

**M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION****SECOND YEAR****PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY****Q.P. Code: 284031****Time : Three Hours****Maximum : 100 marks****Answer ALL questions in the same order.****I. Elaborate on:****Pages Time Marks  
(Max.) (Max.) (Max.)**

- |                                                                                                                                                              |    |         |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---------|----|
| 1. Discuss about the HDR brachytherapy unit, applicator, facility design with model layout and significance of daily and periodic quality assurance program. | 17 | 40 min. | 20 |
| 2. Describe in detail about the treatment planning processes of three- dimensional conformal radiation therapy.                                              | 17 | 40 min. | 20 |

**II. Write notes on:**

- |                                                              |   |         |   |
|--------------------------------------------------------------|---|---------|---|
| 1. Types and procedures of prostate implants.                | 4 | 10 min. | 6 |
| 2. Inverse treatment planning processes.                     | 4 | 10 min. | 6 |
| 3. Total skin electron therapy.                              | 4 | 10 min. | 6 |
| 4. MLC based IMRT treatment techniques.                      | 4 | 10 min. | 6 |
| 5. X-knife and gamma knife.                                  | 4 | 10 min. | 6 |
| 6. Tomotherapy.                                              | 4 | 10 min. | 6 |
| 7. Plan optimization and evaluation.                         | 4 | 10 min. | 6 |
| 8. Ocular brachytherapy.                                     | 4 | 10 min. | 6 |
| 9. Different imaging modalities for treatment planning.      | 4 | 10 min. | 6 |
| 10. Intravascular brachytherapy and its radioactive sources. | 4 | 10 min. | 6 |

\*\*\*\*\*

[LC 0413]

APRIL 2013

Sub. Code: 4031

**M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION**

**SECOND YEAR**

**PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three Hours**

**Maximum : 100 marks**

**Answer ALL questions**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. Describe in detail about different techniques of IMRT dose delivery system and commissioning procedures of IMRT for clinical use.
2. Describe in detail about the stereotactic radiosurgery and stereotactic radiotherapy techniques, immobilization, dosimetry and quality assurance protocol.

**II. Write notes on:**

**(10 x 6 = 60)**

1. HDR pre and post treatment safety checks and emergency procedures.
2. Electron arc therapy and dosimetry.
3. Treatment planning of prostate radioactive seeds implantation.
4. Arterial anatomy, angioplasty and restenosis treatment techniques.
5. Treatment planning of 3DCRT.
6. Image guided radiotherapy.
7. Electronic brachytherapy.
8. Dose volume histogram.
9. Dose verification phantoms, dosimeters and protocol.
10. kV cone beam CT and MU cone beam CT.

\*\*\*\*\*

[LD 1013]

OCTOBER 2013

Sub. Code: 4031

**M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION**

**SECOND YEAR**

**PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three Hours**

**Maximum : 100 marks**

**Answer ALL questions**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. Discuss the various modalities of imaging in intensity modulated radiation therapy, MLC based treatment delivery, planning and verification processes and quality assurance protocols.
2. Describe HDR brachytherapy source calibration, treatment simulation, planning processes, dosimetry and quality assurance program.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Radioactive sources of prostate implants and compare merits and demerits.
2. Types of immobilization and its significance in radiotherapy.
3. Cyber knife therapy.
4. TBI treatment techniques.
5. Image segmentation and registration.
6. Treatment plan verification and delivery.
7. Intra operative radiotherapy.
8. Catheter based intra vascular brachytherapy.
9. Beta source ocular therapy.
10. Stereotactic body radiotherapy.

\*\*\*\*\*

[LE 0414]

APRIL 2014

Sub. Code:4031

**M.Sc (MEDICAL PHYSICS) - DEGREE EXAMINATION  
SECOND YEAR  
ADVANCED TECHNIQUES OF RADIOTHERAPY**

**Q.P. Code: 284031**

**Time: 3 hours**

**maximum: 100 marks**

**I. Elaborate on:**

**(2X20=40)**

1. Discuss about the HDR brachytherapy unit, applicator, facility design with model layout and significance of daily and periodic quality assurance program.
2. Describe in detail about the treatment planning processes of three-dimensional conformal radiation therapy.

