

Reg. No.										
----------	--	--	--	--	--	--	--	--	--	--

MANIPAL UNIVERSITY

FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2017

SUBJECT: ANATOMY
(NEW REGULATIONS)

Friday, June 02, 2017

Time: 10.00 - 11.30 Hrs.

Max. Marks: 40

 Answer ALL the questions.

1. Name the parts of the respiratory tract. Describe the features, arterial supply and nerve supply of the lateral wall of the nasal cavity.

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

2. Write short notes on:

- 2A. Typical spinal nerve
- 2B. Right atrium of heart
- 2C. Stomach
- 2D. Spermatic cord
- 2E. Thyroid gland
- 2F. Corpus striatum

(5 marks × 6 = 30 marks)



MANIPAL UNIVERSITY

FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2017
SUBJECT: MIT 104 PHYSIOLOGY/ BOP 102 GENERAL PHYSIOLOGY
(NEW REGULATION)

Monday, June 05, 2017

Time: 10:00 – 11:30 Hours

Maximum Marks: 40

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

1. Essay questions:

- 1A. Draw and label a normal electrocardiogram (ECG) from limb lead II. Mention the causes for different waves. Give two uses of ECG.
- 1B. In the form of a flow chart, describe the events that occur during neuromuscular transmission in skeletal muscle.
- 1C. Write the pathway for intrinsic mechanism of blood clotting.
- 1D. Draw a neat labeled diagram of oxygen hemoglobin dissociation curve. Mention any two factors that shift the curve to the right.

(5 marks × 4 = 20 marks)

2. Write short answers for the following:

- 2A. Classify body fluid compartments.
- 2B. Define resting membrane potential. Give its normal value in a neuron.
- 2C. Name the hormones secreted by adrenal cortex and adrenal medulla.
- 2D. List two ascending tracts in the spinal cord.
- 2E. List any two functions of placenta.
- 2F. Mention the components of gastric juice.
- 2G. Name the receptors for vision. Where are they located?
- 2H. Write any two features of Parkinson's disease.
- 2I. Mention the normal GFR value. Mention any two factors affecting GFR.
- 2J. Write any two differences between first and second heart sounds.

(2 marks × 10 = 20 marks)



Reg. No.																			
----------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MANIPAL UNIVERSITY

FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2017

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

Friday, June 09, 2017

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ Answer ALL questions.

1A. Explain qualitative and quantitative variables with suitable examples.

1B. Discuss systematic random sampling and stratified random sampling.

(5+5 = 10 marks)

2A. Write the properties of normal distribution. List any two applications of normal distribution.

2B. Define sampling distribution and standard error. Explain the formula for 95% confidence interval for (i) mean and (ii) proportion.

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

3A. Name the statistical test used for comparing the means of a variable between two independent groups.

3B. How do you define the null and alternate hypotheses for the above test?

3C. Explain the formula for the test statistic of this test.

3D. What are the assumptions for this test?

3E. What is the degrees of freedom for this test?

3F. How do you take a decision on the acceptance or rejection of null hypothesis for this test?

(1+2+3+2+1+1 = 10 marks)

4A. In a study conducted to compare drug and surgical treatments for chronic lower back pain, 80 out of 120 patients treated surgically experienced relief from their pain, while 56 out of 110 patients receiving a nonsteroidal anti-inflammatory agent experienced relief. Test whether the difference observed in the proportion of patients afforded relief from their back pain by surgery and by medication is due to chance. (The table value at 5% level of significance is 3.84)

4B. A study was planned to know the prevalence rate of goitre in 10-12 year children in a district in Karnataka, India. How many households should be randomly selected so that the maximum error is 10% and with a confidence level of 95%? Based on a previous study conducted in the same population few years back the expected prevalence of goiter was 20%.

(5+5 = 10 marks)

- 5A. Define epidemiology. Write any four uses of epidemiology.
- 5B. Explain the design of a case control study. Enumerate the advantages and disadvantages of this design.

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

6. Describe the structure of research thesis.

(10 marks)

7. **Write short notes on:**

- 7A. ANOVA
- 7B. Non-parametric tests
- 7C. Randomization in experimental studies
- 7D. Validity of a screening test

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



Reg. No.									
----------	--	--	--	--	--	--	--	--	--

MANIPAL UNIVERSITY

FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2017

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

Monday, June 12, 2017

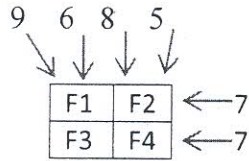
Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ Answer Any EIGHT questions of the following.

