

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION**SECOND YEAR****PAPER III – PHYSICS OF NUCLEAR MEDICINE & INTERNAL DOSIMETRY****Q.P. Code: 284033****Time : Three Hours****Maximum : 100 marks****Answer ALL questions in the same order.****I. Elaborate on:****Pages Time Marks
(Max.) (Max.) (Max.)**

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|--|----|---------|----|
| 1. What is two compartmental model? Describe two compartmental model with and without back transference. | 17 | 40 min. | 20 |
| 2. Write in detail about PET detector and scanner design. | 17 | 40 min. | 20 |

II. Write notes on:

- | | | | |
|---|---|---------|---|
| 1. Accelerator based radionuclides. | 4 | 10 min. | 6 |
| 2. Photonuclear activation. | 4 | 10 min. | 6 |
| 3. Life span of RBC. | 4 | 10 min. | 6 |
| 4. Pinhole collimator. | 4 | 10 min. | 6 |
| 5. Three dimensional imaging techniques. | 4 | 10 min. | 6 |
| 6. Single Photon Emission Computed Tomography. | 4 | 10 min. | 6 |
| 7. Working of medical cyclotron. | 4 | 10 min. | 6 |
| 8. Positron emitting radionuclides. | 4 | 10 min. | 6 |
| 9. Dose reciprocity theorem. | 4 | 10 min. | 6 |
| 10. Treatment of thyroid cancer with ^{131}I . | 4 | 10 min. | 6 |

[LC 0413]

APRIL 2013

Sub. Code: 4033

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

SECOND YEAR

PAPER III – PHYSICS OF NUCLEAR MEDICINE & INTERNAL DOSIMETRY

Q.P. Code: 284033

Time : Three Hours

Maximum : 100 marks

Answer ALL questions

I. Elaborate on:

(2 x 20 = 40)

1. Describe in detail about the construction and function of a gamma camera.
2. Discuss the principle of coincidence detection and explain the application of PET scan in medicine and advantage over gamma camera.

II. Write notes on:

(10 x 6 = 60)

1. Spatial resolution, Temporal resolution.
2. Medically useful radionuclide produced by cyclotron.
3. Pulse height analyzer.
4. Difference between static and dynamic gamma imaging.
5. Desirable properties required for gamma imaging radionuclide & radiopharmaceutical.
6. Function of collimator and types of collimator.
7. Define: Physical half-life, biological and effective half-life of a radionuclide and establish relationship between them.
8. Radiation safety procedures for personnel & patient during radionuclide administration.
9. Positron emission tomography.
10. Technetium generator.

[LD 1013]

OCTOBER 2013

Sub. Code: 4033

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

SECOND YEAR

PAPER III – PHYSICS OF NUCLEAR MEDICINE & INTERNAL DOSIMETRY

Q.P. Code: 284033

Time : Three Hours

Maximum : 100 marks

Answer ALL questions

I. Elaborate on:

(2 x 20 = 40)

1. Describe in detail about the three methods for producing nuclear medicine radionuclides.
2. Discuss about principles of operation of single photon emission tomography

II. Write notes on:

(10 x 6 = 60)

1. Internal dosimetry and discuss about MIRD method.
2. Contrast and resolution.
3. Coincidence detection.
4. Image reconstruction and image quality.
5. Attenuation correction and scatter correction.
6. Calculate the total energy production and energy of each photon during annihilation processes.
7. Dead time, field of view and field uniformity.
8. PET detector materials.
9. Radiation synovectomy and its isotopes.
10. Waste disposal methods used in nuclear medicine laboratory.

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

SECOND YEAR

PAPER III – PHYSICS OF NUCLEAR MEDICINE & INTERNAL DOSIMETRY

Q.P. Code: 284033

Time : Three Hours

Maximum : 100 marks

Answer ALL questions

I. Elaborate on:

(2 x 20 = 40)

1. Describe in detail about the planning and installation of medical cyclotron and PET/CT in nuclear medicine department.
2. Discuss in detail about the various methods of image reconstructions and image quality.

