MANIPAL UNIVERSITY

FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER I: ANATOMY

Tuesday, May 28, 2013

Time: 10.00-11.30 Hrs.   Max. Marks: 40

✍   Answer ALL the questions.

1.   Describe the lobes and functional areas of cerebral hemisphere.

(2+6 = 8 marks)

2.   Describe the position, lobes, surfaces, relations, blood supply and nerve supply of liver.

(1+2+1+2+1+1 = 8 marks)

3.   **Write briefly on:**

3A.   Ureter

3B.   Spermatic cord

3C.   Breast

3D.   Cartilage

3E.   Thoraco-abdominal diaphragm

3F.   Retina

3G.   Superior vena cava

3H.   Pituitary gland

(3×8 = 24 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PHYSIOLOGY

(NEW REGULATION)

Thursday, May 30, 2013

Time: 10.00-11.30 Hours.   Max. Marks: 40

✍ **Answer ALL questions. Draw diagrams wherever necessary.**

1.   **Essay questions:**

1A.   Classify leucocytes. Mention one function of each.

1B.   Draw a neat labeled diagram of the visual pathway.

1C.   Mention the site of formation and circulation of cerebrospinal fluid. List any two functions of cerebrospinal fluid.

1D.   List five actions of cortisol.

(5×4 = 20 marks)

2.   **Write short answers for the following:**

2A.   Mention any two transport mechanisms across the cell membrane.

2B.   Mention any two differences between the first and second heart sounds.

2C.   Enumerate any two differences between skeletal and smooth muscles.

2D.   Mention any two anticoagulants.

2E.   Define stroke volume. Give its normal value.

2F.   Mention the different forms in which oxygen is transported in the blood.

2G.   List any two functions of liver.

2H.   Define alveolar ventilation. Mention its normal value.

2I.   List any two functions of placenta.

2J.   Define renal threshold. Mention the renal threshold for glucose.

(2×10 = 20 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER II: BIOCHEMISTRY

(NEW REGULATION)

Saturday, June 01, 2013

Time: 10.00-11.30 Hours

Max. Marks: 40

1. Write in detail the reactions of urea cycle. Add a note on two disorders of urea cycle.

(8 marks)

2. Explain the metabolism of ketone bodies.

(6 marks)

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

3A. Structure of DNA

3B. Secondary structure of proteins

3C. Digestion of starch

3D. Reactions of β- oxidation of palmitic acid in mitochondria

(4×4 = 16 marks)

4. **Answer the following:**

4A. Give two functions of dietary fibers.

4B. Name two important products each derived from tyrosine and glycine.

4C. List four functions of calcium.

4D. Write the normal serum levels of total protein, uric acid, creatinine and total cholesterol.

4E. What are proenzymes? Give two examples.

(2×5 = 10 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER – IV: ADVANCED BIOSTATISTICS & RESEARCH METHODOLOGY
(NEW REGULATION)

Tuesday, June 04, 2013

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

1. Explain the format of a research protocol.

(10 marks)

2. Discuss independent t test and paired t test.

(10 marks)

3A. Write a short note on Mann Whitney U test.

3B. In a study of the relationship between smoking and anxiety, 1000 people simultaneously classified according to smoking status (smoker or nonsmoker) and current level of anxiety (high or low). The data is summarized in the table below

Smoking status	Anxiety level	
	High	Low
Smoker	200	300
Nonsmoker	100	400

Use appropriate test of hypothesis to examine whether there is any significant association between smoking status and anxiety level at 5% level of significance.($\chi^2_{(1df)} = 3.84$).

(5+5 = 10 marks)

4A. Discuss the design, analysis, merits and demerits of cohort study.

4B. In a study to find the association between work stress and the risk of death from cardiovascular disease, 812 employees working in different factories in Finland were followed for 10 years. All the 812 employees were free from cardiovascular disease at the beginning of the study. The results after the follow up were summarized in the table below.

