[LA 0512] **MAY 2012** **Sub. Code: 4017**

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

FIRST YEAR

(Revised Regulations for Candidates admitted from 2010-2011)

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code: 284017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions in the same order.

I. Elaborate on:	**Pages (Max.)**	**Time (Max.)**	**Marks (Max.)**
1. Explain the detail the design and working of a medical linear accelerator.	17	40 min.	20
2. Describe the acceptance, commissioning and quality assurance protocol for installing a remote after loading equipment.	17	40 min.	20
II. Write notes on:			
1. Drive the relationship between Tissue Maximum Radio and Percentage Depth Dose.	4	10 min.	6
2. How a integrated brachytherapy facility works. Give the sequence of procedures that is followed in such facilities.	4	10 min.	6
3. Describe the construction of travelling and standing wave guides.	4	10 min.	6
4. Describe the construction and working of a Van De Graff generator.	4	10 min.	6
5. A patient has to receive 250cGy by rotation therapy using 4 MV X-rays. The field size is 6x10 sq.cm. at the isocenter which is at 100cms. The average TMR is 0.756, Machine output is 200 MU/min, collimator scatter factor for the given field size is 0.98 and phantom scatter is 0.99. Find the number of monitoring units required to deliver the treatment.	4	10 min.	6
6. Explain the how the skin sparing effect is achieved by the high energy photon beams.	4	10 min.	6
7. Describe the dose and volume specification for reporting gynecological treatments using ICRU 38 protocol.	4	10 min.	6
8. Describe the setup for measuring the back scatter factor and peak scatter factor.	4	10 min.	6
9. Describe the dose volume histograms and conformity indices used for studying the merits of a treatment plan.	4	10 min.	6
10. Explain the Clarkson's method used for calculation the irregular treatment field.	4	10 min.	6

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[LB 1012] **OCTOBER 2012** **Sub. Code: 4017**

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

FIRST YEAR

(Revised Regulations for Candidates admitted from 2010-2011)

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code: 284017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions in the same order.

I. Elaborate on:	**Pages (Max.)**	**Time (Max.)**	**Marks (Max.)**
1. Describe the evaluation of Radiation therapy.	17	40 min.	20
2. Describe the physical significance of volume Delineation in dose specification.	17	40 min.	20
II. Write Notes on :			
1. Describe the Pin and Arc method.	4	10 min.	6
2. Describe the various shutter mechanisms.	4	10 min.	6
3. Describe the Van De Graff generators.	4	10 min.	6
4. Describe the relation between Tissue air ratio and percentage depth dose.	4	10 min.	6
5. Describe the Multi leaf Collimators.	4	10 min.	6
6. Describe the Clarkson techniques for irregular fields.	4	10 min.	6
7. Describe the general guidelines for patient positioning.	4	10 min.	6
8. Describe the beam flatteners and symmetry.	4	10 min.	6
9. Describe the conformal therapy.	4	10 min.	6
10. Describe the different tissue compensators.	4	10 min.	6

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[LC 0413] **APRIL 2013** **Sub. Code: 4017**

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

FIRST YEAR

(Revised Regulations for Candidates admitted from 2010-2011)

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code: 284017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions

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

1. Describe the output calibration of high energy teletherapy Unit on the basis of IAEA TRS 398 protocol.
2. Describe the various beam modifying and shaping devices And its clinical importances.

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

1. Describe the Virtual Simulations.
2. Describe the asymmetric collimations.
3. Describe the travelling and standing wave guide.
4. Describe the Field analyser.
5. Describe the Dynamic Wedges.
6. Explain the ICRU 50.
7. Describe the electron dosimetry.
8. Explain the neutron capture therapy.
9. Describe the significance of Percentage Depth dose and Tissue Maximum, ratio.
10. Describe the cyclotron.