**II. Write notes on:**

**(10X6=60)**

1. Types and procedures of prostate implants
2. Intravascular brachytherapy and its radioactive sources
3. Inverse treatment planning processes
4. Total skin electron therapy
5. MLC based IMRT treatment techniques
6. X-knife and gamma knife
7. Tomotherapy
8. Plan optimization and evaluation
9. Ocular brachytherapy
10. Different imaging modalities for treatment planning

\*\*\*\*\*

[LF 1014]

OCTOBER 2014

Sub. Code: 4031

**M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION**

**SECOND YEAR**

**PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three Hours**

**Maximum : 100 marks**

**Answer ALL questions**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. Compare the physical aspects of mMLC based X-Knife, Gamma knife and Cyber Cyber Knife based Treatment.
2. Compare the Physical aspects of HDR Brachy using Ir-192 and Co-60 as source and also it's room layout planning.

**II. Write notes on:**

**(10 x 6 = 60)**

1. Image Guided Radiotherapy (IGRT).
2. Four Dimensional CT (4DCT).
3. Image Segmentation and Registration.
4. Total Body Irradiation (TBI).
5. Ocular Brachytherapy.
6. Stereotactic Body Radiotherapy (SBRT).
7. MV Cone Beam CT (MVCT).
8. Step and Shoot verses Dynamic window Technique.
9. Dose Volume Histogram.
10. Intensity Modulated Arc Therapy (IMAT).

\*\*\*\*\*

[LH 0415]

OCTOBER 2015

Sub. Code: 4031

**M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION**  
**(Revised Regulations for Candidates admitted from 2010-2011 Batch onwards)**

**SECOND YEAR**

**PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code : 284031***

**Time: Three Hours**

**Maximum: 100 marks**

**Answer ALL questions**

**I. Elaborate on:**

**(2 x 20 = 40)**

1. Write the physical aspects of Stereotactic Radiosurgery (SRS).
2. Write the physical aspects of Image Guided Radiotherapy (IGRT).

**II. Write Notes on:**

**(10 x 6 = 60)**

1. Static and Dynamic Wedge Technique.
2. Cyber Knife planning.
3. Ocular Brachy Procedures.
4. Tomotherapy.
5. Prostate Implant Dosimetry Technique.
6. Patient Specific QA procedures in IMRT.
7. Dose Volume Histogram (DVH).
8. Radioactive Source selection in Brachytherapy.
9. Mammosite Treatment Technique.
10. Brachy source Calibration procedure.

\*\*\*\*\*

[LJ 1016]

OCTOBER 2016

Sub. Code: 4031

**M.Sc. MEDICAL PHYSICS EXAMS  
SECOND YEAR  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three hours**

**Maximum : 100 Marks**

**I. Elaborate on:** **(2 x 20 = 40)**

1. Explain in detail the total body Irradiation and total skin electron therapy techniques with suitable illustrations.
2. Compare the physical aspects of HDR brachytherapy using Ir-192 and Co-60 sources and draw their room layouts indicating typical wall thicknesses.

**II. Write notes on:** **(10 x 6 = 60)**

1. Image registrations and segmentations.
2. Dose Volume Histograms (DVHs).
3. Immobilization devices and their importance.
4. Target volume and treatment techniques in Intravascular brachytherapy.
5. Quality Assurance Tests for Stereotactic Radio surgery (SRS) and Stereotactic Body Radiotherapy (SBRT).
6. Cyber knife unit.
7. Image Guided Radiotherapy (IGRT).
8. Four Dimensional CT (4DCT).
9. Physical properties of different radioactive sources used in prostate implants.
10. Electronic brachytherapy.

\*\*\*\*\*

[LK 0517]

MAY 2017

Sub. Code: 4031

**M.Sc. MEDICAL PHYSICS EXAMS  
SECOND YEAR  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three hours**

**Maximum : 100 Marks**

**I. Elaborate on:** **(2 x 20 = 40)**

1. Write in detail about the machine and patient specific quality assurance procedures for Intensity Modulated Radiotherapy (IMRT).
2. Write in detail about the physical aspects of Image Guided Radiotherapy (IGRT).

