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## MANIPAL UNIVERSITY

SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER I: RADIO PHARMACY – II

Monday, June 02, 2014

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

**Answer ALL the questions.**

**1. Write in short about the following:**

- 1A. Fate of  $^{99m}\text{Tc}$  –DTPA in kidney
- 1B. Design Concept of Central Radiopharmacy
- 1C. Preparation  $^{99m}\text{Tc}$ - Sulphur Colloid
- 1D. Advantages of Cold Kits for Radiopharmaceuticals

(5 marks  $\times$  4 = 20 marks)

**Answer the following questions.**

2. Write desired criteria for theragnostic radio pharmaceuticals.
3. Describe in brief the preparation protocol of any one C-11 labeled tracer used for PET imaging.
4. Write relationship between GMP and ISO with reference to Radiopharmaceuticals.
5. Write method of Molybdenum break through detection in  $^{99m}\text{Tc}$  eluate.

(5 marks  $\times$  4 = 20 marks)

**Answer the following questions.**

6. What is the Fate of  $^{18}\text{F}$ (Fluorine-18) administered intravenously in humans ?
7. What is Lyophilization? Why it is required for the manufacturing of Cold Kits suitable for radiolabelling.
8. Describe the principle of Chromatography and their types. What are the limitations of miniature chromatography?
9. Draw typical layout plan of hospital radio pharmacy lab. Make a list of items required to setup the hospital Radiopharmacy lab.

(10 marks  $\times$  4 = 40 marks)



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## MANIPAL UNIVERSITY

SECOND YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER II: NUCLEAR MEDICINE INSTRUMENTATION – II

Wednesday, June 04, 2014

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions.**

✍ **Draw neat and labeled diagram as and when required.**

1. What are dose calibrators? Explain the QC measures adopted to ensure the good working condition of a dose calibrator.

(20 marks)

2. “Collimator is an integral device of the imaging unit- gamma camera.” Opine on this statement. How are collimators manufactured? Only list but in detail give the classification of collimators.

(20 marks)

3. Explain on filters and the role of filters in Nuclear Medicine.

(10 marks)

4. Do a comparison on the various detectors used in PET system and as per your comparison state which is the best.

(10 marks)

5. **Write short notes on the following:**

5A. Pocket dosimeter

5B. Simple Backprojection

5C. NECR

5D. PMT

(5 marks × 4 = 20 marks)



**MANIPAL UNIVERSITY**  
**SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014**  
**SUBJECT: PAPER III: NON IMAGING NUCLEAR MEDICINE TECHNIQUES**

Friday, June 06, 2014

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

**Answer ALL the questions.**

**1. Write in detail on followings:**

- 1A. Tracers in RIA and IRMA – Need, desirable characteristics and suitable Radio iodination method.
- 1B. Radioisotope Dilution Principles, Methods and clinical applications.
- 1C. Bacterial metabolism study - Radiotracers characteristics, Methods and Applications.
- 1D. Plasma Iron absorption Study – radiolabel characteristics, methods and applications.
- 1E. Procedure for NAA and its applications.

(10 marks × 5 = 50 marks)

- 2A. Explain the precautions to be taken in preparing a sample that has to be assayed in LSC.
- 2B. List the quench correction techniques adopted in LSC. Explain on Internal standard method with its merit and demerits.

(5+10 = 15 marks)

3. Briefly explain about the errors in RIA experiments and also explain how to find the Pipetting error.

(5+5 = 10 marks)

4. Write the PET tracer by compartmental way.

(5 marks)



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## MANIPAL UNIVERSITY

SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER IV: IMAGING NUCLEAR MEDICINE TECHNIQUES

Monday, June 09, 2014

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

**Answer all questions.**

1. A patient is referred to the department of Nuclear Medicine with elevated PTH levels suspected of having primary hyperparathyroidism. Explain the procedure protocol & the different methods to perform the study?  
(20 marks)
2. Explain in detail the different radiopharmaceuticals, the procedure protocol & interpretation for infarct avid imaging.  
(20 marks)
3. Explain the different mechanisms of localization of infection imaging agents.  
(20 marks)
4. **Write short notes on:**
  - 4A. Procedure for  $^{131}\text{I}$  thyroid uptake study
  - 4B. Spleen Scintigraphy using radiolabelled denatured RBCs
  - 4C. DMSA(III) Scan
  - 4D. Gall bladder ejection fraction

(5 marks  $\times$  4 = 20 marks)





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## MANIPAL UNIVERSITY

SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER V: THERAPEUTIC NUCLEAR MEDICINE PROCEDURES

Wednesday, June 11, 2014

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

☞ Answer ALL the question.

