

**Pravara Institute of Medical Sciences  
(Deemed University)**

Loni Bk - 413 736, Tal. Rahata, Dist. Ahamadanagar (M.S.)

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**Syllabus  
D.M.R.T. (Radiotherapy)**

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**DEPARTMENT OF RADIOTHERAPY  
RURAL MEDICAL COLLEGE**

Loni Bk., Tal: Rahata, Dist: Ahmednagar-413736

# D.M.R.T

## **Paper I: Basic Medical Sciences as applied to Radiotherapy**

### **1. Applied Anatomy and Physiology**

- a) Anatomy of oral cavity , larynx ,pharynx ,paranasal sinuses, CSF pathways, salivary glands, middle ear, breast, broncho-pulmonary segments, mediastinum,oesophagus, liver, spleen, small and large bowels, pelvic and genito- urinary organs (bladder, uterus, ovary, testis, rectum anal canal etc)
- b) Lymphatic systém and drainage
- c) Relationship of vital structures
- d) General principles of physiology of respiratory ,cardio-vascular ,nervous and biliary systems

### **2. Pathology of Benign and Malignant diseases**

- a) Principles and methods of definite diagnosis surgical biopsy
- b) Exfoliative Cytology ,Fine needles aspiration Cytology and biopsy
- c) General histological & cytologic features of malignancy.
- d) Classification of benign and malignant tumours and their interpretation
- e) Methods of dissemination of cancer and its biological behaviour
- f) Degree of differentiation of cancer
- g) Radiation Pathology

1. **Various investigation and Imaging procedures in Diagnosis, Staging, Management and Follow up of different types of Cancer.**

2. **Recent Advances related to topic for Paper I**

## **Paper II: Clinical Radiotherapy including Chemotherapy**

### **1. Clinical Practice of Radiotherapy and Oncology**

- a) Principles of Radiotherapy
- b) Techniques of Radiotherapy

- c) Clinical Practice
- d) Treatment Planning and Presentation

**2. Diagnosis and management of following cancers**

- a) Central nervous system, Ocular and Adnexal tumour, Ear tumours, head and neck tumors, Salivary gland, Thyroid
- b) Endocrine system, Breast cancer, Bronchus, G.I. cancers, Urogenital system, Skin cancer, Bone tumours, Soft tissue tumours, Leukemia, Lymphoma, Cancer in childhood, Multiple Myeloma, Aids-related cancer.
- c) Total body & Hemi body irradiation.

**3. Cancer Chemotherapy, Hormones and Immunotherapy**

- a) Chemotherapy: Structure, mechanism of action, pharmacokinetic, indication, doses, schedules, side effects and interaction
- b) Hormone therapy
- c) Immunotherapy
- d) Gene Therapy

**4. Related Specialties**

- a) Principles and Practice of general surgery, gynaecology & paediatric surgery as related to cancer, Surgical treatment decisions, Surgical diagnosis and staging of cancer, Clinical staging, Staging procedures, Methods of clinical staging and TNM classification
- b) Terminal care of cancer patients, Principles and practice of control of pain.
- c) Cancer registry and epidemiology
- d) Prevention and early detection in cancer
- e) Cancer education and oncology organization
- f) Statistical methods.

**3. Recent Advances related to topic for Paper II**

**Paper III: Physics as applied to Radiotherapy, Nuclear Medicine, Radiobiology and Recent Advances in Radiotherapy**

## **1. Physics:**

- a) Atomic and Nuclear Structure
- b) Radioactive Decay including artificial & natural radioactivity
- c) Production and properties of X-rays
- d) Clinical Radiation Generators
- e) Interactions of ionizing radiation with matter
- f) Brachytherapy
- g) Measurement of ionizing radiation: Dosimetric aspects
- h) Radiation Quantities & Quality assurance
- i) Calibration of High Energy Photon and electron Beams
- j) Dose Distribution of External Beam Therapy
- k) Sealed & unsealed source Therapy
- l) TPS & Manual treatment planning
- m) Radiation Protection & Hazards
- n) Planning of New Radiotherapy Department and maintenance

## **2. Nuclear Medicine**

- a) Radioactive Isotopes in Clinical Medicine and Clinical diagnosis
- b) Sealed and unsealed source
- c) Types of diagnostic test
- d) Organ scanning
- e) Gamma Camera & Whole body counter
- f) Calibration and standardization of Radioactive Isotopes
- g) Internal therapeutic uses of Radioactive Isotopes and their dosimetry

## **3. Radiobiology**

- a) Mammalian Cell Radiosensitivity: Interphase and reproductive death, Cell Survival curves in vitro, Characterization of cell survival curves, Critical sites and target theory, Dose response curves in vivo, Quantitative normal tissue reaction based on systems.
- b) Factors that modify Radiation Response: The oxygen effect, The age response function, Potentially lethal damage, Sublethal damage, Dose Rate, Radiosensitizers, Radioprotectors.
- c) Linear Energy Transfer (LET) and Relative Biological Effectiveness(RBE)
- d) Cells and tissue Kinetics: The cell cycle, Autoradiography, Constituent parts of the cell cycle,

Percent labelled mitoses technique, Growth fraction, Cell loss factor, Growth Kinetics of human tumours.

