DIPLOMA IN MEDICAL RADIATION TECHNOLOGY SYLLABUS (DMRT)

Revised in 2021

Government of Odisha
Health & Family Welfare Department
Revised vide DMET-LT/RT-Board-

DIPLOMA IN MEDICAL RADIATION TECHNOLOGY
(DMRT) COURSE CURRICULUM

GENERAL INFORMATION

1. The Duration of Diploma Course of Medical Radiation Technology (DMRT) is two years.
2. The minimum educational qualification for selection of trainees for the Diploma Course of Medical Radiation Technology is +2 Science with Biology or Mathematics one of the subject.
3. A total mark of the DMRT Course is 1000.
4. Minimum pass mark of the trainees is 40% in Theory, 50% in Oral & Practical and 50% in Aggregate.
5. 1st Class mark is 60% in Theory, Practical & Oral in aggregate respectively.
6. Less than 40% either in Theory or in Practical or in Oral in any paper will be treated as unsuccessful (Fail).

Examination schedule: There will be two Regular Annual Examinations one in each year

Part-1: Annual: In First year

Part-2: Annual: In Second year

There will be a supplementary examination within six weeks of annual result publication.

1st Year

	Subjects	Mark distribution	Hours
Paper-I	**ANATOMY**	**Total Mark 100**	**40**
Paper-II	**Section-A** Health, Disease and Environment	**Total Mark 75**	**30**
	Section-B Human Physiology, Related Pathology & Microbiology	**Total Mark 75**	**20X3=60**
Paper-III	Radiation physics, Radioactivity, production of X-rays and uses in diagnosis	**Total Mark-100**	**40**
Oral & Practical	Anatomy 25 Physiology 25 Pathology 25 Microbiology 25 Radio diagnosis 50	**Total Mark-150**	**10X5=50**

2nd Year DMRT 2020 Admission Batch

Papers	Subjects	Mark distribution	Hours
Paper-I	**Section (A)** Modern Atomic Structure & Physics, Radioactivity, Production of X-ray, Physical principles of X-ray Diagnosis, Radiation Units	**Total Mark-75**	**40**
	Section (B) Radiation Hazards, Radiation Protection and control	**Total Mark-75**	**40**
Paper-II	Basics and principles of Radiotherapy, Use of computers in Diagnosis and Treatment	**Total Mark-100**	**40**
Paper-III	Modern Imaging Techniques & Nuclear Medicine	**Total Mark-100**	**50**
Oral & Practical	Paper-I, II & III 50 mark each	**Total Mark-150**	**30**

DMRT Part-I (First Year)

PAPER-I

Human Anatomy

1. **Introduction:** Introduction to Anatomy, Physiology, Pathology, definition of topographic term / terms used to describe body.

2. **Structure of Body:** Basic unit cells & tissues of body.

3. **Musculoskeletal system :** structure of bone, types of bone, skull, PNS, Mastoid, vertebral column, bones of shoulder griddle, bones of supper extremity, thoracic cage, Pelvic griddle, bones of lower extremity, joints- type of joints, movement, important joints- their structure & location, types of muscles (striated, non-striated, cardiac). Origin insertion & function of some important muscles, Radio-anatomy of bones.

4. **Cardiovascular System:** Heart, major vessels, portal vein & tributaries.

5. **Lymphatic system (structure, function) :** Circulation of lymph, lymph glands, thoracic duct.

6. **Abdominal organs / Digestive system:** Oral cavity, pharynx, esophagus, stomach, small & large intestine, gall bladder, pancreas, liver, spleen.

7. **Respiratory system (Respiratory passage & organs):** Larynx, Trachea, Lungs, Bronchus.

8. **Nervous System:** Brain, Meninges, Ventricles, Spinal Cord.

9. **Genitourinary & Reproductive system :** Kidney, Ureter, Bladder, Prostate in Males, Male & female Urethra, Ovary, Fallopian tubes, Uterus, cervix, scrotum tests, vas deference, seminal vesicle.

10. **Endocrine system (Name, Location & function):** Pituitary, Thyroid & Parathyroid Gland, Supra-renal.

11. **Ear :** Structure

12. **Eye:** Bony orbit & soft parts.

PRACTICAL

Experiments related to Anatomy, physiology and Pathology

1. Surface markings of organs like heart, lungs, liver, spleen, stomach, kidney, bladder, important bony landmarks, femoral artery & vein, brachial artery & vein, radial artery, carotid artery, different quadrants of abdomen.

