

[LF 0212]

AUGUST 2014

Sub.Code :2122

**B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR
PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three hours

Maximum : 100 Marks

Answer All questions

I. Elaborate on:

(3x10=30)

1. Write about the choice of radiopharmaceutical for the clinical situation and the equipments in hand in your hospital.
2. Write in detail absorbed dose from any three diagnostic or therapeutic nuclear medicine procedures.
3. Explain biological effects of radiation.

II. Write notes on:

(8x5=40)

1. Explain background radiation.
2. Nuclear medicine and pregnant women.
3. Annual personnel dose limits for radiation workers as per AERB rules.
4. Define the terms; absorbed dose, equivalent dose, effective dose
5. How do you ensure the workplace is free of contamination?
6. The mechanism of cell killing.
7. Explain cell cycle.
8. Risk versus benefits of radiation in nuclear medicine.

III. Short answers on:

(10x3=30)

1. Stochastic effects.
2. Electromagnetic spectrum
3. Radioprotectors.
4. Difference between photons and charged particle interaction with matter.
5. Define LET. What is the LET for different types of radiation?
6. Lethal damage.
7. What is RBE? What is the RBE for different types of radiation?
8. Effects of radiation on embryo.
9. Structure of DNA.
10. Protective clothing.

[LH 0815]

AUGUST 2015

Sub. Code: 2122

B.Sc. NUCLEAR MEDICINE TECHNOLOGY

THIRD YEAR

**PAPER II – RADIATION BIOLOGY AND RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Maximum : 100 Marks

Answer All questions

I. Elaborate on:

(3 x 10 = 30)

1. Describe the effects of radiation on embryo.
2. Enumerate the maximum permissible levels of radiation to public and radiation workers (Whole body and organs).
3. Explain in detail the various personnel radiation monitoring devices for radiation workers.

II. Write notes on:

(8 x 5 = 40)

1. Principle of contamination clothing disposal in N.M.
2. Electromagnetic spectrum.
3. Define LET and mention the LET for various types of radiation.
4. Carcinogenesis due to radiation.
5. What is RBE and mention the same for various types of radiation?
6. LD50/60.
7. Define absorbed dose, equivalent dose and effective dose.
8. Mechanism of cell killing.

III. Short answers on:

(10 x 3 = 30)

1. Mediums of radiation detection.
2. Ionizing radiation.
3. Interaction of ionizing radiation with matter.
4. FDG storage container.
5. Properties of beta particles.
6. Examples of nonionizing radiation.
7. $I = I_0 e^{-\mu X}$.
8. Contraindications for high dose I131 therapy.
9. What is Radiation sickness?
10. Duration of fetal period.

**B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR
PAPER II – RADIATION BIOLOGY AND RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on:

(3 x 10 = 30)

1. Write in detail about Radiation risks.
2. Describe in detail the induction of radiation injury.
3. Explain in detail the various personnel radiation monitoring devices for radiation workers.

II. Write notes on:

(8 x 5 = 40)

1. Radiation protection for Occupational workers.
2. Contamination monitoring.
3. Radiation protection for Patients in nuclear medicine.
4. Thermo luminescence dosimeter (TLD).
5. Define the cell cycle and describe the cell cycle phases.
6. Calculation of absorbed dose.
7. Effects of Time, Distance and Shielding in Radiation protection.
8. Internal radiation hazard / Internal contamination.

III. Short answers on:

(10 x 3 = 30)

1. Effective Half life.
2. Radiation weighing factor.
3. Chromosome aberration.
4. External exposure.
5. Radiation sickness.
6. Occupational exposure.
7. Biological Half life.
8. Effective Dose.
9. Equivalent Dose.
10. Internal Radiation dosimetry.

**B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR
PAPER II – RADIATION BIOLOGY AND RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Maximum: 100 Marks

Answer all questions

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

1. Describe the AERB regulatory guidelines to set up a nuclear medicine facility with neat layout sketch.
2. Discuss the risk of radiation during different stages of pregnancy.
3. Describe the characteristics of stochastic and deterministic effects of ionizing radiation. Give an example for each effect.