- e) Tissue Radiosensitivity: Classification based on radiation pathology, Types of cell populations.
- f) Time-dose and Fractionations: The 4 R's of radiobiology, The basis of Fractionations, The Strandquist's plot, Nominal standard dose, Linear Quadratic equation.
- g) New Radiation Modalities: Protons, Neutrons, Pions, High energy heavy ions
- h) Hyperthermia: Methods for heating, Systematic hyperthermia, Localised heating, Cellular response to heat, Repair of thermal damage, Thermotolerance, Hyperthermia combined with ionising radiation, Time sequence of heat and irradiation, Hypoxic cells and heat, Effect of pH on the response of Hypothermia, Response of transplanted tumours to heat, Response of spontaneous tumours to heat, Response of normal tissues to heat, heat and therapeutic gain factor, Hyperthermia and Chemotherapy.
- i) Total body Irradiation and its acute effects: Prodromal radiation syndrome, Central nervous system /cerebrovascular system, Gastrointestinal syndrome, Hematopoietic syndrome, Mean Lethal dose, Treatment of radiation accidents
- j) Total body Irradiation and its Late Effects: Non-specific life shortening, Carcinogenesis.
- k) Mechanism of Radiation Carcinogenesis and Genetics of irradiations
- l) Radiation protection in the Developing Embryo and Fetus
- m) Radiophysiology of human Tissues: Effects of irradiation of the skin, bone & cartilage, kidney, lung, nervous tissues, ovary, testis, eye, lymphoid tissues, bone marrow, oral, pharyngolaryngeal & esophageal mucous membrane, salivary glands, human embryo and Radiation effects observable in clinical radiotherapy.

**Practical Training is same as for DMRT candidate (For 02 years except thesis)**

## Teaching and Learning Activities

A candidate pursuing the course should work in the institution as a full time student. No candidate should be permitted to run a clinic/laboratory/nursing home while studying postgraduate course. Each year should be taken as a unit for the purpose of calculating attendance. Every student shall attend teaching and learning activities during each year as prescribed by the department and not absent himself / herself from work without valid reasons.

A list of teaching and learning activities designed to facilitate students acquire essential knowledge and skills outlined is given below:

1. **Lectures:** Lectures are taken by subject related Faculties in pathology, Radiation Physics, Radiobiology, Chemotherapy and Radiation Oncology.
2. **Journal Club:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. Further, every candidate must make a presentation from the allotted journal(s), selected articles at least four times a year and a total of 12 seminar presentations in three years.
3. **Subject Seminar:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. Further, every candidate must present on selected topics at least four times a year and a total of 12 seminar presentations in three years. A timetable for the subject with names of the student and the moderator should be scheduled at the beginning of every year.
3. **Ward Rounds:** Ward rounds may be service or teaching rounds.
  - a) **Service Rounds:** Postgraduate students and Interns should do every day for the care of the patients. Newly admitted patients should be worked up by the PGs and presented to the seniors the following day.
  - b) **Teaching Rounds:** Every unit should have 'grand rounds' for teaching purpose in which a case is presented or group discussion on one topic is to be done. A diary should be maintained for day to day activities by the students.

Entries of (a) and (b) should be made in the Log book.

4. **Clinical Case Presentations:** Minimum of 5 cases to be presented by every candidate each year. They should be assessed using check lists and entries made in the log book

5. **Tumour Board Meetings:** Students should present cases in the tumour board meeting and take active participation.
6. **Clinico-Pathological Conference:** Recommended once a month for all post graduate students. Presentation be done by rotation. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPCs.
7. **Student Symposium/ Seminar:** Recommended as an optional multi disciplinary programme. The evaluation may be similar to that described for subject seminar.
8. **Inter Departmental Meetings:** Strongly recommended particularly with departments of Pathology and Radio-Diagnosis at least once in a month. These meetings should be attended by post graduate students and relevant entries must be made in the Log Book.  
**Teaching Skills:** Post graduate students must teach under graduate students  
(eg. medical, nursing) by taking demonstrations, bed side clinics, tutorials, lectures etc.
9. **Continuing Medical Education Programmes (CME) :** Recommended that at least 2 state level CME programmes should be attended by each student in 3 years.
10. **Conferences:** Attending conferences is encouraged.

### **Log book**

The log book is a record of the important activities of the candidates during his training; internal assessment should be based on the evaluation of the log book. Collectively, log books are a tool for the evaluation of the training programme of the institution by external agencies. The record includes academic activities as well as the presentations and procedures carried out by the candidate.

Every candidate shall maintain a work diary and record of his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the candidate. The work diary shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the university practical/clinical examination.



