

**1. Syllabus of written exam for the various posts of Senior Scientific Assistant & Scientific Assistant against Advt. No. 05/2023, Cat. No. 01, 02, 05, 06, 07, 08 & 10**

**Technical Syllabus**

**Introduction to Forensic Science:** Definitions, History and Development Crime Scene Management and Investigation: collection, Preservation, Packing and Forwarding of Physical and Trace evidences for analysis: Legal and Court Procedure pertaining to Expert Testimony.

**Forensic Statistics:** Mean, Mode, Median, Correlation and Regression analysis, Null Hypothesis, Variance, t-test. Chi. Square test. Type of Data, Measure of Central Tendency, Dispersion of Data, Correlation, Probability and Proof.

**Biomolecules and Biochemical techniques:** Overview of physical aspects in Biochemistry. Classification, Structure and functions of carbohydrates, Lipids, Proteins and nucleic acids. Methods for the isolation, purification and characterization of protein, denaturation of proteins and nucleic acid. Nucleic acid sequencing, proteome analysis.

**Microscopy:** Basic principles, instrumentation and applications of microscopy. Bright field, phase-contrast, fluorescence and confocal microscopy. Electron microscope - scanning and transmission microscopy. Principle methodology and applications of different types of electrophoresis, blotting and PCR techniques.

**Human Physiology:** Physiology of digestive system. Saliva and gastric juices, digestion and absorption. Nervous system: reflex action reflex arc and nerve impulse, Physiology of respiratory system exchange of gases, Physiology of human circular system- Heart structure, double circulation, cardiac cycle and its regulation, blood pressure, composition of blood, mechanism of blood clotting. Anti-coagulants for blood. Physiology of human reproductive system, Human male and female reproductive system, gamete formation, fertilization and implantation.

**Metabolism and Enzymology:** Glycolysis, glycogen metabolism, citric acid cycle. Pentose phosphate pathway, Gluconeogenesis, Ultrastructure of mitochondria, electron transport chain, oxidative Phosphorylation, Fatty acid synthesis and degradation, ketone, bodies. Eicosanoids, phospholipid metabolism. Metabolism of lipoproteins, Metabolism of amino acids and nucleic acids. Regulation of metabolic pathways, associated metabolic disorders. Nomenclature and classification of enzymes, isolation and purification of enzymes, Enzyme kinetics. Enzyme inhibition, vitamins as coenzymes, active site. Mechanism of Enzyme action. Regulation of enzyme activity. Allosteric enzymes, Isoenzymes, Industrial and clinical applications of enzymes.

**Human genetics:** Genes, Genetic code, eukaryotic gene expression, regulation of gene expression alleles, karyotypes, genetic disorders, mutation types and their causes. Mendel's Law of inheritance, Extension of Mendelian principles-co-dominance, incomplete dominance, linkage and crossing over.

**Forensic Immunology and DNA Examination:** Forensic Immunology- Innate and adaptive immunity, B cell/ T cell structure, development, diversity and recognition, Antigen and antibody's structure, types and function of antibody, monoclonal antibodies, antigen, hap ten, adjuvants, antigen-antibody interaction and their application in forensic serology. Blood groups- ABO, MN, Rh polymorphic blood groups, application of ABO blood group in disputed paternity cases, polymorphic enzymes and polymorphic proteins in the reference of forensic serology. HLA antigen, secretor and non-secretor status. Blood grouping in biological fluids other than blood.

**DNA profiling:** Use of DNA polymorphism in Forensic cases, DNA typing and individualization, source of DNA in forensic case, isolation of DNA (organic extraction), PCR, SNP, STRs. Mitochondrial DNA polymorphism.

**Techniques in Forensic Serology:** Electrophoresis Methods, Presumptive & confirmatory Tests for blood, Identification of blood properties, blood grouping, Applications of immunological techniques in forensic serology Determination of species by precipitin test

(diffusion method) and Gel electrophoresis. UV, Visible Spectrophotometry, Blood group determination of stains by absorption inhibition, absorption elution and mixed agglutination methods. Microscopy: simple microscope, compound microscope, phase contrast microscope, electron microscope.

### **40% Weightage**

#### **General Awareness & G.K:**

Questions will be designed to test the ability of the candidate's General Awareness of the environment and its relevance to the society. The questions will also be designed to test knowledge of the current events and of such matters of everyday observation as may be expected of an examinee appearing for the test. The test will include questions relating to India and neighboring countries, especially pertaining to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, National/International Organizations /Institutions, Environment, Globalization, Climate, Events, General Science, Computer literacy etc.

### **10% Weightage**

#### **Reasoning & Mental ability:**

The syllabus includes questions of both verbal and non-verbal types. Test may include questions on Semantic Analogy, Symbolic operations, Symbolic Number Analogy, Trends, Figural Analogy, Space Orientation, Semantic Classification, Observation, relationship, concepts, Venn Diagrams, Symbolic, Number Classification, Drawing inferences, Figural Classification, Punched hole pattern-folding & unfolding, Semantic Series, Figural Pattern folding and completion, number series, Embedded figures, Figural series, critical thinking, problem solving, emotional intelligence, arithmetical number series, arithmetical reasoning, Word building, Social intelligence, Coding and decoding, other sub-topics etc.