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

1. Aim of Radiation Protection.
2. Environmental monitoring instruments.
3. Write short notes on early and late effects.
4. Worktop surfaces and Fume hood.
5. Discuss the risk of radiation induced malignancy.
6. Radiation monitors for safety survey.
7. ICRP 60 report recommendations.
8. Radiation induced chromosome damage.

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

1. Exposure.
2. Tissue weighting factor.
3. DAC and ALI.
4. Activity.
5. ALARA Principle.
6. Occupational exposure.
7. Biological Half life.
8. Internal exposure.
9. Equivalent Dose.
10. Genetic Mutation.

[LL 0817]

AUGUST 2017

Sub. Code: 2122

B.Sc. NUCLEAR MEDICINE TECHNOLOGY

THIRD YEAR

**PAPER II – RADIATION BIOLOGY AND RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on:

(3 x 10 = 30)

1. Write in detail about radiation risks.
2. Describe the effects of radiation on embryo.
3. Enumerate the maximum permissible levels of radiation to public and radiation workers.

II. Write notes on:

(8 x 5 = 40)

1. Contamination monitoring.
2. TLD.
3. Calculation of Effective Dose.
4. Radiation protection for occupational workers.
5. Internal radiation hazard / internal contamination.
6. Carcinogenesis due to radiation.
7. Define LET and mention the LET for various type of radiation.
8. LD50/60.

III. Short answers on:

(10 x 3 = 30)

1. Swipe sampling.
2. Mutation.
3. FDG storage container.
4. Radiation sickness.
5. Examples of nonionizing radiation.
6. HVT.
7. MIRD.
8. Beta particles properties.
9. Chromosomal aberration.
10. Stochastic effects.

B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR
PAPER II – RADIATION BIOLOGY AND RADIATION SAFETY IN
NUCLEAR MEDICINE

Q.P. Code: 802122

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on:

(3 x 10 = 30)

1. Write in detail about the absorbed dose from any three diagnostic of therapeutic Nuclear medicine procedures.
2. Write about the choice of radiopharmaceutical for the clinical situation and equipments in hand in your hospital.
3. Explain the biologic effects of radiation.

II. Write notes on:

(8 x 5 = 40)

1. Mechanism of cell killing.
2. Explain background radiation.
3. Nuclear medicine and pregnant woman.
4. Explain cell cycle.
5. Define the terms absorbed dose, equivalent dose and effective dose.
6. RBE and mention the same for various types of radiation.
7. Electromagnetic spectrum.
8. Principles of contamination clothing disposal in nuclear medicine.

III. Short answers on:

(10 x 3 = 30)

1. PET CT dosimetry.
2. Effects of radiation.
3. Radiation safety considerations in High dose I131 therapy.
4. Explain the misadministration of isotopes in Nuclear medicine
5. Permissible levels of I31 for burying, cremation and embalming.
6. HVL of lead for Tc99m, I131 and F18.
7. ALARA.
8. ALI.
9. Barrier nursing.
10. Hematopoietic syndrome.

B.Sc. NUCLEAR MEDICINE TECHNOLOGY

THIRD YEAR

**PAPER II – RADIATION BIOLOGY AND RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on:

(3 x 10 = 30)

1. Describe the various devices used for personnel radiation monitoring of radiation workers.
2. Explain the instruments used in Radiation Survey and Monitoring.
3. Describe the absorbed dose, equivalent dose and effective dose.

II. Write notes on:

(8 x 5 = 40)

1. Barriers of Gamma/X ray shielding.
2. Time, distance and shielding in radiation protection.
3. Annual personnel dose for radiation workers as per AERB rules.
4. Describe the cell cycle and explain the different phases.
5. Long term complications of I131 therapy.
6. Radiation protection for occupational workers.
7. Risk vs. benefits in nuclear medicine.
8. How do you ensure work place is free of contamination?

III. Short answers on:

(10 x 3 = 30)

1. Deterministic effects of radiation.
2. Explain the misadministration of isotopes in NM.
3. HVL of lead for Tc99m, I131 and F18.
4. TVT.
5. Gastro Intestinal Syndrome.
6. ALI.
7. Gamma Zone Monitor.
8. Radiation safety considerations in High dose I131 therapy.
9. Cerebrovascular Syndrome.
10. DAC.

