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MANIPAL UNIVERSITY

SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2012

SUBJECT: PAPER I: RADIO PHARMACY – II

Monday, May 28, 2012

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

Answer ALL Questions.

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

1A. Radiochemical Purity check of Cold kits

1B. Function of hospital radiopharmacy

1C. Enzymatic method of iodination

1D. N-13 Ammonia synthesis

(5×4 = 20 marks)

2A. Enlist the names of non-kit based radiopharmaceuticals used in Nuclear Medicine (no details).

2B. Enlist the various Commercial Automatic Synthesis modules for preparation of F-18 labelled radiotracers (No details).

2C. State how to handle PET radiotracers safely with examples.

2D. Describe in brief about lyophiliser and points to be consider during lyophilisation process.

(5×4 = 20 marks)

3A. What are the quality control checks to be done in hospital radiopharmacy practices and how?

3B. Describe various mechanism of localization of radiopharmaceuticals in different organs. Support the answers with suitable examples.

3C. Describe the direct and indirect methods of ^{99m}Tc labelling to antibodies.

3D. Write about desired and undesired drug interactions with radiopharmaceuticals.

(10× 4 = 40 marks)

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SECOND YEAR M.Sc. N.M.T. DEGREE EXAMINATION – MAY/JUNE 2012

SUBJECT: PAPER II: NUCLEAR MEDICINE INSTRUMENTATION – II

Wednesday, May 30, 2012

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

Answer ALL the questions.

1. Write in detail about Pulse Height Analyzer.

(10 marks)

2. **Justify the following statements:**

2A. "Septal thickness is a criteria in the design and performance characteristics of parallel hole collimators".

2B. "One way to reduce the effects of tissue attenuation in SPECT study is conjugate counting".

(5+5 = 10 marks)

3. Write in detail about the design of detectors in PET.

(10 marks)

4. Explain about dead time.

(10 marks)

5. What is direct Fourier Transform reconstruction?

(10 marks)

6A. Normalization is an important requirement in PET scanners. Justify.

6B. What are the different types of events in PET and how they affect the data?

(4+6 = 10 marks)

7. **Write short notes on any TWO:**

7A. Pocket dosimeter

7B. Volume sensitivity in SPECT system

7C. Time of flight in PET

(10 marks)

8. What are the different Phantoms you have in your department and what are they used for? Explain the test associated with any of the two phantoms with procedure.

(3+7 = 10 marks)

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SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2012

SUBJECT: PAPER III: NON IMAGING NUCLEAR MEDICINE TECHNIQUES

Friday, June 01, 2012

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

Answer ALL the questions. Each question carries TEN marks.

1. Why the patient is not placed as close to the detector face for the thyroid uptake study? Explain with the help of diagram/s.

2A. Explain propagation of error formula with sums and difference, multiplication and division.

2B. Explain comparing counting system statistically.

3. **Write short notes on:**

3A. Automated Radiometric Detection System (labelled diagram)

3B. Clinical application of Radiometric System

4A. Write the assumption for GFR calculation.

4B. Write the application of radiotracer kinetics in nuclear medicine with simple example in ERPF estimation.

5. A female patient is suffering from suspected H Pylori infestation. By a non- invasive procedure how will you confirm the presence of H Pylori in the patient's stomach?

6. What is Quenching in liquid scintillation counting? Explain any one Quench correction method.

7. Write in detail about the quality control of RIA.

8. Write about the various separation systems used in RIA.

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SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2012

SUBJECT: PAPER IV: IMAGING NUCLEAR MEDICINE TECHNIQUES

Monday, June 11, 2012

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

✍ **Answer ALL the questions.**

✍ **Long Questions:**

1. A 30 years old lactating female patient has been referred to rule out Right PUJ obstruction. Discuss the patient preparation, the imaging protocol, image processing and renogram patterns.

2. A 10 years old boy with a suspicion of acute osteomyelitis of the middle third of the left femur has been referred to for a three phase bone scan. Write about the:

2A. Pharmaceutical preparation

2B. Dose

2C. Patient preparation pre and post injection

2D. Acquisition protocol

2E. Interpretation of the study

3. Describe the procedure protocol for LVEF estimation.

(20×3 = 60 marks)

4. **Write short notes on:**

4A. Perchlorate discharge test

4B. Adrenal Cortex Scintigraphy

4C. Gastric Emptying acquisition protocol

4D. Patient preparation for I-131 MIBG Scan

(5×4 = 20 marks)

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SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2012

SUBJECT: PAPER V: THERAPEUTIC NUCLEAR MEDICINE PROCEDURES

Wednesday, June 13, 2012

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

✍ **Answer ALL the questions.**

✍ **Long Questions:**

1. Planning and design of isolation ward for therapeutic nuclear medicine (for high dose 131I).

2. Enumerate the different radionuclides used for palliation of painful bone metastasis. What are the advantages and disadvantages of each radionuclide?

3. Enumerate the radioisotopes used for treating patients suffering from recurrent malignant ascitis. Describe the procedure protocol of such therapy.