Work stress	Number of participants	Number of cardiovascular cases detected during the study period
Low	607	44
High	205	32
Total	812	76

Find the Relative risk and interpret it.

(10+5 = 15 marks)

5A. With help of scatter diagrams enumerate the properties of Pearson's correlation coefficient.

5B. Briefly explain cluster sampling method.

$$(5+5 = 10 \text{ marks})$$

6. Write short notes on:

6A. Measurement scales

6B. Normal distribution

6C. Confidence interval for proportion

6D. Logistic regression

6E. Evaluation of a diagnostic test

$$(5 \times 5 = 25 \text{ marks})$$

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER VII: RADIATION PHYSICS

Thursday, June 06, 2013

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

✍   **Answer all questions.**

1.   Draw a neat labelled diagram of Medical Cyclotron (typical design). Write the name of the components and explain the operation principle.

(20 marks)

2.   Explain the working principle of various radiation detectors used in Nuclear Medicine with examples. Compare and contrast between the various detectors.

(20 marks)

3.   What is gamma ray spectroscopy? With the help of neat and labelled spectra explain the various peaks.

(10 marks)

4.   Explain about quenching in radiation detecting systems.

(10 marks)

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

5A.   Photomultiplier tube.

5B.   Bragg's curve.

5C.   Linear and Mass attenuation coefficient.

5D.   Nuclear Fission.

(5×4 = 20 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER VIII: RADIOPHARMACY – I

Saturday, June 08, 2013

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

✍ **Answer all Questions.**

1. **Write in very short about the followings:**

1A. Normal Solution

1B. Exothermic reaction

1C. Isobars.

1D. Atomic weight

1E. Electrovalent Bonding

1F. F18 Sodium Fluoride

1G. Excitation

1H. Bronsted - Lowry base

1I. Phosphorescence

1J. Membrane filtration

$(2\times10 = 20$ marks$)$

2A. Enlist the various types of ultrashort lived radionuclide generators used in nuclear medicine. (no details).

2B. Describe the protocol for the preparation of 99mTc-Ethyl Dicystein (EC)radiopharmaceuticals.

2C. Write down important points for the safe handling of biological specimens in the laboratory.

2D. Describe the transient equilibrium in ^{99}Mo – ^{99m}Tc decay.

$(5\times4 = 20$ marks$)$

3A. What do you understand by chemical reaction? Write down the different types of chemical reactions. Give examples.

3B. Explain briefly the typical design and working principle of radionuclide generator. What are ideal characteristics it should have?

3C. Describe principle of paper chromatography. How to calculate R_f value and Radiochemical purity of radiopharmaceuticals with paper chromatography?

3D. How are PET radiopharmaceuticals different from 99mTc Radiopharmaceuticals? Explain importance of reducing agents in cold kits for 99mTc Radiopharmaceuticals.

$(10\times4 = 40$ marks$)$

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER III: MATHEMATICS IN NUCLEAR MEDICINE

Monday, June 10, 2013

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

✍ **Answer any EIGHT questions of the following:**

1A. Prove that: $\dfrac{\tan A - \sin A}{Sin^3 A} = \dfrac{\sec A}{1 + \cos A}$

1B. Let A = { x / 0<x < 10 all even no.}; B = { y/ 5< y< 10} Find A∪B, A∩ B and draw Venn diagram.

1C. If a = i + 2j – 3k ; b = 2i – j – 5k find a × b and find their magnitude.

1D. Convert 250mCi into GBq.

$(2+2+4+2 = 10$ marks)

2A. Express the complex number $\dfrac{(1+i)(1+2i)}{1+3i}$ in the polar form and hence find their modulus and amplitude.

2B. Prove that: $\displaystyle \operatorname*{Lt}_{x \to a} \dfrac{x^n - a^n}{x - a} = n\, a^{n-1}$

$(5+5 = 10$ marks)

3A. Find the value of θ such that $\dfrac{3 + 2i \sin \theta}{1 - 2i \sin \theta}$ is 1) real 2) pure imaginary.

