

Syllabus for the post of Technician (Radiotherapy) (Core Subject)

Advt No. I/10/6/Rectt/2026-27

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

1. Introduction to healthcare delivery system
 - a. Healthcare delivery system in India at primary, secondary and tertiary care
 - b. Community participation in healthcare delivery system
 - c. Health system in developed countries.
 - d. Private Sector
 - e. National Health Mission
 - f. National Health Policy
 - g. Issues in Health Care Delivery System in India
2. National Health Programmes
3. Introduction to AYUSH system of medicine
4. Health scenario of India- past, present and future
5. Demography & Vital Statistics
6. Epidemiology

Medical terminologies and record keeping

- 1) Derivation , prefixes, and suffixes.
- 2) Conventions for combined morphemes and the formation of plurals.
- 3) Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
- 4) Interpret basic medical abbreviations/symbols.
- 5) Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system.
- 6) Interpret medical orders/reports.
- 7) Data entry and management on electronic health record system.

Basic computers and information science

Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.

Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems). Processor and memory/ Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices. Introduction of windows / Introduction to MS-Word /

Introduction to Excel/ Introduction to power-point: introduction, creating and manipulating presentation,

Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.

Medical law and ethics

1. Medical ethics - Definition - Goal - Scope
2. Introduction to Code of conduct/ Confidentiality/ Malpractice and negligence / Autonomy and informed consent - Right of patients/ Care of the terminally ill- Euthanasia
3. Organ transplantation
4. Medico legal aspects of medical records
5. Professional Indemnity insurance policy
6. Development of standardized protocol to avoid near miss or sentinel events / obtaining an informed consent

Communication and soft skills

1. Basic Language Skills: Grammar and Usage.
2. Business Communication Skills/ Basic concepts & principles of good communication /Special characteristics of health communication/ Types & process of communication
3. Barriers of communication & how to overcome

Introduction to Quality and patient safety

1. Quality assurance and management -
 - a. Concepts of Quality of Care
 - b. Quality Improvement Approaches
 - c. Standards and Norms
 - d. Quality Improvement Tools
 - e. Introduction to NABH guidelines
2. Basics of emergency care and life support skills - Basic life support (BLS) is the foundation for saving lives following cardiac arrest. Fundamental aspects of BLS include immediate recognition of sudden cardiac arrest (SCA) and activation of the emergency response system, early cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED).
3. Bio medical waste management and environment safety :
 - a. Definition of Biomedical Waste
 - b. Waste minimization
 - c. BMW – Segregation, collection, transportation, treatment and disposal (including color coding)/ Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste

- d. Modern technology for handling BMW / Use of Personal protective equipment (PPE)
- e. Monitoring & controlling of cross infection (Protective devices)

Infection prevention and control - The objective of this section will be to provide a broad understanding of the core subject areas of infection prevention and control and to equip AHPs with the fundamental skills required to reduce the incidence of hospital acquired infections and improve health outcomes. Concepts taught should include –

- a. Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)],
- b. Prevention & control of common healthcare associated infections,
- c. Components of an effective infection control program, and
- d. Guidelines (NABH and JCI) for Hospital Infection Control

4. Antibiotic Resistance and antibiotic stewardship

5. Disaster preparedness and management- The objective of this section will be to provide knowledge on the principles of on-site disaster management

Professionalism and values

1. Professional values- Integrity, Objectivity, Professional competence and due care, Confidentiality

Research Methodology and Biostatistics: Basic concepts

Elementary mathematics & physics:

1. Elementary Mathematics

- ✓ Calculation of percentage, Profit & Loss, Simple interest, compound interest, time & work, Ratio & proportion, Surds, Indices, Logarithm, Inverse Square Law,
- ✓ Geometry of triangles, similar triangles, Properties of Triangles.
- ✓ Trigonometry: Height & Distance.
- ✓ Graphical Representation of Exponential and Inverse exponential functions, Linear and semi log graphs.

2. Basic Physics, Electrostatics, Magnetism & Current Electricity

- ✓ Units & Dimension, Newton's Laws of Motion, Velocity & Speed, Force, Momentum etc.
- ✓ Coulomb's Law, Electric field & potential, Capacitance, Ohm's Law, Heating effect of current, Biot-Savart law, Definition of Tesla and Gauss, Magnetic field due to circular coil. Elementary Principles of-Magnetization of Materials by electric current, Electromagnets. Lorentz force. Magnetic flux. Electromagnetic induction, mutual and self-inductance. Transformer, Eddy current. Alternating Current, RMS and Average Current. Variation of Voltage and current in AC circuit consisting only Resistor, Only Induction and Only Capacitor. Power factor of the AC circuit. Instruments: Electrometer, Galvanometer, Ammeter, & Voltmeter.

