Code of conduct for medical laboratory personnel

Safety & Quality Management:

- Universal precautions and laboratory safety protocols
- Bio-safety levels and hazard management (biological, chemical, fire)
- Laboratory accidents: prevention, emergency procedures, and first aid
- Biomedical waste management and disposal methods
- Standard Operating Procedures (SOPs)
- Internal quality control and external quality assessment

- Total Quality Management (TQM), Quality Assurance (QA), and Quality Control (QC)

Laboratory Materials & Techniques:

- Water purification, chemical storage, and reagent preparation
- Units of measurement and SI units
- Buffer systems and pH management
- Solution preparation (normal, molar, percentage w/v, v/v)
- Cleaning and maintenance of laboratory glassware and equipment
- Sterilization methods: autoclaves, hot air ovens, and other techniques

3. SPECIMEN MANAGEMENT & PHLEBOTOMY

Collection & Handling:

- Specimen collection, storage, and transportation protocols
- Blood collection techniques (venous and capillary puncture)
- Order of blood draw
- Preservation of blood sample; Changes during blood storage
- Materials required for blood collection
- Home collection procedures and preservation methods
- Anticoagulants: types, uses, and mechanisms of action
- Sample processing and analysis workflows

Sample Types:

- Blood specimens and components
- Urine collection and preservation
- Stool, semen, and sputum samples
- Body fluids (CSF, synovial, serous fluids)
- Tissue specimens for histopathology

4. LABORATORY APPARATUS & INSTRUMENTATION

Basic Equipment:

- Layout and organization of medical laboratories
- Glassware: beakers, flasks, pipettes, burettes, test tubes
- Specialized containers: reagent bottles, specimen bottles, cuvettes
- Flasks - different types (Volumetric, round bottom, Erlenmeyer conical)
- Funnels – different types (Conical, Buchner)
- Bottles – Reagent bottles – graduated and common, Wash bottles – different type
- Specimen bottles
- Measuring cylinders, Test tubes, centrifuge tubes, test tube, Wire gauze, Bunsen burner.
- Cuvette – Bottle, Test tube, Pipette Desiccator
- Measuring devices and calibration
- Reagent Preparation & Storage

Advanced Instrumentation:

- Microscopy: principles, types, and applications
- Analytical balances: operation and maintenance
- Centrifugation: principles, types, and applications
- Colorimetry and spectrophotometry
- Electrochemistry principles
- pH meters: calibration and maintenance
- Point of Care Testing (POCT) platforms
- Laboratory automation systems

PART B: CLINICAL DISCIPLINES

1. CLINICAL PATHOLOGY & BODY FLUID ANALYSIS

Urine Analysis:

- Collection methods (random, 24-hour, midstream)
- Physical examination: colour, clarity, specific gravity
- Chemical analysis: proteins, sugars, ketones, blood, bile
- Microscopic examination: cells, casts, crystals, parasites
- Clinical significance and interpretation

Other Body Fluids:

- **Cerebrospinal Fluid (CSF):** collection, processing, physical, and chemical analysis
- **Semen Analysis:** physical, chemical, and microscopic examination
- **Sputum Examination:** collection and analysis techniques
- **Synovial Fluid:** collection and clinical significance
- **Serous Fluids:** pleural, pericardial, peritoneal fluid analysis

Cytology:

- Specimen collection and processing techniques
- Exfoliative cytology and Fine Needle Aspiration Cytology (FNAC)
- Pap smear and cervical cytology
- Cytological stains: Giemsa, PAS, H&E, Ziehl-Nielsen
- Liquid-based cytology techniques

2. HEMATOLOGY

Basic Concepts:

- Haematopoiesis and bone marrow function
- Blood composition and cellular components
- Haemoglobin: structure, synthesis, and degradation
- Normal ranges for haematological parameters

Laboratory Procedures:

- Blood film preparation and staining
- Bleeding Time & Clotting Time
- Complete Blood Count (CBC) components
- Haemoglobin estimation methods (Sahli's, cyanmethemoglobin)
- Cell counts: RBC, WBC, platelet, reticulocyte
- Erythrocyte Sedimentation Rate (ESR)
- Packed Cell Volume (PCV) and haematocrit

Specialized Tests:

- Red cell indices and clinical significance
- Differential leucocyte count (DLC), AEC, ANC, IT Ratio
- Blood grouping and cross-matching
- Platelet Function Tests
- Coagulation studies: PT, APTT, bleeding time, clotting time
- Haemoglobin electrophoresis and variant detection
- Bone marrow slide preparation
- LE Cell Test
- Alkali Denaturation Test
- Sickle Cell Preparation
- Supravital Stains
- Heinz Body, Pappenheimer Body

Investigation & Workup of Pathological Conditions:

- RBC, WBC, Platelet Disorders
- **Anaemia:** iron deficiency, megaloblastic, aplastic, haemolytic
- **Benign Lymphocyte Reactions:** Leucocytosis, Leukopenia, Neutrophilia, Lymphocytosis, Eosinophilia, Monocytosis
- **Leukemoid Reactions:** Myeloid, Lymphoid
- **Leukaemia:** AML, CML, ALL, CLL classification and diagnosis
- **Multiple Myeloma**
- **Bleeding Disorders:** platelet function tests, coagulation disorders
- **Hemoglobinopathies:** thalassemia, sickle cell disease
- **Parasitic Infections:** malaria, microfilaria identification, LD bodies

Instrumentation:

- Automated cell counters: principles and troubleshooting
- Hemacytometer usage and maintenance
- Haemoglobinometry: Methods, principle, procedure, application, and error analysis.
- Anticoagulants and preservatives: Mode of action, composition, merits and demerits of EDTA, citrate, oxalate, heparin. and sodium fluoride.
- Quality control in haematology

3. HISTOPATHOLOGY

Tissue Processing:

- Knowledge of material and equipment used
- Specimen collection, fixation, and labelling
- Grossing Methods
- Fixatives: types, composition, advantages/disadvantages
- Decalcification procedures for processing of bone tissue for histopathological studies
- Tissue processing: dehydration, clearing, embedding
- Microtomy: sectioning techniques, knife maintenance
- Mounting
- Processing of eyeball for histology

Staining Techniques:

- **Staining Procedures:** Theory & Types of Staining agents
- **Mordants & Differentiation**
- **Routine Stains:** Haematoxylin and Eosin (H&E) – Types & Preparation
- **Eosin Stock & Other Counterstains**
- **Metachromatic Dyes**
- **Special Stains:**
 - Connective tissue: collagen, reticulin, elastin
 - Carbohydrates: PAS, glycogen demonstration
 - Lipids and pigments: fat, iron, bile, melanin, lipofuscin
 - Amyloid, Mucin, Calcium, Iron, Copper
 - Microorganisms: Gram, acid-fast, silver stains
 - Demonstration of neuron, neuroglia, myelin, and axon

Advanced Techniques:

- Histochemistry principles and applications
- Immunohistochemistry principles
- Frozen section techniques

Record Keeping

- Preservation of specimens, blocks, reports
- Museum preparation and specimen preservation

4. CYTOPATHOLOGY

- Different types of techniques & equipment used to obtain materials, including various guided procedures.
- Methods: FNAC, imprint smear, pap smear, nipple discharge smear, vaginal smear, buccal smear, cytospin cytosmears
- Collection, preservation, transportation, and processing of cytological specimens (Sputum, Bronchial brush, Oesophageal and gastric brush, oral scraping, Breast aspiration)
- Cytological Stains: Introduction, Composition of Cytological Stains; Giemsa stain, Periodic Acid-Schiff (PAS) stain, Haematoxylin and eosin stain, Ziehl-Nielsen stain.
- Preparation of fluids for cytological examination
- Neubauer's Chamber

- Liquid based Cytology
- Synovial Fluid Analysis

5. BIOCHEMISTRY

Basic Biochemistry:

- **Principles of assay procedures**
- **Normal ranges in blood, serum, plasma, urine, and reference values**
- **pH:** Definition, Henderson Hasselbach equation, Pka value, pH indicator, methods of measurement of pH, pH paper, pH meter.
- **Volumetric Analysis:** Normal & molar solutions, standard solutions
- **Preparation of reagents and storage of chemicals**
- **Electrophoresis:** working principles, applications, types – paper, agarose gel, cellulose acetate, PAGE
- **Chromatography:** working principles, applications, types – paper, TLC, ion exchange, affinity gel, filtration, gas chromatography & HPLC
- **Working principles & applications of photometry, spectrophotometry, and colorimetry**
- **Carbohydrates:** structure, classification, metabolism disorders
- **Lipids:** classification, lipoproteins, dyslipidemia
- **Proteins:** structure, plasma proteins, clinical significance
- **Non-Protein Nitrogen Substances (NPN)**
- **Enzymes:** classification, clinical enzymology, organ-specific markers
- **Nucleic Acids:** DNA/RNA structure and clinical applications
- **Macro- & Micro- Nutrients:** Vitamins & Minerals