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[LD 1013] **OCTOBER 2013** **Sub. Code: 4017**

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

FIRST YEAR

(Revised Regulations for Candidates admitted from 2010-2011 onwards)

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code: 284017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions

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

1. Describe the design and working of a Medical Electron linear accelerator.
2. Describe Low dose Rate (LDR), Medium Dose Rate (MDR), Pulsed Dose Rate (PDR) and High Dose Rate (HDR) in Brachytherapy. Compare HDR brachytherapy with LDR brachytherapy in detail. Describe the sources used in HDR and LDR remote after loading machines.

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

1. Describe a CT Simulator and explain Virtual Simulation.
2. Explain in detail the Treatment time calculation method and the factors used for calculating the treatment time calculation for a cobalt unit.
3. What are isodose curves and explain the methods of obtaining the same. Compare an open beam isodose curve with a 30_o wedge isodose curve for a 6 MV photon beam.
4. Explain beam directional devices and patient setup devices. Compare SSD and SAD treatment setups
5. What are the plan evaluation techniques? Explain them in detail with examples.
6. What is pseudo isocenter? What is planning isocenter and how are these used for patient setup?
7. How EPID is used for patient setup?
8. What is in-vivo dosimetry and how is it performed?
9. What is inverse planning? Write a note on Optimization in External beam therapy
10. Write a note on commissioning and quality assurance of a Treatment Planning system.

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[LF 1014] **OCTOBER 2014** **Sub. Code: 4017**

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

FIRST YEAR

(Revised Regulations for Candidates admitted from 2010-2011 onwards)

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code: 284017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions

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

1. Describe in detail about the brachytherapy techniques and dosimetry system.
2. Write about beam modifying and field shaping devices and explain their clinical application.

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

1. Klystron and magnetron.
2. Derive the relationship between TAR and PDD.
3. Application of EPID in radiotherapy.
4. Radiation field analyser.
5. Ideal characteristics of brachytherapy source.
6. Explain the uses of dose volume histogram.
7. Patterson and Parker dosimetry system.
8. Explain the necessity of shutter mechanism in telecobalt radiotherapy treatment unit.
9. Differentiate between SSD and SAD treatment technique.
10. Travelling wave guide.

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[LH 0415] **OCTOBER 2015** **Sub. Code: 4017**

M.Sc., MEDICAL PHYSICS DEGREE EXAMINATION
(Revised Regulations for Candidates admitted from 2010-2011 Batch onwards)
FIRST YEAR
PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

Time : Three hours **Maximum : 100 marks**

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

1. Explain the beam modifying and beam shaping devices used in radiotherapy.

2. Describe in detail about the daily, monthly and annual quality assurance tests for linear accelerator.

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

1. Multileaf collimator.
2. Klystron and Magnetron.
3. Surface dose and Build up region.
4. Radiation field analyzer.
5. Correction for contour irregularities.
6. General guidelines for patient setup.
7. Depth dose characteristics of electron beam.
8. RAKR and AKR.
9. Dose Volume Histograms.
10. ICRU 38.

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[LI 0416] APRIL 2016 **Sub. Code: 4017**

M.Sc., MEDICAL PHYSICS DEGREE EXAMINATION
FIRST YEAR
PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

Time : Three hours **Maximum : 100 Marks**

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

1. a) Describe the construction and working of Telecobalt unit.
   b) Describe the various shutter mechanisms.

2. Describe the characteristics of Electron Beam and explain the application of Electron Beams in Radiotherapy.

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

1. CT simulation.
2. Van De Graff generator.
3. Derive the relationship between TAR and PDD.
4. Compare and contrast physical and dynamic wedges.
5. Tissue in homogenity correction.
6. Volume delineation as per ICRU50.
7. Electronic portal imaging device.
8. Advantages and disadvantages of manual and remote after loading techniques.
9. Quality assurance tests for HDR Brachy Therpy.
10. Different algorithms used in treatment planning systems.

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[LJ 1016] OCTOBER 2016 **Sub. Code: 4017**

M.Sc. MEDICAL PHYSICS EXAMS
FIRST YEAR
PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

Time : Three hours **Maximum : 100 Marks**

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

1. Explain in detail the construction and working of the medical linear accelerator.
2. Explain the beam modifying and beam shaping devices used in radiotherapy.