3B. Find the second derivative of: $x^2 . \log x$

$(5+5 = 10$ marks)

4A. Find the maxima and minima of the function $2x^3 - 12x^2 + 18x + 5$.

4B. Find out the tangent and normal equations for the curve $(1 + x^2)y = 2 - x$ at the point where it crosses the x-axis.

4C. Differentiate the equation: $y = (x^2+1)(1-2x^2)$ with respect to x.

$(5+3+2 = 10$ marks)

5A. Find Laplace transform of: $t^2 \sin at$

5B. Find the inverse of square matrix $A = \begin{bmatrix} 1 & 3 & 2 \\ 0 & 1 & 2 \\ 2 & 1 & 3 \end{bmatrix}$

$(4+6 = 10$ marks)

6A. Explain modulation transfer function mathematically and its use in Nuclear Medicine.

6B. Approximate $\int_2^3 \dfrac{dx}{1+x}$ using Simpson's Rule with $n = 4$.

(5+5 = 10 marks)

7A. Evaluate: $\int \cos 3x \cdot \cos 2x \, dx$

7B. Evaluate: $\int \dfrac{2x+1 \, dx}{x^2 - 3x + 2}$

7C Explain log-log graph.

(3+5+2 = 10 marks)

8A. 500 mCi of I-131 is available on Monday at 12 noon. 2 patients are treated with 100mCi and 75 mCi on the same day. What is the remaining activity available on Thursday at 11 am? One patient is treated with 100mCi on Thursday. What would be the activity available on Saturday at 10 am? (Half life – 8 days)

8B. Calculate the exposure rate from 100mCi of I-131 at 2 meter distance.

8C. Derive the decay constant by the half life concept of the radioactivity.

(5+3+2 = 10 marks)

9A. Write a short note on Fourier transformation and inverse Fourier transformation used in Nuclear Medicine

9B. Find x: $\log_7 x + \log_7 x^2 + \log_7 x^3 = 6$.

9C. Prove $(\sin A + \operatorname{Cosec} A)^2 + (\operatorname{Cos} A + \sec A)^2 = 7 + \tan^2 A + \cot^2 A$

9D. Define onto, one-to-one function, even function, odd function.

(4+2+2+2 = 10 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER V: COMPUTERS IN NUCLEAR MEDICINE

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

✍ **Answer all the questions.**

1. "Analogue to Digital Converter is an essential device in Nuclear Medicine" Justify the statement with reason/s.

    a)   What are the different types of ADCs used in Nuclear Medicine?

    b)   Explain the operation principle of any one ADC.

    c)   What are the characteristics of an ADC?

                                                                    (20 marks)

2. As a Nuclear Medicine Technologist what are the parameters you should set to generate good digital images during dynamic image acquisition? Give reason(s) for each settings opted.

                                                                     (5 marks)

3. Apply a moving average and a weighted average (2,4,1) 9 point filter on the given matrix. Is it essential to apply filters on image matrix? Why?

8	8	25	40	40	100
10	9	80	104	58	110
12	42	100	500	300	250
12	35	130	284	315	120
5	10	150	300	180	32
4	5	80	137	175	54
8	7	64	98	8	10
6	2	50	87	8	8

                                                                    (10 marks)

4. Write on network services.

                                                                     (5 marks)

5. Write a C program to find greatest of three numbers.

                                                                     (5 marks)

6. Explain network topologies.

                                                                     (5 marks)

7. Write the steps to insert picture into a power point slide.

(2½ marks)

8. What is interpolation?

(2½ marks)

9. Explain if else ladder with an example.

(5 marks)

10. Reason why computers are said to be an integral part of modern Nuclear Medicine? Write in detail about the classification of computers.

