

B.Sc. RADIOTHERAPY TECHNOLOGY

(New Syllabus 2014-2015)

THIRD YEAR

**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY AND RADIATION
SAFETY IN RADIOTHERAPY**

Q.P. Code: 801938

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on:

(3 x 10 = 30)

1. Discuss in detail about the acceptance test procedures of a HDR Brachytherapy remote after loader machine.
2. Discuss about the daily quality assurance procedures of a teletherapy equipment.
3. Discuss about TLD dosimeter and state the proper handling procedures of a TLD dosimeter.

II. Write notes on:

(8 x 5 = 40)

1. Test procedure to check the Jaw Symmetry.
2. How to measure and specify photon beam energy?
3. Acceptance testing procedures of a simulator.
4. Output calibration of a linear accelerator machine.
5. Emergency procedures during power failure in teletherapy treatments.
6. Effect of ionising radiation on cell.
7. Pocket Dosimeter.
8. Radiation survey meter.

III. Short answers on:

(10 x 3 = 30)

1. What is Monitor Units in Linear accelerator?
2. Write about film badge used in radiation personnel monitoring.
3. Define Isocenter.
4. Parameters to be checked on a treatment chart.
5. Auto radiograph test.
6. Radiation dose limits recommended by AERB for radiation workers.
7. Principles of radiation protection.
8. What is equivalent dose?
9. What is RBE?
10. What is LET?

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**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY AND
RADIATION SAFETY IN RADIOTHERAPY**

Q.P. Code: 801938

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on:

(3 x 10 = 30)

1. Discuss in detail about the acceptance test procedures of a Linear Accelerator machine installed in a radiotherapy department.
2. Discuss about Electronic Portal Imaging Device in modern era.
3. Discuss in detail about the acceptance test procedures of a simulator installed in a radiotherapy department.

II. Write notes on:

(8 x 5 = 40)

1. Congruence test procedure for Optical field and Radiation field.
2. Output calibration of a Linear accelerator.
3. Autoradiograph test for a Brachytherapy machine.
4. Specific QA tests to be done on Co-60 teletherapy machine.
5. Emergency procedures to be followed in brachytherapy.
6. Somatic effects and hereditary effects.
7. Film badge.
8. Pocket Dosimeter.

III. Short answers on:

(10 x 3 = 30)

1. Define Isocenter.
2. Define Percentage depth dose.
3. Define Monitor units.
4. Wedge transmission factor.
5. Optical Distance Indicator.
6. What is swipe test performed in brachytherapy?
7. Define MLC.
8. What is effective dose?
9. Define RBE.
10. Define LET.

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Q.P. Code: 801938

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on: (3 x 10 = 30)

1. Describe in detail about the mechanical and radiation quality assurance (QA) procedures of medical linear accelerator.
2. Explain the principle and working of TLD badge as a personnel monitoring device with a neat diagram.
3. (a) Define chromosomal aberration. Explain different types of chromosomal aberration.
(b) Describe stochastic and non-stochastic effects of radiation.

II. Write notes on: (8 x 5 = 40)

1. Relationship between linear energy transfer (LET) and oxygen enhancement ratio (OER).
2. Significance of time, distance and shielding in radiation safety.
3. Explain free air ionization chamber with neat diagram.
4. Classification of brachytherapy based on dose rates.
5. Direct and indirect effects of ionizing radiation.
6. Merits and demerits of film badge.
7. Responsibilities of radiation safety officer (RSO).
8. List the important quality assurance test to be performed weekly and monthly in a telecobalt unit.

III. Short answers on: (10 x 3 = 30)

1. Relative biological effectiveness (RBE).
2. LD_{50/60}.
3. Effective dose.
4. Fluence and its unit.
5. Somatic effect.
6. Annual effective dose limits of occupational worker and member of public as per ICRP and AERB.
7. Gamma zone monitor.
8. What is hyperthermia?
9. What are primary and secondary barriers?
10. What is swipe test?

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Q.P. Code: 801938

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on: (3 x 10 = 30)

1. a) Describe the various components of medical linear accelerator unit.
b) Describe in detail about the quality assurance (QA) of high dose rate brachytherapy unit.
2. Elaborate on various shutter mechanism used in telecobalt unit.
3. Elaborate on 5R's of Radiobiology and its significance in radiotherapy.