**II. Write notes on:** **(10 x 6 = 60)**

1. Techniques in Total Skin Electron Therapy (TSET).
2. Compare and contrast X-Knife and Gamma knife.
3. Write in detail about the calibration of HDR source.
4. Write about Cyber Knife.
5. Discuss about the various types of applicators in HDR brachytherapy.
6. Four Dimensional CT (4DCT).
7. Write about immobilization and acquisition of image data for 3DCRT planning.
8. Temporary and Permanent prostate implants.
9. Write about the necessity of IVBT and discuss about the sources used for IVBT.
10. Write briefly about ocular brachytherapy.

\*\*\*\*\*

[LL 1017]

OCTOBER 2017

Sub. Code: 4031

**M.Sc. MEDICAL PHYSICS EXAMS  
SECOND YEAR  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three hours**

**Maximum : 100 Marks**

**I. Elaborate on:** **(2 x 20 = 40)**

1. Discuss in details about the step-by-step workflow, starting from patient imaging for Intensity Modulated Arc Therapy till treatment delivery.
2. Describe the HDR treatment unit with a schematic diagram, list the different sources used in various units, source calibration procedure and explain the treatment planning workflow.

**II. Write notes on:** **(10 x 6 = 60)**

1. Intra-operative radiotherapy.
2. X knife and Gamma Knife.
3. Different types of immobilization.
4. Image Guided Radiation Therapy.
5. Machine specific Quality Assurance for Intensity Modulated Radiation Therapy.
6. Cyber Knife radiotherapy.
7. Sources used for prostate implants.
8. Treatment techniques for intravascular brachytherapy.
9. Electronic brachytherapy.
10. Flowchart of treatment planning process in Three-Dimensional Computed Tomography.

\*\*\*\*\*

[LM 0518]

**MAY 2018**

**Sub. Code: 4031**

**M.Sc. MEDICAL PHYSICS EXAMS  
SECOND YEAR  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three hours**

**Maximum : 100 Marks**

**I. Elaborate on:** **(2 x 20 = 40)**

1. Stereotactic radio-surgery techniques and discuss in detail about the treatment planning process including immobilization, imaging, treatment plan generation and treatment delivery.
2. Explain in detail the various steps involved in 3DCRT.

**II. Write notes on:** **(10 x 6 = 60)**

1. Different imaging modalities for treatment planning.
2. Inverse treatment planning process.
3. Tomotherapy.
4. Cumulative and Differential Dose Volume Histograms.
5. Different techniques in Total Body Irradiation.
6. Image segmentation and registration.
7. Kilo-voltage cone beam computed tomography.
8. Step and shoot treatment delivery.
9. Intensity Modulated Arc Therapy.
10. Enhanced Dynamic Wedge.

\*\*\*\*\*

[LN 1018]

OCTOBER 2018

Sub. Code: 4031

**M.Sc. MEDICAL PHYSICS EXAMS  
SECOND YEAR  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three hours**

**Maximum : 100 Marks**

**I. Elaborate on:** **(2 x 20 = 40)**

1. What is the role of image guidance in radiation treatment delivery? Explain in detail the different techniques of delivering Image Guided Radiotherapy (IGRT).
2. Describe in detail the sources, the dose calculation formalism and the dose delivery systems used in Intravascular Brachytherapy.

**II. Write notes on:** **(10 x 6 = 60)**

1. Different techniques of Intensity Modulated Radiotherapy (IMRT) delivery.
2. Treatment planning and dosimetry of plaque-based Brachytherapy.
3. Components of the Three-dimensional Conformal Radiation Therapy (3DCRT) treatment chain.
4. Quality assurance for Stereotactic Radiosurgery (SRS).
5. Electronic Brachytherapy and its advantages over External Beam Radiotherapy and Conventional Brachytherapy.
6. Four-dimensional Computed Tomotherapy (4DCT) and its role in improving the accuracy of Radiotherapy delivery.
7. Different detectors and phantoms used for patient-specific quality assurance (QA) for Intensity Modulated Radiotherapy (IMRT).
8. Role of image registration and fusion in accurate image segmentation in Radiotherapy Treatment Planning.
9. Analytical Anisotropic Algorithm (AAA) and its advantages over Pencil Beam Convolution (PBC) in dose calculation.
10. Intra-operative radiotherapy and its advantages over conventional techniques in Radiotherapy.