(10 marks)

11. Explain C operators.

(10 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER VI: BIOMEDICAL ELECTRONICS

Friday, June 14, 2013

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

✍ **Answer all the following questions.**

✍ **Draw suitable circuit diagram, block diagram, waveform or characteristics wherever it is necessary.**

1A. Explain PMT and its mathematical model.
1B. Explain negative feed back and positive feed back in op-amp.

(5+5 = 10 marks)

2A. Explain filter used in image reconstruction.
2B. Write a short note on pinch-off in JFET.
2C. Define Ohms Law and Kirchoff's Law.

(4+4+2 = 10 marks)

3A. Explain 3 types of UPS.
3B. Find $(1100001)_2 - (11111)_2$, $(111001)_2 \times (101)_2$ and convert the answer in decimal form.

(6+4 = 10 marks)

4A. Briefly explain ADC and DAC.
4B. Explain amplifier distortion

(6+4 = 10 marks)

5A. Explain charge sensitive and voltage sensitive amplifier.
5B. Explain NAND gate, NOR gate and OR gate.

(5+5 = 10 marks)

6A. Explain full-wave rectifier, its efficiency and ripple factor.
6B. Explain Oscillator.

(5+5 = 10 marks)

7A. Explain Pulse Shaping.
7B. Explain Differentiator amplifier circuit.
7C. Explain Electronic Noise.

(4+3+3 = 10 marks)

8A. Briefly explain Extrinsic and intrinsic semiconductor.
8B. Explain CRT.

(5+5 = 10 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2013

SUBJECT: PAPER IX: NUCLEAR MEDICINE INSTRUMENTATION – I

(NEW REGULATION)

Monday, June 17, 2013

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

✐   **Answer all the questions.**

1.   Explain the performance characteristics of GM counter.

2.   You have taken a sample from the delay tank. How will you determine the activity and isotope in the sample?

3.   Explain about the principle, design and calibration of whole body counters.

4.   Explain working principle of an Intraoperative probe.

5.   Write short notes on the following:
5A.   Information density.
5B.   H-D curve.

6.   Explain the working principle of Isotope calibrator. Write about any two QC test carried out in the justifying the importance of the test in your routine practice.

7.   Explain the different performance parameters of gamma ray spectrometer.

8A.   A sample is counted in a well counter using a "narrow" pulse height analyser 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?

8B.   Explain types of Measurement error.

(10×8 = 80 marks)

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FIRST YEAR MASLP (NR)/M.Sc. MLT/M.Sc. MIT/M.Sc. NMT/M.Sc. ECHOCARDIOGRAPHY DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: STATISTICS & RESEARCH METHODS/BIOSTATISTICS/PAPER IV: ADVANCED BIOSTATISTICS & RESEARCH METHODOLOGY/EPIDEMIOLOGY & BIOSTATISTICS

Wednesday, December 18, 2013

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

1.   Define Biostatistics and enumerate its applications in Para-medical research.

(5 marks)

2.   What are different methods of drawing a simple random sample? Explain any.

(2+3 = 5 marks)

3.   Define and explain the interrelations among the concepts of sampling distribution, standard error and confidence interval with an example.

(10 marks)

4.   **Distinguish between**

4A.   Parametric and non-parametric tests

4B.   Null and alternate hypothesis

4C.   Two sided and one sided test

4D.   Type I and type II error

4E.   Level of significance and p-value

(2×5 = 10 marks)

5.   Prior to the time that germ theory of disease was established, the mortality rate from surgery was very high due to infection. Joseph Lister sprayed the air with carbolic acid and used it in patients dressing. Lister compared 80 operations in which this procedure was used with 70 others where it was not used. The results are given in the following table.

	Patient lived	Patient died	Total
Carbolic acid used	68	12	80
Carbolic acid not used	38	32	70
Total	106	44	150

At 5% level of significance, test whether the outcome of the surgery is independent of the use of carbolic acid or not. ($\chi^2_{1df}(0.05) = 3.84$)

(10 marks)

6. Explain with distinction positive and negative correlation and list the properties of Pearson's correlation coefficient.