The test will cover Number System including questions on Simplification, Decimals, Fractions, Relationship between numbers. L.C.M., H.C.F., Ratio & Proportion, Percentage, roots, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Partnership business, Mixture and Allegation Time & Work, Time & Distance, Tables & Graphs, Trigonometry, basic Algebra, Geometry etc.

### **10% Weightage**

#### **English Language:**

Spot the Error, Fill in the Blanks, Synonyms/ Homonyms, Antonyms, Spellings/ Detecting mis-spelt words, Idioms & Phrases, One word substitution, Improvement of Sentences, Active/ Passive Voice of Verbs, Conversion into Direct/ Indirect narration, Shuffling of Sentence parts, Shuffling of Sentences in a passage, tenses, Cloze Passage, Comprehension Passage etc.

### **05% Weightage**

#### **Hindi Language:**

शब्द, अलंकार, विकारीशब्द, वाक्य, अविकारीशब्द, पद, पदबंध, मुहावरें, लोकोक्तियां, संधि, उपसर्ग, प्रत्यय, समास, पर्यायवाची, विलोम व अनेकार्थीशब्द, अयोगवाह, वाक्य शोधन, निपात (अवधारक), विरामचिन्ह, संबंधबोधक, अनेकशब्दों के लिए एक शब्द, एकार्थकशब्द, युग्मशब्द, वर्तनी (शब्द एवं वाक्य शुद्धिकरण), वर्ण, स्वर, व्यंजन, विदेशी ध्वनियाँ, संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रियाविशेषण, समुच्चय बोधक, विस्मय बोधक, वचन, लिंग, कारक, काल, तदभव-तत्सम शब्द

### **05% Weightage**

#### **General Knowledge of Haryana State:**

General awareness which includes History, Literature, Geography, Economy, Civics, Polity, Environment, Art, Culture, Customs, Norms, Society, Current Affairs. Events etc. of Haryana

### **25% Weightage**

## **Computer Knowledge:**

Basic knowledge in computer terminology, basic hardware & software, peripheral devices, Ms Office, Ms Word, Excel. spreadsheet etc.

**05% Weightage**

## **2. Syllabus of written exam for the various posts of Senior Scientific Assistant & Scientific Assistant against Advt. No. 05/2023, Cat No. 03, 04 & 09.**

### **Technical Syllabus**

Introduction to Forensic science Definition and scope of Forensic Science. History and development of Forensic science. Need and Principle. Police and, Forensic science laboratories / institutions in India. Organizational Structure of a Forensic Science Laboratory/Institution. Services provided by other institutions, Functions and responsibility of Forensic scientist.

**Introduction to the crime scene,** Types of crime scene. Evaluation and processing of crime scene. Securing the scene of crime. Documenting the crime scene, role of the first arriving officer at the crime scene. Searching techniques of Crime scene, crime scene ethics types of physical evidences. Classification and Role of physical evidences in Criminal Investigations & Trails. Collection of evidences. Safety measures for evidence collection. Preservation, Packaging, sealing, labeling and forwarding of physical evidences. Maintaining the chain of custody. Probative value of physical evidences. Reconstruction of scene of crime. Introduction to physical evidences.

**Basic principles of statistics:** Probability, mean, median, mode, measurement of uncertainty. Chi-square test, t-test, z-test, f-test, systematic and random sampling.

The metric system: Unit of measurement, Measurement devices. Accuracy, sensitivity and precision of measuring instruments. Errors in measurement, Significant figures.

**Laser:** Production. Properties of laser beams such as intensity, monochromaticity, coherence, directionality and brightness. Basic laser system: Gas Lasers, Solid State Laser, Excimer laser, Laser beam propagation.

**Mechanics:** Velocity and acceleration along radial and transverse direction, tangential and normal acceleration, motion under variable forces. Motion in a resistive medium, projectile motion. Newtonian Mechanics of one and many particle systems, conservation laws work energy theorem, systems with variable mass, frame of reference, inertial and non inertial frames, Central forces, two body Moment and product of inertia of a body. D'Alembert principle, Motion about a fixed axis, Euler's equation for rigid body motion.

**Fluid Mechanics:** General introduction of Fluid dynamics, Kinematics of flow fields, conservation of momentum, irrotational motion, equation of continuity, Bernoulli's theorem, viscous fluids, streamline and turbulent flow, Poiseuille's law, Surface tension capillary tube flow, Reynolds's number, Stoke's law.

**Spectroscopic techniques:** Introduction: Properties of light, Interaction of Matter and light, Electro-magnetic radiation & its application in forensic science UV/Visible Spectrophotometer and its application in Forensic Science, Molecular Fluorescence, Infrared (IR) Spectrometry & its Application in Forensic Science, Raman Spectroscopy, Mass Spectroscopy, Atomic Absorption Spectroscopy, and its application in Forensic Science, Separation methods- Thin Layer Chromatography, Gas Chromatography for qualitative and quantitative

Principle & working of SEM-EDX, Raman Spectrophotometer, GC-MS, Neutron Activation Analysis.

