Reg. No.									

MANIPAL UNIVERSITY

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 2014

SUBJECT: PHYSIOLOGY

Thursday, June 05, 2014

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

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

1. **Essay questions:**

1A. Define cardiac output. Give its normal value and describe the factors regulating cardiac output.

1B. List any five actions of thyroid hormones.

1C. Define erythropoiesis. Mention its stages and list any two factors regulating it.

1D. Define a reflex. Draw a neat labeled diagram of a reflex arc.

(5 marks × 4 = 20 marks)

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

2A. Write any two differences between simple diffusion and facilitated diffusion.

2B. Draw a neat labeled diagram of a neuron.

2C. List any four hormones secreted by anterior pituitary.

2D. Name the two divisions of autonomic nervous system.

2E. Mention any two contraceptive methods in males.

2F. List two functions of liver.

2G. Mention the location of rods and cones. State one function of each.

2H. Classify hypoxia.

2I. Define GFR and give its normal value.

2J. Draw a labeled diagram of a sarcomere.

(2 marks × 10 = 20 marks)

M.Sc NMT

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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.

FIRST SEMESTER B OPTOM./B.Sc. H.I.A./ B.Sc. P.F.T.

DEGREE EXAMINATION – JUNE 2014

SUBJECT: ANATOMY/GENERAL ANATOMY

Tuesday, June 03, 2014

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

✍ **Answer ALL the questions.**

1.   Name the parts of respiratory system. Describe the right lung in detail.

(5+5 = 10 marks)

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

2A.   Spermatic cord

2B.   Pericardium

2C.   Gall bladder

2D.   Spinal cord

2E.   Tongue

2F.   Fibrous joints

(5 marks × 6 = 30 marks)

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FIRST YEAR BPT/BOT/B.Sc. MLT/ B.Sc. NMT/B.Sc. RT/B.Sc. MIT/B.Sc. CVT/ B.Sc. RRT & DT/M.Sc. NMT

DEGREE EXAMINATION – JUNE 2014

SUBJECT: BIOCHEMISTRY

Saturday, June 07, 2014

Time: 10.00-11.30 Hours   Max. Marks: 40

- ✍ **Answer ALL the questions.**
- ✍ **Draw diagrams and flow charts wherever appropriate.**

1. Explain gluconeogenesis under the following headings:

1A. Site and subcellular site

1B. Reactions of synthesis of glucose from lactate

(1+7 = 8 marks)

2. Classify enzymes giving one example for each class.

(6 marks)

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

3A. Structure of starch

3B. Reactions of β-oxidation of fatty acyl CoA

3C. Four differences between DNA and RNA

3D. Classification and functions of lipoproteins

(4 marks × 4 = 16 marks)

4. **Answer the following:**

4A. Define and write the normal values of BMR

4B. Name two essential fatty acids and write their functions

4C. Write the normal serum levels of total protein, creatinine, calcium and urea

4D. List four differences between kwashiorkor and Marasmus

4E. Mention the fate of the end product of glycogenolysis in liver and muscle

(2 marks × 5 = 10 marks)

Reg. No.									

MANIPAL UNIVERSITY

FIRST YEAR M.Sc. N.M.T (NR) DEGREE EXAMINATION – JUNE 2014
SUBJECT: (PAPER IV) - ADVANCED BIOSTATISTICS & RESEARCH METHODOLOGY

Tuesday, June 10, 2014

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

✍ **Answer ALL the questions.**

1A.   Compute the various measures of central tendency for the following data.
      Age in years: 35   45   38   32   41   48   36   34   46   32
1B.   With the help of an example explain stratified random sampling. Write its merits and
      demerits.

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

2A.   Enumerate the properties of normal distribution with an appropriate diagram.
2B.   An epidemiologist wishes to know what proportion of adults living in a large metropolitan
      area have hepatitis B virus. A random sample of 500 adults from the same population gave a
      prevalence of 15%. Find the 95% and 99% confidence intervals for the prevalence of hepatitis
      B virus in the study population. (Standard normal table value for 95% and 99% are 1.96 and
      2.58 respectively).

                                                     (5+5 = 10 marks)

3A.   Write an example for Chi square test for association. Write the assumptions, test statistic
      formula and degrees of freedom for this test.
3B.   Write short notes on Mann Whitney U test and Kruskal Wallis test.

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

4.   A study was conducted to compare the measurements made by two instruments a Wright Peak
      Flow meter and a Mini Peak Flow Meter in measuring PEFR. 12 subjects were randomly
      chosen and measured their PEFR (lt/min) using the two instruments. The results are given
      below:

Subjects:	1	2	3	4	5	6	7	8	9	10	11	12
Wright:	490	397	512	401	470	415	431	429	420	275	165	421
Mini:	525	415	508	444	500	460	390	432	420	227	268	443

4A.   Name the statistical test to compare the mean PEFR between the two instruments.
4B.   What are the assumptions for this test?
4C.   State the null and alternate hypothesis for the above study.
4D.   Write the test statistic formula.
4E.   What is the degrees of freedom?
4F.   Briefly explain how would you take a decision about the acceptance or rejection of the null
      hypothesis.