II. Write notes on: (8 x 5 = 40)

1. Describe stochastic effects.
2. Write any three chromosomal aberrations with neat diagram.
3. Radiation weighting factors of ionizing radiations.
4. Relationship between kerma and absorbed dose.
5. Describe the emergency procedures during "source stuck" in telecobalt unit.
6. Explain the factors involved in the shielding calculation of radiation facility.
7. Principle and working of thimble chamber.
8. Explain the significance of laser in patient setup and necessary QA.

III. Short answers on: (10 x 3 = 30)

1. What are the factors considered to reduce the radiation exposure to a radiation worker?
2. What is genetic effect?
3. Annual equivalent dose limit of eye lens and extremities for occupational worker as per ICRP.
4. Define isocentre.
5. Fluence rate and its unit.
6. Define Exposure and its unit.
7. Contamination monitor.
8. What is ALARA?
9. What are leakage and scattered radiations?
10. Use of a survey meters in radiotherapy.

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Q.P. Code: 801938

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on: (3 x 10 = 30)

1. Elaborate on the acceptance testing procedures of newly installed telecobalt unit.
2. a) Principles of radiation protection.
b) Annual limits of radiation exposure for occupational worker and member of public as per ICRP and AERB recommendations.
3. What are the responsibilities of licensee and radiation safety officer (RSO)?

II. Write notes on: (8 x 5 = 40)

1. What is linear energy transfer (LET)? List two examples of high LET radiation along with their values.
2. Construction and working principle of pocket dosimeter and its applications.
3. Define fluence rate and energy fluence rate with appropriate units.
4. Explain the working principle of film badge with neat diagram.
5. Explain any three important quality assurance (QA) tests of simulator unit.
6. Draw a neat labeled layout of high dose rate brachytherapy unit.
7. Describe the biological effects of radiation.
8. Explain the use of gamma zone monitors in a radiation facility.

III. Short answers on: (10 x 3 = 30)

1. 5R's of Radiobiology.
2. Electronic equilibrium.
3. Define quality assurance (QA).
4. Equivalent dose and its unit.
5. Define KERMA and its unit.
6. Ionization and excitation.
7. Optical and radiation field congruence test.
8. List three radiation emergencies in radiation facility.
9. What is dicentric chromosomal aberration?
10. What is oxygen enhancement ratio OER?

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Q.P. Code: 801938

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on: (3 x 10 = 30)

1. Describe in detail about the mechanical and radiation quality assurance procedure of medical linear accelerator.
2. a) Explain the various components of cobalt – 60 teletherapy machine.
b) Describe in detail about the quality assurance of HDR brachytherapy unit.
3. Explain in detail the 5 R's of radiobiology and its significance in radiotherapy.

II. Write notes on: (8 x 5 = 40)

1. Chromosomal aberrations with neat diagram.
2. Explain primary and secondary barriers and last man out switch.
3. Advantages and disadvantages of various detectors.
4. Acceptance testing of treatment planning system.
5. Explain shrinking field technique.
6. Define and elaborate the classification of harmful effects of radiation in human body.
7. Principle and working of thimble chamber.
8. Field congruence test in teletherapy units.

III. Short answers on: (10 x 3 = 30)

1. How will you find out the Timer Error in HDR brachytherapy system?
2. Define isocentre.
3. Define LET and RBE.
4. Write short notes on radiation symbol.
5. What are the instruments used in output measurement of telecobalt machine?
6. Define wedge transmission factor.
7. Mention three responsibilities of licensee.
8. Define maze.
9. What is ionization and excitation?
10. Define oxygen effect.

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

[LR 1220]

**DECEMBER 2020
(AUGUST 2020 EXAM SESSION)**

Sub. Code: 1938

**BACHELOR IN RADIOTHERAPY TECHNOLOGY
THIRD YEAR**

(New Syllabus 2014-2015)

**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION SAFETY
IN RADIOTHERAPY
Q.P. Code: 801938**

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on: (3 x 10 = 30)

1. a) Explain the various components of cobalt – 60 Teletherapy machine.
b) Describe in detail about the quality assurance of HDR Brachytherapy unit.
2. Discuss in detail about the radiation survey in the following Radiotherapy equipments with diagram.
a) Linear Accelerator b) Telecobalt c) HDR Brachytherapy.
3. a) Define chromosomal aberrations and its different types.
b) Describe the relationship between linear energy transfer LET and oxygen enhancement ratio OER.