**X-ray Spectroscopy:** X-ray absorption and fluorescence methods, X-rays diffraction, EDX, Auger Emission Spectroscopy (AES), electron spectroscopy for Chemical analysis (ESCA) Thermal Analysis Methods: Basis principles and theory, differential scanning calorimetric and differential analysis, the MO gravimetry. Nuclear Magnetic Resonance Spectroscopy: Basic principles, theory and instrumentation, applications.

Lenses, magnifiers, measuring instruments, Principle and working of Simple – Microscope, Stereo microscope, Zoom stereo microscope, Comparison, light sources-UV, IR, transmitted, oblique light, spotlight.

Firearms characteristics & classification of firearms, History and background of firearms, Functional assembly & Operating principle of firearms, Characteristics & Working mechanism of Standard: Rifled firearms, Small arms, Shot guns & Non-standard: Improvised, Country made, Imitative firearms, identification of origin.

Ammunition & its constructional parts, Classification of Ammunition on basis of constructional features, Functional assembly of different types of ammunition & their types, Safety aspects for handling firearms and ammunition, cartridge-firing mechanism.

**Internal ballistics:** General elementary & other principle problems: Heat problems. Pressure. Recoil, Vibration & Jump, Barrel Fouling.

**External Ballistics:** Trajectory formation & its computation. Vacuum Trajectories & its measurement, Influence of earth trajectory. Effect of air resistance on trajectories. Parameters involved in exterior ballistics.

**Terminal/ Wound ballistics:** Effect of projective on target based on: nature of target, bullet shape, striking velocity, striking angle and nature of target, intermediate targets, range, etc. Basic concepts of wound ballistics & phenomenon involved: threshold velocity for penetration of skin / flash/ bones. Nature of wound of entry & exit wound. Characterization & evaluation of injuries depending upon Range, Velocity, Projectile types, Firearms types etc.

Identification of firearms, ammunition and their components: Principles. Processing of firearm Exhibits involved, Class characteristics & individual characteristics (Identifiable marks) produced during firing process on cartridge cases & projectiles and their linkage with firearms. Analysis of GSR- Composition of GSR. Location & Collection. Mechanism of formation, chemical & Instrumental techniques involved in analysis. Shooter Identification technique. Determination of range of fire & its related phenomenon. Techniques involved in ballistic studies, Stereo and comparison microscopy. BDAS, IBIS, The Arms Act, 1959, Arms rules, 2016.

**Chromatography and Electrophoresis:** General Principles and types of chromatographic techniques: Paper chromatography, column chromatography, thin layer chromatography, adsorption chromatography, partition chromatography, Gas chromatography, Gas-liquid chromatography, Ion exchange chromatography, Exclusion (permeation) chromatography,

**Forensic Document Examination:** Legal aspects of forensic document examination, 293Crpc, Section 45 evidence act, definition of expert. Indian Penal Code Under sections viz. 29, 463, 405, and 420. Classification of documents, Care, handling, preservation of documents; Preliminary' examination of case documents, Principle of handwriting examination; Importance of natural variations, Holographic documents. Comparison of handwriting, principle of fundamental divergence, natural variations in handwriting, nature and types of forgeries, characteristics of genuine and forged signatures, their detection, artificial and natural tremor. basic tools needed for forensic documents examination and their significance.

**Alterations in documents:** addition, deletion, obliterations, substitutions, overwriting, built up documents, determination of sequence of intersecting strokes, Ink examination, chemical composition of different types of inks, destructive and non-destructive techniques involved in differentiation of ink: Writing instruments, working of fountain pen, ball pen, gel pen, writing inks, Printing inks and printing toners. Viscosity, Surface tension, Capillary rise

**Paper examination:** Physical comparison, chemical composition, sizing & loading materials, tensile strength, comparison techniques: destructive & non-destructive. Examination of printed labels, wrappers, rubber seal impressions, Facsimile document, Photocopy and scanned document: process of scanning. Indented writings, charred 'documents: preservation and examination techniques involved.

**Printed document examination:** Printing technology, examination of type-script, classification of printers: identification of printed matter, different printing technologies, Examination of computer printouts, Concept of e-documents and digital signature.

**Examination of security documents:** Currency notes, Passport, Visa, Various identity cards, Stamp. papers, travel documents. OVI ink, thermal ink, Examination of credit, debit and other plastic cards

### **40% Weightage**

#### **General Awareness & G.K:**

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### **10% Weightage**

#### **Reasoning & Mental ability:**

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### **10% Weightage**

#### **English Language:**

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### **05% Weightage**

#### **Hindi Language:**

शब्द, अलंकार, विकारीशब्द, वाक्य, अविकारीशब्द, पद, पदबंध, मुहावरें, लोकोक्तियां, संधि, उपसर्ग, प्रत्यय, समास, पर्यायवाची, विलोम व अनेकार्थीशब्द, अयोगवाह, वाक्य शोधन, निपात (अवधारक), विरामचिन्ह, संबंधबोधक, अनेकशब्दों के लिए एक शब्द, एकार्थकशब्द, युग्मशब्द, वर्तनी (शब्द एवं वाक्य शुद्धिकरण), वर्ण, स्वर, व्यंजन, विदेशी ध्वनियाँ, संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रियाविशेषण, समुच्चय बोधक, विस्मय बोधक, वचन, लिंग, कारक, काल, तदभव—तत्समशब्द

### **05% Weightage**

#### **General Knowledge of Haryana State:**

General awareness which includes History, Literature, Geography, Economy, Civics, Polity, Environment, Art, Culture, Customs, Norms, Society, Current Affairs. Events etc. of Haryana

### **25% Weightage**

### **Computer Knowledge:**

Basic knowledge in computer terminology, basic hardware & software, peripheral devices, Ms Office, Ms Word, Excel. spreadsheet etc.