[LO 0219]

FEBRUARY 2019

Sub. Code: 2122

**B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR
PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Maximum: 100 Marks

Answer all questions

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

1. Write in detail about Radiation risks.
2. Write in detail about the absorbed dose from any three diagnostic of therapeutic Nuclear medicine procedures.
3. Explain in detail the various personnel radiation monitoring devices for Radiation workers.

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

1. Nuclear medicine and pregnant women.
2. Annual personnel dose limits for radiation workers as per AERB rules.
3. Explain background radiation.
4. Explain cell cycle.
5. The mechanism of cell killing.
6. Define the terms; absorbed dose, equivalent dose, effective dose.
7. Define LET. What is the LET for different types of radiation?
8. What is RBE? What is the RBE for different types of radiation?

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

1. Fume hood.
2. Finger dose.
3. Misadministration.
4. TLD.
5. Radioactive spill.
6. Transport index.
7. Inverse square law.
8. Lethal damage.
9. Radio protectors.
10. Decontamination kit.

B.Sc. NUCLEAR MEDICINE TECHNOLOGY

THIRD YEAR

**PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN NUCLEAR
MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Maximum: 100 Marks

Answer all questions

I. Elaborate on:

(3 x 10 = 30)

1. Write about the choice of radiopharmaceutical for the clinical situation and equipments in hand in your hospital.
2. Describe the effects of radiation on embryo.
3. Enumerate the maximum permissible levels of radiation to public and workers handling radio active equipment (Whole body and organs).

II. Write notes on:

(8 x 5 = 40)

1. PET CT Dosimetry.
2. Protective clothing.
3. Principle of contamination clothing disposal in N.M.
4. LD50/60.
5. ALARA.
6. ALI.
7. Hematopoietic syndrome.
8. I=I₀e^{-μX}.

III. Short answers on:

(10 x 3 = 30)

1. Medium of radiation protection.
2. Working of pocket dosimeter.
3. Barrier nursing.
4. GM counter.
5. Late effects of radiation.
6. Duration of fetal period.
7. Cerebrovascular syndrome.
8. FDG storage containers.
9. Use of different filters in film badge.
10. Various instruments used in radiation monitoring.

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

[LR 1220]

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

Sub. Code: 2122

**BACHELOR IN NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR – (Regulation from 2010-2011)
PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN NUCLEAR MEDICINE
Q.P. Code: 802122**

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. A female occupation radiation worker declared that she is pregnant. As a Radiological Safety officer whether you will allow her to work in the department of nuclear medicine. If she is allowed work to what are the precaution to taken?
2. Role of Radiological Safety Officer (RSO) in a Nuclear Medicine department. Discuss his/her duties and responsibilities.
3. Define the Linear Energy Transfer (LET) function. Discuss the LET of alpha, beta and Gamma Radiations.

II. Write notes on:

(8 x 5 = 40)

1. What is the dose rate at 1.5 meter from a vial containing 500MBq of ^{18}F -FDG? How will you reduce the dose rate to one forth?
2. Discuss Annual dose limit for Occupational Medical Radiation worker as per Atomic Energy Regulatory Board.
3. Find Value of Attenuation Coefficient (μ) for Aluminum, if .45cm thickness of aluminum reduced the radiation level by 50%.
4. Contamination and Decontaminating procedures.
5. Tissue & Radiations Weighting factors.
6. Explain the effect of Ionizing Radiation in the Cell Cycle.
7. Radiation emergencies in Nuclear Medicine.
8. Define Half-life and Mean life. Derive the Relation between them.

III. Short answers on:

(10 x 3 = 30)

1. Stochastic effect of Radiation.
2. Mass Attenuation Coefficient.
3. Define Half Value Layer (HVL).
4. Convert 33MBq to micro-Curie.
5. Define DAC and ALI.
6. Specific Ionization Power.
7. Shielding materials used for X-ray and Gamma Radiation.
8. Radiation Sickness.
9. Pen type Dosimeter.
10. Medical Exposure.

