

Reg. No.

# MANIPAL UNIVERSITY

FIRST YEAR B.Sc. M.L.T./B.Sc. N.M.T./B.Sc. R.T./B.Sc. M.R.T./B.Sc. M.I.T./ B.Sc. C.V.T./  
B.Sc. R.R.T & D.T./M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2015

**SUBJECT: ANATOMY**

Tuesday, June 02, 2015

Time: 10.00-11.30 Hrs.

Max. Marks: 40

 **Answer ALL the questions.**

1. Name the parts of urinary system. Describe the right kidney.

(5+5 = 10 marks)

2. **Write short notes on:**

2A. Spinal cord

2B. Vas deferens

2C. Typical synovial joint

2D. Nasal septum

2E. Ovary

2F. Maxillary air sinus

(5 marks × 6 = 30 marks)



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FIRST YEAR BOT/B.Sc. MLT/B.Sc. CVT/B.Sc. MIT/B.Sc. RT/B.Sc. NMT/  
B.Sc. RRT & DT/B.Sc. MRT/M.Sc. NMT DEGREE EXAMINATION – JUNE 2015

SUBJECT: PHYSIOLOGY

Thursday, June 04, 2015

Time: 10.00-11.30 Hours.

Max. Marks: 40

✍ Answer ALL questions. Draw diagrams wherever necessary.

1. Essay Questions:

- 1A. Explain the chemical regulation of respiration.
- 1B. Draw and label an electrocardiogram (ECG) from limb lead II. Indicate any two intervals of ECG. Mention any two uses of ECG.
- 1C. Mention any two functions of cerebellum. List any three features of cerebellar lesion.
- 1D. Mention any two actions of growth hormone. List any three clinical features of acromegaly.

(5 marks × 4 = 20 marks)

2. Write short answers for the following:

- 2A. List any two functions of hemoglobin.
- 2B. List any two functions of white blood cells.
- 2C. Write a note on achalasia cardia.
- 2D. Name the parts of the vestibular apparatus and mention one function of vestibular apparatus.
- 2E. Define blood pressure. Mention the normal systolic and diastolic blood pressure range in a normal adult, at rest.
- 2F. Mention any two functions of skin.
- 2G. Name two indicators of ovulation.
- 2H. Mention two differences between facilitated diffusion and active transport mechanism.
- 2I. Mention two differences between skeletal and cardiac muscles.
- 2J. Give any two differences between rods and cones.

(2 marks × 10 = 20 marks)



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B.Sc. RRT & DT/M.Sc. NMT DEGREE EXAMINATION – JUNE 2015

SUBJECT: BIOCHEMISTRY

Saturday, June 06, 2015

Time: 10.00-11.30 Hours

Max. Marks: 40

✍ Answer ALL the questions.

✍ Draw diagrams and flow charts wherever appropriate.

1. Explain anaerobic glycolysis and add a note on its energetics.

(8 marks)

2. Give a diagrammatic representation of the processes of emulsification and absorption of lipids in the intestine.

(6 marks)

3. Write short notes on the following:

3A. Components of electron transport chain and order of their arrangement

3B. Reactions of  $\beta$ -oxidation in mitochondria

3C. Importance of dietary fibers

3D. Secondary structure of proteins

(4 marks  $\times$  4 = 16 marks)

4. Answer the following:

4A. List four differences between DNA and RNA.

4B. Write two reactions where the coenzyme form of niacin is required.

4C. List the four key enzymes of gluconeogenesis.

4D. Name one condition in which these biochemical parameters are increased in blood: glucose, uric acid, bilirubin and urea.

4E. Define buffer and write the Henderson- Hasselbalch equation.