## **Recommended Books and Journals for MD & DMRT**

### **List of Journals**

1. International Journal of Cancer, UICC, Wiley Inc,
2. Genes Chromosomes and Cancer, Wiley
3. Oral Oncology: EJC Publications
4. Seminars in Oncology - W.B. Saunders Company,
5. Seminars in Surgical Oncology - UICC, Wiley Less
6. Seminars in Radiation Oncology – WB Saunders Company,
7. Cancer Detection and prevention – International Society for Preventive Oncology,
8. ACTA Oncologica – Scandinavian University Press,
9. International Journal of Radiation Oncology, Biology, and Physics – Elsevier
10. Journal of Clinical Oncology – Lippincott Williams and Wilkins
11. Journal of Surgical Oncology – UICC, Wiley
12. Gynecologic Oncology – Academic Press
13. British Journal of Cancer – Church Livingstone
14. Journal of NCI - Oxford University Press
15. Radiotherapy and Oncology – Elsevier.
16. Indian Journal of Cancer
17. Journal of Clinical Radiotherapy & Oncology
18. Association of Medical Physicist of India Journal

### **A) List of Text Books**

1	Principles of Practice of Radiation Oncology by Carlos A. Perez, Luther W. Brandy (Lippincott Raven)6th
2	Text Book of Radiotherapy by G. K. Rath
3	Cancer – Principles & Practice of Oncology by Vincent T De Vita, Samuel Hellman Steven A. Rosenberg, 10 <sup>th</sup> edition. (Lippincott – Raven)
4	Fundamental Physics of Radiology, 3 <sup>rd</sup> Edition, Meredith and Massey, Varghese
5	The Physics of Radiation Therapy, 2 <sup>nd</sup> Edition, Faiz M. Khan, William and Wilkins
6	Text Book of Radiobiology by Eric J. Hall, J.B. Lippincott
7	Textbook of Radiotherapy by Gilbert H.Fletcher
8	Radiation Oncology – Imaging and Treatment - Gaffney
9	Frontiers of Radiation Therapy and Oncology Vol. 43 IMRT.IGRT.SBRT
10	Radiotherapy in Practice: Brachytherapy – 2 <sup>nd</sup> Edi

11	Radiotherapy Treatment Planning – LQ Radiobiology
12	Radiotherapy in Practice – Physics for Clinical Oncology
13	Delineating Organs at Risk in Radiation Therapy
14	Target Volume Delineation for Conformal & Intensity Modulated Radiation Therapy
15	Target Volume Definition in Radiation Oncology
16	Challenging Concepts in Oncology : Bhattacharyya
17	Hutchinson's Clinical Methods – 23 <sup>rd</sup> Edi.
18	The Molecular Basis of Cancer – Mendelsohn
19	Manual of Clinical Oncology – 9 <sup>th</sup> Edi.
20	Hermans: Head and neck Cancer Imaging – 2 <sup>nd</sup> Edi.
21	Text Book of Radiation Oncology, Leibel Philips, Saunders,

### **ADDITIONAL READING:**

1. Indian Council of Medical Research, "Ethical Guidelines for Biomedical Research on Human Subjects", I.C.M.R, New Delhi, 2000.
2. Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956. Medical Council of India, Kotla Road, New Delhi.
3. Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi, 1994.
4. Internal National Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991; 424-8
5. Mahajan B K, Methods in Bio statistics for medical students, 5<sup>th</sup> Ed. New Delhi, Jaypee Brothers Medical Publishers, 1989.
6. National Health Policy, Min. of Health & Family Welfare, Nirman Bhawan, New Delhi, 1983

## Marks Distribution for D.M.R.T. Radiotherapy Examination

**Total Marks: 600 (Theory 300 + Practical 300)**

	<u>Total Marks</u>	<u>Duration</u>
<b>I. <u>Theory</u> *</b>	<b>300</b>	<b>3x3= 9 Hours</b>
1.Paper I- Basic Medical Sciences as applied to Radiotherapy	100	3 hours
2.Paper II- Clinical Radiotherapy including Chemotherapy	100	3 hours
3.Paper III- Physics as applied to Radiotherapy, Nuclear Medicine & Radiobiology, and Recent Advances in Radiotherapy	100	3 hours

\*Each theory paper has

Full Questions 3 x 20 marks = 60 Marks

Short Notes 4 x 10 marks = 40 Marks

**Total = 100 Marks**

## II. Practical and Viva-voice for D.M.R.T. Radiotherapy

**Total Marks-400**

**Duration- 6 hours.**

1. Long case:	80x1= 80
2. Short Case:	35x2= 70
3. Pathology specimen (Spot)	20
4. Instruments & Medical Physics Equipments:	20
5. Chemotherapy drugs & Charts	15
6. X-ray / CT / MRI / Nuclear Medicine scan	15
7. Grand Viva	Radiotherapy 50 +Medical Physics 30 = 80
<b>Grand Total</b>	<b>300</b>