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

[AHS 0122]

JANUARY 2022

Sub. Code: 2122

(FEBRUARY 2021 & AUGUST 2021 EXAM SESSION)

B.Sc. NUCLEAR MEDICINE TECHNOLOGY

THIRD YEAR – (Regulation from 2010-2011)

PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN NUCLEAR MEDICINE

Q.P. Code: 802122

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Describe the various principles of reducing the radiation exposure to the body from external sources.
2. A nuclear medicine technologist accidentally dropped a vial containing high dose Radioactive Iodine (^{131}I) on the floor, when he was about to administer it to a patient in Chennai. How should a Radiological Safety Officer handle this situation?
3. What are the common types of Ionizing Radiation commonly used in medical field – for diagnosis and for treatment purposes. Describe in detail about shielding from gamma radiation.

II. Write notes on:

(8 x 5 = 40)

1. Equivalent Dose.
2. Linear Energy Transfer.
3. Internal Contamination.
4. Transport Index and TREM Card.
5. Radiation effect on foetus.
6. TLD Monitors.
7. Genetic Effects of Radiation.
8. Methods of Waste Disposal in Nuclear Medicine.

III. Short answers on:

(10 x 3 = 30)

1. ALARA Principle.
2. Carrier Free Radionuclide.
3. AERB.
4. Natural Sources of Radiation.
5. Tissue Weighting Factor.
6. Exposure to General Public and dose limit.
7. Stochastic Effects of Radiation.
8. Lead Apron.
9. Name of the syndromes associated with Acute Radiation Sickness.
10. Effective Half Life.

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

[AHS 0922]

SEPTEMBER 2022

Sub. Code: 2122

(FEBRUARY 2022 & AUGUST 2022 EXAM SESSIONS)

B.Sc. NUCLEAR MEDICINE TECHNOLOGY

THIRD YEAR – (Regulation from 2010-2011)

**PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN NUCLEAR
MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Describe the design and construction of High Dose Radioiodine Therapy Wards.
2. Discuss about the Radiation Safety Equipment required for safety in Nuclear Medicine practice. Write in brief about ALARA principle.
3. How do we limit the exposure to open, unsealed radioisotopes used in Nuclear Medicine?

II. Write notes on:

(8 x 5 = 40)

1. Radioprotectors and Radiosensitizers.
2. Deterministic Effects of Radiation.
3. External Contamination.
4. Acute effects of ionizing radiation.
5. Free radicals and their role in radiation injuries.
6. Personal monitoring devices.
7. Genetic Effects of Radiation.
8. Natural Sources of Radiation.

III. Short answers on:

(10 x 3 = 30)

1. Role of Plastic cover on TLD Badge.
2. Equivalent Dose.
3. Types of Ionizing Radiation.
4. G.M. Counter.
5. ¹³¹Iodine Whole Body Scan.
6. Effective Dose Equivalent.
7. Deterministic Effects of Radiation.
8. Syringe Shield.
9. Acute Radiation Sickness Syndrome.
10. Nuclear Regulators of India.

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

[AHS 0424]

APRIL 2024

Sub. Code: 2122

B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR – (Regulations 2010-2011 & 2018-2019 onwards)
PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN
NUCLEAR MEDICINE
Q.P. Code: 802122

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

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

1. Enumerate the maximum permissible levels of Radiation to public and radiation workers.
2. Explain the Biologic effects of Radiation.
3. Write in detail about the absorbed dose from any three Diagnostic or Therapeutic Nuclear Medicine procedures.

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

1. ALARA.
2. Decontamination kit.
3. Transport index.
4. Acute radiation syndrome.
5. Surface contamination limits (monitored, lab and non-radioactive areas).
6. Cell survival curve.
7. HVL of lead for Tc99m, I 131 and F18.
8. Barriers of gamma X-ray shielding.

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

1. Properties of Beta particles.
2. Examples of nonionizing radiation.
3. Internal exposure.
4. Tissue weighting factor.
5. ICRP 60 report recommendations.
6. Radiation induced chromosome damage.
7. Effective Half-life.
8. Equivalent Dose.
9. Contraindications for high dose I 131 therapies.
10. Duration of fetal period.

