

**MANIPAL ACADEMY OF HIGHER EDUCATION**  
**FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2018**  
**SUBJECT: PAPER V: COMPUTERS IN NUCLEAR MEDICINE**  
**(NEW REGULATION)**

Saturday, June 02, 2018

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions.**

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

1. Define computer and list the classification of computers. Discuss on the characteristics and generations of computer.

(20 marks)

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

18	8	25	40	40
40	90	80	104	58
12	420	100	500	300
12	350	800	700	400
50	100	150	300	180

(10 marks)

3. Assume a worksheet with name “SALES” having column names ITEMCODE, UNITS, PRICE, SALES, COMMISSION and REMARKS. Write the appropriate MS-Excel functions for performing the following operations:

- a) Calculate the commission:

<u>Sales</u>	<u>Commission</u>
<2000	2% of sales
2001-6000	3% of sales
>6001	6% of sales

- b) Decide the remarks:

<u>Sales</u>	<u>Remarks</u>
< 2000	POOR
2001-6000	GOOD
>6000	EXCELLENT

- c) Calculate the total sales of items having units >2000.  
 d) Sum the commission for remarks is “Excellent”.  
 e) Count for units greater than 2000.  
 f) Calculate average of commission.

(10 marks)

4. What are input and output devices? Write short note on any one device from each. (5 marks)
5. How advantageous is computer networking in our day to day life? (5 marks)
6. Explain if else ladder with an example. (5 marks)
7. With example define time activity curve and its role in Nuclear Medicine. (5 marks)
8. Explain the difference between looping and selection statements. (5 marks)
9. What is an array? Write a program to display the sum of odd numbers present in an integer array. (5 marks)
10. What is a pivot table? Why is it used in MS-Excel? (2 marks)
11. Give the syntax of **countif** function in MS Excel with example. (2 marks)
12. Write the syntax of nested if in MS Excel for deciding the student's result as "pass" or "fail" based on the average  $> 35$  or average  $< 35$ . (2 marks)
13. Write steps to draw insert a chart in presentation. (2 marks)
14. What is an operating system? Give some examples. (2 marks)



**MANIPAL ACADEMY OF HIGHER EDUCATION**  
**FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2018**  
**SUBJECT: PAPER VI: BIOMEDICAL ELECTRONICS**  
**(NEW REGULATION)**

Tuesday, June 05, 2018

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 the types of filters.

1B. List the types of electronic oscillator and explain briefly.

(5+5 = 10 marks)

2A. Explain the ideal op-amp with symbol.

2B. Explain on comparators and their use in Nuclear Medicine.

(4+6 = 10 marks)

3A. Explain the unipolar transistor.

3B. Explain Zener diode.

3C. Explain the atomic configuration in semiconductors.

(4+3+3 = 10 marks)

4A. List and briefly explain on the types of voltage regulator power supply.

4B. Explain the application of diodes.

4C. Label and draw the PMT circuit.

(5+3+2 = 10 marks)

5A. Explain charge sensitive pre-amplifier.

5B. Explain the differentiator op-amp.

5C. Explain successive approximation ADC.

(3+3+4 = 10 marks)

6A. Explain binary algebra and write their use in Nuclear medicine.

6B. What is logic gate? Explain AND and OR gate.

6C. What is pulse pile-up? Why it occurs?

(4+4+2 = 10 marks)

7A. Explain quality of amplifier.

7B. Explain Norton equivalent circuit.

7C. Explain R-S flip-flop.

(5+2+3 = 10 marks)

8A. List and briefly explain on the various types of amplifier distortion.

8B. Explain coincidence and anticoincidence circuit and write the use of same in Nuclear medicine.