Human Anatomy and Physiology: Basic and Applied

Radiographic Anatomy

Emphasis on plain and cross-sectional radiographic anatomy

1. Surface anatomy
2. Plain film / conventional radiographs
3. Mammography
4. Computed Tomography (CT)
5. Magnetic Resonance Imaging (MRI)
6. Ultrasound
7. Nuclear medicine
8. Digitally Reconstructed Radiographs (DRR)
9. Portal imaging

Oncology Science

1. Pathology- general pathology of tumours
2. Malignancies- local and general effects of tumours and its spread
3. Carcinogenesis
4. Co-morbidities
5. Etiology and epidemiology
6. Genetics
7. Prevention
8. Early detection
9. Signs and symptoms
10. Public awareness on early signs and symptoms
11. High risk groups
12. Staging of tumours

Principles of Radiation and Radiotherapy Techniques

1. Effects of various radiation on normal tissues and malignant tumor: Early and late reaction on Skin, Mucous membrane, GI tract, Genito urinary system, respiratory system, CNS
2. Application of radiotherapy in benign conditions
3. Application of radiotherapy in malignant condition
4. Single and multiple field techniques for all treatment sites (from Head to Feet) with appropriate immobilizing device(s).
5. Fix, Rotation, Arc and Skip therapy procedures.
6. Use of Rubber traction, POP, Orfit, Body Frame in treatment technique.
7. Evaluation of patient setup for simple techniques.
8. Use of Beam Modifying devices, such as wedges, Tissue compensators, Mid Line Block (MLB) in the treatment of respective sites.
9. Customized shielding blocks and its properties.

10. Asymmetric jaws
11. Motorized wedges
12. Simulation procedures including CT simulation

Radiation Quantities, Units and Detection/Measurement

1. Radioactivity, Flux, Fluence, Kerma, Exposure, Absorbed Dose, Equivalent Dose, Weighting Factors, Effective Dose, Natural Background Radiation, Occupational Exposure Limits, Dose limits to Public.
2. Detection and measurement of radiation - Ionisation of gases, Fluorescence and phosphorescence, Effect on photographic emulsion, Ionisation chambers, Proportional Counters, G.M. Counters, Scintillation Detectors, Liquid scintillator, Pocket Dosimeters, TL Dosimeters and their use in personnel monitoring badges. Advantages and disadvantages of various detectors, appropriateness of different types of detectors for different types of radiation measurement.

Basic Radiation physics

1. Atomic Structure, Nucleus, Atomic No., Mass No., Electron orbit and energy levels, Isotopes and isobars, Radioactivity, Radioactive decay, Half-life, Particle radiation, Electromagnetic Radiation, Production of X-rays, Continuous X-ray spectrum, Bremsstrahlung radiation Characteristic X-rays, Filters, Quality of X-rays, Effect of voltage and current on the intensity of X-rays, Properties of X-rays.
2. Interaction of Radiation with Matter : Photoelectric effect, Compton Effect, Pair production, Ionisation of matter, Energy absorbed from X-rays, X-rays Scattering, X- rays transmission through the medium, linear and mass attenuation coefficient, HVT and TVT, Interaction of charged particle and neutrons with matter.

Radiotherapy Equipment

1. Brachytherapy- Design features, Radiation sources, Technique, High dose-rate (HDR), Low dose-rate (LDR), Pulsed dose-rate (PDR), various types of applicators.
2. Teletherapy Machines & Accessories:
 - Telecobalt Machines
 - Medical linear accelerators.
 - Tomotherapy
 - Machine properties.
 - Beam directing, modifying and defining devices.
 - Other accessories.