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

[AHS 0125]

JANUARY 2025

Sub. Code: 2122

B.Sc. NUCLEAR MEDICINE TECHNOLOGY

THIRD YEAR – (Regulations 2010-2011 & 2018-2019 onwards)

**PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN
NUCLEAR MEDICINE**

Q.P. Code: 802122

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Describe the effects of Radiation on an Embryo.
2. Explain in detail the various personnel Radiation monitoring devices for Radiation workers.
3. Write in detail about Radiation Disaster Management among public.

II. Write notes on:

(8 x 5 = 40)

1. Receiving and monitoring of Radioactive packages.
2. Decontamination and maintenance of records in Nuclear Medicine.
3. Explain the Cell cycle and describe the cell cycle phase.
4. What is RBE? What is the RBE for different types of Radiation?
5. Gastrointestinal syndrome.
6. Finger dosimeter.
7. HVT of I131 in lead, brick and concrete.
8. How will you do swipe test?

III. Short answers on:

(10 x 3 = 30)

1. Barrier Nursing.
2. FDG storage containers.
3. Use of different filters in film badge.
4. Late effects of Radiation.
5. Radioactive spill.
6. MIRD method of Dose estimation.
7. Hematopoietic syndrome.
8. PET CT dosimetry.
9. Permissible levels of I31 for burying, cremation and embalming.
10. Stochastic effects.

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

[AHS 0425]

APRIL 2025

Sub. Code: 2122

**B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR – (Regulations 2010-2011 & 2018-2019 onwards)
PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN
NUCLEAR MEDICINE
Q.P. Code: 802122**

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Explain the instruments used in Radiation Survey and Monitoring.
2. Layout of planning of Nuclear Medicine facility.
3. Define Linear Energy Transfer (LET) function. Discuss the LET of alpha, beta and Gamma Radiations.

II. Write notes on:

(8 x 5 = 40)

1. Gamma zone monitor.
2. Explain the misadministration of isotopes in Nuclear medicine.
3. Radiation safety considerations in High dose I131 therapy.
4. Cerebrovascular Syndrome.
5. Pen type dosimeter.
6. e-Licensing of Radiation Applications (eLORA).
7. Interaction of ionizing radiation with matter.
8. Convert 33MBq to micro-Curie.

III. Short answers on:

(10 x 3 = 30)

1. Shielding agents for Alpha, Beta and Gamma Rays.
2. Liquid scintillation counter.
3. Protective clothing.
4. Lethal damage.
5. Radio protectors.
6. Stochastic effects.
7. Chromosome aberration
8. Genetic Mutation.
9. Nuclear medicine and pregnant woman.
10. Medium of radiation protection.

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

[AHS 1125]

NOVEMBER 2025

Sub. Code: 2122

B.Sc. NUCLEAR MEDICINE TECHNOLOGY
THIRD YEAR – (Regulations 2010-2011, 2016-2017 & 2018-2019 onwards)
PAPER II – RADIATION BIOLOGY & RADIATION SAFETY IN
NUCLEAR MEDICINE
Q.P. Code: 802122

Time: Three Hours

Answer ALL Questions

Maximum: 100 Marks

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

1. Write about Radioactive waste & its disposal. Explain about the decontamination procedures in Nuclear Medicine.
2. Draw a layout design for Nuclear Medicine Laboratory with PET facility and explain about shielding requirements.
3. Explain Biological effects of radiation and induction of radiation injury.

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

1. Radiation Accidents and medical management.
2. Normal and abnormal human exposure to radiation.
3. Risk vs benefits in Nuclear Medicine.
4. Administration of diagnostic and therapeutic radiopharmaceuticals.
5. Effects of radiation on embryo.
6. Explain the mechanism of cell killing.
7. Radiation weighting factor for different types of radiation as per ICRP 103.
8. Explain about the aim and principle of Radiation Protection.

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

1. Responsibility of nuclear technologist to implement basic safety standard.
2. Transport index.
3. Effective Dose.
4. Lead apron.
5. Cerebrovascular Syndrome.
6. Dose limits for occupational radiation worker as per AERB (Atomic Energy Regulatory Board) rule.
7. Define DAC and ALI.
8. Decontamination of an injection table.
9. Gamma Zone Monitor.
10. Barrier Nursing.