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



## MANIPAL UNIVERSITY

### FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2015

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

Tuesday, June 09, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL questions.**

- 1A. Differentiate prevalence and incidence with examples.
- 1B. What is Stratified sampling? Explain the procedure with example. List the advantages and disadvantages of this technique.
- (5+5 = 10 marks)
- 2A. Explain the characteristics of Binomial distribution.
- 2B. The average number of heartbeats/min for a random sample of 49 subjects was found to be 90. Assume that the population is normally distributed with a standard deviation of 10. Construct 95% confidence interval for the population mean number of heart beats (Given  $Z_{1-\alpha/2}=1.96$ ).
- (5+5 = 10 marks)
- 3A. Define the following terms:
- i) Sampling distribution of mean
  - ii) Statistical inference
  - iii) Level of significance
- 3B. Describe with example the situation in which you would use one way ANOVA. What is the null hypothesis tested by analysis of variance? List the assumptions of ANOVA. Why not just compute t-tests among all pairs of means instead of computing an analysis of variance?
- ((2+2+1)+(1+1+2+1) = 10 marks)
- 4A. Differentiate two sample t-test and Mann-Whitney U test.
- 4B. Write a short note on Chi-square test for association.
- (5+5 = 10 marks)
- 5A. A hospital administrator wishes to estimate the mean serum bilirubin level of 4-day old infants in her hospital. How large a sample of infants should be taken if she wants 95 percent confidence interval with error margin 2mg/100cc? Assume that a reasonable estimate of standard deviation is 4 mg/100 cc. (Given  $Z_{1-\alpha/2}=1.96$ ).
- 5B. Write a short note on survival analysis.
- (5+5 = 10 marks)

6. Discuss cohort study under:

6A. Design

6B. Steps

6C. Advantages and disadvantages

(10 marks)

7. Outline the structure of a research protocol and state its uses.

(10 marks)

8. Write short notes on the following:

8A. Cross sectional study design

8B. Predictive values of a Diagnostic test

(5 marks × 2 = 10 marks)





## MANIPAL UNIVERSITY

## FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2015

SUBJECT: PAPER III: MATHEMATICS IN NUCLEAR MEDICINE-I, STATISTICS-I  
(NEW REGULATION)

Thursday, June 11, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ Answer any EIGHT questions of the following

- 1A. Express the complex number  $\frac{(1+i)(1+2i)}{1+3i}$  in the polar form and hence find their modulus and amplitude.
- 1B. If  $\sin A = 4/5$  and  $\pi/2 < A < \pi$  find the value of  $\frac{3 \sin A - \cos A}{4 \operatorname{cosec} A + 3 \tan A}$
- 1C. Express the complex number  $\sqrt{3} + i$  in the polar form and hence find the modulus and amplitude.

(5+2+3 = 10 marks)

2A. Find derivatives of  $\log \left[ x^2 + \sqrt{(x^2 + a^2)} \right]$

2B. Find x:  $\log_x 16 + \log_x 4 = 6$

2C. Explain the Newton's Iterative method and write the use in Nuclear Medicine.

(3+2+5 = 10 marks)

3A. 400 mCi of I-131 is available on Monday at 12 noon. 2 patients are treated with 100mCi and 50 mCi on the same day. What is the remaining activity available on Saturday at 10 am?

3B. Evaluate  $\int \log x \, dx$ .

3C. Find the scalar product of the vectors  $a = 2i - 3j + k$ ,  $b = 5i + j - k$ . Also find the cosine of the angle between a and b.

(3+3+4 = 10 marks)

4A. Evaluate  $\int_0^{\pi/2} x^2 \cos x \, dx$ .

4B. Evaluate:  $\int \frac{3x-2}{(x+1)(x^2+4)}$

(5+5 = 10 marks)

5A. Write short note on logit-log graph and write its use in Nuclear Medicine.

5B. Derive the exponential law of radioactive decay using differential equation also derive the half-life.

5C. Find out the second derivative of the function:  $e^{ax} \sin(x+c)$ .

(2+5+3 = 10 marks)

- 6A. Differentiate with respect to  $x$ :  $x^4 + 8x^2 + 12x + 18$ .
- 6B. Derive single open compartment with single inlet and single outlet having same rate.
- 6C. Define subset, union set, onto function, one-one function.

(2+6+2 = 10 marks)

- 7A. If exposure rate from an unshielded source of I-131 at 2 meter distance is 8 mR/hr then find the activity of the source.
- 7B. Write about Fourier Transformation used in Nuclear Medicine.
- 7C. Convert 400mCi into MBq.