II. Write notes on: (8 x 5 = 40)

1. Define stochastic effects.
2. Explain the Regularity requirement procedure in procurement of Brachytherapy source.
3. Output calibration of Linear accelerator.
4. Explain the significance of Laser in patient setup and necessary quality assurance.
5. Role of Radiotherapy technician in handling radiation emergencies.
6. Radiation weighting factors of ionizing radiation.
7. Time, dose, Fractionation relationship.
8. Relationship between Kerma and absorbed dose.

III. Short answers on: (10 x 3 = 30)

1. Front pointer and back pointer.
2. Beam ON-OFF mechanism.
3. RHM and RMM.
4. What are the steps to be taken if a radiation worker is said to be overexposed?
5. What are Free radicals?
6. Draw the flow chart diagram of TLD reader for dose estimation.
7. Explain swipe test.
8. Define Risk models.
9. What are the different types of meters used for radiation survey and Area monitoring?
10. Define Tenth Value Layer. What is the TVL values of concrete for cobalt -60 and Cs¹³⁷?

B.Sc. RADIOTHERAPY TECHNOLOGY
THIRD YEAR – (Regulations from 2014-2015 and 2018-2019)
PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION SAFETY
IN RADIOTHERAPY
Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Explain the four types of beam ON and OFF mechanisms used in Telecobalt unit.
2. Draw a neat layout diagram plan to install 15MV X ray Linear Accelerator unit. Explain the factors that determine the thickness of primary barrier.
3. Explain the direct and indirect biological effects of radiation and discuss the characteristics of oxygen effects during radiation therapy.

II. Write notes on:

(8 x 5 = 40)

1. Light field and radiation field congruence test.
2. Role of front pointer and back pointer in teletherapy unit.
3. Advantages and disadvantages of LDR and HDR brachytherapy.
4. Role of Time, Dose and Fractionation in radiation therapy.
5. Dose limits set by AERB & ICRP for radiation worker and general public.
6. ALARA concept.
7. Relationship between KERMA and absorbed dose.
8. Requirement of AERB in the procurement of teletherapy source.

III. Short answers on:

(10 x 3 = 30)

1. Beam quality index.
2. Laser alignment.
3. Asymmetric Jaws.
4. Pulsed Dose rate Brachytherapy.
5. Flux and fluence.
6. Thimble chamber.
7. Survey meter.
8. Multi Leaf Collimator.
9. Gamma Zone Monitor.
10. Tissue Weighting Factor.

B.Sc. RADIOTHERAPY TECHNOLOGY
THIRD YEAR – (Regulations from 2014-2015 & 2018-2019)
PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION SAFETY
IN RADIOTHERAPY
Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Discuss the different types of radiation detectors used in megavoltage beams with their advantages and disadvantages.
2. With neat diagram explain the principle of Film dosimeter and TLD. Explain the role of Film badge and TLD badge in personnel monitoring.
3. Discuss the mechanical and radiation Quality Assurance tests procedures for Linear Accelerator unit.

II. Write notes on:

(8 x 5 = 40)

1. Somatic effects and hereditary effects of radiation.
2. What is pulsed dose rate brachytherapy?
3. Role of pocket dosimeter and contamination dosimeter during radioactive source unloading procedures.
4. What is photodynamic therapy?
5. AERB.
6. Explain the relationship between LET and RBE.
7. Explain the acceptance tests of a CT simulator.
8. Explain the responsibility of employer in enforcing the regulatory requirement.

III. Short answers on:

(10 x 3 = 30)

1. Beam Flatness.
2. LD_{50/60}.
3. Radio Sensitizers.
4. High LET radiation.
5. Sievert and REM.
6. Phantoms.
7. eLORA.
8. Dose limits for general public.
9. Front Pointer.
10. Exposure.

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

[AHS 0423]

APRIL 2023

Sub. Code: 1938

B.Sc. RADIOTHERAPY TECHNOLOGY

THIRD YEAR – (Regulations 2014-2015 & 2018-2019 onwards)

**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION SAFETY
IN RADIOTHERAPY**

Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. a) Types of Chromosomal aberrations and their applications for the Biological Dosimetry.
b) Describe the relationship between Linear Energy Transfer (LET), Oxygen Enhancement Ratio (OER) and Relative Biological Effect (RBE).
2. Draw a neat room layout of a Linear Accelerator unit. Explain the different factors that are used for barrier thickness calculation.
3. Different QA tests performed in the Telecobalt unit.