Radiation safety

- Radiation Hazard evaluation and control
- Radiation Emergency Preparedness
- Regulatory requirements

Patient care, positioning and immobilization

1. Principles of positioning and immobilization

- Positioning aids-Breast boards,Lung boards, Belly boards, Head-and-neck fixation devices, Vacuum packs, Stereotactic systems
- Internal organ motion control- Bite blocks, Gating systems, Active breathing control, Diaphragm compression, Prostate immobilization, Tracking systems. Laser/ positioning systems
- Marking systems
- Isocentre determination
- Reference points
- Treatment couch
- Image acquisition for planning (and/or verification)
- Modalities for image acquisition for planning
- Simulation- Conventional Simulation, CT Simulation, Virtual Simulation
- Image processing and archiving
- Treatment verification
- Protocols- Imaging protocols: development and implementation, Non-action levels (NAL), On-line/off-line corrections, Matching/co-registration procedures, Geometric uncertainties, Documentation, Adaptive radiotherapy, Information management³⁵

Radiotherapy Equipment

- Familiarization with treatment planning systems-external beam planning and brachytherapy
- Various types of phantoms including the water-phantoms, RFA
- Various types of dosimeters including in-vivo dosimeters
- EPID and other on-board imaging systems
- Record and Verify Systems, Oncology Information Systems, Image/Patient data archiving, storage and transfer.
- CT Simulator

Quality Assurance in Radiotherapy

Basic Radiotherapy Physics

Historical developments in Radiotherapy, Physical components of Telecobalt Unit / Linear Accelerator Unit

/ Remote After Loading Brachytherapy Unit / Gamma Knife Unit / Simulator /Brachytherapy units and their descriptions, Various types of sources used in Radiotherapy and their properties, Physics of Photons, electrons, protons and neutrons in radiotherapy, Physical parameters of dosimetry such as Percentage Depth Dose, Tissue-Air Ratio, Tissue Maximum Ratio, Physics of Bolus and Phantom materials, Compensators, Wedges, Shielding Blocks, Patient immobilization devices, Port film, processing and development, Special techniques in Radiotherapy such as SRS, SRT, IMRT, IGRT and Tomotherapy.

Biological Effects of Radiation

The Cell, Effect of ionising radiation on Cell, Chromosomal aberration and its application for the biological dosimetry, Somatic effects and hereditary effects, stochastic and deterministic effects, Acute exposure and Chronic exposure, LD50/60. Role of RTT in managing the acute effects of radiation.

Clinical Radiobiology

- Cell kinetics
- Cell cycle control mechanisms
- Tumour biology
- The five 'R's of radiobiology
- Tissue structure and radiation effect
- The Linear Quadratic (LQ) model
- Tumour control probability (TCP), Normal Tissue Complications Probability (NTCP) models
- Acute and late side effects
- Sensitizers/protectors/side effect reduction
- Fractionation
- Treatment combinations
- Treatment scheduling
- Mould Room /Motion Management Techniques

Mould room and motion management techniques are essential part of modern precision radiotherapy. An RTT has to be competent in designing various types of moulds for patient immobilization and applicator fixation (in brachytherapy) as well as in various motion management techniques:

- Historical evolution of the mould materials and techniques to make moulds
- Thermoplastic moulds
- Breath hold, motion reduction, tracking and gating techniques

Special RT Techniques and Recent advances

- Wedges-tissue compensator-irregular field-SSD&SAD technique-oblique field-arc-rotational and moving field
- Mantle field-irregular field-Hemi body irradiation-whole body irradiation-total body skin irradiation
- Special techniques in Radiation Therapy, (SRT) – Stereo tactic Radio surgery (SRS) –. Methods – BRW and CRW frames – angiographic localizer box – preparation of target sheets – Quality Assurance – Isocentric check – Treatment execution – care to be taken – check list.
- Conformal Radiotherapy: Principles of 3 D treatment.
- Recent developments in radiotherapy and treatment techniques

Radiological/Nuclear Medicine/Other Imaging Techniques in Radiotherapy Planning

- 2D (radiography, fluoroscopic, USG), 3D (CT, MRI) and functional (PET/SPECT) imaging and their application in radiotherapy planning
- Understand Gross Tumour Volume (GTV), Clinical Target Volume (CTV), Internal Target Volume (ITV), Planning Target Volume (PTV), Organs at Risk (OAR) delineation
- Conduct image fusion at the treatment machine console
- Do bony matching
- Do soft tissue matching for estimating the preliminary data for applying shifts
- Prepare documentation
- The RTT should understand the principles of: Four-dimensional (4D) planning and be familiarized with IMRT and IGRT planning.

Radiotherapy treatment delivery

- Orthovoltage / superficial
- Supervoltage / Megavoltage
- Brachytherapy
- Stereotactic radiotherapy- Stereotactic radiosurgery, Stereotactic radiotherapy, Cranial Extra cranial (Stereotactic body radiotherapy SBRT), Total Body Irradiation (TBI), Total Skin Electron Irradiation (TSEI), Radiation therapy with neutrons, protons, and heavy ions

Operational Issues in Radiotherapy