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

1. Conventional simulator.
2. Advantage and disadvantages in manual and remote after loading techniques.
3. Phantom materials used in radiotherapy.
4. Define TAR and TMR and the factors influencing these quantities.
5. Tissue compensators.
6. ICRU 38.
7. Portal and invivo dosimetry.
8. Volume delineation as per ICRU 62.
9. Integrated Brachytherapy unit.
10. LDR, HDR, PDR.

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[LK 0517] MAY 2017 **Sub. Code: 4017**

M.Sc. MEDICAL PHYSICS EXAMS
FIRST YEAR
PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

Time : Three hours **Maximum : 100 Marks**

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

1. Construction and working of telecobalt unit and its source design.
2. Output calibration of high energy X-ray beam using IAEA TRS 398 protocol.

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

1. Beam directional devices.
2. Wave guides for wave acceleration.
3. Central axis dosimetry parameters- TAR, TMR and SAR.
4. Isodose curve and charts.
5. Comparison of SSD and SAD techniques.
6. Integral dose.
7. Any two methods of tissue Inhomogeneity correction.
8. Bragg peak.
9. Advantage of remote after loading system over manual after loading systems.
10. Dose volume histograms.

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[LL 1017] OCTOBER 2017 **Sub. Code: 4017**

M.Sc. MEDICAL PHYSICS EXAMS
FIRST YEAR
PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

Time : Three hours **Maximum : 100 Marks**

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

1. Describe the dose prescription and reporting parameters for intracavitary brachytherapy of carcinoma cervix as per ICRU 38 and give their relevance in modern brachytherapy.

2. Describe the acceptance, commissioning and quality assurance protocol of radiotherapy treatment planning system based on IAEA TRS 430 protocol.

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

1. Describe the major features of the Paris dosimetry system.
2. Describe the various quality assurance tests performed in a teletherapy unit.
3. Explain standing waveguide and travelling waveguide.
4. Describe the construction and working of a cyclotron.
5. Describe CT Simulator and Virtual Simulation.
6. Derive the relationship between percentage Depth Dose and Tissue Air Ratio.
7. Explain the depth dose characteristics of clinical electron beams with neat diagram.
8. Differentiate between SSD and SAD treatment technique.
9. Describe the method to determine the source strength of a brachytherapy source using well type ionization chamber.
10. Describe the different types of wedge filters.

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[LN 1018] OCTOBER 2018 **Sub. Code: 4017**

M.Sc. MEDICAL PHYSICS DEGREE EXAMS

FIRST YEAR

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

Time : Three hours **Maximum : 100 marks**

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

1. Output calibration of electron beams using IAEA TRS 398 protocol.

2. Acceptance, commissioning and quality assurance protocol for installing a remote after loading brachytherapy equipment.

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

1. Beam modifying and field shaping devices.
2. Klystron and Magnetron.
3. Relationship between Tissue Air Ratio and Percentage Depth Dose.
4. Isodose curves and charts.
5. Multileaf collimators.
6. Heavy ion therapy.
7. Electronic portal imaging device.
8. ICRU 38 and 58 protocols.
9. Monte Carlo based algorithms.
10. Ideal characteristics of brachytherapy source.

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[LP 1019] OCTOBER 2019 **Sub. Code: 4017**

M.Sc. MEDICAL PHYSICS DEGREE EXAMS

FIRST YEAR

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

Time : Three hours **Maximum : 100 marks**

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

1. Describe in detail, construction and working of the medical linear accelerator.
2. Describe in details about the brachytherapy technique and dosimetry system.

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

1. Pin-Are.
2. Merits of Linear Accelerator over Cobalt 60 teletherapy machine.
3. X-ray simulator.
4. Betatron.
5. Derive the relationship between TAR and PDD.
6. Dynamic wedge.
7. Clarkson technique for irregular field.
8. Explain the ICRU 50.
9. Describe general guideline for patient position.
10. Neutron capture theory.