II. Write notes on:

(8 x 5 = 40)

1. Light field and Radiation field congruence test.
2. Different types of beam ON and OFF mechanisms used in the Telecobalt unit.
3. Somatic effects and hereditary effects.
4. Time, Distance and Shielding in Radiation protection.
5. Dose limits set by AERB and ICRP for Radiation workers and the general public.
6. Relationship between KERMA and Absorbed dose.
7. Gas-filled and scintillation detectors.
8. Responsibilities of Radiation Safety Officer and Employer.

III. Short answers on:

(10 x 3 = 30)

1. ALARA concept.
2. LD50/60.
3. Beam shaping devices.
4. Acute and chronic exposure.
5. Direct and indirect effect of Radiation.
6. Conversion factor for Roentgen to rad.
7. Pocket dosimeter.
8. Safety and security of Radiation sources.
9. Gamma Zone Monitor.
10. Thimble Chamber.

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

[AHS 1123]

NOVEMBER 2023

Sub. Code: 1938

B.Sc. RADIOTHERAPY TECHNOLOGY

THIRD YEAR – (Regulations 2014-2015 & 2018-2019 onwards)

**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION
SAFETY IN RADIOTHERAPY**

Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on: (3 x 10 = 30)

1. Discuss in detail the various deterministic effects of ionising radiation on human being.
2. What are the permission and approvals need to be obtained from AERB during the installation and commissioning of Telecobalt unit from regulatory point of view?
3. Discuss the mechanical and radiation Quality Assurance tests procedures for Telecobalt unit.

II. Write notes on: (8 x 5 = 40)

1. ICRP recommendation on Radiation dose limits.
2. Explain the role of Gamma zone monitor for Telecobalt and Brachytherapy installations.
3. Narrate the steps to be taken by the Radiotherapy technologist during source struck up in Telecobalt unit.
4. Explain the factors influencing the thickness of secondary barrier.
5. Explain the theory of Gas filled detector.
6. Explain the working principle of Thermo Luminescence Dosimeter.
7. Explain the acceptance tests for Treatment planning system.
8. Explain the responsibility of Radiation Safety Officer in enforcing the regulatory requirement.

III. Short answers on: (10 x 3 = 30)

1. Type Approval of radiation generating equipment.
2. Free radicals.
3. Hyperthermia.
4. Tissue weighting factors.
5. Background radiation.
6. Pocket dosimeter.
7. Leakage radiation.
8. Air Kerma.
9. Radiation isocentre.
10. Chromosomal aberrations.

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

[AHS 0424]

APRIL 2024

Sub. Code: 1938

B.Sc. RADIOTHERAPY TECHNOLOGY

THIRD YEAR – (Regulations 2014-2015 & 2018-2019 onwards)

PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION

SAFETY IN RADIOTHERAPY

Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Direct and Indirect Biological effects of Radiation and the characteristics of Oxygen effects during Radiation Therapy.
2. a) Principles of Radiation protection.
b) Responsibilities of Licensee and Radiation Safety Officer (RSO).
3. Different QA tests performed in the Brachytherapy unit.

II. Write notes on:

(8 x 5 = 40)

1. Dose limits set by AERB and ICRP for Radiation workers and the General Public.
2. Optical and Field congruence test.
3. Primary and Secondary barriers and last man out switch.
4. Role of Time, Dose and Fractionation in Radiation therapy.
5. Relationship between KERMA and Absorbed dose.
6. Working principle of Thermoluminescence dosimeter with neat diagram.
7. Requirement of AERB in procurement of Teletherapy source.
8. Relationship between Linear Energy Transfer (LET), Oxygen Enhancement Ratio (OER) and Relative Biological Effect (RBE).

III. Short answers on:

(10 x 3 = 30)

1. Front and Back Pointer.
2. Free Radicals.
3. Beam shaping jaws.
4. Stochastic and Deterministic effect.
5. ALARA.
6. Thimble chamber.
7. Hyperthermia.
8. Leakage and Scattered Radiation.
9. Contamination monitor.
10. Equivalent and Effective dose.