**05% Weightage**

### **3. Syllabus of written exam for the various posts of Lab Assistant against Advt. No. 05/2023, Cat. No. 11, 12, 13, 14 & 15**

#### **Technical Syllabus**

Atomic structure, Hybridization and its different types, Chemical bonding, Mechanics, Thermal Physics, Electromagnetism, Waves and Oscillations, Optics, Atomic Physics, Chemistry of block elements, Introduction to Forensic Science, Definition and Types of Crime, Police Organization, Crime Scene, Introduction, Methods of Purification, Electronic displacement, Stereo-isomerism, Pesticides & Insecticides, Introduction and Characteristics of Bacteria, Angiosperms, Non-Chordates, Genetics, Evolution, Human Physiology, Criminal Procedure code, the constitution of courts, hierarchy of courts and their powers

Constitution of India, Indian Evidence Act, Indian Penal code, Narcotic Drugs & Psychotropic Substances Act, Acid and Bases, Electrochemistry, Chemical Kinetics, Adsorption and Catalysis, Thermodynamics, Colligative Properties, Microscopy, Chromatography, Documents, Ballistics, Fingerprints Examination

Matrix, Differential Calculus, Statistics, Testing of Hypothesis, History and development of computers, General awareness of computer hardware, Basic operating system concept, Cyber Crimes, Crime Detection Devices.

Ultrastructure of different cell organelles of animal cell, Plasma Membrane: Fluid mosaic model, various modes of transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis, Endoplasmic reticulum (ER) : types, role of ER in protein synthesis and transportation in animal cell, Golgi complex: Structure, Associated enzymes and role of Golgi-complex in animal cell, Ribosomes: Types, biogenesis and role in protein synthesis, Lysosomes: Structure, enzyme and their role; polymorphism, Mitochondria: Mitochondrial DNA; as semiautonomous body, biogenesis, mitochondrial enzymes (only names), role of mitochondria, Cytoskeleton: Microtubules, microfilaments, centriole and basal body, Cilia and Flagella

Ultrastructure and functions of Nucleus: Nuclear membrane, nuclear lamina, nucleolus, fine structure of chromosomes, nucleosome concept and role of histones, euchromatin and heterochromatin, lamp brush chromosomes and polytene chromosomes, Mitosis and Meiosis (Cell reproduction), Brief account of causes of cancer, An elementary idea of cellular basis of Immunity

Elements of Heredity and variations, the varieties of gene interactions, Linkage and recombination: Coupling and repulsion hypothesis, crossing-over and chiasma formation; gene mapping, Sex determination and its mechanism: male and female heterozygous systems, genetic balance system; role of Y-chromosome, male haploidy, cytoplasmic and environmental factors, role of hormones in sex determination, Sex linked inheritance : Hemophilia and colour blindness in man, eye colour in Drosophila, Non-disjunction of sex-chromosome in Drosophila; Sex-linked and sex-influenced inheritance, Extra chromosomal and cytoplasmic inheritance: i) Kappa particles in Paramecium ii) Shell coiling in snails. iii) Milk factor in mice.

Phylum Hemichordate: General Character; Type Study of Belanglo's, Multiple allelism: Eye colour in Drosophila; A, B, O blood group in man, Human genetics: Human karyotype, Chromosomal abnormalities involving autosomes and sex chromosomes, Nature and function of genetic material: Structure and type of nucleic acids; Protein synthesis, Eugenics, eugenics and eugenics; spontaneous and induced (chemical and radiations) mutations; gene mutations; chemical basis of mutations; transition, transversion, structural chromosomal aberrations (deletion, duplication, inversion and translocation); Numerical

aberrations (autopolyploidy, euploidy and polyploidy in animals), Applied genetics : genetic counselling, pre-natal diagnostics, DNA-finger printing, transgenic animals

**40% Weightage**

**General Awareness & G.K:**

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**10% Weightage**

**Reasoning & Mental ability:**

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The test will cover Number System including questions on Simplification, Decimals, Fractions, Relationship between numbers. L.C.M., H.C.F., Ratio & Proportion, Percentage, roots, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Partnership business, Mixture and Allegation Time & Work, Time & Distance, Tables & Graphs, Trigonometry, basic Algebra, Geometry etc.

**10% Weightage**

**English Language:**

Spot the Error, fill in the Blanks, Synonyms/ Homonyms, Antonyms, Spellings/ Detecting mis-spelt words, Idioms & Phrases, one word substitution, Improvement of Sentences, Active/ Passive Voice of Verbs, Conversion into Direct/ Indirect narration, Shuffling of Sentence parts, Shuffling of Sentences in a passage, tenses, Cloze Passage, Comprehension Passage etc.