- 1A. Prove that $\sec^4 x - \sec^2 x = \tan^4 x + \tan^2 x$
- 1B. Explain De Morgan's law in set theory.
- 1C. Find the cross product of the $3i-2j+k$, $2i+j-4k$ pairs of vectors, and also find their magnitude.
(3+3+4 = 10 marks)
- 2A. 600 mCi of I-131 was available on Monday at 12 noon. 2 patients were treated with 150 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.
- 2B. A Nuclear Medicine procedure was performed with 150mCi Tc^{99m} source, maintaining an average distance of 30cm for 10min. what is the exposure received by him/her?
(5+5 = 10 marks)
- 3A. Find the modulus of the vectors: $2i+3j+6k$.
- 3B. Explain the types of vectors and the use of the vector concept in Nuclear Medicine
- 3C. Express the complex number $(1-i)/(1+i)$ in the polar form and hence find their modulus and amplitude.
(2+4+4 = 10 marks)
- 4A. Prove that the curves $y = x^3 - 3x^2 + 5x + 7$ and $y = x^2 + 16x + 13$ touch one another at the point $(-1, -2)$. Also find the equation of the common tangent.
- 4B. If $A = \begin{bmatrix} 1 & 3 \\ 1 & 0 \end{bmatrix}$ Prove that $A^2 - A - 3I = 0$
(4+6 = 10 marks)
- 5A. Evaluate $\int \sin^2 x \, dx$.
- 5B. Convert 200mCi into GBq.
- 5C. Evaluate: $\int \frac{3}{(x+2)(x-1)} dx$
(3+2+5 = 10 marks)

- 6A. Find the values of 4 pixels from the provided 6 bin values using the method of algebraic reconstruction technique.



- 6B. Deduce the appropriate compartment model. Where $C_p(t)$, $C_f(t)$, $C_b(t)$ and $C_n(t)$ are radioactivity concentrations at time t [min] for each compartment.

$$\frac{dC_b(t)}{dt} = k_3 C_f(t) - k_4 C_b(t)$$

$$\frac{dC_f(t)}{dt} = k_1 C_p(t) + k_6 C_n(t) + k_4 C_b(t) - (k_2 + k_3 + k_5) C_f(t)$$

$$\frac{dC_n(t)}{dt} = k_5 C_f(t) - k_6 C_n(t)$$

(6+4 = 10 marks)

- 7A. Explain the Newton's interpolation formula and where we use this in Nuclear Medicine.
 7B. 1 uSv/hr is equivalent to how much mR/hr?
 7C. Calculate the exposure rate at 1 metre from a Cs-137 source of activity 0.2 GBq. It assume that 86% of the transformation is associated with the emission of 0.66MeV gamma photon.

(4+3+3 = 10 marks)

- 8A. Prove that $\log x/y + \log y/x + \log z/x + \log x/z = 0$
 8B. Form the differential equation by eliminating the arbitrary constant a in the equation:

$$y = x^2 + ax.$$

- 8C. Evaluate $\int_0^1 (x^3 - 3x^2 + 2x + 1) dx$

(3+3+4 = 10 marks)

- 9A. Differentiate $\sqrt{\sin x}$
 9B. By using De Moivre's theorem prove that $(1-i)^9 = 16-16i$.
 9C. Find the second derivative of $x^3 \cos^2 x + 3x^2 \sin x$.

(2+5+3 = 10 marks)



MANIPAL UNIVERSITY

FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2017

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

Wednesday, June 14, 2017

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 care and quality assurance measures that should be adopted for Nuclear Medicine Computers.

(10 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	60
40	90	80	104	58	110
12	420	100	500	300	150
12	350	800	700	400	120
50	100	150	300	180	32
40	50	80	137	175	54
80	70	64	98	8	10
60	20	50	87	8	8

(10 marks)

3. Briefly explain the different switching techniques in Networking.

(5 marks)

4. Write on the advantages and disadvantages of internet.

(5 marks)

5. Write a C program to calculate net-salary for given basic salary, considering the following conditions.

- i) If basic salary is greater than 10000, bonus is 25% of basic salary otherwise bonus is 10% of basic salary.
- ii) Net-salary = Basic salary + bonus.

(5 marks)

6. Explain the usage of switch statement with an example.

(5 marks)

7. Write short note on RISC.

(4 marks)

8. What is Gamma Camera Interface? With reason state is it an essential device in Nuclear Medicine?

(4 marks)

9. Convert the following:

9A. $(6534)_{10} = ()_2$

9B. $(101101)_2 = ()_{10}$

(2 marks \times 2 = 4 marks)

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

(2 marks)

11. Explain the working of sum function with an example in MS Excel.

(2 marks)

12. What are input devices? Give examples.

(2 marks)

13. For a gamma camera having 0.96cm as FWHM and 550mm as the dimension, which matrix size would give an optimum resolution?

(2 marks)

14. Define the following terms:

14A. BUS

14B. Compiler

14C. Region of Interest

14D. Variable

14E. Software

14F. Cache Memory

14G. Dead Time

14H. Dynamic Acquisition

14I. Latency Period

14J. Identifier

(2 marks \times 10 = 20 marks)



MANIPAL UNIVERSITY

FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2017

**SUBJECT: PAPER VI: BIOMEDICAL ELECTRONICS
(NEW REGULATION)**

Friday, June 16, 2017

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 on filters used in image reconstruction.
1B. Write a short note on Zener diode.
1C. Define Ohm's Law and Kirchhoff's Law.