B.Sc. RADIOTHERAPY TECHNOLOGY

THIRD YEAR – (Regulations 2014-2015 & 2018-2019 onwards)

**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION
SAFETY IN RADIOTHERAPY**

Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Discuss about TLD dosimeter and state the proper handling procedures of a TLD dosimeter.
2. a) Describe the various components of Medical linear accelerator unit.
b) Describe in detail about the Quality Assurance (QA) of high dose rate Brachytherapy unit.
3. Discuss in detail about the Radiation survey in the following Radiotherapy equipment with diagram.
a) Linear Accelerator b) Telecobalt C) HDR Brachytherapy.

II. Write notes on:

(8 x 5 = 40)

1. Time, dose, fractionation relationship.
2. Explain the significance of Laser in patient setup and necessary Quality Assurance.
3. Advantages and disadvantages of LDR and HDR brachytherapy.
4. Somatic effects and hereditary effects of Radiation.
5. Explain the relationship between LET and RBE.
6. Gas-filled and scintillation detectors.
7. Explain primary and leakage Radiation.
8. Dose limits for Radiation workers as per AERB code.

III. Short answers on:

(10 x 3 = 30)

1. Hyperthermia.
2. Shrinking Field Technique.
3. IAEA and WHO.
4. ALARA.
5. Density of concrete used for construction of Radiotherapy treatment rooms.
6. REM and Sv.
7. Lead bricks.
8. Internal hazard.
9. How do time, distance and shielding affect the control of Radiation?
10. Design of doors.

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

[AHS 0425]

APRIL 2025

Sub. Code: 1938

B.Sc. RADIOTHERAPY TECHNOLOGY

THIRD YEAR – (Regulations 2014-2015 & 2018-2019 onwards)

**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION
SAFETY IN RADIOTHERAPY**

Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on: (3 x 10 = 30)

1. Atomic Energy Regulatory Board (AERB) prescribed Dose limits for Radiation Workers, Occupational exposure to women and Dose limits to members of the public.
2. Emergency preparedness for a telecobalt unit.
3. Effects of Radiation on cells.

II. Write notes on: (8 x 5 = 40)

1. Natural background Radiation exposure.
2. Draw the layout of a linear accelerator and High Dose Rate (HDR) brachytherapy facility.
3. Pocket Dosimeter.
4. Survey meter and Gamma Zone monitor.
5. Define Dose, Equivalent Dose and Effective Dose.
6. Guidelines to use Thermoluminescent Dosimeter (TLD) Badge.
7. Principles of Radiation protection.
8. Manmade sources of radiation with four examples.

III. Short answers on: (10 x 3 = 30)

1. International Commission on Radiological Protection (ICRP).
2. Pain ladder.
3. T-rod.
4. Half-Value Thickness (HVT).
5. Design of doors.
6. Describe any one Radiation incident.
7. Radiation units.
8. LD 50/60.
9. Differences between primary and secondary barrier.
10. AERB recommendation regarding qualification of a Radiotherapy Technologist.

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

[AHS 1125]

NOVEMBER 2025

Sub. Code: 1938

B.Sc. RADIOTHERAPY TECHNOLOGY

THIRD YEAR – (Regulations 2014-2015 & 2018-2019 onwards)

**PAPER III – QUALITY ASSURANCE, RADIOBIOLOGY & RADIATION
SAFETY IN RADIOTHERAPY**

Q.P. Code: 801938

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. a) Technician role in Quality Assurance (QA) test on Telecobalt and Linear Acceleration.
b) Write about Beam Shaping Blocks.
2. Safety features in external beam therapy and brachytherapy.
3. Responsibilities of Radiotherapy technologies as per AERB safety code.

II. Write notes on:

(8 x 5 = 40)

1. Explain shrinking field technique.
2. Emergency procedures during power failure in teletherapy treatments.
3. Pocket dosimeter.
4. Surveymeter and Gamma Zonemonitor.
5. Congruence test procedure for Optical field and Radiation field.
6. Somatic effects and hereditary effects.
7. Principles of Radiation protection.
8. Classification of brachytherapy based on dose rates.

III. Short answers on:

(10 x 3 = 30)

1. Describe any one Radiation incident briefly.
2. Define Occupancy factor.
3. ALARA principles and its outcome.
4. Absorbed dose.
5. Radiation weighting factor for alpha, beta, gamma rays and heavy ions.
6. Qualification of a Radiotherapy Technologist.
7. Radiation units.
8. Pocket dosimeter.
9. Lead Bricks.
10. Monitor units in Linear Accelerator.