Clinical Chemistry:

- **Glucose Metabolism:** diabetes diagnosis, glucose tolerance tests, HbA1c
- **Lipid Profile:** cholesterol, triglycerides, HDL, LDL, VLDL
- **Liver Function Tests:** bilirubin, aminotransferases, alkaline phosphatase
- **Kidney Function:** urea, creatinine, electrolytes
- **Pancreatic Function:** Amylase, Lipase
- **Cardiac Markers:** troponins, CK-MB, myoglobin
- **Tumour Markers:** PSA, CEA, AFP, CA 125
- **Electrolytes & Blood Gases**

Endocrinology:

- **Current Concepts:** RIA, ELISA, CLIA, ECLIA
- **Physiological effects produced by normal and abnormal levels of various hormones**
- **Thyroid Function:** T3, T4, TSH
- **Reproductive Hormones:** Testosterone, Oestrogen, Progesterone, LH, FSH
- **Diabetes Markers:** Insulin, C-Peptide, Glucagon
- **Stress Hormones:** Cortisol, ACTH

Specialized Areas:

- **Therapeutic drug monitoring**
- **Toxicology and drug analysis**

- Trace elements and vitamins
- Inborn errors of metabolism
- Study/ Estimation of sugar, protein, and chloride from Cerebro Spinal Fluid (CSF), pleural fluid, peritoneal fluid, amniotic fluid - foam test.
- Estimation of Ketone bodies in blood/ urine.
- Estimation of Vitamin A, C, E/ & Metabolites of Vitamins in serum /Urine (B complex)
- Methods for electrolyte estimation -Na/ K/ Cl/ Ca in serum/urine
- Porphyrins – Including appropriate specimen collection & preservation techniques
- Acid-base balance and blood gases
- Radio isotope techniques
- Calculi formation and analysis

6. MICROBIOLOGY

General Microbiology:

- Sample: Types and Procedures for collection
- General characteristics and classification & nomenclature systems of microbes
- Immunity, antigen, and antibody reactions
- Vaccines
- Serology & culture techniques
- Bacterial morphology and physiology
- Growth requirements and culture conditions
- Sterilization and disinfection methods
 - Physical agents: Dry heat (flaming, incineration, and hot air oven),
 - Moist heat (pasteurization, boiling, autoclaving and Tyndallisation), filtration and UV radiation.
 - Chemical agents: ethanol, phenol, and ethylene oxide.
- Disposal of used media and specimens
- Normal flora and pathogenicity
- Nosocomial Infections

Culture Techniques:

- **Media Preparation:** types and compositions
 - Basic: nutrient agar, nutrient broth
 - Enriched: blood agar, chocolate agar
 - Selective: MacConkey, DCA
 - Differential: specialized media for organism identification
 - Dorsett's egg media, Mac Conkey's media, Lowenstein-Jensen's media
- Pure culture techniques and preservation methods
- Anaerobic culture systems

Identification Methods:

- **Staining Techniques:** Gram, acid-fast, capsule, spore stains, India ink
- **Biochemical Tests:** catalase, coagulase, oxidase, IMViC
- **Antimicrobial Susceptibility:** disk diffusion, MIC determination

- **Rapid Identification:** automated systems, molecular methods

Systematic Bacteriology:

- Characterization of aerobic and anaerobic bacteria, including fastidious organisms
- Gram's staining method, Albert stain, AFB Stain, Capsular stain – reagents preparation & staining
- Principles, procedure, and interpretation of biochemical tests for identification of bacteria
- Antimicrobial agents and antimicrobial susceptibility test
- **Gram-positive:** Staphylococcus, Streptococcus, Bacillus, Clostridium
- Catalase Test, Coagulase Test
- **Gram-negative:** Enterobacteriaceae, Pseudomonas, Haemophilus
- Oxidase Test, IMViC Test, Sugar Fermentation Test
- **Acid-fast:** Mycobacterium species
- **Anaerobes:** identification and clinical significance

Mycology:

- Fungal morphology and classification
- Culture media and identification techniques
- Types of Media for fungus (Sabouraud's Dextrose Agar (SDA), Brain Heart Infusion (BHI),
- Potato Dextrose Agar (PDA)
- Sample collection and processing
- Techniques used for isolation of medically important fungi
- **Common Infections:** dermatophytosis, candidiasis, systemic mycoses
- Laboratory diagnostic methods
- Identification of yeast and moulds

Virology:

- Viral classification and characteristics – DNA/ RNA Viruses
- Sample collection and processing
- **Diagnostic Methods:** serology, ELISA, antigen detection, PCR
- **Important Viruses:** hepatitis, HIV, influenza, dengue
- Tests based on immunochromatography
- Maintenance of virology laboratory

Parasitology:

- Classification of parasites and vectors
- Collection, transportation, preservation of stool specimen for parasite examination
- **Stool Examination:** Ova & Cyst – Normal Saline and Lugol Iodine mounts
- **Protozoa:** Plasmodium, Entamoeba, Giardia, Leishmania
- **Helminths:** Ascaris, Taenia, Schistosoma, Ancylostoma
- **Arthropods:** mosquitoes, flies, ticks, mites
- Diagnostic techniques and life cycle studies (Pictorial Representation)

Applied Microbiology:

- Clinical specimen processing

- Infection control and nosocomial infections
- Food and water microbiology
- Biomedical waste management

Automation in Microbial Identification:

- Automation in Bacteriology – Blood Culture Systems
- Antimicrobial Sensitivity Tests – Disk Diffusion Test (Kirby Bauer) – MIC-E Test
- Automation in bacterial identification
- Principle of action of antibiotic agents
- Detection of Multi Drug Resistance (MDR) Bacteria – ESBL, MRSA, VRE, Mycobacterium
- Serological tests for antigen and antibody detection

7. IMMUNOHEMATOLOGY (BLOOD BANKING)

Blood Group Systems:

- ABO system: genetics, serology, variants
- Rh system: antigens, antibodies, clinical significance
- Other systems: Kell, Duffy, Kidd, MNS
- Antibody screening and identification

Blood Collection & Processing:

- Donor selection criteria and screening
- Blood collection procedures and equipment
- Component preparation and storage
- Quality control testing and labelling of Blood Bags
- Testing for Transfusion Transmitted Infections

Transfusion Medicine:

- Pre-transfusion testing: crossmatching, compatibility
- **Specialized Tests:** direct/indirect Coombs, antibody titration
- Transfusion reactions: recognition and investigation
- Problems & troubleshooting in Blood Grouping & Crossmatching
- Haemolytic disease of the newborn
- Therapeutic apheresis procedures
- Cryoprecipitate

Additional Aspects:

- Organization and operation of blood donation camp
- Quality control in blood banking
- Advances in transfusion medicine: Cord blood bank, Automation
- Obstetric and Paediatric Transfusion

8. MOLECULAR DIAGNOSTICS & ADVANCED TECHNIQUES

Sample: Collection, Transportation, Handling, Processing

Molecular Biology Techniques:

- DNA/RNA extraction and purification
- Polymerase Chain Reaction (PCR) and RT-PCR
- Gel electrophoresis and analysis
- Sequencing and genotyping methods
- NAAT

Immunological Techniques:

- ELISA: principles and applications
- Immunofluorescence assays
- Immunodiffusion
- Western blotting
- Flow cytometry concepts
- Radioimmunoassay (RIA)
- Chemiluminescence immunoassays (CLIA)

Fundamental Genetics:

- DNA structure and replication
- Mendelian inheritance patterns
- Chromosomal abnormalities
- Sex-linked inheritance

Applied Genomics:

- Human Genome Project implications
- Molecular diagnostics applications
- Genetic counseling basics
- Population genetics principles

Point-of-Care Testing:

1. Rapid diagnostic tests
2. Portable analyzers
3. Quality assurance for POCT

PART C: SUPPORT SUBJECTS

1. MEDICAL RECORDS & ETHICS

Documentation:

- Medical record forms and content requirements
- Utility & functions of Medical Records in Laboratories
- Laboratory information systems (LIMS, Apex LIS, eLAB)
- Report writing and data management
- Record maintenance and retrieval systems

Ethical Considerations:

- Basic principles of medical ethics
- Patient confidentiality and informed consent
- Patient rights and autonomy
- Professional conduct and malpractice prevention

