

MANIPAL UNIVERSITY

FRIST YEAR MSc. MLT / MSc. NMT / SECOND SEMESTER M.Sc. CLINICAL
PSYCHOLOGY / M.Sc. EXERCISE AND SPORTS SCIENCE / M.Sc. HHIA
DEGREE EXAMINATION – DECEMBER 2015

SUBJECT: BIOSTATISTICS / PAPER IV: ADVANCED BIOSTATISTICS & RESEARCH
METHODOLOGY (NR) / ADVANCED BIOSTATISTICS & RESEARCH METHODOLOGY
(MCP 106) / RESEARCH METHODOLOGY & BIOSTATISTICS (MES 608 T) /
EPIDEMIOLOGY & BIOSTATISTICS (MHI 606) (2013 SCHEME)

Tuesday, December 15, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ Answer ALL the questions.

- 1A. Explain rate ratio and proportion with example.
- 1B. What is Stratified sampling? Explain the procedure with Example. List the advantages and disadvantages of this technique.
(5+5 = 10 marks)
- 2A. Write short note on Binomial distribution.
- 2B. In the study of fingerprints an important quantitative characteristic is the total ridge count for the 10 fingers of an individual. Suppose that the total ridge counts of individuals in a certain population are approximately normally distributed with a mean of 140 and a standard deviation of 50. Find the probability that an individual picked at random from this population will have a ridge count:
- Between 140 and 190
 - Less than 90
- (5+5 = 10 marks)
- 3A. Define the following terms:
- Inference
 - Type one and type two error in testing of hypothesis
 - Level of significance
- (2+2+1 = 5 marks)
- 3B. Describe with example the situation in which you would use a 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?
(1+1+2+1 = 5 marks)
- 4A. Differentiate parametric and non-parametric tests. Explain the situation for Mann-Whitney U test.
- 4B. Write short note on the application of Chi-square test.
(5+5 = 10 marks)

5A. A hospital administrator wishes to estimate the mean weight of babies born in her hospital. How large a sample of birth records should be taken if she wants a 95 percent confidence interval with error margin $d=0.5$ pound? Assume that a reasonable estimate of σ is 1 pound. (Given $Z_{1-\alpha/2}=1.96$)

5B. Write a short note on Survival Analysis.

(5+5 = 10 marks)

6. Discuss Case Control study under:

6A. Design

6B. Features

6C. Steps

6D. Advantages and disadvantages

(10 marks)

7. Outline the structure of a research protocol.

(10 marks)

8. Write short note on the following:

8A. Cross sectional study design

8B. Evaluation of diagnostic tests

(5+5 = 10 marks)



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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – DECEMBER 2015

SUBJECT: PAPER VII: RADIATION PHYSICS (NEW REGULATION)

Thursday, December 17, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL questions.**

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

1. Comment on the following statement with proof/(s) - "The radionuclides used in modern Nuclear Medicine all are of manufactured variety."

(20 marks)

2A. Derive law of radioactive decay and half- lives. Elaborate on each terms.

2B. Explain on beta decay and internal conversion.

(10+10 = 20 marks)

3. What are radiation detectors? Discuss on gas filled detectors principle, characteristics, properties and application/(s) in Nuclear Medicine under each class with suitable examples.

(20 marks)

4. A consignment of $^{131}\text{I-NaI}$ was received in your therapy hotlab on Monday the 10th at 7 hours. The packing note stated calibration details as 1Ci in 6ml at 10hours for the same day. Calculate the:

4A. Volume to be withdrawn for the following patients posted for ablation therapy.

Date/ Day	Time	Activity
10 th Monday	8 hours	i)100mCi ii) 200mCi
11 th Tuesday	9 hours	i) 30mCi ii) 150mCi
15 th Wednesday	14 hours	68mCi

4B. Thickness of lead required to bring down the remaining activity to 10% on 15th.

(8+2 = 10 marks)

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

5A. Transient equilibrium

5B. Energy Spectrum

(5 marks × 2 = 10 marks)



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

Friday, December 18, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

☞ **Answer ALL the questions.**

1. Write in very short about the followings:

- 1A. Homogenous Solution
- 1B. Strong Acid and Strong Base
- 1C. Bateman's Equation
- 1D. Secular equilibrium
- 1E. Equation for production of radionuclides
- 1F. Specific activity
- 1G. Solvent front in ITLC Chromatography
- 1H. Cardinal Principles for radiation protection
- 1I. Chemiluminescence
- 1J. Elution efficiency of radionuclide generator

(2 marks × 10 = 20 marks)

2. Write in detail the production of radionuclides.

(5 marks)

3. Write a brief note on ^{99m}Tc MAG3

(5 marks)

4. Discuss the important features of ^{68}Ge - ^{68}Ga generator.

(5 marks)

5. Why automatic synthesis modules are required in radiochemistry lab?

(5 marks)

6. Differentiate between followings:

- 6A. Normal Solution and Molar Solution
- 6B. Saturated and Supersaturated Solution

(5+5 = 10 marks)

7. Why Tc99m is considered as a life line for all nuclear medicine centres across the country?

(10 marks)

8. Write the names of various types of chromatography useful in hospital radiopharmacy and radiochemistry lab. What are important points to be consider for doing ascending paper chromatography.