**05% Weightage**

**Hindi Language:**

शब्द, अलंकार, विकारीशब्द, वाक्य, अविकारीशब्द, पद, पदबंध, मुहावरें, लोकोक्तियां, संधि, उपसर्ग, प्रत्यय, समास, पर्यायवाची, विलोम व अनेकार्थीशब्द, अयोगवाह, वाक्य शोधन, निपात (अवधारक), विरामचिन्ह, संबंधबोधक, अनेकशब्दों के लिए एक शब्द, एकार्थकशब्द, युग्मशब्द, वर्तनी (शब्द एवं वाक्य शुद्धिकरण), वर्ण, स्वर, व्यंजन, विदेशी ध्वनियाँ, संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रियाविशेषण, समुच्चय बोधक, विस्मय बोधक, वचन, लिंग, कारक, काल, तदभव—तत्समशब्द

**05% Weightage**

**General Knowledge of Haryana State:**

General awareness which includes History, Literature, Geography, Economy, Civics, Polity, Environment, Art, Culture, Customs, Norms, Society, Current Affairs. Events etc. of Haryana

**25% Weightage**

**Computer Knowledge:**

Basic knowledge in computer terminology, basic hardware & software, peripheral devices, Ms Office, Ms Word, Excel. spreadsheet etc.

**05% Weightage**

**4. Syllabus of written exam for the post of Dark Room Attendant against Advt. No. 05/2023, Cat. No. 16**

**Technical Syllabus**

1. Introduction to Human Anatomy

Cell- Tissues Properties, Different Tissues, Digestive System & Hepatobiliary System, Respiratory System, Cardio Vascular System, Lymphatic System, Bones and Joints, Nervous System, Endocrine System, Sense Organs, Excretory System, Reproductive System Basics of Physiology

2. Introduction to Human Physiology

Blood, Cardio Vascular System, Lymphoid System, Digestive System, Respiratory System, Nervous System, Endocrine System, Excretory System, Reproductive System, Sense Organs

3. Basics of Bio – Chemistry

1. Introduction to Basics of Bio-chemistry including code of ethics for Medical Lab Technicians and Medical Lab Organization.

4. Introduction to Pathology in brief

1. Urine – Analysis – Physical Examination – specific gravity PH, reaction, color. Chemical Examination – Sugar Albumin, bile salts, bile Pigments etc. Microscopic, Sediment for RBC, WBC, Epithelial cells, casts, crystals, parasites. Preparation of Reagents, procedure and principle of tests. 2. Sputum Analysis – Physical Examination, Preparation and staining smear for Microscopic Examination. 3. Semen Analysis – Physical Examination Microscopy – counting, motility, staining, Morphology, abnormal and normal forms. 4. Body Fluids – Differential count of Peritoneal, pericardial, pleural fluids and CSF, charging chamber, Identifying and counting the cells.

Basics of Microbiology

- I. Introduction to Microbiology in brief Definition, History II. Microscopy a) Principle working and maintenance of compound Microscope. b) Principle of Fluorescent microscope, Electron Microscope, Dark Ground Microscope.
- II. A. Hospital Awareness

A brief idea of hospital as an organization management different units of a hospital effective communication skills, communication channel Maintenance of records Effective leadership General patient care medical terminologies Vital signs Unit preparation Transporting & Transferring patients Sterilization Techniques Control of infection Medication – Oral & parenteral Admission – Discharge procedure Bandages Practical's: Posted in ward & taught clinically

Surgical Department

Familiarization of different tubes 1. Drainage tube 2. Post Operative Exercises 3. Post OP Management of Patient 4. Shock of Management 5. Changing Surgical Dressing. 1. Preoperative preparation of patient 2. Preanesthetic preparation 3. Assisting in operation 4. Anesthesia 5. CSSD 1. Recovery room 2. Movement of papers 3. Scheduling of theaters 4. Supplying of articles 5. Specific area practices a. As scrub nurse b. As circulating nurse,

Dark Room Procedures

Dark room Techniques

1. Darkroom Construction. 2. List of darkroom accessories. 3. Radiographic film. 4. Handling of X-Ray films, types of films. 5. Processing of X-Ray films. 6. Methods of processing. 7. Mixing of processing solutions. 8. Chemistry of processing solutions. 9. Maintenance of processing solutions. 10. Safe light. 11. The radiographic image. 12. Film Density. 13. Film contrast. 14. The characteristic curve. 15. Control of radiographic image definition. 16. Latitude of exposure. 17. Variation in exposure time. 18. Intensifying screens / fluorescent screens. 19. Cassettes. 20. Faults in Radiography 21. CR. Computer Radiography 22. DR. Digital Radiography 23. Pass box.



X-rays Generation, Properties and Interaction: Electromagnetic, Spectrum and general properties: Wave and quanta concept, Processes of x-ray generation: General and characteristic radiation, X-ray spectrum, Factors influencing the intensity of x-rays. Basic interactions diagnostic x-rays and matter: Coherent scattering photo electric effect and Compton Effect – Probability of occurrence and its applications in radiology. Biological effects of radiation. Attenuation: Linear and mass attenuation coefficients, Half Value Layer, Factors affecting attenuation, practical aspects of these phenomenon in Radiology, scatter radiation.