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

[AHS 0321] MARCH 2021 Sub. Code: 4017

(OCTOBER 2020 EXAM SESSION)

M.Sc. MEDICAL PHYSICS

FIRST YEAR (From 2010-2011 onwards)

PAPER VII – PHYSICS OF RADIATION THERAPY

Q.P. Code : 284017

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

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

1. Write a detailed note on kilovoltage therapy and its various sub-categories. List the merits and demerits of each range.
2. Explain in detail the formalism to determine the reference air kerma rate (RAKR) for brachytherapy source calibration.

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

1. Explain the role of klystron. How is its function different from that of the magnetron?
2. Construction and working of a Pneumatic shutter system.
3. Merits and demerits of manual and remote afterloading techniques in brachytherapy.
4. Explain the principle and working of a simulator.
5. Give the role of dose calculation algorithms in RT and mention about the different types of algorithms used in treatment planning systems.
6. Quality assurance of a high dose rate (HDR) brachytherapy unit.
7. Multi-leaf collimators and their role in modern radiotherapy
8. Illustrate with diagram the principle, functioning and drawbacks of a travelling waveguide.
9. Explain how the XYZ co-ordinate system method is used for isocenter set-up.
10. What is the planning target volume (PTV)? Explain the factors contributing to PTV margin.

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

[AHS 0921] **SEPTEMBER 2021** **Sub. Code: 4017**
(MAY 2021 EXAM SESSION)

M.Sc. MEDICAL PHYSICS
FIRST YEAR (From 2010-2011 onwards)
PAPER VII – PHYSICS OF RADIATION THERAPY
Q.P. Code : 284017

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

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

1. What are the advantages of the proton beam over the photon beam? Describe the principle, construction and working of a Proton synchrotron with a neat schematic.
2. Describe in detail classification of brachytherapy based on application technique and highlight their clinical uses.

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

1. How does the magnetron work in a linear accelerator? List its limitations.
2. Construction and working of a Mercury shutter system.
3. List the ideal characteristics of a brachytherapy source.
4. Depth dose characteristics of a clinical electron beam.
5. Write briefly about the Pencil beam algorithm and list its advantages and disadvantages.
6. Manchester system for dose calculation in brachytherapy.
7. Explain the build-up region based on charged particle equilibrium.
8. Integrated brachytherapy unit.
9. Define tissue maximum ratio (TMR) and percentage depth dose (PDD) and derive the relationship between them.
10. Explain the role of the wedge filter and its different types.

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

[AHS 0222] **FEBRUARY 2022** **Sub. Code: 4017**
(OCTOBER 2021 EXAM SESSION)

M.Sc. MEDICAL PHYSICS
FIRST YEAR
(Candidates admitted from 2010-2011 onwards – Paper VII)
(Candidates admitted from 2020-2021 onwards – Paper VIII)
PAPER VII & VIII – PHYSICS OF RADIATION THERAPY
Q.P. Code : 284017

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

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

1. Describe the principle, construction and working of a Van De Graff generator and its role in megavoltage therapy. Also, highlight its advantages and disadvantages.
2. Explain in detail the role of a shutter system in a Telecobalt unit and describe the different types of shutter systems with neat diagrams and list their uses and limitations.

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

1. Selection of energy for patient treatment with electron beam therapy.
2. *In vivo* dosimetry and its applications in radiotherapy.
3. What is a dose volume histogram? How is used in the evaluation of treatment plans?
4. Classification of brachytherapy based on dose-rate.
5. Commissioning of a new treatment planning system in radiotherapy.
6. Explain Sievert integral method.
7. Principle and working of a betatron for radiotherapy.
8. Write about the concept of surface dose in photon beam therapy, its impact with beam energy and its clinical implications.
9. List the various radioisotopes used in brachytherapy and tabulate their physical characteristics such as energy, half-life, specific activity, and exposure rate constant.
10. How does a standing waveguide accelerate electrons in a linear accelerator? Emphasize its merits over the travelling waveguide.

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