\*\*\*\*\*

[LP 1019]

OCTOBER 2019

Sub. Code: 4031

**M.Sc. MEDICAL PHYSICS EXAMS  
SECOND YEAR  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time : Three hours**

**Maximum : 100 Marks**

**I. Elaborate on:** **(2 x 20 = 40)**

1. Describe the treatment planning process in three dimensional conformal radiotherapy treatments.
2. Describe in detail about the HDR Brachytherapy source strength measurement procedure using reentrant well-type chamber. Compare the physical aspects of single stepping Iridium-192 and Cobalt-60 sources used in HDR brachytherapy.

**II. Write notes on:** **(10 x 6 = 60)**

1. Forward and Inverse treatment planning processes.
2. Image guided radiotherapy (IGRT).
3. Total skin electron therapy (TSET).
4. Stereotactic radio-surgery using x-knife and gamma knife units.
5. Ocular brachytherapy.
6. Radioactive sources used for prostate implants.
7. Intravascular brachytherapy treatment techniques and the characteristics of beta-ray sources.
8. Tomotherapy.
9. Dose computation algorithms used in Treatment Planning Systems.
10. Intra-operative radiotherapy (IORT).

\*\*\*\*\*

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

**[AHS 0321]**

**MARCH 2021**

**Sub. Code: 4031**

**(OCTOBER 2020 EXAM SESSION)**

**M.Sc. MEDICAL PHYSICS**

**SECOND YEAR (From 2010-2011 onwards)**

**PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code : 284031***

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. Write in detail about the principles, techniques and of Intensity Modulated Radiotherapy (IMRT).
2. a) Write in detail about the calibration of source in HDR.  
b) Explain about the QA procedures for HDR in detail.

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Techniques used in TBI.
2. Dose Volume Histogram.
3. A prostate gland implant with I-125 seeds delivered an initial dose rate of 0.07 Gy/h to the prostate gland. What will be the dose delivered
  - a) After one month
  - b) After complete decay of the sources.
4. Electron arc therapy
5. Ocular brachytherapy
6. Four Dimensional CT (4DCT)
7. Temporary and Permanent prostate implants.
8. Write about any two radiation delivery systems in IVBT.
9. Write briefly about patient specific quality assurance
10. 3-D Conformal Radiotherapy (3DCRT)

\*\*\*\*\*

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

**[AHS 0122]**

**JANUARY 2022  
(OCTOBER 2021 EXAM SESSION)**

**Sub. Code: 4031**

**M.Sc. MEDICAL PHYSICS  
SECOND YEAR (From 2010-2011 onwards)  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY  
Q.P. Code : 284031**

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on: (2 x 20 = 40)**

1. Write in detail the various steps involved in 3- dimensional conformal radiotherapy.
2. Write in detail about the emergency conditions that can occur in HDR and write down the procedures to manage it.

**II. Write Short Notes on: (10x6 = 60)**

1. Techniques in TSET.
2. Various Immobilization devices for SRS patients.
3. Gamma Knife.
4. Ocular brachytherapy.
5. Various techniques for IMRT delivery.
6. QA procedures for IMRT.
7. Temporary and Permanent prostate implants.
8. Write about any two radiation delivery systems in IVBT.
9. Evaluation of treatment plans in SRS.
10. KV and MV cone beam CT.

\*\*\*\*\*

**THE TAMIL NADU M.G.R. MEDICAL UNIVERSITY**

**[AHS 1022]**

**OCTOBER 2022**

**Sub. Code: 4031**

**M.Sc. MEDICAL PHYSICS  
SECOND YEAR (From 2010 – 2011 & 2020-2021 onwards)  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P.Code : 284031***

**Time: Three hours    Answer ALL Question    Maximum: 100 Marks**

**I. Elaborate notes on: (2 x 20 = 40)**

1. Explain in detail about the source calibration and various QA procedures carried out in HDR Brachytherapy machine.
2. Write in detail the various steps involved in 3D Conformal Radiotherapy.