☞ Long questions:

1. Discuss with diagram the layout of Category 4 nuclear medicine lab.
2. A patient has undergone total thyroidectomy for Papillary carcinoma thyroid and referred to Nuclear Medicine department for  $^{131}\text{I}$  whole body scan and neck uptake? How will you prepare the patient? Discuss the protocol for the same.
3. Discuss the various radionuclides used in radiation synovectomy?

(20 marks  $\times$  3 = 60 marks)

4. Short notes:

- 4A. Ideal characteristics of a therapeutic radionuclide
- 4B. Radionuclide therapy for recurrent malignant ascitis
- 4C. Gamma area monitor
- 4D. Patient preparation for  $^{131}\text{I}$  MIBG therapy

(5 marks  $\times$  4 = 20 marks)



**MANIPAL UNIVERSITY****SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014****SUBJECT: PAPER VI: RADIATION BIOLOGY AND RADIATION PROTECTION**

Friday, June 13, 2014

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

- ✍ **Answer ALL the questions.**
- ✍ **Students are instructed to answer Section – A and Section – B on the separate answer paper.**

**SECTION – A: RADIATION BIOLOGY (30 MARKS)****1. Short Notes:**

- 1A. Radiation effects on Embryo
- 1B. Role of Bremsstrahlung Radiation in Biological effects
- 1C. Law of Bergonie and Tribondeau
- 1D. Somatic Effects of radiation
- 1E. Radiation Hydrolysis of Water

(6 marks × 5 = 30 marks)

**SECTION – B: RADIATION PROTECTION ( 50 MARKS)**

✍ **Answer the following:**

2. Define Effective dose and DAC.
3. Write briefly about the regulatory clearances required for the nuclear medicine practice.

(5 marks × 2 = 10 marks)

✍ **Answer the following.**

- 4A. Write in detail about beta ray dosimetry.
- 4B. Approximately 1 mCi of  $\text{Na}_2^{35}\text{SO}_4$  is given orally to a man. About 0.5% of the activity is absorbed into the blood, and 50% of the absorbed activity is rapidly concentrated in the testes. What are the instantaneous dose rate, the dose delivered over the first week, and the total dose delivered to the testes? The mass of the testes is 40 g in the standard man and for  $^{35}\text{S}$ , only locally absorbed radiation is emitted, with an average energy of 0.049 MeV per disintegration.

(12+8 = 20 marks)

5. Describe the operation of different personnel monitoring device with their advantages and disadvantages.

(20 marks)



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**MANIPAL UNIVERSITY**  
**SECOND YEAR B.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2014**  
**SUBJECT: RADIATION CHEMISTRY AND RADIATION PHYSICS**

Wednesday, June 18, 2014

Time: 10:00-13:00 Hrs.

Max. Marks: 80

✍ **Answer Section – ‘A’ and Section – ‘B’ In Two Separate Answer Books.**

**SECTION – A : RADIATION CHEMISTRY : 30 MARKS**

✍ **Answer ALL the questions.**

1. **Write notes on following:**

- 1A. Rutherford's atomic model
- 1B. Isotopes, isobars, isotones
- 1C. PH- Scale and measurement
- 1D. Reversible and irreversible chemical reaction

(5 marks × 4 = 20 marks)

2. Define Bronsted Strong acid and strong base with examples. What are the limitations of Bronsted theory of acid-base?

(10 marks)

**SECTION – B : RADIATION PHYSICS : 50 MARKS**

✍ **Answer all the questions. Draw neat and labeled diagram as and when required.**

3. Explain on the various atomic models.

(10 marks)

4. "The radionuclides used in modern Nuclear Medicine all are of manufactured variety." Opine on this statement with proofs.

(10 marks)

5. What does radioactive decay mean? Discuss decay by alpha and electron capture.

(2+4+4 = 10 marks)

6. A  $^{99}\text{Mo}$ - $^{99\text{m}}\text{Tc}$  generator calibrated for 5<sup>th</sup> Wednesday with 0.5Ci ( $^{99}\text{Mo}$ ) at 10 hours was received in the Nuclear Medicine department on 4<sup>th</sup> Tuesday at 6 hours. Calculate the yield that can be obtained on 4<sup>th</sup>, 5<sup>th</sup>, 10<sup>th</sup> and 15<sup>th</sup> at 8 hours.

(5 marks)

7. **Write short note on the following:**

- 7A. Photoelectric effect
- 7B. GM counter
- 7C. Semiconductor detector

(5 marks × 3 = 15 marks)