(4+4+2 = 10 marks)

- 2A. Explain differential op-amp and integral op-amp.
2B. Explain comparator. Also write its use in Nuclear Medicine.

(5+5 = 10 marks)

- 3A. Explain the mathematical model used in PMT.
3B. Explain briefly Multivibrator.
3C. Explain Thevenin Equivalent circuit.
3D. Explain charge sensitive Pre-amplifier.

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

- 4A. Explain NAND gate Ex-OR gate and NOR gate.
4B. Find $(11101)_2 + (110001)_2 + (101011)_2$, $(11011)_2 \times (1011)_2$ and convert the answers into decimal form.

(5+5 = 10 marks)

5A. Explain on characteristics of amplifier.

5B. Explain on JFET

(4+6 = 10 marks)

6A. What is ADC? Explain main types of ADC and its use in Nuclear Medicine.

6B. Explain on Bipolar transistor.

(6+4 = 10 marks)

7A. Explain UPS.

7B. Explain voltage regulator Power supply.

(5+5 = 10 marks)

8A. Explain CRT.

8B. Explain Amplifier distortion.

(6+4 = 10 marks)



MANIPAL UNIVERSITY**FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2017****SUBJECT: PAPER VII: RADIATION PHYSICS
(NEW REGULATION)**

Monday, June 19, 2017

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ Answer ALL the questions.

1. Define the following:
 - i) Cerenkov radiation
 - ii) Intrinsic efficiency
 - iii) Decay constant
 - iv) Binding energy
 - v) Annihilation

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

- 3A. Prove that for relatively low photon energies the recoil electron receives only a small fraction of the incident photon energy even in 180° scattering events.
- 3B. Backscatter peak and Compton edge are same in a pulse height spectrum. Opine on this statement.

- 4A. What is the difference between orbital electron binding energy and Nuclear binding energy of an atom?
- 4B. **Write short notes on:**
 - i) Alpha decay
 - ii) Electron capture

- 5A. What is HVL and TVL? How are they related?
- 5B. What is thickness of the Lead required to reduce the exposure of point source of ^{131}I by 70%?

6. Explain the principle and mechanism of Liquid scintillation counting.

7. Write the basic principle for the cyclotron with equations. What are the different types of cyclotron and highlight the differences?

8. Explain the principle of Gas filled detector.

(10 marks \times 8 = 80 marks)

MANIPAL UNIVERSITY**FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2017****SUBJECT: PAPER VIII: RADIOPHARMACY – I
(NEW REGULATION)**

Wednesday, June 21, 2017

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions.**

1. Write in very short about the followings:

- 1A. Solutes and Solvents
- 1B. Rate of reaction
- 1C. Control rod in nuclear reactor
- 1D. Crystallization
- 1E. Distillation
- 1F. ^{18}F -FDG
- 1G. $^{99\text{m}}\text{Tc}$ -DMSA(V)
- 1H. ^{131}I -mIBG
- 1I. Chloramine-T method used for radioiodination
- 1J. Elution efficiency of radionuclide generator

(2 marks \times 10 = 20 marks)

2. Enlist the sources for production of artificial radionuclides. (No details). (5 marks)
3. Explain transient and secular equilibrium. (5 marks)
4. Describe the protocol for the preparation of any Reticulo Endothelial System imaging agent and mention the function of gelatin in the cold kit. (5 marks)
5. Write about ultra-short lived radionuclide generators. (5 marks)
6. What are strong acid and strong bases? Describe limitations of Arrhenius concept of Acid and Base. Give suitable examples. (10 marks)
7. Describe the different factors affecting the designing of a new radiopharmaceutical. (10 marks)
8. Write the names of various types of chromatography useful in hospital radiopharmacy and radiochemistry lab. What are the important points to be considered for doing ascending paper chromatography? (10 marks)
9. Explain the components and working principle of a medical cyclotron. (10 marks)



MANIPAL UNIVERSITY**FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2017****SUBJECT: PAPER IX: NUCLEAR MEDICINE INSTRUMENTATION – I
(NEW REGULATION)**

Friday, June 23, 2017

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ALL the questions.**

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

1. Describe on the specifications, detector characteristics and detection efficiency of NaI(Tl) well counter used for routine radionuclides assay as well as in radioimmunoassay counters.
(20 marks)
- 2A. Role, type and characteristics of calibration sources in Nuclear Medicine. Why ^{137}Cs is so widely used? List the various check sources used for various instruments specifying the activity and test.
(12 marks)
- 2B. How EHT determination of gamma ray spectrometer is achieved?
(8 marks)
3. How the number and size of the holes affect the performance characteristics of the collimator?
(10 marks)
4. Briefly explain on the composition of the solvent used in organic scintillation detectors.
(10 marks)
5. Linearity tests of thyroid uptake probe- explain.
(10 marks)
- 6A. Explain the properties of Normal distribution.
- 6B. Assume gross count rate and back ground count rates are 900cpm and 100cpm respectively. What is the optimal division of a 1.25 minute total counting time and the resulting uncertainty in the net sample counting rate?
(5+5 = 10 marks)