(5+5 = 10 marks)



**MANIPAL ACADEMY OF HIGHER EDUCATION****FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2018****SUBJECT: PAPER VII: RADIATION PHYSICS  
(NEW REGULATION)**

Thursday, June 07, 2018

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions. Draw neat and labelled diagram as and when required.**

1. Write on the detection mechanism adopted in Liquid Scintillation Counters. Elaborate on quenching.  
(20 marks)
2. Discuss on the interaction of radioactive emissions from the radionuclide  $^{99}\text{Mo}_{42}$  with matter.  
(20 marks)
3. Enlist the production method of radionuclides with examples. Explain on the mode by which  $^{15}\text{O}$  is produced.  
(10 marks)
4. Explain on the V-I curve of gas filled detectors.  
(10 marks)
5. **Write short notes of the following:**
  - 5A. Atom
  - 5B. Pocket dosimeter
  - 5C. Half life
  - 5D. Bragg's curve

(5 marks  $\times$  4 = 20 marks)



**MANIPAL ACADEMY OF HIGHER EDUCATION**  
**FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – MAY/JUNE 2018**  
**SUBJECT: PAPER IX: NUCLEAR MEDICINE INSTRUMENTATION – I**  
**(NEW REGULATION)**

Saturday, June 09, 2018

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions.**

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

1. Two gamma ray spectrometers attached to the respective well counters from the same company are available in your department. A sample was taken by the RSO from the delay tank of  $^{131}\text{I}$  therapy ward for the estimation of activity present in it.
  - 1A. How to determine the activity level in the sample?
  - 1B. But it was noted that in the lab the sample got contaminated with another radionuclide. What would you do to give the result to the RSO?
  - 1C. How would you ensure your spectrometer unit is working fine? State your answers in the right order.

(20 marks)
2. What is quenching? Differentiate between the quenching used in GM counters and Liquid scintillation counters.
 

(10 marks)
- 3A. A sample is counted in a well counter using a “narrow” pulse height analyser window (N) and net sample and background counts are 600 counts and 100 counts respectively. The sample is counted with the same system but using a “wide” window (W) and the net sample and background counts are 900 counts and 500 counts respectively. Which window setting offers the statistical advantage?
 

(5+5 = 10 marks)
- 3B. Explain types of Measurement error.
 

(5+5 = 10 marks)
4. “Resolution of a scanner influences the detectability of a lesion”. How this can be measured? Explain.
 

(10 marks)
5. Explain about the principle and design of whole body counters.
 

(10 marks)
6. What are the features you should look for when you are going to purchase a gamma operative probe?
 

(10 marks)
7. **Write short notes on the following:**
  - 7A. H-D curve
  - 7B. Information density

(10 marks)



**MANIPAL ACADEMY OF HIGHER EDUCATION**

FRIST YEAR MSC. RT / MOPT/MSc. ECG/MSc. CCIT/ MSc. NMT/ MSc. MLT/ MOT/ MSc. RRT & DT/ MASLP  
SECOND SEMESTER M.Sc. MRP/MSc. EXERCISE AND SPORTS SCIENCE / M.Sc. MIT/ M.Sc. HIM/M.Sc. CLINICAL PSYCHOLOGY  
DEGREE EXAMINATION – MAY/JUNE 2018

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

Tuesday, May 29, 2018

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

**Answer ALL the questions.**

- 1A. Define mean, median, mode, standard deviation and coefficient of variation.  
1B. What do you mean by simple random sampling? Explain lottery method in simple random sampling with the help of an example.  
(5+5 = 10 marks)
- 2A. Write two examples of Poisson random variable. Enumerate the properties of Poisson distribution.  
2B. Define sampling distribution, standard error and confidence interval. Write two applications of standard error in inferential statistics.  
(5+5 = 10 marks)
- 3A. Briefly explain the steps involved in one way ANOVA.  
3B. A research team wants to know the prevalence of anaemia among primary school going children in a rural area in southern India. A previous study conducted few years before in the same population showed that the prevalence of anaemia among primary school children was 15%. What is the minimum sample size required if absolute precision (margin of error) is 3% and confidence level of 95%?  
(5+5 = 10 marks)
4. Explain the structure of a research thesis.  
(10 marks)
5. A sample of 160 women between 75 and 80 years old were classified into one of two groups based on whether they took Vitamin E supplements at the time of enrolment. Each woman was subsequently given a test to measure cognitive ability. Higher scores on this test indicate better cognition. The average test score amongst 60 women taking vitamin E was 27 with standard

deviation of 6.9 as compared to a mean score of 24 with a standard deviation of 6.2 among 100 women not taking the supplements. The research team wants to know whether the mean scores differ significantly between the two groups.

