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# MANIPAL ACADEMY OF HIGHER EDUCATION

## MD (RADIATION ONCOLOGY) DEGREE EXAMINATION – NOVEMBER 2025

### PAPER I

Monday, November 10, 2025

Time: 14:00 – 17:00 Hrs. Max. Marks: 100

✍ **Answer ALL the questions.**

1. Explain the structure and function of the lymphatic drainage system and its importance in cancer staging.

2. Discuss the principles of staging cancer using TNM and AJCC systems with relevant examples.

3. Describe the mechanisms of radioactive decay and their application in radiotherapy.

4. What is LET (Linear Energy Transfer)? Explain its significance in radiation biology.

5. Describe the production and clinical applications of X-rays in radiotherapy.

6. Explain the interactions of gamma rays with matter and their impact on therapeutic effectiveness.

7. Discuss the biological effects of ionizing radiation on cellular DNA and repair mechanisms.

8. Describe the principles of IMRT (Intensity-Modulated Radiation Therapy) and its clinical applications.

9. Explain the different immobilization techniques used in radiotherapy and their importance.

10. Discuss radiation protection measures required in a radiotherapy department.

(10 marks × 10 = 100 marks)

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# MANIPAL ACADEMY OF HIGHER EDUCATION

## MD (RADIATION ONCOLOGY) DEGREE EXAMINATION – NOVEMBER 2025

## PAPER II

Tuesday, November 11, 2025

Time: 14:00 – 17:00 Hrs. Max. Marks: 100

✍ **Answer ALL the questions.**

1. Describe the anatomy of the nasopharynx. Discuss the Gross tumor volume and Clinical target volume delineation principles for a patient with Carcinoma Nasopharynx which involves the right parapharyngeal space and a right retropharyngeal lymph node. Staged after evaluation as cT2N1M0 TNM Stage II.

2. Discuss the guidelines for accelerated partial breast irradiation. Discuss the different modalities available by which one can deliver the treatment.

3. In locally advanced cervical cancer, evaluate the role of image-guided adaptive brachytherapy (IGABT) using MRI based planning. Include the advantages, limitations, and impact on toxicity profile and local control rates.

4. What is the anatomy of the mesorectum? What is meant by circumferential resection margin and a threatened circumferential resection margin in rectal cancers? Discuss its implications on the choice of radiotherapy. Add a note on the current evidence for total neoadjuvant therapy (TNT) in locally advanced rectal cancer.

5. Discuss the anatomical distribution of mediastinal lymph node stations relevant to staging in lung cancer. Elaborate on the role of radiotherapy in the management of a patient with Squamous cell Carcinoma of the right lung with cT3 N2 M0 disease.

6. Outline the management of a 67 year old male patient with no co-morbidities who has been diagnosed with biopsy proven adenocarcinoma of the prostate Gleason Score: 4+4=8. The current PSA levels are 28 ng/ml.

7. Discuss the optimal radiation therapy approach for stage IIC seminoma. Include the rationale for target volume selection and add a note on role of prophylactic mediastinal irradiation.

8. Discuss the treatment plan for a 56 year old male patient with good performance score, diagnosed with Right frontal lobe Glioblastoma Multiforme IDH- wild Type Who Grade 4 with MGMT- promoter region Methylation post Gross total resection of the primary tumor 3 weeks ago.

9. Define oligometastatic disease. Outline the Stereotactic body radiation therapy (SBRT)planning considerations for D12 vertebral metastases: Include target volume definition, dose constraints, and strategies to minimize cord toxicity while considering 3-5 fractions of SBRT.

10. What are the indications and modalities available for radiation therapy in extremity soft tissue sarcomas. Compare the outcomes of preoperative versus postoperative radiotherapy. Add a note on target volume considerations in the post op setting.

(10 marks × 10 = 100 marks)

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# MANIPAL ACADEMY OF HIGHER EDUCATION

## MD (RADIATION ONCOLOGY) DEGREE EXAMINATION – NOVEMBER 2025

## PAPER III

Wednesday, November 12, 2025

Time: 14:00 – 17:00 Hrs. Max. Marks: 100

✍ **Answer ALL questions.**

1. Indications and techniques of hyperthermic intraperitoneal chemotherapy.
2. Describe systemic therapies in breast cancer.
3. Describe the various oncological emergencies and their management.
4. Describe mechanism and applications of immunohistochemistry.
5. Describe the management approach for non muscle invasive high grade carcinoma in situ of bladder after maximal TURBT.
6. Discuss the indications of surgery in laryngeal cancer.
7. Describe the types and clinical applications of cancer vaccines.
8. Discuss the role of PET CT in radiation planning.
9. Describe the indications, mechanism of action, dose schedules and toxicity of capacetabine.
10. Define paraneoplastic syndromes, various types with their clinical features.

(10 marks × 10 = 100 marks)

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# MANIPAL ACADEMY OF HIGHER EDUCATION

## MD (RADIATION ONCOLOGY) DEGREE EXAMINATION – NOVEMBER 2025

## PAPER IV

Thursday, November 13, 2025

Time: 14:00 – 17:00 Hrs. Max. Marks: 100

✍ **Answer ALL the questions.**

1. Discuss the clinical significance, advantages and limitations of real-time adaptive radiotherapy platforms like the MR-Linac and Ethos.
2. Compare and contrast the role of tumor-agnostic therapies like pembrolizumab for MSI-H/dMMR tumors versus traditional histology-based approaches. What are the implications for future cancer treatment paradigms?
3. Discuss the emerging role of circulating tumor DNA (ctDNA) in monitoring treatment response and detecting minimal residual disease. How might this technology reshape follow-up protocols in clinical practice?
4. Evaluate the potential impact of CAR T-cell therapy in solid tumors, considering the current limitations and recent technological advances.
5. What is FLASH radiotherapy (RT)? Discuss the differential oxygen depletion mechanism in FLASH-RT. What technical challenges need to be addressed before its widespread clinical implementation?
6. Critically analyze the role of artificial intelligence in radiation oncology planning. How might this technology bridge the gap between expert and non-expert centers in resource-limited settings?
7. Discuss the Recent Advances in Brachytherapy using Radioactive Nanoparticles as an Alternative to Seed-Based Brachytherapy.
8. A phase III randomized controlled trial compared a new targeted therapy (Drug A) to standard chemotherapy in advanced non-small cell lung cancer. After a median follow-up of 24 months, the hazard ratio for overall survival was 0.65 (95% CI: 0.52-0.81, $p<0.001$). What is hazard ratio? How is it different from relative risk and overall survival? In this context kindly explain the interpretation of the value 0.65, Confidence Interval (CI) and p value. Add a note on the limitations of hazard ratio.

9. Design a Phase 3 randomized controlled trial comparing standard of care versus standard of care plus pembrolizumab in locally advanced head and neck squamous cell carcinoma. Specifically discuss your primary and key secondary endpoints, key stratification factors, sample size calculation assumptions and the major anticipated challenges in trial conduct.

10. What is the National Cancer Grid in India? How can this network be leveraged to improve standardization of cancer care and reduce disparities in treatment outcomes across different regions?

(10 marks × 10 = 100 marks)