MANIPAL UNIVERSITY

SECOND YEAR B.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2010

SUBJECT: FUNDAMENTALS OF ELECTRONICS AND NUCLEAR MEDICINE INSTRUMENTATION

Monday, June 07, 2010

Time: 14:00-17:00 Hrs.   Max. Marks: 80

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

SECTION – A : FUNDAMENTALS OF ELECTRONICS : 30 MARKS

✍ **Answer any SIX questions of the following.**
   Draw suitable circuit diagram, block diagram, waveform or characteristics wherever it is necessary.

1A. Explain Ohm's law. Write the unit of current and resistance.

1B. Calculate the total capacitance of 3 capacitors of $10\mu F$, $20\mu F$ and $30\mu F$ are connected in series.

(2+3 = 5 marks)

2A. Write a note on Extrinsic semiconductor.

2B. Write a note on working of n-p-n Transistor.

(2+3 = 5 marks)

3A. Write a short note on U.P.S.

3B. Explain full-wave rectifier.

(2+3 = 5 marks)

4. Explain pre-amplifier.

(5 marks)

5A. Find binary subtraction of $(1101101)_2 - (100101)_2$ and convert answer into decimal.

5B. Convert 420, 0.75 into binary and find the product of $(1101101)_2 \times (101)_2$.

(2+3 = 5 marks)

6. Explain Inverting and non-inverting Op-Amp.

(5 marks)

7. **Write a short note on:**

7A. Pulse shaping.

7B. AND gate and OR gate.

($2\frac{1}{2} + 2\frac{1}{2} = 5$ marks)

SECTION – B: NUCLEAR MEDICINE INSTRUMENTATION: 50 MARKS

8. With a neat and labeled block diagram explain the principle and working of rectilinear scanner.

(20 marks)

9. Explain the principle of Dose calibrator. Add a note on its Quality control.

(6+4 = 10 marks)

10. Write short notes on:

10A. Dead time.
10B. Intrinsic Efficiency.
10C. PinHole Collimator.
10D. Energy resolution.

(5×4 = 20 marks)

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SECOND YEAR B.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2010

SUBJECT: RADIATION CHEMISTRY AND RADIATION PHYSICS

Wednesday, June 09, 2010

Time: 14:00-17:00 Hrs.   Max. Marks: 80

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

SECTION – A : RADIATION CHEMISTRY : 30 MARKS

1. Write short notes on:

1A. Exothermic and endothermic reactions.

1B. Chemical Bonds

1C. Atomic structure

1D. Buffers

1E. Tyndall Effect and Brownian movement

1F. Chemical Equilibrium

$(5×6 = 30$ marks)

SECTION – B : RADIATION PHYSICS : 50 MARKS

2. Answer any TWO:

2A. Derive the expression $N = N_0 e^{-\lambda t}$.

2B. What are different modes of decay? Explain Isomeric transition and internal conversion.

2C. i) If relatively high-energy gamma rays scattered at 180 degree by Compton scattering, what is the maximum energy of the scattered photon.

ii) Why does pair production requires a min of 1.02 Mev energy?

$(5×2 = 10$ marks)

3. Answer the following:

3A. i) Give the equation for the production of radionuclide.

ii) Describe the method of production of radionuclide in a cyclotron.

$(5+15 = 20$ marks)

3B. Describe the principle of Scintillation detectors and explain NaI(T1) detector.

$(20$ marks)

MANIPAL UNIVERSITY
SECOND YEAR B.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2010
SUBJECT: RADIOPHARMACY – I

Friday, June 11, 2010

Time: 14:00-15:30 Hrs.   Max. Marks: 40

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

1.   Justify the statement "^{99m}Tc is the work horse of Nuclear Medicine". How is ^{99m}Tc labeled with a Pharmaceutical?

(10 marks)

2.   Explain the indirect method of producing radionuclides with examples.

(10 marks)

3.   Solve the following:

3A.   If a radionuclide decays at a rate of 20% hr, what is its half-life?

3B.   If 35% of ^{131}I-Sodium iodide is eliminated via renal excretion, 25% by fecal excretion and 3.5% by perspiration in 12hrs from the human body, what is the effective half-life radiopharmaceutical?

(5 marks)

4.   Write short notes on the following:

4A.   Flux and Rate constant.

4B.   Ideal Tracer.

4C.   Sterility of radiopharmaceuticals.

($5\times3 = 15$ marks)

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