- i) Name the statistical test used for comparing the mean scores between the two groups.
- ii) What are the assumptions for this test?
- iii) State the null and alternate hypothesis for this test?
- iv) Compute the test statistic for this test.
- v) State whether the test is one sided or two sided test. Justify your answer.

(1+2+2+4+1 = 10 marks)

6. Explain the design, measure of strength of association, strength and weakness of cohort study design.

(10 marks)

7. **Write short notes on:**

- 7A. Wilcoxon signed rank test
- 7B. Cross sectional study design
- 7C. Logistic regression
- 7D. Validity of diagnostic tests

(5 marks × 4 = 20 marks)



# MANIPAL ACADEMY OF HIGHER EDUCATION

**FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – MAY/JUNE 2018**

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

Thursday, May 31, 2018

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer Any EIGHT questions of the following.**

- 1A. Find the value of:  $\sin 420^\circ \cdot \cos (-300)^\circ$
- 1B. Explain the graph of semi log.
- 1C. Solve the equation  $x^2 - 5x - 14 = 0$  by using factorizing method.
- 1D. Find  $x$ :  $\log_7 x + \log_7 x^2 + \log_7 x^3 = 6$
- 1E. Define one-one function, onto function, even function and odd function.  
(2 marks  $\times$  5 = 10 marks)
- 2A. State and prove the Lagrange's Mean Value Theorem.
- 2B. Find the second derivative of:  $x^3 - 6x^2 + 2x + 5$  with respect to  $x$ .
- 2C. 500 mCi of I-131 was available on Monday at 12 noon. 2 patients were treated with 100 mCi and 75 mCi respectively on the same day at 12 noon. Calculate the remaining activity in the same consignment for the following Saturday at 10 am.  
(3+3+4 = 10 marks)
- 3A. If  $a = i + 2j - 3k$ ;  $b = 2i - j - 5k$  find  $a \times b$ , their magnitude and unit vector.
- 3B. Find the maximum and minimum values of  $\frac{1+x+x^2}{1-x+x^2}$   
(5+5 = 10 marks)
- 4A. Express the complex number  $1 - i$  in the polar form and hence find the modulus and amplitude.
- 4B. Write short note on Euler's formula in complex analysis.
- 4C. Find the adjoint of the square matrix  $A = \begin{bmatrix} 2 & 5 & 1 \\ 3 & 1 & 2 \\ 4 & 3 & 1 \end{bmatrix}$   
(3+2+5 = 10 marks)
- 5A. Calculate the exposure rate at 1 metre from a cesium-137 source of activity 0.1 GBq. It may be assumed that 86% of transformation is associated with the emission of 0.66 MeV gamma photons.



5B. Physical half life of an isotope is 10 hrs and biological half life is 3 hrs. Find Effective half life.

5C. Find the square root of 612 by Newton's Iterative method. Consider initial guess value as 10.  
(3+2+5 = 10 marks)

6A. Explain Fourier central Slice theorem used in SPECT image reconstruction.

6B. Explain Radon transformation used in SPECT image reconstruction.  
(5+5 = 10 marks)

7A. Evaluate  $\int \frac{x+4}{(x-2)(x+1)^2} dx$

7B. Evaluate :  $\int_0^{\pi/2} \cos^3 x dx$   
(5+5 = 10 marks)

8A. Find the counts at pixel3 ( $p_3$ ) by using Newton's interpolation formula. Data are given below:

Pixel no.	2	4	6	8	10	12
Counts	106k	130k	150k	168k	184k	200k

8B. Convert 350 mCi into GBq.

8C. Evaluate :  $\lim_{x \rightarrow 0} \frac{\sqrt{(1+x)} - 1}{x}$   
(6+2+2 = 10 marks)

9A. Find the maxima and minima of the function  $2x^3 - 12x^2 + 18x + 5$ .

9B. Derive single open compartment with single inlet and single outlet having same rate.  
(4+6 = 10 marks)