    (5 marks)

7. Discuss case-control and cohort study designs and enumerate their relative merits and demerits.

    (10 marks)

8. A cohort study was conducted to find the effect of oral contraceptive (OC) use on breast cancer. Ten thousand women free from breast cancer were selected for the study and followed up for 10 years. Forty out of 8000 non users of OC and 14 out of 2000 OC users developed breast cancer. Calculate appropriate measure of strength of association and interpret the same.

    (5 marks)

9. Explain the situation for the application of logistic regression with the help of a suitable example.

    (5 marks)

10. Draw an appropriate dummy table and give the formula for sensitivity, specificity, positive predictive value and negative predictive value.

    (5 marks)

11. Explain in detail the format of reporting in scientific journals.

    (10 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: PAPER I: ANATOMY

Thursday, December 19, 2013

Time: 10.00-11.30 Hrs.   Max. Marks: 40

1. Describe the external features and internal features of spinal cord.

(5+5 = 10 marks)

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

2A. Spermatic cord

2B. Thoracic duct

2C. Typical synovial joint

2D. Trachea

2E. Ureter

2F. Ventricles of the heart

(5×6 = 30 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: PHYSIOLOGY

Friday, December 20, 2013

Time: 10.00-11.30 Hours. Max. Marks: 40

✍ **Answer all questions. Draw diagrams wherever necessary.**

1. **Essay Questions:**

1A. Define erythropoiesis. List different stages of erythropoiesis. Mention any two factors regulating it.

1B. With the help of a flow chart describe the neuromuscular transmission.

1C. List the three stages of deglutition. Describe the events in second phase of deglutition.

1D. Draw a labeled diagram of the visual pathway.

(5×4 = 20 marks)

2. **Write short answers for the following:**

2A. Mention two functions of basal ganglia.

2B. What is the normal duration of spermatogenesis? Mention two factors that influence spermatogenesis.

2C. Define glomerular filtration rate. Give its normal value.

2D. List any four hormones of anterior pituitary gland.

2E. Mention the normal heart rate in adults. Mention any two conditions for tachycardia.

2F. Mention two functions of cerebrospinal fluid.

2G. Define hypoxia and cyanosis.

2H. Name the hormone released from parathyroid gland and mention one action of it.

2I. Give two differences between active and passive transport mechanisms.

2J. Define blood pressure. Give its normal value.

(2×10 = 20 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: PAPER III: MATHEMATICS IN NUCLEAR MEDICINE

Saturday, December 21, 2013

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

✍ **Answer any EIGHT questions of the following:**

1A. Find out the value of x from the equation : $x \tan 30°. \cos^2 45° = \dfrac{\cot^2 30^0 \tan 45^0}{Sec\ 60^0}$

1B. $A = \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix}$ $B = \begin{pmatrix} 0 & 2 \\ 4 & 6 \end{pmatrix}$ Show that $AB \neq BA$

1C. Find the scalar product of the vectors a= 2i – 2j+ k and b= 2i- 3j+ 6k. Also find the cosine of the angle between a and b.

(3+3+4 = 10 marks)

2A. Solve using Cramer's rule $5x – 2y - 3z = 17$; $3x – y + z = 15$; $x+ y – 6z = -13$

2B. Solve the simultaneous equation $0.6x - 0.8y = 0.5$; $0.9x + 0.7y = 1.7$.

2C. Convert 350 mCi into GBq.

(6+2+2 = 10 marks)

3A. Find out tangent and normal equations for: $x^3 -3xy + y^3 =17$ at point (2, 3)

3B. Derive differential equation by eliminating the arbitrary constant a. $r = a(1 - \cos \theta)$

3C. Explain iterative reconstruction algorithms in Nuclear Medicine.