II. Write notes on:

(10 x 6 = 60)

1. Thyrotoxicosis.
2. Specific activity.
3. Emission computed tomography.
4. Measurement of life span of RBC.
5. Radio immune assay.
6. Rectilinear scanner.
7. Gamma camera.
8. Physical characteristics and decay scheme of radionuclide used in nuclear medicine.
9. MIRD technique of internal dosimetry.
10. The biological half-life of iodine in human thyroid is about 60 days and physical half-life of I-131 is 8 days. Calculate the effective half-life of I-131 in the thyroid.

[LF 1014]

OCTOBER 2014

Sub. Code: 4033

M.Sc. (MEDICAL PHYSICS) DEGREE EXAMINATION

SECOND YEAR

PAPER III – PHYSICS OF NUCLEAR MEDICINE & INTERNAL DOSIMETRY

Q.P. Code: 284033

Time : Three Hours

Maximum : 100 marks

Answer ALL questions

I. Elaborate on:

(2 x 20 = 40)

1. Various methods of production of radionuclides and their application.
2. a) Principle of working of PET.
b) Working of cyclotron.

II. Write notes on:

(10 x 6 = 60)

1. Renogram.
2. Principles of scintillation camera.
3. Thyroid uptake measurement.
4. Various collimators and briefly about pinhole collimator.
5. Sources of error in PET and methods of correction.
6. Principles of RIA and its applications.
7. Waste disposal methods in Nuclear Medicine.
8. Classical methods of dose evaluation.
9. Dose Reciprocity theorem.
10. Dosimetry of low energy electromagnetic radiation.

[LH 0415]

OCTOBER 2015

Sub. Code: 4033

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

SECOND YEAR

**PAPER III – PHYSICS OF NUCLEAR MEDICINE AND
INTERNAL DOSIMETRY**

Q.P. Code : 284033

Time: Three Hours

Maximum: 100 marks

Answer ALL questions

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

1. Describe in detail about various methods of waste management in nuclear medicine department.
2. What is internal dosimetry. Explain about various parameters of dose calculation?

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

1. Thyroid uptake measurement.
2. Scintillation camera.
3. Emission computed tomography.
4. Detector characteristics of PET scan.
5. Display system of nuclear medicine devices.
6. Patient image data acquisition.
7. Differentiate between converging and diverging collimator in clinical application.
8. Phosphorus-32 therapy in polycythemia rubra vera.
9. Attenuation and scatter correction.
10. Back projection method of image reconstruction.

[LJ 1016]

OCTOBER 2016

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS EXAMS
SECOND YEAR
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time : Three hours

Maximum : 100 Marks

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

1. Describe planning radiation safety regulatory requirements of AERB to install PET/CT scan.
2. What is internal dosimetry? Explain the methodology of beta particle dosimetry.

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

1. Derive the relationship between Physics Half-life and biological Half-life.
2. Explain about photonuclear activation.
3. Write about ideal characteristics of nuclear medicine isotopes.
4. Explain the Thyrotoxicosis.
5. Write about S factor.
6. Write a note on MIRD technique.
7. What is the necessity of delay tank?
8. Write about two compartmental model without back transference.
9. The prepared activity of iodine-131 for patient administration after time period lapse of three half-life is 12.5 MBq. Calculate what the original activity was?
10. Differentiate between spatial resolution, temporal resolution.

[LK 0517]

MAY 2017

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS EXAMS
SECOND YEAR
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time : Three hours

Maximum : 100 Marks

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

1. Describe in detail the basic principle, design and working of Gamma camera.
2. What is a compartmental model? Discuss about single compartmental model, two compartmental model without back transference.