**II. Write Short Notes on: (10x6 = 60)**

1. Dose Volume Histograms.
2. Ocular Brachytherapy.
3. Gamma Knife.
4. Patient Specific QA in IMRT.
5. TSET.
6. Temporary and Permanent prostate implant.
7. Four Dimensional CT (4DCT).
8. Step and shoot Vs. Dynamic window Technique.
9. Cone beam CT.
10. Intravascular Brachytherapy.

\*\*\*\*\*

**THE TAMIL NADU M.G.R. MEDICAL UNIVERSITY**

**[AHS 1023]**

**OCTOBER 2023**

**Sub. Code: 4031**

**M.Sc. MEDICAL PHYSICS  
SECOND YEAR (From 2020–2021 onwards)  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P .Code: 284031***

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. Explain in detail physical and biological optimization in Intensity Modulated Radiation Therapy.
2. Explain in detail Electronic brachytherapy.

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Explain IEC requirements for HDR brachytherapy after loading systems.
2. TBI treatment techniques.
3. Compare X-knife and gamma knife.
4. 4D Cone Beam Computed Tomography.
5. Step and Shoot versus Dynamic IMRT Techniques.
6. Intraoperative External Beam therapy Versus Intraoperative HDR Brachytherapy.
7. Explain Single focus, Doubles focus and Double layer Multi leaf Collimators.
8. Image registration and fusion.
9. Volumetric Modulated Arc Therapy.
10. Patient Specific Quality Assurance.

\*\*\*\*\*

**THE TAMIL NADU M.G.R. MEDICAL UNIVERSITY**

**[AHS 1024]**

**OCTOBER 2024**

**Sub. Code: 4031**

**M.Sc. MEDICAL PHYSICS  
SECOND YEAR (From 2020–2021 onwards)  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. Explain in detail Tumour motion management in Radiotherapy.
2. Describe in detail about the HDR Brachytherapy source calibration procedure using well-type chamber. Compare the physical aspects of Iridium-192 and Cobalt-60 sources used in HDR brachytherapy.

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Model based dose calculation algorithms used in brachytherapy.
2. Total skin electron therapy.
3. Explain Single focus, Double focus and Double layer Multi leaf Collimators.
4. Radioactive sources used for prostate implants.
5. Explain IEC requirements for HDR brachytherapy after loading systems.
6. Advantages of Electronic Brachytherapy over Conventional Brachytherapy.
7. Gamma Index Analysis.
8. Image registration and fusion.
9. Quality Assurance in Volumetric Modulated Arc Therapy.
10. Intraoperative External Beam therapy Versus Intraoperative HDR Brachytherapy.

\*\*\*\*\*

**THE TAMIL NADU M.G.R. MEDICAL UNIVERSITY**

**[AHS 1025]**

**OCTOBER 2025**

**Sub. Code: 4031**

**M.Sc. MEDICAL PHYSICS  
SECOND YEAR (From 2020–2021 onwards)  
PAPER I – ADVANCED TECHNIQUES OF RADIOTHERAPY**

***Q.P. Code: 284031***

**Time: Three hours**

**Answer ALL Questions**

**Maximum: 100 Marks**

**I. Elaborate notes on:**

**(2 x 20 = 40)**

1. Discuss the various immobilization and localization devices used for Stereotactic Radiotherapy (SRT) and Radiosurgery (SRS). Also, compare and contrast the two treatment modalities.
2. Describe in detail the sources, the dose calculation formalism and the dose delivery systems used in Intravascular Brachytherapy.

**II. Write Short Notes on:**

**(10x6 = 60)**

1. Principle and physics of Tomotherapy.
2. Treatment planning and dosimetry of plaque-based Brachytherapy.
3. Different types of Dose Volume Histograms (DVH) and their applications in Treatment Planning.
4. Image registration and image fusion.
5. Analytical Anisotropic Algorithm (AAA) and its advantages over Pencil Beam Convolution (PBC) in dose calculation.
6. Kilovoltage Cone Beam Computed Tomotherapy (kV-CBCT) and its advantages over Megavoltage Cone Beam Computed Tomotherapy (MV-CBCT).
7. Electronic Brachytherapy and its advantages.
8. Total Skin Electron Therapy (TSET) and its applications.
9. Patient-specific quality assurance in Intensity Modulated Radiotherapy (IMRT).
10. The physical aspects of Total Body Irradiation (TBI).

\*\*\*\*\*