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MANIPAL UNIVERSITY

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

SUBJECT: PAPER I: RADIO PHARMACY – II

Wednesday, December 17, 2014

Time: 10:00 – 13:00 Hrs. Max. Marks: 80

✍ **Answer ALL the questions.**

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

1A. Chemisorption mode of localization

1B. Biological behavior of sodium pertechnetate in human body

1C. Radionuclide purity Test

1D. Factors affecting stability of Cold Kits for Radiopharmaceuticals

(5 marks × 4 = 20 marks)

✍ **Answer the following questions.**

2. Write briefly about the importance of the different constituents present in the 99mTc-cold kits.
3. Write down the preparation protocol of FDG synthesis used for brain PET imaging.
4. Write about role of Hospital radio pharmacy and Central radio pharmacy lab (No details).
5. What is the difference between quality control and quality assurance with respect to radiopharmaceuticals?

(5 marks × 4 = 20 marks)

✍ **Answer the following questions.**

6. What are the ideal characteristics of ^{18}F (Fluorine-18) has for PET Imaging?
7. Define Lyophilization process. What are the main components present in the lyophilizer? How it works and how it is useful in cold kit production.
8. Describe the method of performing Thin Layer Chromatography (TLC) used to check the quality of Radiopharmaceuticals. How miniature chromatography method is useful for hospital radio pharmacy?
9. Describe about the Automatic synthesis modules. Enlist characteristics of few commercially available Automatic Synthesis modules.

(10 marks × 4 = 40 marks)

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

SUBJECT: PAPER II: NUCLEAR MEDICINE INSTRUMENTATION – II

Thursday, December 18, 2014

Time: 10:00 – 13:00 Hrs. Max. Marks: 80

Answer ALL the questions.

1. List the different gas based radiation detectors used in our department. Among them which can be used for activity determination? Justify your answer

(3+7 = 10 marks)

2A. What determines collimator sensitivity and resolution in Gamma Camera? Explain with diagrams and relevant equations.

2B. What are the current developments in the scintillation detectors using for gamma detection.

(5+5 = 10 marks)

3. **Write short notes on ANY TWO from the following:**

3A. SPECT-CT Hybrid camera

3B. Criteria for selection of gamma camera

3C. Filtered Back projection technique

(5+5 = 10 marks)

4. Describe the instrumentation of PET scanner along with diagram.

(10 marks)

5. Write about the various attenuation correction methods used in SPECT.

(10 marks)

6. What are the different performance parameters of PET? Explain any three

(4+6 = 10 marks)

7. Explain the following with diagram:

7A. Sinogram

7B. Block detector design in PET

(5+5 = 10 marks)

8A. What is recovery coefficient and where it is used?

8B. What is scatter and how does it affect the image in SPECT? What are the different methods used for scatter correction?

(5+5 = 10 marks)

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

SUBJECT: PAPER III: NON IMAGING NUCLEAR MEDICINE TECHNIQUES

Friday, December 19, 2014

Time: 10:00 – 13:00 Hrs. Max. Marks: 80

Answer ALL the questions.

1. **Write short notes on the following:**
   i) Carbon 14 breath analysis.
   ii) Factors affecting radiometric detection of bacterial metabolism.
   (10 marks)

2. Compare and contrast between RIA and IRMA. Discuss about the problems in IRMA.
   (10 marks)

3. Write about the different plots in RIA with its advantages and disadvantages.
   (10 marks)

4. A patient has been admitted in the emergency department with a history of road traffic accident and severe blood loss. How will you estimate the:
   i) Total blood volume of the patient
   ii) Do in vivo cross matching of blood
   (10 marks)

5A. Briefly explain about the application of counting statistics in Nuclear medicine.
5B. Explain propagation of error formula with sums and difference multiplication and division.
(5+5 = 10 marks)

6A. Write the application of radiotracer kinetics in nuclear medicine with simple example in ERPF estimation.
6B. Explain plasma sampling in single compartment model.
(5+5 = 10 marks)

7. In brief explain the working principle of Liquid Scintillation counters.
   (10 marks)

8. i) As a Nuclear Medicine Technologist what are the features to be considered for an ideal intraoperative gamma probe?
   ii) Write short note on iso response curve of a flat field collimator.
   (10 marks)

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

SUBJECT: PAPER IV: IMAGING NUCLEAR MEDICINE TECHNIQUES

Saturday, December 20, 2014

Time: 10:00 – 13:00 Hrs. Max. Marks: 80

Answer ALL the questions.

1. A 65 year old woman complains of back pain because of a injury two weeks ago. Radiographs of the pelvis, hips demonstrate only degenerative changes in lumbar spine. Discuss the procedure protocol you will adopt for the evaluation of back pain.

(20 marks)

2. A patient is referred to the department of Nuclear Medicine after chemotherapy for assessing the left ventricular function. Write down the procedure protocol for the same.

(20 marks)

3. A patient with acute scrotal pain is referred to the department of Nuclear Medicine to rule out testicular torsion. Describe in detail the procedure protocol for the study.

(20 marks)

4. Write short notes on:

4A. Perchlorate discharge test

4B. Mechanism of localization of ^{123}I- mIBG

4C. ^{99m}Tc-sulphur colloid

4D. ^{133}Xe cerebral blood flow study

(5 marks × 4 = 20 marks)

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

SUBJECT: PAPER V: THERAPEUTIC NUCLEAR MEDICINE PROCEDURES

Monday, December 22, 2014

Time: 10:00 – 13:00 Hrs. Max. Marks: 80

✍ **Answer ALL the question.**

✍ **Long answer questions:**

1. A female patient suffering from painful skeletal metastases has been referred for palliation of the pain with radionuclide therapy:

1A. Enumerate the ideal characteristics of a radionuclide to be used.

1B. Properties of 89 Sr Chloride and 153 Samarium EDTMP.

1C. Patient preparation.

(5+10+5 = 20 marks)

2. A patient of follicular carcinoma thyroid underwent I-131 scan six weeks post-total thyroidectomy. The scan did not show any residual thyroid tissue and the neck count was similar to background. Discuss the reasons. Suggest and discuss an alternative radionuclide scan to detect the residual tissue.

(20 marks)

3. What is ALARA? How do you achieve it?

(20 marks)

4. **Write short notes on:**

4A. 169-Er

4B. HVT and TVT

4C. Survey monitor

4D. Ideal Characteristics of radioisotope for radiosynovectomy

(5 marks × 4 = 20 marks)

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

SUBJECT: PAPER VI: RADIATION BIOLOGY AND RADIATION PROTECTION

Tuesday, December 23, 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)

Answer all questions

1. **Short notes on:**

1A. Human fetal irradiation
1B. Threshold Dose and Non Threshold Dose (NTD) effects of Radiation
1C. Acute Radiation Syndrome (ARS)
1D. Lethal effects due to Radiation Dose
1E. Radiation Sickness

(6 marks × 5 = 30 marks)

SECTION – B: RADIATION PROTECTION (50 MARKS)

Answer the following.

2A. Write a short note on TREMCARD
2B. Briefly explain the term Effective Dose Equivalent indicating the role of Weighing Factors.

(5 marks × 2 = 10 marks)

Answer the following.

3A. Describe the procedure monitoring contamination and decontamination.
3B. What are the basic guidelines for disposal of radioactive waste? Explain with an example.

(10 marks × 2 = 20 marks)

4. Write down safety precaution to be taken in I-131 ablation therapy.

(20 marks)