2. Identification of bones of skeleton.

3. Identification of various parts structures of human body in charts & models. (Interior of thorax with organs in situ in models, interior of abdomen, pelvis & reproductive organs model)

4. Identification of various anatomical structures in x-ray plate (heart, lungs, bones, liver, spleen, kidney, bladder, and on barium study : stomach, small and large intestine)

5. Demonstration of brain & spinal cord.

6. Visit to Anatomy museum for specimen recognition.

7. Respiration / Pulse / Temperature recording.

8. Maintenance of TPR chart.

9. Recording of Blood pressure, Blood Pressure instrument.

10. Different weights & measures (liquid & solid), familiarity with Laboratory, glassware - cleaning of glass wares.

11. Visit to pathology museum for identification of common pathological specimen.
12. Radiography in various positions for all the special radiological procedure using contrast made as per syllabus.

PAPER - II

Section -A : Health, Disease and Environment (50 MARKS) (Theory 30hrs)

1. **Health and Disease :**
   Definition of Health, Infections, Communicable, Non-communicable and degenerative diseases, Interaction between agent, host and environment resulting diseases. Modes of transmission of communicable diseases, contact Air-borne, water-borne, Vector-borne and Occupational diseases, industrial situation, Agricultural situation, service and Management situation.

2. **Health Care Delivery System and National Health Policy :**

Health Care Delivery System - Primary Health Care, Secondary Health Care and Tertiary Health Care. Provision for health in constitution of India, Health Administration and Management at different levels in India.

3. **Organization of Health care delivery system :**
   i) Village Level: Trained birth attendants, village health guides, Anganwadi workers.
   ii) Sub-centre Level: Females Health workers, Male Health workers and their functions.
   iii) Sector Level: Male Health supervisors, female health supervisors.
   iv) Primary Health Centre-organization, Staffing and functions.
   v) Community Health Centre-organization, staffing and functions.
   vi) Sub-Divisional Level
   vii) District Level: District Health Organization, Staffing and its functions.
   viii) State Level : Health Department, Directorates
   ix) National Level: Ministry of Health, Govt. of India, National Health Programme, Referral and Apex Health Institutions and Laboratories.

4. **Hospital Organization (Administration) :** Management functions and its application, WHO definition of Hospital, Types of Hospitals, Hospital services in relation to radiological services, Returns, reports and records in hospital, indents books, registers and log-book etc. in relation to radiological services, Hospital and the Community Hospital hazards.

5. **Health Education :** Personal Hygiene, Aims and Objectives of Health Education,
   Communication Media.

6. **First Aids :** Definition, Simple first-aid kit material etc., Shock, Coma and its management,
   control of bleeding, splitting a patient, Transportation of injured, immediate first-aid to
   Drowning patient.

<u>Section - B : Human Physiology, related Pathology and Microbiology (50 MARKS)</u>

1. **Physiology : (Theory 10hrs Practical 5 hrs)** Circulation & Physiology of Blood, Blood volume, constituents of blood, Bleeding time, clotting time, Blood Group, Normal Blood Pressure, Physiology of Heart : Systole, diastole, Maintenance of cardiac output, Normal Pulse, Normal respiration : types of respiratory muscles, abnormal respiration, Normal temperature, maintenance of body temperature, Kidney function.

2. **Pathology : (Theory 20hrs Practical 10 hrs)** Cell Biology : structure of cell, cell division, Cell growth, cell deformities, defense mechanism, cell damage and cell repair. Definition, Etiology & classification of pathological processes

& terms: Infection, Inflammation, Neoplasia, Metabolism, Congenital, Immunity: Fracture, types of fracture, fracture healing, dislocation of joints, Neoplasia : Benign & Malignant including its mode of growth & metastasis. Physical and chemical carcinogens: common Neoplasm of different systems : Oral, oro-pharyngeal, laryngeal, GI tract, Breast, Cervix, Bone tumors, soft tissue sarcoma, penis, lymphoma, Leukemia.

3. **Microbiology: (Theory 10hrs Practical 5 hrs)** Classification of bacteria, virus, fungus: characteristics, shape and arrangements, special characters - spores, capsules enzyme, mortality asepsis, disinfections and

DMRT Part-I (Final Year)

PAPER-I

Radiation physics, Radioactivity, production of X-rays and uses in diagnosis

1. **Modern Atomic Structure & Physics:** Constitutes of matters & atomic structure, orbits & orbital, binding energy and mass defect, isotopes, isotones and isobars, electromagnetic and particle radiations.

2. **Radioactivity:** Radioactivity decay, half-life & mean-life, decay series, modes of decay: alpha, beta and gamma radiation, electron capture, internal conversion, isomeric transition, production of radioisotopes.

3. **Production of X-ray:** Discovery and origin of X-rays, Nature and properties of X-ray, Energy spectrum, characteristic radiations, Absorption, scattering and quality of X-rays, HVT and TVT, Angular distribution.

4. **X-ray tube and Generators:** Features of X-ray tube, anode, cathode and filament, characteristics of target materials, cooling system, insulation and tube housing, filters, rating of tubes, faults of X-ray tubes; Gas tube, Mammography X-ray tube; X-ray generators, power supply: transformers, Half-wave and full-wave rectifications, timer.

