MANIPAL ACADEMY OF HIGHER EDUCATION
(Deemed University)

SECOND YEAR B.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2005

SUBJECT: FUNDAMENTALS OF ELECTRONICS AND NUCLEAR MEDICINE INSTRUMENTATION
Tuesday, June 14, 2005

Time: 3 Hrs.   Max. Marks: 80

✍ ANSWER SECTION – A AND SECTION – B IN TWO SEPARATE ANSWER BOOKS.
✍ Answer all questions.

SECTION – A : FUNDAMENTALS OF ELECTRONICS : 30 MARKS

1. Derive an equation for the equivalent resistance of parallel combination of three resistances.

2. Write short notes on: a) PN junction   b) Transistors.

3. Explain photo multiplier tubes with neat diagram.

4. Compare conductors, semiconductors and insulators.

5. Explain how an op-amp can be used for the following application with circuit diagram and expression.

5A. Inverting amplifier

5B. Differentiator

6. Convert:

   a) $(56.87)_{10}$ to binary   b) $(1001.01)_2$ to decimal   c) $(56.85)_{10}$ to octal

                                                              $(5 \times 6 = 30$ marks$)$

SECTION – B: NUCLEAR MEDICINE INSTRUMENTATION: 50 MARKS

7A. What are the advantages of Gamma Camera over Rectilinear scanner?

7B. Write on the importance of collimators of a Gamma Camera.

                                                              (20 marks)

8. What are the Quality Control parameters of a scintillation camera?

                                                              (20 marks)

9. Answer for any *two*:

9A. Intrinsic and Extrinsic Uniformity.

9B. Semiconductor Detectors.

9C. Single Channel Analyzer.

                                                              $(2 \times 5 = 10$ marks$)$

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SECOND YEAR B.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2005

SUBJECT: RADIATION CHEMISTRY AND RADIATION PHYSICS
Wednesday, June 15, 2005

Time: 3 Hrs.   Max. Marks: 80

✍ Answer Section – 'A' & Section – 'B' In Two Separate Answer Books.

SECTION – A : RADIATION CHEMISTRY : 30 MARKS

1.   Answer any *SIX*:

1A. Solvents

1B. Covalent Bonds

1C. Colloids

1D. Chelating Compounds

1E. Noble Gases

1F. Brownian Movement

1G. Oxidation Reduction Reactions

(5×6 = 30 marks)

SECTION – B : RADIATION PHYSICS : 50 MARKS

2.   Answer any *TWO*:

2A   Define half-life, mean life and specific activity.

2B. Discuss the mechanism of photoelectric effect. Does this process increase or decrease with increasing energy of the gamma ray and with increasing atomic number of the absorber.

2C. How do neutrons interact with matter? Explain.

(5×2 = 10 marks)

3.   Answer the following:

3A. Describe the different methods of production of radionuclides in brief. Which method gives relatively more proton rich and neutron rich radionuclides.

(20 marks)

3B. i)   Describe the principle and operation of ionization chamber based detectors.

ii)   A patient is orally given a 10 µCi I – 131 capsules. Before administering, the count rate of the capsule in a thyroid phantom is 297000 cpm. The 24 hr count rate of patient's thyroid is 168000 cpm. If the room background is 200 cpm and the patient's thigh count is 1000 cpm, calculate the thyroid uptake.

(15+5 = 20 marks)

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SECOND YEAR B.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2005

SUBJECT: RADIOPHARMACY

Thursday, June 16, 2005

Time: 3 Hrs.   Max. Marks: 80

✍   **Answer all questions. Draw diagrams and flow charts wherever appropriate.**

1.   What are the basic properties of an ideal generator? Explain the different secondary sources of radionuclide production that you know.

(20 marks)

2.   Which were the earlier Bone imaging agents? Explain the various 99mTc Bone agents and mention the advantages of the latter over the earlier agents.

(20 marks)

3.   Compare and contrast between the 99mTc and 201T1 myocardial perfusion agents. Add a note on the chemistry of each radionuclide.

(20 marks)

4.   Write short notes on any **FOUR**:

4A.   Biological Quality control tests

4B.   Transchelation

4C.   Radioactive spillage

4D.   Indium radiopharmaceuticals

4E.   Blood pool labeling

(5×4 = 20 marks)