Radiation Protection & Measurements: Radiation quantities and units, Radiation measuring instruments: Gas filled detectors: ionization chamber, proportional counter, Geiger-Muller counter, scintillation counter, solid state detector, Personal monitoring devices: Film, Thermo-luminescent and Pocket dosimeters. Aim of radiation protection, concept of As Low as Reasonably Achievable, International Commission on Radiation Protection (ICRP) and Atomic Energy Regulatory Board (AERB) recommendations, maximum permissible dose, Principles of protection in X-ray department for patient, personnel and public, Time-Distance-Shielding, protective devices, X-ray room design.

Radiographic Photography: X-ray films, Screen – film cassette, Characteristic curve, Radiographic Image Quality, Automatic Film Processor, Laser Camera: Wet and Dry, Computed Radiography & Digital Radiography.

Electric Power & Transformers: Generation and distribution of electric power, Single and Polyphase supply, Fuses, Earthing. Construction, types, working principle and losses of transformers. Auto transformer: Construction, Working principle and Applications.

X-Ray equipment & units: Construction of diagnostic X-ray tube: Stationary and rotating anode type, Line- Focus principle, Heel effect, X-ray tube rating, Grid controlled and Metal – Ceramic X-ray tubes. Mammography, Mobile X-ray unit, Dental x-ray unit, Dual Energy X-ray Absorptiometry.

X-ray generators: Filament and High Voltage circuits, Single phase generators. Self, half wave and Full wave rectified, three phase generators: 6 pulse-rectifier, 6 pulse-12 rectifier, 12 pulse 12 rectifier circuits, Power Storage Generators, High Frequency Generators, Falling Load Generators, Exposure Switches and Timers.

Accessories in Fluoroscopy: X-ray beam restrictors, filters: Inherent, added, k-edge filters. Grids: Types, grid-ratio grid cut-off, moving grid. Air gap technique. Basic principle, construction and working principle of image intensifier tube. Image characteristics, Image display and recording devices

Radiation Hazards and Protections

1. During radiography 2. During fluoroscopy 3. Effects of radiation on human tissues 4. Permissible doses 5. Measurement of radiation doses 6. Dosages in diagnostic radiology 7. Protective gadgets in RD Department 8. Radiation safety duties of radiologist, radiographer & patient.

Radiation Preventive Maintenance

1. General care 2. Maintenance of log book 3. Practical precautions 4. Brakes & locks 5. HT cables care 6. Care of meters & controls 7. Care of tube stands & tracks 8. Care of accessory equipment 9. Functional tests for any faults 10. Failure of x ray tubes 11. Failure of HT cables 12. Common trouble – shooting & remedies.

Regional Radiography

General Head & neck Spine Chest Abdomen Pelvis Upper Limbs Lower Limbs Special Macro – radiography Xero – radiography Mammography Dental radiography Orthopantomogram High K V Technique Subtraction techniques

Special Diagnostic Procedures

GUT-IVP, RAP, RAU, MEUG, Cystography, AGP, HSG. GIT – Sialography, Barium swallow, BM Study, BMFT, SB enema, Ba enema, SPVG. Billiary system – pTC, T tube cholangiogram, OCG. Respiration – Bronchography Vascular – Angiography of limbs, aorta, carotid vessels. Contrast media – Type, reaction, treatment.

Positioning Radiography and Contrast Procedures General:

Age subject types and sex, anatomical landmarks-postural variations-erect and horizontal technique-respiratory movement and diaphragm level-regional densities preparations-and immobilization of patient-pathological conditions-injuries, fractures and dislocations congenital, localized views-periodic examination-use of dry bones positioning terminology identification system

### Positioning Radiography –

Skeletal System Upper Limb: Techniques for hand-fingers-thumb-wrist joint-forearm-elbow joint-humerus-shoulder joint and sterno-clavicular joint. Lower Limb: Techniques for foot-calcaneum-ankle joint-leg-knee joint-patella-and femur (lower two thirds) Pelvic Girdle: Techniques for pelvic-iliac fossa-ischium-and Sacro iliac joint. Vertebral Colum: Techniques for Atlanto-occipital articulation, cervical vertebrae, cervical-thoracic junction, thoracic vertebrae, lumbar vertebrae, lumbosacral articulation, sacrum, Bones of Thorax: Techniques for sternum, ribs (upper and lower). Skull: Techniques for cranium, facial bones, Sella turcica, temporal Bone and optic foraminae, sinuses, mandible and tempura mandible joint, Abdomen: Routine and radiographs on cute condition Bedside radiography – techniques for acute chest conditions-intestinal obstruction, abdominal perforations-vertebral injuries-skull injuries-fractures immobilized. Theatre radiography-introduction to C-arm image intensifier-exposure & training. Contrast Procedures – I Barium Swallow-Barium meal series-Barium enema-double contrast barium enema, small bowel enema, double and single contrast, ERCP, PTBD, sonograms, fistula-grams, mammograms. Contrast Procedures – II IVU, retrograde pyelogram, MCU, AUG, Opposing Urethrogram, Dacrography, Sialo-gram, HSG, T-Tube cholangiogram, operative cholangiogram (on table in theatre).