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

5A. A study was planned to compare the left ventricular end diastolic volume between male and female healthy volunteers in the age group of 30-40 years. What is the minimum sample size required in each group if the investigators considered a difference of 10 mL as clinically significant with power of 80% and level of significance (los) of 5%? From a pilot study it was observed that the pooled standard deviation of left ventricular end diastolic volume was 25 mL. (The standard normal table value for 5% los and 80% power is 1.96 and 0.84 respectively).

5B. Distinguish between incidence rate and prevalence rate.

(5+5 = 10 marks)

6. Explain the various steps in a randomized controlled trial.

(10 marks)

7. Write short notes on:

7A. Review of literature

7B. Systematic reviews

7C. Validity of diagnostic tests

7D. Logistic regression

(5 marks × 4 = 20 marks)

MANIPAL UNIVERSITY

FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER VII: RADIATION PHYSICS

Thursday, June 12, 2014

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

- ✎ **Answer ALL questions.**
- ✎ **Draw neat and labelled diagram as and when required.**

1. Explain on atom, structure and the various atomic models.

(20 marks)

2A. State the mode of producing ^{137}Cs. Also explain on the operation of same.

2B. Draw the energy spectrum of ^{137}Cs. Explain on each peak.

(10+10 = 20 marks)

3A. A ^{99}Mo-^{99m}Tc generator calibrated for 5th Friday with 1Ci (^{99}Mo) at 10 hours was received in the Nuclear Medicine department on 2nd Tuesday at 6 hours. Calculate the yield that can be obtained on 2nd 4th, 5th, 10th and 15th at 8 hours.

3B. How should you assay the presence of Molybdenum 99 in the yields obtained above? What is the principle behind it?

3C. For the isotope ^{131}I calculate the thickness of the absorber lead required to reduce the activity by 30%.

(5+3+2 = 10 marks)

4. **Write short note on the following:**

4A. Trilinear chart

4B. Alpha decay and interaction

4C. Dead time

4D. Solid state detectors

4E. Quenching in GM counters

4F. PMT

(5 marks × 6 = 30 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER VIII: RADIOPHARMACY – I

Saturday, June 14, 2014

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

✍ **Answer ALL the questions.**

1.   **Write short notes on:**

1A.   Neutralization

1B.   Bronsted Acid and Bronsted Base

1C.   Lewis acid and Lewis Base

1D. F^{18}-FDG

1E.   Ultra-centrifuge

1F.   Solvents in chromatography

1G.   Transition energy

1H.   Annihilation radiations

1I.   Auger conversion electrons

1J.   Ligands

(2 marks × 10 = 20 marks)

2A.   Write short notes on all radioactive decay.

2B.   Discuss on neutron capture.

2C.   A 3000mCi Moly generator calibrated for Friday 8:00 p.m. was eluted at 8:00 a.m. the following Wednesday. Assuming that 80% of Tc^{99m} activity was eluted, what would be the theoretical activity of Tc^{99m} on the column at 1:00 p.m. on the same day (Wednesday)?

2D.   Elaborate on Tc^{99m} Chemistry.

(5 marks × 4 = 20 marks)

3A.   Define solution. Write important properties of solutions. Compare Homogenous and Hetrogenous solution with examples.

3B.   Mechanisms of retention of ^{99m}Tc HMPAO & ^{99m}Tc ECD in the brain.

3C.   Describe the basic principle of ^{99m}Tc-sulfur colloid preparations. Why gelatin and EDTA added to ^{99m}Tc-sulfur colloid?

3D.   Describe the methods of preparation of ^{18}F-FDG

(10 marks × 4 = 40 marks)

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FIRST YEAR M.Sc. N.M.T. DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER III: MATHEMATICS IN NUCLEAR MEDICINE

Monday, June 16, 2014

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

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

1A. Form the differential equations by eliminating the arbitrary constant a : $xy = a^2$.

1B. Find $\displaystyle \lim_{x \to 0} \frac{\sqrt{1+x} - 1}{x}$

1C. Solve using Cramer's rule $5x–2y–3z = 17$; $3x–y+z = 15$; $x+y–6z= –13$.

(2+2+6 = 10 marks)

2A. Find the maxima and Minima of the function $2x^3–12x^2+18x+5$.

2B. Integrate $\tan^4 x$.

(5+5 = 10 marks)

3A. Find out the exposure level at 80 cm from 150 mCi of I-131 kept in a lead pot having thickness of 3.0 cm (I-131 k factor – 2.2 R/hr, HVT = 0.3 cm).

3B. Explain two – dimensional Fourier Transformation in image reconstruction.

(4+6 = 10 marks)

4A. Explain iterative reconstruction algorithms in Nuclear Medicine.

4B. Express the complex number $\sqrt{3}+ i$ in the polar form and hence find the modulus and amplitude.

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

(4+3+3 = 10 marks)

5A. 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.

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

5C. Convert 250 mCi into GBq.

(4+4+2 = 10 marks)

6A. Deduce the appropriate compartment model.