(20×3 = 60 marks)

4. **Write short notes on:**

4A. Radionuclide treatment for polycythemia vera

4B. 131 I MIBG therapy patient preparation

4C. Radioimmunotherapy

4D. Radiation detectors used in 131-I therapy

(5×4 = 20 marks)

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SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2012

SUBJECT: PAPER VI: RADIATION BIOLOGY AND RADIATION PROTECTION

Friday, June 15, 2012

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

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

SECTION A: RADIATION BIOLOGY (30 MARKS)

1. **Write short notes on:**

1A. Law of Bergonie and Tribondeau

1B. Stages of Acute Radiation Syndromes

1C. Concept of LD50/30

1D. Deterministic effects Vs Stochastic effects

1E. Compton effect

(6×5 = 30 marks)

SECTION B: RADIATION PROTECTION (50 MARKS)

2A. Define absorbed dose, equivalent dose, and effective dose.

2B. What is meant by a package? Write short note on Type A and Type B package.

(5×2 = 10 marks)

3A. Write down the safety precautions to be taken in I – 131 ablation therapy.

3B. Write in detail about absorbed fraction method of internal dosimetry.

(20×2 = 40 marks)

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SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2012

SUBJECT: PAPER I: RADIO PHARMACY – II

Monday, December 17, 2012

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

✍ **Answer ALL Questions.**

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

1A. Radioactive Fume Hood Vs Laminar Air Flow Bench

1B. Centralised radiopharmacy

1C. HPLC

1D. F-18 Fluoride radiotracers

(5×4 = 20 marks)

2A. Enlist the physical characteristics of positron emitting radionuclides produced by cyclotrons suitable for PET imaging. (no details).

2B. Describe investigational new drugs in Nuclear Medicine.

2C. Write the method for checking the Molybdenum and Aluminium present in the ^{99m} Tc eluate.

2D. Why automatic synthesis modules are required in radiochemistry lab? (no details).

(5×4 = 20 marks)

3A. How are PET radiopharmaceuticals different from ^{99m}Tc Radiopharmaceuticals? Explain the importance of reducing agents, antioxidants and stabilizers in cold kits of ^{99m}Tc Radiopharmaceuticals.

3B. What is the principle of radio iodination and write about any two methods of iodination technique.

3C. Describe mechanism of localization of radiopharmaceuticals in different organs.

3D. Describe the methods of pyrogen testing and biodistribution study as quality control parameters for checking the cold kits.

(10×4 = 40 marks)

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SECOND YEAR M.Sc. N.M.T. DEGREE EXAMINATION – DECEMBER 2012

SUBJECT: PAPER II: NUCLEAR MEDICINE INSTRUMENTATION – II

Tuesday, December 18, 2012

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

Answer ALL the questions.

1. **Write short notes on any TWO:**

1A. Paralysable and non paralysable system

1B. List mode vs Frame mode

1C. Cathode Ray Tube

1D. Static vs Dynamic imaging

(5+5 = 10 marks)

2. How does PMT convert light into electrical signal? What are the recent developments in the Photomultiplier tubes for developing multimodality imaging?

(4+6 = 10 marks)

3. What is direct Fourier Transform reconstruction?

(10 marks)

4. What are different events in Annihilation coincidence detection? What are the corrective measures taken for the same?

(6+4 = 10 marks)

5. Write in detail about the design of detectors in PET.

(10 marks)

6. What is the basic principle for the working of a SURVEY meter? How do you differentiate between beta contamination and gamma contamination using a Contamination monitor? Justify and suggest which will be the best instrument to be used as survey meter.

(3+7 = 10 marks)

7. What are the different quality control tests for the Dose calibrator? Explain any three.

(4+6 = 10 marks)

8. What are the different instruments in general you can find in a PET facility? Write about the Radiation Protection measures to be taken in a PET LAB.

(5+5 = 10 marks)

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SECOND YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2012

SUBJECT: PAPER III: NON IMAGING NUCLEAR MEDICINE TECHNIQUES

Wednesday, December 19, 2012

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

Answer ALL the questions. Each question carries TEN marks.

1. A male patient suffering from Iron deficiency anemia has been referred to the department of Nuclear Medicine for a ferrokinetic study. Write in details the patient preparation and the procedure protocol for
   i) Plasma iron clearance
   ii) Iron utilisation

2. Write short notes on the following:

2A. Carbon 14 breath analysis

2B. Factors affecting radiometric detection of bacterial metabolism

3A. A sample is counted in a well counter using a "narrow" pulse height analyzer window (N) and net sample and background counts are 500 counts and 200 counts respectively. The sample is counted with the name system but using a 'wide' window (W) and the net sample and background counts are 800 counts and 400 counts respectively. Which window setting offers the statistical advantage?

3B. What is the specific requirements consideration in radiotracer kinetics?

4. In brief explain the working principle of Liquid Scintillation counters.

5A. As a Nuclear Medicine Technologist what are the features to be considered for an ideal intraoperative gamma probe?

5B. Write short note on iso response curve of a flat field collimator.

6A. Write the assumption for GFR Calculation.

6B. Explain the bi-exponential curve in measuring plasma concentration by administered DTPA.

7. Compare and contrast between RIA and IRMA. Discuss about the problems in IRMA.

8. Write about the different plots in RIA with its advantages and disadvantages.