### Radiographic Technique and Radiographic Anatomy

Contrast media: Barium preparation, Iodine preparation, Air-Oxygen. Skeletal system: Upper limb, lower limb, shoulder, girdle and thorax, vertebral column, pelvic girdle and hip region. Teeth jaw. Accessory nasal sinuses: Lachrymal system Cardiovascular system: Upper respiratory passage, lungs, pleura, diaphragmatic excursion, Mediastinum, bronchography, artificial pneumothorax. Genito-urinary system: Straight X-ray of abdomen, pyelography, cystography, urethrography, gas insufflation, pneumoperitoneum. Obstetrics and Gynecology: Radiation protection, pregnancy, pelvimetry, hysteron salpingography, paleontography. Central nervous system: Routine and special projections of skull, ventriculography and encephalography, cerebral angiography, myelography. Alimentary system: Barium suspension, Barium-meal and follow through Barium enema. Liver and spleen: Spleno-portal venography. Silvery glands: Sialography. Arthrography, singraphy, Lymphangiography, Operation theatre technique and ward radiography. Stereoscopy, Magnification, High and Low K.V. technique and Mammography.

### First Aid, Basic Nursing, Handling of Patients

Shock, convulsion, asphyxia, artificial respiration, Administration of Oxygen, Burns and scalds. Electric shock and burns. Wound, hemorrhage, pressure points, Tourniquet, Injuries to Bones, Joints and muscles, Dressing of Bandages, Plaster of Paris technique, Splints, Drug reaction, Poisons, Basic Nursing. Drug in Department: Storage labeling. Checking, Regulation regarding dangerous drugs, Units of measurement. Medical Ethics: Ethical law and professional etiquette s applied to members of profession associated with medicine. Nursing and Handling of patients: Hospital and Departmental procedure, Hospital staffing and organization. Records and departmental statistics. Medico-legal aspects. Appoints. Stock taking and stock keeping. Care of patients: Reception, Elementary hygiene. Nursing Care: Temperature, pulses and respiration. Application of sterile dressings. Preparation of patients for General X-ray examination: Departmental instructions to out-patients or ward-staff. Instructions for various special investigations. Nursing care before and after special X-ray. Drug allergy. Principles of asepsis: Methods of sterilization. Care and identification of instruments. Setting of trays and trolleys. Elementary operating theatre procedure. Tomography - History: Basic principle and data acquisition/C.T. generations, Gantry and patient table - Travel Speed, Load capacity, X-ray tubes. Rotating anode; cooling system; Collimator; Pencil beam; Fan beam Anode heat storage capacity; Detector system: Type, number, Efficiency Generator, UPS & Voltage Stabilizer. Rectifier.

### Magnetic Resonance Imaging History:

Basic Physics Magnets - Types, Powers, Magnetism; Nuclear Spin, Proton density; Lerner equation; Radio Frequency (RF) Pulse; T1 (Longitudinal relaxation time) T2 [Transverse relaxation time] Free induction decay TR [time to repeat] and TE [time to echo] Flip Angle Imaging process Fourier transformation, Pixel, Matrix, Gantry and different types of coils, Magnetsandfield gradients RF pulse and pulse sequences Partial saturation & saturation recovery sequences Inversion reversion sequence, Spine-echo sequence Fast imaging sequence Selection of slices; Slice thickness; Image storage; Contrast agents, MR angiography & Dynamic MR Spectroscopy; Hazards and safety.

## BASIC AND ADVANCED ULTRASOUND IMAGING

Ultrasound – Generation, Properties and Interaction: Basic Acoustics, Ultrasound terminologies: acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity. Interaction of US with matter: reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients. Production of ultrasound: Piezoelectricity, Medical ultrasound transducer: Principle, Construction and Working, Characteristics of US beam. Image Formation, Display and Quality: Ultrasound display modes: A, B, M, T-M mode, B-scan, Scan-converters: Analog and Digital, Image Quality: Axial, Lateral and Elevational resolutions, US Machine Controls, US Focusing. Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducer: mechanical and electronic arrays, Ultrasound Artifacts. Techniques: Techniques for imaging different anatomic areas, Patient preparation for Doppler, Vascular sonography, Quantitative ultrasound densitometry. Doppler Ultrasonography: Doppler Effect, Doppler ultrasound techniques: Continuous Wave Doppler, pulsed Doppler, Duplex scanning, Doppler spectrum, Color Doppler, Power Doppler. Harmonic imaging Extended FOV imaging 3D US imaging: acquisition methods & reconstruction 4D & 5D US imaging

## INTERVENTIONAL PROCEDURES AND ANGIOGRAPHY

Principle & Instrumentation: Digital Subtraction Angiography: Instrumentation, Principle of Digital Subtraction Angiography, Various Digital Subtraction Techniques. Basics of Invasive Radiology: Procedure of image guided biopsies and drainage procedure. Invasive Angiography & Venography: 4 Vessel DSA Aortogram Selective Angiogram Venogram Invasive Monitoring: NIBP, Pulseoximetry, Cardiac resuscitation measures, IBP, ECG, Management of Shock. Interventional Procedures: PTBD, Stenting, PTA + stenting, stent graft, Embolization TIPS, drainage procedure. Neuro Interventional Procedures: Embolization, GDC Glue embolization Vertebroplasty Direct puncture Adult & Pediatric Invasive Cardiology: Basics of cardiac catheterization Invasive monitoring Coronary angiogram

## BASIC AND ADVANCED CT IMAGING

CT Imaging – Principle: Basic principle of Computed Tomography, Comparison of CT with Conventional Radiography and Tomography, Generations of CT.