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

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

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

6B. Calculate the exposure rate at 1 mtr from a cesium-137 source of activity 0.1GBq. Assume that 86% of the transformation is associated with the emission of 0.66MeV gamma photons.

6C. Physical half-life of an isotope is 10 hrs and biological half-life is 3 hrs. Find the effective half-life.

(5+3+2 = 10 marks)

7A. Find x : $\log_7 x + \log_7 x^2 + \log_7 x^3 = 6$

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

7C. Define onto, one-to-one function, even function, odd function.

7D. Find the Laplace transform of : $t^2 \sin at$.

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

8A. Write the formula of Simpson's 1/3 rule, Simpson's 3/8 rule.

8B. Explain sin graph.

8C. Find derivatives of $\log[x + \sqrt{(x^2+a^2)}]$

8D. Find the second derivative of the $6x^3 + 3x^2 + 2x + 5$

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

9A. Explain Finite Forward Differences and Finite Backward Differences.

9B. Evaluate: $\int \frac{2x+1 \, dx}{x^2 - 3x + 2}$

(5+5 = 10 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER V: COMPUTERS IN NUCLEAR MEDICINE

Wednesday, June 18, 2014

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

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

1. What are filters? Explain in detail the role of filters used in Nuclear Medicine with examples.
    (10marks)

2. What is a protocol? Specify different types of protocols used in the Computer Network. Describe any of the protocol in detail.
    (10 marks)

3A. Assume a worksheet with name "Salary" having column names Emp Code, Name, Department, and Salary. Write the appropriate MS-Excel functions for performing the following operations:
    Calculate the net salary based on the following:

Salary	DA	TAX
<50000	7% of salary	5%
50000-80000	9% of salary	7%
>80000	11 % of salary	8%

3B. Analyze as below: (write the appropriate functions with proper syntax)
    i)   Count how many number of people getting salary > 80000
    ii) Find the total salary paid by the organization for all the employees
    iii) Find the person who has paid the maximum tax
    iv) Find the person who has been paid minimum
    (10 marks)

4. What are header files? Why are they used in C program? Name some commonly used header files in C along with functions they include with proper syntax.
    (5 marks)

5. Why 'break', 'return' and 'continue' statements are used in C? Explain with an example.
    (5 marks)

6. Write short note on the following:
6A. Input devices with examples.
6B. Cache Memory
6C. Gamma Camera Interface
6D. BUS

(5marks × 4 = 20 marks)

7. For the following scans which matrix size and pixel size would you opt for:
   i)   First pass radionuclide scan (camera dimension of 20cm and system resolution 0.9 cm)
   ii) Renal scan (camera dimension of 64cm and FWHM 0.5cm)

   (5 marks)

8. Write short note on Image algebra.

   (5 marks)

9. Explain how MS-Office is used in different real world applications.

   (5 marks)

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

    (5 marks)

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER VI: BIOMEDICAL ELECTRONICS

Friday, June 20, 2014

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. List the different types of comparator and their use in Nuclear medicine.
1B. Explain the relaxation oscillator circuits.

(5+5 = 10 marks)

2A. What is Flip-Flop and write its properties.
2B. Explain renowned two-terminal equivalent circuits.
2C. What is coincidence circuit and anti-coincidence circuit?

(3+4+3 = 10 marks)

3A. "The quality of an amplifier can be characterized by a number of specifications". Explain
3B. What is amplifier distortion and explain the types of distortion.

(5+5 = 10 marks)

4A. What is transducer and explain the transducer used in Nuclear Medicine.
4B. Explain the various shaping techniques of electronic pulses.

(4+6 = 10 marks)

5A. Explain the measures of voltage regulator quality.
5B. Explain types of UPS with the circuit.

(4+6 = 10 marks)

6A. Explain the op-amp.
6B. Explain on low pass filters.

(6+4 = 10 marks)

7A. Explain the working principle of JFET.
7B. Explain the types of semiconductor.

(5+5 = 10 marks)

8A. Explain the AND and OR gate.
8B. Convert 45 into binary and $(10011)_2$ into decimal.
8C. Explain resistors connected in series and parallel.
8D. Explain the hole current.

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

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FIRST YEAR M.Sc. NMT DEGREE EXAMINATION – JUNE 2014

SUBJECT: PAPER IX: NUCLEAR MEDICINE INSTRUMENTATION – I

Monday, June 23, 2014

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 explain the operation of Rectilinear Scanner.

(20 marks)

2.   What does the term quenching mean in GM counters and LSC? How should you handle quenching in these instruments? Explain

(20 marks)

3.   As a Nuclear Medicine Technologist what are the parameters you would consider during the procurement of a surgical probe?

(10 marks)

4.   How to assay the activities in a sample containing two radionuclides?

(10 marks)

5.   Why you have to perform accuracy, precision, constancy and background checks for a dose calibrator along with other tests?

(10 marks)

6A. If S is source Count Rate; G- gross count rate and B-background count rate then derive the optimization of counting experiment.

6B. In a 4 minute counting measurement, gross sample counts and background counts were found to be 6000 and 4000 counts respectively. What is the net sample counting rate and its uncertainty?

(5+5 = 10 marks)