2. BIOMEDICAL INSTRUMENTATION

Instrument Categories:

- **Optical Instruments:** microscopes, spectrophotometers, colorimeters
- **Separation Techniques:** centrifuges, electrophoresis, chromatography
- **Measurement Devices:** pH meters, analytical balances, thermometers
- **Specialized Equipment:** autoclaves, incubators, laminar flow hoods

Maintenance & Troubleshooting:

- Preventive maintenance protocols
- Calibration procedures
- Common problems and solutions
- Safety protocols for instrument operation

3. COMPUTER APPLICATIONS & INFORMATION SYSTEMS

Basic Computer Skills:

- Hardware and software concepts
- Operating systems and file management
- Internet applications and email

Laboratory Informatics:

- Laboratory Information Management Systems (LIMS)
- Electronic health records integration
- Data analysis and statistical software
- Report generation and transmission

Microsoft Office Applications:

- Word processing for documentation
- Excel for data analysis and calculations
- PowerPoint for presentations
- Database management basics

4. LABORATORY ACCREDITATION & QUALITY MANAGEMENT

Accreditation Standards:

- NABL (National Accreditation Board) requirements
- ISO 15189 medical laboratory standards
- CAP (College of American Pathologists) guidelines
- Good Laboratory Practices (GLP)

Quality Systems:

- Document control and management
- Internal audit procedures
- Corrective and preventive actions
- Management review processes
- Continuous improvement strategies

5. COMMUNICATION SKILLS

Professional Communication:

- Verbal and non-verbal communication
- Patient interaction skills
- Telephone etiquette and email protocols
- Medical terminology usage

Presentation Skills:

- Public speaking and confidence building
- Visual aid preparation and use
- Group discussion participation
- Interview skills and resume writing

Healthcare Communication:

- Patient education techniques
- Interdisciplinary team communication
- Conflict resolution strategies
- Cultural sensitivity in healthcare settings

6. RESEARCH METHODOLOGY & BIostatISTICS

Research Fundamentals:

- Research design and methodology
- Literature review techniques
- Hypothesis formulation and testing
- Data collection methods

Statistical Analysis:

- Descriptive & Inferential Statistics
- Data presentation and interpretation
- Statistical software applications

PART C: RAJBHASHA

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P.6
Abhishek

NORTHERN RAILWAY

PS/DRM
28/7/25
Sr.DPO
Headquarters Office
Baroda House
New Delhi

P.S. No. 15998/2025

No. 831-E/004/Policy/Pt.III/EIIBII

Dated: /07/2025

The General Manager(P)
Rail Coach Factory, Kapurthala
Diesel Locomotive Modernisation Workshop, Patiala

The Director General
Research Design & Standard Organization

The Medical Director, Northern Railway, Central Hospital, Basant Lane, New Delhi.
DRMs /P-DLI, FZR, LKO, MB & UMB.

Sub:- Syllabus for Selection for the post of OTA-III/Dresser/Level-2.

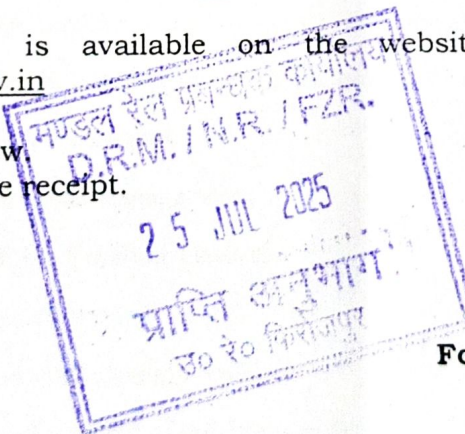
Ref:- 1) PCPO/NR letter no. PCPO/Sel./2025 dated 15.05.2025.
2) Northern Railway's Medical Department No. 7-Med/E-3/QB-SY/Group-C dated 30.06.2025.

In reference to above subject, the syllabus for selection for the post of OTA-III/Dresser/Level-2, is enclosed herewith for your information and necessary action please.

The above PS No. is available on the website given as under:-
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(Udot Jha)
For General Manager (P)

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4. Genl. Secy./AIOBC Rly Emp. Asso. 171/A3, Basant Lane, New Delhi.
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6. Genl. Secy. NRPOA Room No.301, HQ Office, Baroda House, New Delhi.
7. Dy.CPO/IT, HQs Office, Baroda House, NDLS for uploading on the website.