(3+5+2 = 10 marks)

- 8A. Solve using Cramer's rule  $4x + y = 7$ ;  $3y + 4z = 5$ ;  $5x + 3z = 2$
- 8B. Differentiate:  $y = \frac{(x^2+1)^5}{(2x-1)^3(3x+1)^7}$  with respect to  $x$ .

(6+4 = 10 marks)

- 9A. Find the maximum and minimum values of:  $\frac{1+x+x^2}{1-x+x^2}$ .
- 9B. Explain Finite Integral.

(6+4 = 10 marks)



# MANIPAL UNIVERSITY

## FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2015

### SUBJECT: PAPER V: COMPUTERS IN NUCLEAR MEDICINE (NEW REGULATION)

Saturday, June 13, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL questions.**

✍ **Draw neat and labelled diagram as and when required.**

1. Define computers. Mention the components, its role and operation of a computer. Add a note on BUS. (10 marks)
  
2. Assume an excel worksheet contains voltage measured, counts1, counts2, measured count and background corrected count as data. Write the function/ formulae in excel for the following:
  - i) To calculate the operating voltage
  - ii) To find sum of counts where the counts have the same value (assume some value for count)
  - iii) Find maximum voltage and count value
  - iv) To count how many no. of voltage values are there where count remains equal to 30
  - v) If counts < 610 put threshold value = 40 else threshold value = 60(10 marks)
  
3. Role of ADCs in Nuclear Medicine. Enlist a few ADC. Explain in detail the working principle of any one ADC. (10 marks)
  
4. What are static scans? Give examples. What are the parameters you should consider during static scan acquisition and processing? (10 marks)
  
5. Convert the following:
  - i)  $(16)_{10} = ( )_2$
  - ii)  $(83)_{10} = ( )_2$
  - iii)  $(110)_2 = ( )_{10}$
  - iv)  $(10110101)_2 = ( )_{10}$(5 marks)



6. Smoothen the following data with a weighted filter:

Time (secs)	5	10	15	20	25	30	60	90	120	240
counts	100	623	999	5800	9231	1800	981	568	123	50

(5 marks)

7. Using switch..case statement, write a C program to do all arithmetic operations on any two numbers.

(5 marks)

8. Write a program to accept a string and display vowels present in that string.

(5 marks)

9. Explain LAN, WAN and MAN.

(5 marks)

10. Explain different switching techniques.

(5 marks)

11. Write a C program to calculate area of a rectangle and right angled triangle.

(5 marks)

12. In brief explain on image addition and image multiplication

(5 marks)



**MANIPAL UNIVERSITY**  
**FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2015**  
**SUBJECT: PAPER VI: BIOMEDICAL ELECTRONICS**  
**(NEW REGULATION)**

Monday, June 15, 2015

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 resistor in series and parallel connection in circuit.

1B. Explain various type of semiconductors with example.

1C. Explain working of NPN bipolar transistor.

(2+5+3 = 10 marks)

2A. Explain full wave rectifier.

2B. Explain JFET.

2C. Write the main types of Power Supply.

(3+5+2 = 10 marks)

3A. Explain the quality of amplifier.

3B. Explain equivalent circuit.

3C. Write short note on comparator.

(3+4+3 = 10 marks)

4A. Explain on amplifier distortion.

4B. Explain Low pass filter.

(5+5 = 10 marks)

5A. What is Flip-Flop and explain RS Flip-Flop.

5B. Explain Types of Pulse Modulation.

5C. Explain pulse shaping.

(3+4+3 = 10 marks)

6A. Explain UPS.

6B. Explain DAC.

6C. Write short note on Noise.

(4+4+2 = 10 marks)

7A. Explain transducer used in Nuclear Medicine.

7B. Explain inverting and non inverting op-amp.

(5+5 = 10 marks)

8A. Explain CRT.

8B. Find  $(1100001)_2 - (11111)_2$ ;  $(111101)_2 \times (101)_2$ . Convert the answer into decimal.