(3+3+4 = 10 marks)

4A. Express the complex number $\dfrac{(1+i)(1+2i)}{1+3i}$ in the polar form and hence find their modulus and amplitude.

4B. Derive the exponential law of radioactive decay and derive the half-life equation.

(5+5 = 10 marks)

5A. Find x : $\log_x 16 + \log_x 4 = 6$

5B. Differentiate: $y = \dfrac{(x^2 +1)^6}{(2x-1)^8 (3x+1)^5}$ with respect to x

5C. Evaluate $\int_0^{\pi/2} x \cos x\ dx$

(2+4+4 = 10 marks)

6A. Evaluate : $\displaystyle \mathop{Lt}_{x \to 2} \frac{x^3 - 3x^2 + 2}{x - 2x - 5}$

6B. Find out tangent and normal equations for: $2x^3 - 9xy + 2y^3 = 0$ at point (2, 1)

6C. The activity Tc^{99m} at the time of disposal in lead dustbin was 0.5 mCi. What is the activity after 10 days when it was sent for disposal along with general non-radioacitve waste and write the answer in Curie?

$(2+3+5 = 10 \text{ marks})$

7A. Explain Radon Transformation used in SPECT image Reconstruction.

7B. Evaluate : $\int \cos 3x . \cos 2x \, dx$

7C. Explain log-log graph, sine graph, Logit log graph and write the use in Nuclear Medicine.

$(4+3+3 = 10 \text{ marks})$

8A. $\log_x 2 + \log_x 4 = 2$, Find x

8B. Calculate the exposure rate at 1 mt from a Cs^{137} source of activity 0.1GBq. Assume that 86% of the transformation is associated with the emission of 0.66MeV gamma photons.

8C. Deduce the appropriate compartment model.

$dV_1/dt = k_{01}V_0 + k_{21}V_2 + k_{41}V_4 - k_{12}V_1 - k_{14}V_1$

$dV_2/dt = k_{12}V_1 - k_{21}V_2 - k_{23}V_2$; $\quad dV_3/dt = k_{23}V_2 - k_{30}V_3$;

$dV_4/dt = k_{14}V_1 - k_{41}V_4 - k_{45}V_4$; $\quad dV_5/dt = k_{45}V_4 - k_{50}V_5$

$(2+3+5 = 10 \text{ marks})$

9A. Define onto, one-to-one function, even function, odd function.

9B. Explain Fourier transform used in image reconstruction.

9C. Write about the Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$, and Trapezoidal rule.

$(2+3+5 = 10 \text{ marks})$

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: PAPER VI: BIOMEDICAL ELECTRONICS

Monday, December 23, 2013

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

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

1A. Explain JFET.
1B. Explain various types of semiconductors.

                                                                (5+5 = 10 marks)

2A. Explain series and parallel connection of capacitor.
2B. Explain briefly on half wave and full wave rectifier.
2C. Explain I-V Characteristic curve of diode.

                                                                (3+4+3 = 10 marks)

3A. Explain Comparators used in Nuclear Medicine.
3B. Explain op-amp with symbol, Ideal op-amp and types of op-amp.

                                                                (5+5 = 10 marks)

4A. Explain Schottky diode.
4B. Explain Equivalent circuit.
4C. Write short note on Flip-Flop.

                                                                (3+4+3 = 10 marks)

5A. Explain low pass and high pass filters.
5B. Explain on Transducers used in Nuclear Medicine.

                                                                (5+5 = 10 marks)

6A. Short note on Modulator and Demodulator.
6B. Explain on Voltage sensitive pre-amplifier and write the use of pre-amplifiers in Nuclear Medicine.
6C. Write short note on Noise in Pulse shaping.

                                                                (3+4+3 = 10 marks)

7A. Explain on ADC.
7B. Explain on CRT.

                                                                (5+5 = 10 marks)

8A. Explain NAND gate, OR gate, Ex-NOR gate.
8B. Explain UPS.

