

**MANIPAL UNIVERSITY****FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS)  
DEGREE EXAMINATION – JANUARY 2016****SUBJECT: PAPER I: BASIC MEDICAL SCIENCES (ANATOMY & PHYSIOLOGY)**

Friday, January 01, 2016

Time: 10:00 – 13:00 Hrs.

Max. Marks: 60

- ✍ Answer both Section 'A' and 'B' in TWO Separate Answer Books.  
✍ Answer ALL questions. Draw diagrams wherever necessary.

**SECTION – A: ANATOMY: 40 MARKS**

1. Describe the internal features, blood supply and nerve supply of the larynx.  
(6+2+2 = 10 marks)
  
2. Write short notes on the following:
  - 2A. Cartilages
  - 2B. Middle ear
  - 2C. Spermatic cord
  - 2D. Cerebellum
  - 2E. Thyroid gland
  - 2F. Venous drainage of the heart(5 marks × 6 = 30 marks)

**SECTION – B: PHYSIOLOGY: 20 MARKS**

1. Essay questions:
  - 1A. Draw a spiogram and label the various lung volumes and capacities.
  - 1B. List three functions of middle ear. Describe any two functions.  
(5 marks × 2 = 10 marks)
  
2. Write short answers for the following:
  - 2A. Name the contractile proteins in the skeletal muscle
  - 2B. List four factors affecting the myocardial contractility
  - 2C. Mention two functions of plasma proteins
  - 2D. Describe primary active transport with an example
  - 2E. Enumerate the different types of hypoxia  
(2 marks × 5 = 10 marks)



## MANIPAL UNIVERSITY

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS)  
DEGREE EXAMINATION – JANUARY 2016

SUBJECT: PAPER II: MATHEMATICAL METHODS IN PHYSICS

Monday, January 04, 2016

Time: 10:00 – 13:00 Hrs.

Max. Marks: 100

✍ Answer ALL the questions.

1A. Define the following with an example:

- i) Constant function
- ii) Identity function
- iii) Polynomial function
- iv) Exponential function

(6 marks)

1B. Show that  $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$ .

(5 marks)

2A. Evaluate the following limits:

i)  $\lim_{x \rightarrow 1} (1-x) \tan\left(\frac{\pi}{2}x\right)$

ii)  $\lim_{x \rightarrow 0} \frac{\sqrt{1+x^2} - \sqrt{1-x^2}}{x}$

iii)  $\lim_{x \rightarrow 3} \frac{\sqrt{2x+3} - \sqrt{4x-3}}{x^3 - 27}$

(6+6+6 = 18 marks)

2B. Find the derivatives of the following functions.

i)  $x^x + x^a + a^x + a^a$

ii)  $\sqrt{\tan \sqrt{\tan \sqrt{\tan x}}}$

(6+6 = 12 marks)

2C. Evaluate the following integrals.

i)  $\int \frac{\cot(\sin^{-1} x)}{\sqrt{1-x^2}} dx$

ii)  $\int_1^e \frac{4^{\log x}}{x} dx$

iii)  $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$

(4+4+6 = 14 marks)

3A. Find the inverse Laplace transform of the following function  $\frac{1}{(s+1)(s^2+4)}$ 

(5 marks)

3B. Evaluate the following integrals.

i)  $\int_0^{\infty} \frac{e^{-x^2}}{\sqrt{x}} dx \cdot \int_0^{\infty} x^2 e^{-x^4} dx$

ii)  $\int_0^{\infty} e^{-t} t \sin^2 3t dt$

(5+5 = 10 marks)

3C. Solve the equation  $y'' + 2y' + 5y = 0$  given  $y(0) = 0$  and  $y'(0) = 1$

(5 marks)

4A. A rectangular box open at the top is said to have volume of 32 cubic feet. Find the dimensions of the box requiring least material for its construction.

4B. Find the possible percentage error in computing the resistance  $r$  from the formula  $\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2}$  where  $r_1$  and  $r_2$  are both in error by 2% each.

(6+5 = 11 marks)

5A. If the half-life of uranium is 1500 years. Find percentage of original amount that will remain after 4500 years.

5B. Solve the following differential equations:

i)  $y' = 4y + 2x - 4x^2$

ii)  $\frac{dy}{dx} = (4x + y + 1)^2$ , given  $y(0) = 1$

(4+(5+5) = 14 marks)



**MANIPAL UNIVERSITY****FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE  
EXAMINATION – JANUARY 2016****SUBJECT: PAPER III: ELECTRONICS**

Wednesday, January 06, 2016

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

- ✍ Answer ALL the questions.  
✍ Any missing data may be assumed suitably.