Instrumentation: Gantry, Patient couch, X-ray tube, Filters, Collimators, Detectors, Data Acquisition System (DAS).

Image Formation: Image Formation in CT, CT Image Reconstruction, Hounsfield Unit, Windowing, CT image display, CT Image Quality, CT artifacts.

Advances in CT Imaging: Helical CT scan: Slip ring technology, Advantages, Multi Detector CT, Cone-Beam geometry, Reconstruction of helical CT images, CT Fluoroscopy, HRCT, Post Processing Techniques: MPR, MIP, Min IP, 3D rendering : SSD and VR, Ct Dose.

Patient Preparation & Protocols: Patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography: Aortogram, Selective angiogram head, neck and peripheral, Image documentation: Filling, Maintenance

**40% Weightage**

### **General Awareness & G.K:**

Questions will be designed to test the ability of the candidate's General Awareness of the environment and its relevance to the society. The questions will also be designed to test knowledge of the current events and of such matters of everyday observation as may be expected of an examinee appearing for the test. The test will include questions relating to India and neighboring countries, especially pertaining to History, Indian Polity & Constitution, Art & Culture, Geography, Economics, General Policy, National/International Organizations /Institutions, Environment, Globalization, Climate, Events, General Science, Computer literacy etc.

**10% Weightage**

### **Reasoning & Mental ability:**

The syllabus includes questions of both verbal and non-verbal types. Test may include questions on Semantic Analogy, Symbolic operations, Symbolic Number Analogy, Trends, Figural Analogy, Space Orientation, Semantic Classification, Observation, relationship, concepts, Venn Diagrams, Symbolic, Number Classification, Drawing

inferences, Figural Classification, Punched hole pattern-folding & unfolding, Semantic Series, Figural Pattern folding and completion, number series, Embedded figures, Figural series, critical thinking, problem solving, emotional intelligence, arithmetical number series, arithmetical reasoning, Word building, Social intelligence, Coding and decoding, other sub-topics etc.

The test will cover Number System including questions on Simplification, Decimals,

Fractions, Relationship between numbers. L.C.M., H.C.F., Ratio & Proportion, Percentage, roots, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Partnership business, Mixture and Allegation Time & Work, Time & Distance, Tables & Graphs, Trigonometry, basic Algebra, Geometry etc.

**10% Weightage**

**English Language:**

Spot the Error, fill in the Blanks, Synonyms/ Homonyms, Antonyms, Spellings/ Detecting mis-spelt words, Idioms & Phrases, one word substitution, Improvement of Sentences, Active/ Passive Voice of Verbs, Conversion into Direct/ Indirect narration, Shuffling of Sentence parts, Shuffling of Sentences in a passage, tenses, Cloze Passage, Comprehension Passage etc.

**05% Weightage**

**Hindi Language:**

शब्द, अलंकार, विकारीशब्द, वाक्य, अविकारीशब्द, पद, पदबंध, मुहावरें, लोकोक्तियां, संधि, उपसर्ग, प्रत्यय, समास, पर्यायवाची, विलोम व अनेकार्थीशब्द, अयोगवाह, वाक्य शोधन, निपात (अवधारक), विरामचिन्ह, संबंधबोधक, अनेकशब्दों के लिए एक शब्द, एकार्थकशब्द, युग्मशब्द, वर्तनी (शब्द एवं वाक्य शुद्धिकरण), वर्ण, स्वर, व्यंजन, विदेशी ध्वनियाँ, संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रियाविशेषण, समुच्चय बोधक, विस्मय बोधक, वचन, लिंग, कारक, काल, तदभव—तत्समशब्द

**05% Weightage**

**General Knowledge of Haryana State:**

General awareness which includes History, Literature, Geography, Economy, Civics, Polity, Environment, Art, Culture, Customs, Norms, Society, Current Affairs. Events etc. of Haryana

**25% Weightage**

**Computer Knowledge:**

Audio & Visual Aids. COMMUNICATION Process Types of communication Strategies for effective Communication Barriers of communication SOFT SKILLS Presentation with the use of visual aids such as power point Conversation Extempore speech, usage of effective language for communication of health work. Case studies and situational analysis Survey and Reporting

COMPUTER Computer basic MS – Office MS – Word MS – Excel MS – Power Point INTERNET CONCEPTS Browsing Down- Loading Use of Slide Projector

**05% Weightage**

**Note: - The total no. of questions will be 100 with weightage of 0.95 marks for each question. All questions are compulsory, at least one of the four options for each question shall be filled mandatorily. 5 Minutes extra shall be given to mark at least one of the four options. Total time allowed for the paper will be (100+5)=105 minutes including these five minutes. In case a candidate doesn't mark none of the four options for a question then 0.95 marks for each un-attempted question.**