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

1. Accelerator based radio nuclides.
2. Explain about the attenuation correction and scatter correction in gamma camera.
3. Explain about the thyroid uptake measurement.
4. Explain the principle of Annihilation co-incidence in PET.
5. Construction and working of Medical Cyclotron.
6. Discuss about any two reconstruction techniques used in nuclear medicine.
7. Write about S factor.
8. Explain about the palliative therapy using Phosphorus-32.
9. Limitations of MIRD techniques.
10. What is a radio pharmaceutical? List down its various applications.

[LL 1017]

OCTOBER 2017

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS EXAMS
SECOND YEAR
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time : Three hours

Maximum : 100 Marks

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

1. Describe in detail about the planning and shielding calculations of PET- CT installation.
2. Describe in detail the basic principle, design and working of Gamma camera.

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

1. Two dimensional data acquisition in PET.
2. Explain about the iterative reconstruction and their draw backs.
3. Construction and working of Medical Cyclotron.
4. What is emission computed tomography.
5. Limitations of MIRD Technique.
6. Radio-nuclides produced from the cyclotron and their applications.
7. Explain the term specific absorbed dose fraction and dose Reciprocity theorem.
8. Estimation of Life span of RBC.
9. Gamma ray dosimetry of Internal radioactive isotope.
10. Image display and recording systems used in Nuclear medicine.

[LM 0518]

MAY 2018

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS EXAMS
SECOND YEAR
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time : Three hours

Maximum : 100 Marks

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

1. Describe the working principle, data acquisition and data corrections in Positron Emission Tomography.
2. Discuss in detail about the cumulated activity, equilibrium absorbed dose constant and specific absorbed fraction used in MIRD Technique.

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

1. Radio nuclides produced from the nuclear reactor.
2. Principle of radionuclide generator.
3. Thyroid uptake measurements.
4. Radiation Synovectomy.
5. Waste disposal methods in Nuclear medicine.
6. Explain about Renogram.
7. Discuss about the beta dose calculation methods.
8. Basic principle and working of Rectilinear scanner.
9. Thyrotoxicosis.
10. Discuss about the different types of collimators used in nuclear medicine.

[LP 1019]

OCTOBER 2019

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS EXAMS
SECOND YEAR
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time : Three hours

Maximum : 100 Marks

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

1. PET- detector, design, construction, coincidence detection and applications.
2. Therapy room planning with delay tank and approval as per AERB.

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

1. Quality control of Radiopharmaceuticals.
2. Any diagnostic procedure in detail.
3. Convert Bq to Ci and vice versa for 100 Bq, 370Bq, 500Bq.
4. Pre & Post instructions to patients for I131 Radionuclide therapy.
5. RIA Procedure and Limitations.
6. Quality control procedure for Uniformity, Resolution & COR in Gamma Camera.
7. Protective clothing.
8. Various reconstruction techniques-advantages and disadvantages.
9. Rectilinear scanner.
10. Compartment model.

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

[AHS 0321]

MARCH 2021

Sub. Code: 4033

(OCTOBER 2020 EXAM SESSION)

M.Sc. MEDICAL PHYSICS

SECOND YEAR (From 2010-2011 onwards)

**PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code : 284033

Time: Three hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate notes on:

(2 x 20 = 40)

1. Describe the working principle of PET and reconstruction methods involved.
2. Quality Control of Radiopharmaceuticals for clinical use.

II. Write Short Notes on:

(10x6 = 60)

1. PET CT quality assurance tests.
2. Red cell survival studies in NM.
3. Types of collimators used in Gamma camera.
4. Scintillators and scintillation principles.
5. Decontamination of a radioactive spill.
6. Resolution recovery in SPECT.
7. Layout design recommended by AERB for a PET facility.
8. Bone scintigraphy.
9. Radiation Synovectomy.
10. Palliative therapeutic radiopharmaceuticals used in Nuclear medicine.