5. **Physical principles of X-ray Diagnosis**: Radiological images: Photon fluence, Unsharpness, resolution, Contrast, scattered radiation, grids, Radiographic film processing: Flim, Density of flims, Characteristic curves, gamma factor, flim processing, Intensifying screens, speed, fluoroscopy.

6. **Radiation Units:** Units for activity, specific activity, Kerma, exposure, absorbed dose, dose rate, dose equivalent, specific gamma-ray constant, RHM, RMM factors. Effective dose, quality and RBE factor.

PAPER–II

1. **Basics and Principles of Radiotherapy:** Introduction to external & internal Radiotherapy of Radical & Palliative intention, heliotherapy sources, brachy-therapy sources, teletherapy, Features of tele gamma and therapy X-ray machines,macine parameters and their functions,linear accelerators and other machines used in Radiotherapy in India, and patient's interaction.

2. **Use of computers in Treatment.**
   - i- Basics of computers: Historical evolution, structure & configuration of computers, familiarization with input and output devices, their use functions, Algorithms and flow-charts.
   - ii- Communication with a computer, common operating knowledge on hardware and software, Operating system, application software, input output statements, Ms-DOS.
   - iii- Computer languages, simple BASIC Programming.
   - iv- Application of windows, MS-Office, MS-Word, MS-Excel, MS-Power point etc.
   - v- Application of computers in patient treatment.

PRACTICAL
Experiments related to Radiotherapy

1. Different types of patient setups in treatment machines.
2. Familiarization of machine parameters and functions.
3. Treatments with different beam modifiers and accessories.
4. Preparation of moulds as per theory syllabus.

Principle of Radiation Detection and Measurement, Radiation Hazards and Protection

Radiation Interaction : Photoelectric effect, Compton Effect, Pair Production, Attenuation Coefficients, Radio Biology, RBE, OER, Four r's of Radio Biology, somatic and genetic effects of radiations

Dose & Dose rate effect: time-dose – fractionations concept, stochastic and non stochastic effects, LD50/30, survival fraction and target theories

Principle of Detection and measurements:
Gas filled detector, ionisation chamber, proportional counter, GM counter, Survey Meters, Dosy Meters, and contamination monitors

Radiation Hazards, Evaluation and control:

Personal monitoring, Gamma Zone Monitor, Film Badge, TLD badge, Concept of time, distance and Shielding, survey of radiography installation

Radiation Protection and Operational Limits:

Aims of radiation protection, System of dose limits for radiation workers and general public,

Radiation Installation

Planning of Radiological Department:

Model layout of X-Ray rooms and dark rooms, Mammography installations, Universal Angio cardiac catheterization lab, CT installation, radiography room of a Dental Hospital, Planning of radiotherapy installation, Brachytherapy wards,

Radiological safety Level, ALARA Principles

PAPER - III
Modern Imaging Techniques & Nuclear Medicine

1. Mammography: Introduction and historical developments, method of examination, examination of milk duct.

2. Circulation System: Cerebral angiography, Photographic subtraction technique (DSA), interventional Radiography.

3. Cardiac Catheterization: Specialised Equipments.

4. Computed Tomography Historical Development, equipment and methodology, Reconstructed image parameters, Examination protocol.

5. Digital Radiography, Xero-radiography, Fluoroscopic imaging.

6. Magnetic Resonance Imaging: Historical Development and equipments, Biological effect of MRI, Examination protocols.

7. Diagnostic Ultrasound: Historical development and equipments, principles of ultra-sonographic scanning.

8. Nuclear Medicine: Principles of Thyroid uptake, Rectilinear scanners and Gramm Camera scanning.

PRACTICAL
Experiments related to Radiodiagnosis

1. To check the lead apron for any crack.
2. Survey of an X-ray installation.
3. To demonstrate that the intensifying effect of X-ray intensifying sceen is due to the light produced by its fluorescence and not the x-rays.
4. Verification of Optical & Radiation field coincidence.
5. To study the effect of KV & mA on X-ray production.
6. Testing of safe light.
7. Testing of Intensifying screen for uniform and firm contact.
8. Preparation of developer and fixer solution.
9. Loading and unloading of X-ray film and processing.
10. Loading and unloading of imaging film.
11. Identification of imaging film, cassette & screen, Grid. Cones & LBD, safe light, developer & fixer solution.
12. Taking of X-ray of all the parts of human body as per the theory syllabus.

<u>Model question papers</u> in theory examination:
***Short notes and Brief notes - 40%**
***True or false/fill in the blanks-40%**
***Long questions- 20%**

N.B- The mark allotment per question will be according to full mark for each subject.

Time for Theory Paper
50 Marks----------2hrs
60-100marks-----3hrs

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