(6+4 = 10 marks)



**MANIPAL UNIVERSITY****FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2015****SUBJECT: PAPER VII: RADIATION PHYSICS  
(NEW REGULATION)**

Thursday, June 18, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL questions.**

✍ **Draw neat and labelled diagram as and when required.**

1. Explain the different modes of radioactive decay with example. (20 marks)
2. Elaborate on interactions of electromagnetic radiations with matter. (20 marks)
- 3A. What is gamma ray spectroscopy? What are the factors affecting the spectra?  
3B. “Sharp lines and sharp edges in an ideal spectrum become broadened lines and rounded edges in actual spectra”- Opine and give reasons for your answer. Draw an actual energy spectrum of the radionuclide  $^{137}\text{Cs}$ . (15 marks)
4. In brief explain the working principle of survey meter. (5 marks)
- 5A. Calculate the effective half-life of the radionuclide  $^{131}\text{I}$ . (Assume the biological half-life of  $^{131}\text{I}$  to be 2160 hours).  
5B. What is the thickness of lead required to bring down the exposure to 25%? (2½ marks × 2 = 5 marks)
6. **Write short notes on the following:**
  - 6A. LET
  - 6B. Bremsstrahlung radiations
  - 6C. Importance of scintillators in Nuclear Medicine(5 marks × 3 = 15 marks)



**MANIPAL UNIVERSITY****FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2015****SUBJECT: PAPER VIII: RADIOPHARMACY – I  
(NEW REGULATION)**

Saturday, June 20, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

**Answer ALL questions.**

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

- 1A. Nano colloid Solution
- 1B. Endothermic reaction
- 1C. Isotones
- 1D. Atomic number
- 1E. Single Bonding and double bonding
- 1F.  $^{18}\text{F}$  Sodium Fluoride
- 1G. Metastable state
- 1H. Lewis acid - base
- 1I. Electron capture
- 1J. Steric hindrance

(2 marks  $\times$  10 = 20 marks)

2. Enlist the characteristics of any three ultra-short lived radionuclide generators useful in Nuclear Medicine. (No details).

(5 marks)

3. Describe the protocol for the preparation of any one renal tubular imaging radiopharmaceutical.

(5 marks)

4. Explain the different methods for checking the biological QC of a radiopharmaceutical.

(5 marks)

5. Write the parent daughter decay- growth equation. Show the transient equilibrium of  $^{99}\text{Mo} - ^{99\text{m}}\text{Tc}$  decay in graphical representation only.

(5 marks)

6. What do you understand by Nuclear reaction? Write down the different type of nuclear reactions? Give examples.

(10 marks)



7. Explain briefly the typical design and working principle of column type radionuclide generator. What are ideal characteristics it should have?  
(10 marks)
8. What are the differences between traditional paper chromatography and miniature chromatography? How to calculate  $R_f$  value and Radiochemical purity of radiopharmaceuticals with traditional paper chromatography?  
(10 marks)
9. Why  $^{99m}\text{Tc}$  is considered as “workhorse” of diagnostic Nuclear Medicine? Explain the importance of antioxidants and stabilizers used in cold kits of  $^{99m}\text{Tc}$  Radiopharmaceuticals.  
(10 marks)



**MANIPAL UNIVERSITY****FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2015****SUBJECT: PAPER IX: NUCLEAR MEDICINE INSTRUMENTATION – I  
(NEW REGULATION)**

Monday, June 22, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ Answer ALL the questions.

✍ Draw neat and labeled diagram as and when required.

1. Explain on the working principle and the various types of whole body counters. Add a note on the calibration of same.

(20 marks)

2. List the factors affecting the performance of focusing collimator. Explain on each factor.

(20 marks)

3. In brief explain about detector characteristics and detection efficiency of NaI(Tl) well counter.

(10 marks)

4. Why an optimum working distance is opted in thyroid uptake studies? How do you determine the same?

(10 marks)

5. How does quenching occur in LSC? How do you rectify the same?

(10 marks)

6A. A sample is counted in a well counter using a “narrow” pulse height analyzer window (N) and net sample and background counts are 2000 counts and 800 counts respectively. The sample is counted with the same system but using a “wide” window (W) and the net sample and background counts are 3000 counts and 1200 counts respectively. Which window setting offers the statistical advantage?

6B. Preliminary measurements in a sample counting procedure indicate gross and background counting rate of  $R_g = 1100$  cpm,  $R_b = 100$  cpm respectively. What counting time is required to determine the net sample counting rate to be within 5%.

(5+5 = 10 marks)