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

[AHS 0122]

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

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS
SECOND YEAR (From 2010-2011 onwards)
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL DOSIMETRY
Q.P. Code : 284033**

Time: Three hours

Answer ALL Questions

Maximum: 100 Marks

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

1. Describe the principle of SPECT CT and reconstruction methods.
2. Discuss in detail the MIRD technique to calculate specific absorbed fraction.

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

1. Precautions during Radioiodine(I^{131}) therapy.
2. Principle of radionuclide wet generator system.
3. Two Compartment models.
4. Rectilinear scanner and its principle.
5. Radioactive waste management in Nuclear medicine.
6. RIA and IRMA techniques.
7. Layout design recommended by AERB for a SPECT facility.
8. Attenuation Correction in PET.
9. Synthesis of ^{18}F FDG.
10. Thyroid Uptake study.

THE TAMIL NADU M.G.R. MEDICAL UNIVERSITY

[AHS 1023]

OCTOBER 2023

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS
SECOND YEAR (From 2020-2021 onwards)
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time: Three hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate notes on:

(2 x 20 = 40)

1. Write in detail about, construction and function of Gamma camera.
2. Discuss about principles and operation of single photon emission tomography.

II. Write Short Notes on:

(10x6 = 60)

1. What is internal dosimetry and discuss about beta particle dosimetry.
2. Write in detail about principle and design of Anger camera / Scintillation camera.
3. What are the limitation of detector systems and Electronics?
4. Explain scintillation detector and Photo multiplier tube.
5. Discuss various image reconstruction techniques.
6. Discuss in detail about principles of PET scan.
7. Explain construction and working of medical Cyclotron.
8. Mention different types Radio isotopes used in nuclear medicine and tabulate its half life.
9. Explain treatment of Thyrotoxicosis, thyroid cancer with I- 131.
10. Discuss about Renogram, life span of RBC, Blood volume studies.

THE TAMIL NADU M.G.R. MEDICAL UNIVERSITY

[AHS 1024]

OCTOBER 2024

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS
SECOND YEAR (From 2020-2021 onwards)
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time: Three hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate notes on:

(2 x 20 = 40)

1. Describe construction and working of PET scanners and discuss isotopes used in the scanner.
2. Design and evaluation of Radiopharmaceutical laboratories and Technetium-99m elution.

II. Write Short Notes on:

(10x6 = 60)

1. What are the ideal requirements of detector and its characteristics?
2. Explain in detail about Geiger Muller counter and application.
3. Application of Poisson's statistics and goodness fit test.
4. Methods of image reconstruction of whole body scan.
5. Discuss in detail about SPECT cameras in nuclear medicine.
6. Explain operational characteristics, spatial resolution, sensitivity, uniformity.
7. Differentiate PET and SPECT CT scanner systems.
8. Write in detail about liver spleen imaging techniques.
9. Discuss and tabulate functional brain imaging and bone mineral measurement.
10. What is standardization of gamma emitters with scintillation spectrometers?

THE TAMIL NADU M.G.R. MEDICAL UNIVERSITY

[AHS 1025]

OCTOBER 2025

Sub. Code: 4033

**M.Sc. MEDICAL PHYSICS
SECOND YEAR (From 2020–2021 onwards)
PAPER III – PHYSICS OF NUCLEAR MEDICINE AND INTERNAL
DOSIMETRY**

Q.P. Code: 284033

Time: Three hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate notes on:

(2 x 20 = 40)

1. Production of Radionuclides in Nuclear Medicine.
2. I-131 High Dose therapy treatment for Ca. Thyroid.

II. Write Short Notes on:

(10 x 6 = 60)

1. Rectilinear Scanner.
2. Radionuclide image and its developments.
3. Various Image Reconstruction Techniques.
4. Immuno Radiometric Assay.
5. Different compartment model of Internal Radiation Dosimetry.
6. Various Imaging Reconstruction Techniques.
7. PET Detectors.
8. Radiation Synovectomy.
9. Planning and shielding calculation of Installation of SPECT.
10. Waste Disposal Methods in Nuclear Medicine.