                                                                (5+5 = 10 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: PAPER VII: RADIATION PHYSICS

Tuesday, December 24, 2013

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

✍ **Answer ALL questions.**

1. Describe operational principle of ionization chamber based detectors with suitable diagrams. Also state where they are used in Nuclear Medicine.

2. What is Compton Scattering? Prove in Compton scattering $E^{max}_{re} = E_0^2/(E_0 + 0.2555 \text{ MeV})$ with an example.

3. What are the different methods for production of radionuclides? Briefly write about the reactors and components with diagram.

4. Explain Rutherford's and Bohr's atom model. Also note the limitations of each model.

5A. If a radionuclide decays with 10.34% per hour, what is the half-life and in what time it will decay to 10%?

5B. If the activity measured of ^{99m}Tc is 11.1 GBq on 10th May 2013 at 0900 hours, what would have been the activity on 10th May 2013 at 0600 hours and on 11th May 2012 at 1200 hours?

6. **Write short note on:**

6A. Semiconductor detector

6B. Average life

7. Explain radionuclide equilibrium and derive the equation for it.

8. Explain the various mechanisms of gamma ray interaction. Does it depend on atomic number of the interacting material? How these interactions are affected by the energy of the incidence radiation?

(10×8 = 80 marks)

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MANIPAL UNIVERSITY

FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: PAPER VIII: RADIOPHARMACY – I

Thursday, December 26, 2013

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

✍ **Answer ALL questions.**

1. **Write in very short about the followings:**

1A. Heterogeneous solution

1B. Endothermic reaction

1C. Moderator in nuclear reactor

1D. Auger emission

1E. Therapeutic radiopharmaceuticals

1F. Zeta potential

1G. Solvents in Chromatography

1H. Basic Structure of Atom

1I. Misadministration of Radiopharmaceuticals

1J. Elution Profile of radionuclide generator

$(2 \times 10 = 20 \text{ marks})$

2A. Write the various sources for production of artificial radionuclides. (No details)

2B. Describe the protocol for the preparation of any one Hepatobiliary imaging radiopharmaceutical.

2C. Write down the important features of $^{82}Sr\ ^{82}Rb$- generator.

2D. Describe the need of automatic synthesis modules in radiochemistry lab.

$(5 \times 4 = 20 \text{ marks})$

3A. Describe Lewis concept of Acid and Base. How it differs with Bronsted –Lowry concept? Give suitable examples.

3B. What are the desirable characteristics of ^{18}Fluorine as a radionuclide of choice in PET imaging?

3C. Describe about Chromatography techniques used in Nuclear Medicine and its significance.

3D. Describe the different radiopharmaceuticals used for lung imaging.

$(10 \times 4 = 40 \text{ marks})$

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MANIPAL UNIVERSITY

FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2013

SUBJECT: PAPER IX: NUCLEAR MEDICINE INSTRUMENTATION – I

Friday, December 27, 2013

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

✍ **Answer ALL the questions.**

1. With the help of a neat and labelled diagram explain the working principle of Liquid scintillation counters.

    (20 marks)

2. Write in detail about the important factors to be considered in the appropriate selection of a gamma detection probe for its intended clinical application.

    (20 marks)

3. What is an energy spectrometer? What are the different types of spectrometer available? What are the causes for spectral blurring?

    (10 marks)

4A. In brief explain sample volume effects of well counter.
4B. How assay of absolute activity is done by a well counter?

    (10 marks)

5. Graphically explain the PSF or LSF of a focussing collimator at various distances.

    (5 marks)

6. Do you justify the following statement - "Dose Calibrators have energy discrimination capability." Give reason for your answer.

    (5 marks)

7. Write a short note on the charge trapping of semiconductor detectors.

    (5 marks)

8. Write short note on Scalloping effect and Contrast Enhancement Techniques of Rectilinear scanner.

    (5 marks)

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