**PART – A****1. Answer the following:**

- 1A. Derive expressions for charge densities in semiconductors.
- 1B. With a block diagram explain the functioning of digital multimeter.
- 1C. Write a note on op-amp adder with proper diagram.
- 1D. Explain the concept of electrons and holes in semiconductor.
- 1E. Mention the different methods of coupling in transistors and write a note on distortion in amplifiers.
- 1F. With proper diagram explain star-delta transformation.
- 1G. Write a note on optical materials.
- 1H. Explain construction and functioning of n-type enhancement MOSFET.

(5 marks × 8 = 40 marks)

**PART – B****2. Answer the following:**

- 2A. Define spectrum analyser. Explain the functioning of frequency counter using block diagram.
- 2B. Describe the functioning of different parts of microprocessor.
- 2C. With a neat circuit diagram and waveform explain the operation of a half wave rectifier and hence derive the expression for ripple factor, efficiency of rectification.
- 2D. An RLC series circuit has an inductive coil of  $R\Omega$  and inductive of L Henrys in series with capacitance of C Farads. The circuit draws a maximum current of 15A, when connected to 230V; 50Hz supply. If the Q factor is 5, find the parameters of the circuit.
- 2E. Explain the functioning of switched mode power supply.

(8 marks × 5 = 40 marks)





## MANIPAL UNIVERSITY

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE  
EXAMINATION – JANUARY 2016

## SUBJECT: PAPER IV: MODERN PHYSICS

Friday, January 08, 2016

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

- ✍ Answer ALL questions.  
✍ Any missing data may be assumed suitably.

**Physical Constants:**

Speed of light in vacuum,  $c = 3 \times 10^8$  m/s      Planck's constant,  $h = 6.626 \times 10^{-34}$  Js  
Atomic mass unit,  $u = 1.67 \times 10^{-27}$  kg      Electron mass,  $m_e = 9.11 \times 10^{-31}$  kg

- 1A. State and prove Ehrenfest's theorem.  
1B. Derive Schrodinger's time independent and time dependent equations for matter waves. Give a physical interpretation of the wave function. (8+8 = 16 marks)
- 2A. Establish Schrodinger's equation for a linear harmonic oscillator and solve it to obtain its energy levels. Discuss the significance of 'zero-point energy'.  
2B. A Ruby laser emits 693.4 - nm light. Assuming that this light is due to a transition of an electron in a box from the  $n = 2$  state to the  $n = 1$  state, find the width of the box.  
2C. What are 'eigen functions' and 'eigen values' of an operator? If the operator  $P = (-\hbar^2/d^2/dx^2)$  and the wave function  $\psi(x) = \sin 2x$ , what is the eigen value of the operator P? (9+4+3 = 16 marks)
- 3A. Discuss the general characteristics of the nuclear forces.  
3B. Give the theory of ground state of the deuteron for a central square well potential. Show that it is a loosely bound structure. (8+8 = 16 marks)
- 4A. Explain the variation of pulse height with the applied voltage in the case of a gas filled counter.  
4B. Describe the principle and working of a Geiger- Muller counter. Compare its action with that of a proportional counter. (8+8 = 16 marks)
- 5A. Explain the major effects which influence the binding energy of the nucleus in the liquid drop model and hence derive semi- empirical binding energy formula.  
5B. Obtain the expression for the Q value of a nuclear reaction. Classify the nuclear reactions based on their Q value. (8+8 = 16 marks)



# MANIPAL UNIVERSITY

## FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION – JANUARY 2016

**SUBJECT: PAPER V: FUNDAMENTALS OF COMPUTERS AND COMPUTER PROGRAMMING**

Monday, January 11, 2016

Time: 10:00 – 13:00 Hrs.

Max. Marks: 80

✍ **Answer ANY FIVE full questions.**

1A. Explain the five generations of computers in detail.

1B. Differentiate between ROM and RAM.

(10+6 = 16 marks)

2. Perform the following number system conversions.

i)  $(101101)_2 = (\quad)_{10}$     ii)  $(621)_8 = (\quad)_2$

iii)  $(DEC)_{16} = (\quad)_{10}$     iv)  $(1346)_8 = (\quad)_{16}$

(4 marks × 4 = 16 marks)

3A. What is the difference between impact and non impact printers?

3B. Explain the working of the mouse.

3C. Explain the working of a hard disk.

(4+6+6 = 16 marks)

4A. What are the main features of Word Processor software?

4B. What is an Operating System? What are the different types of Operating Systems?

(8+8 = 16 marks)

5A. Draw a flow chart and write a C program to find the sum of the diagonal elements in a two dimensional matrix.

5B. Explain the syntax of a for statement with an example.

(12+4 = 16 marks)

6A. What is the need for setting up a network? Explain the working of the STAR and BUS network topologies with neat diagrams.

6B. What is the difference between data and information? What are the characteristics of a database?

(8+8 = 16 marks)

7A. What is Image Processing? What are the types of methods or techniques used for Image Processing?

7B. Compare and contrast the features of Assembly Level Language with High Level Language.

(8+8 = 16 marks)