(10 marks)

9. Compare and contrast different ^{99m}Tc agents used for bone Scintigraphy with their biologic behaviour.

(10 marks)



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

Saturday, December 19, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

 **Answer ALL the questions.**

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

1. In detail discuss on the principle and operation of pulse height analyzers used in radiation detection instruments. Add a note on the different modes of counting.

(20 marks)

2A. Energy linearity check is an important parameter during the assessment of the performance characteristics of a gamma ray spectrometer". Comment on the statement and explain the procedure for energy linearity check.

2B. Why semiconductor detector spectrometers have excellent energy resolution over NaI(Tl) detector spectrometers?

2C. State the role of gain setting or gain factor dial on spectrometer.

(10+5+5 = 20 marks)

3. What are the features to be considered for an ideal intraoperative gamma probe? Illustrate how to evaluate the quality of laproscopic gamma probe system?

(10 marks)

4. What were the display modes adopted in rectilinear scanner? Add a note on contrast enhancement technique.

(10 marks)

5. "Energy resolution and energy linearity of isotope calibrators are excellent than semiconductor detectors". How will you comment on this statement?

(10 marks)

6A. Explain Propagation of errors used in Nuclear Medicine.

6B. Write a short note on Poisson Distribution.

(5+5 = 10 marks)



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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – DECEMBER 2015

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

Monday, December 21, 2015

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

☞ **Answer any EIGHT questions of the following.**

1A. If $\operatorname{cosec} A = -13/12$ and $180 < A < 270$ find the value of $\frac{4 \sin A + \cos A}{8 \sin A + 2 \cos A}$

1B. $A = \begin{bmatrix} 2 & -3 & 0 \\ 1 & 4 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 6 & 1 \\ 3 & 0 \\ 5 & 2 \end{bmatrix}$ Show that $(AB)' = B'A'$

1C. Explain iterative reconstruction algorithms in Nuclear Medicine.

(2+4+4 = 10 marks)

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

2B. Explain the use of Radon transformation in Nuclear Medicine.

(5+5 = 10 marks)

3A. The activity of Tc99m 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-radioactive waste and write the answer in Curie.

3B. The table gives the distances in cm. of the visible horizon for the given heights in inch above the detector surface:

X=height	10	15	20	25	30	35	40
Y= distance	11	13	15	16	18	19	21

Find value of y when x= 22 by using Newton's interpolation Formula.

(5+5 = 10 marks)

4A. Explain log-log graph, sine graph, Logit log graph and write the use in Nuclear Medicine.

4B. Write the polar co-ordination and Cartesian co-ordination.

4C. Find $\lim_{x \rightarrow \infty} \frac{\operatorname{Lt} (5x+1)(6x+4)}{(x+1)(x-7)}$

(3+4+3 = 10 marks)

5A. Find derivative of the function $y = \sin x$ by first principle.

5B. Show that the curves $y = x^3$; $6y = 7 - x^2$ at (1,1) cut orthogonally.

5C. Solve $dy/dx + xy = xy^2$

(3+3+4 = 10 marks)

6A. Find the second derivative of: $x^2 \cdot \log x$

6B. Simplify $\frac{(\cos 5\theta + i \sin 5\theta)^2 + (\cos 2\theta - i \sin 2\theta)^6}{(\cos 4\theta + i \sin 4\theta)^2 (\cos 3\theta - i \sin 3\theta)^4}$

6C. Convert 2.5 GBq into mCi

(4+4+2 = 10 marks)

7A. Integrate $\tan^4 x$

7B. What would be the radiation level at a distance of 2m from cobalt -60 source activity 10GBq?
(K factor = 0.31mGy/hr/ GBq at 1m)

7C. Derive the decay constant by the half life concept of the radioactivity.

(5+3+2 = 10 marks)

8A. Define onto, one-to-one function, even function, odd function.

8B. Find out tangent and normal equations for: $2x^3 - 9xy + 2y^3 = 0$ at point (2, 1).

8C. 500 mCi of I-131 was available on Monday at 12 noon. 2 patients were treated with 100 mCi and 75 mCi on the same day at 12 noon. On the following Thursday at 11 am a patient was treated from the same consignment with 100mCi. Calculate the remaining activity in the same consignment at 11am on Thursday and on Saturday at 10 am.

(2+3+5 = 10 marks)

9A. Evaluate $\int_0^{\pi/2} x^2 \cos x \, dx$

9B. Evaluate: $\int \frac{2x-2}{(x+1)(x^2+4)}$

(5+5 = 10 marks)