SYLLABUS OF OT-III DRESSER

A. SECTION I: Anatomy & Physiology (Basic Medical Sciences)

- 1.1 Basics of Human Anatomy: Systems overview
- 1.2 Structure and function of skin, muscles, bones, joints
- 1.3 Cardiovascular system
- 1.4 Respiratory system
- 1.5 Digestive system
- 1.6 Genito-urinary system
- 1.7 Central nervous system
- 1.8 Endocrine system
- 1.9 Special senses (Eyes, Ears, Nose)
- 1.10 Common anatomical terms used in the OT

SECTION II: Microbiology, Asepsis & Infection Control

- 2.1 Basic microbiology: types of microbes
- 2.2 Sterilization: methods (autoclaving, ETO, chemical)
- 2.3 Disinfection: hospital-grade chemicals, protocols
- 2.4 Hand hygiene techniques
- 2.5 Biomedical waste management
- 2.6 Use of PPE in Operation Theatres
- 2.7 Universal precautions
- 2.8 OT fumigation & cleaning protocols
- 2.9 Handling and disposal of infectious material

SECTION III: Operation Theatre Techniques & Equipment Handling

- 3.1 OT layout and zoning

- 3.2 Preoperative, Intraoperative, and Postoperative OT protocols
 - 3.3 Role of OT Assistant during surgery
 - 3.4 Surgical positioning of patients
 - 3.5 Handling of surgical instruments
 - 3.6 Setting up OT table and trolleys
 - 3.7 Handling electrosurgical units, suction, diathermy
 - 3.8 Instrument identification and care
 - 3.9 Draping and gowning procedures
 - 3.10 Scrubbing techniques and gowning/gloving
 - 3.11 Counting instruments, sponges, needles (Safety protocols)
-

SECTION IV: Pharmacology & Emergency Drugs

- 4.1 Basics of commonly used drugs in OT (antibiotics, analgesics, anesthetics)
 - 4.2 Drug storage, labeling, and expiry
 - 4.3 Crash cart contents and management
 - 4.4 Emergency drugs in resuscitation (adrenaline, atropine, etc.)
 - 4.5 Oxygen therapy principles
 - 4.6 IV fluids and infusions (types and uses)
-

SECTION V: First Aid, Emergency Response & Patient Handling

- 5.1 CPR and Basic Life Support (BLS)
- 5.2 First aid in case of bleeding, shock, burns
- 5.3 Transporting patients safely
- 5.4 Wheelchair, stretcher use and patient transfer
- 5.5 Lifting techniques to prevent injury

- 5.6 Fire safety in OT

SECTION VI: Legal, Ethical & Communication Skills

- 6.1 OT assistant's responsibilities and duties
- 6.2 Ethics and confidentiality
- 6.3 Consent types and importance
- 6.4 Communication with surgical team and patients
- 6.5 Record keeping and documentation
- 6.6 Professional behavior in hospital settings

B. Rajbhasha



NORTHERN RAILWAY

Headquarters Office
Baroda House
New Delhi

P.S. No. 15993/2025

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The Director General
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The Medical Director, Northern Railway, Central Hospital, Basant Lane, New Delhi.
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Sub:- Syllabus for Selection for the post of Health & Malaria
Inspector/Level-6.

Ref:- 1) PCPO/NR letter no. PCPO/Sel./2025 dated 15.05.2025.

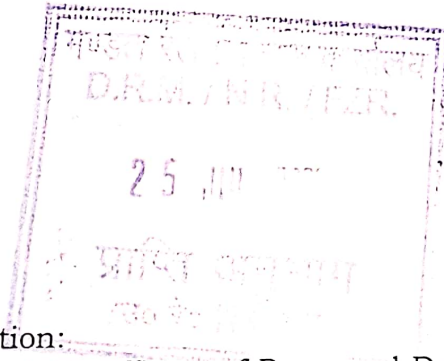
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Health & Malaria Inspectors (Gr II)

A. Public health and Sanitation.

- Food safety
- Water supply and sanitation
- Environmental Sanitation
- Pest control
- Waste management
- Communicable disease and its prevention and control
- Non communicable disease and health education
- Epidemiology
- Health statics
- Epidemiology
- Health statics
- Mass gathering management (MGM)
- FIELD WORK- Contracts, inspection, school health, store.

B. Rajbhasha

