

Question Paper

Exam Date & Time: 18-Apr-2022 (10:00 AM - 01:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER M.Sc. MRP DEGREE EXAMINATION - APRIL 2022

SUBJECT: MRP5121 -MODERN PHYSICS

(2021 SCHEME)

Marks: 100

Duration: 180 mins.

Answer all the questions.

- 1) Explain the Compton effect. Describe how experimental results contradict with classical theory. (20)
Derive the Compton shift equation.
- 2) Discuss the salient features of *liquid drop model* and hence deduce the semi empirical mass (20)
formula.
- 3A) Apply the Schrödinger equation to a particle in a one dimensional "box" of length L and obtain the (10)
expression for wave function and energy values of the particle. Also, Sketch the lowest three energy
states, wave-functions, probability densities for the particle in a one-dimensional "box".
- 3B) Describe the method of estimation of nuclear radius by α scattering experiment. (10)
- 3C) Explain the construction and working of GM counter. Also, explain the terms - Dead time, Recovery (10)
time and Quenching.
- 3D) Explain Yukawa's meson theory and list the properties of Pi-mesons. (10)
- 4A) Derive an expression for Q-value of a nuclear reaction in the lab system. How it is related to the (5)
threshold energy of an endoergic nuclear reaction?
- 4B) Using the simple model of a particle in a box to represent an atom, estimate the energy (in eV) (5)
required to raise an atom from the state $n = 1$ to the state $n = 2$. Assume the atom has a radius of
0.10 nm and that the moving electron carries the energy that has been added to the atom. Atoms
may be excited to higher energy states by absorbing photon energy. Calculate the wavelength of
the photon that would cause the transition from the state $n = 1$ to the state $n = 2$.
- 4C) Calculate the electric field generated at a point, 1 cm, from the anode in a gas filled detector with an (5)
operating voltage of 2000V. Given-inner radius 2 cms, anode wire diameter 0.008 cm and gas
pressure 1 atm.
- 4D) Radio nuclides are useful source of small amounts of energy in space vehicles, remote (5)
communication systems etc. One such radionuclide is Po-210. Calculate the power available in
watts from a 10mg of Po-210, if it is an emitter with an energy of 5.3MeV. Given: Half life of Po-210
 $= 138$ days and mass of Po-210 $= 209.9828$ amu.

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Question Paper

Exam Date & Time: 19-Apr-2022 (10:00 AM - 01:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER M.Sc. MRP DEGREE EXAMINATION - APRIL 2022

SUBJECT: MRP 5102 - ELECTRONICS

(2021 SCHEME)

Marks: 100

Duration: 180 mins.

Answer all the questions.

- 1) Discuss RC coupled amplifier and common emitter amplifier with necessary circuit diagrams and waveforms. Compare its advantages and disadvantages with operational amplifier. For a self bias circuit $R_1=1K\Omega$, $R_c=3.3K\Omega$, $R_e=1K\Omega$, $V_{cc}=30V$. find V_{ce} and I_c . Plot the Load line and mark the quiescent point on it. Assume NPN Transistor with $V_{BE}=0.7V$ and $\beta=100$. (20)
- 2) Explain Avalanche breakdown and Zener breakdown. With neat circuit diagram and characteristic curve. Explain how zener diode works as a voltage regulator with its line and load regulation. Derive the equation to find R_{smin} and R_{smax} . In a Zener regulator circuit load voltage $V_L = 10V$ A 10 V zener is used which has a maximum power dissipation Rating of 50W and needs a minimum current of 10mA to ensure that it operates in the breakdown region. Determine the range values of series resistance R_s to be used in the circuit. (20)
- 3A) Discuss the need of the selection of the transducer. Explain thermocouple transducer with necessary diagram. (10)
- 3B) Explain the internal block diagram of 555 timer. Give its applications. (10)
- 3C) Differentiate active and passive components. Give the steps of source transformation. (10)
- 3D) What is cross over distortion. Explain class B push pull amplifier with neat circuit diagram. (10)
- 4A) Define Kirchhoff's current and voltage law with necessary examples. (5)
- 4B) With a neat block diagram explain the working of Digital multimeter. (5)
- 4C) A silicon diode has a reverse saturation current of 12nA at 20°C. Find its current when it is forward biased by 0.65V. also calculate the current in the same diode when the temperature rises to 100°C. (5)
- 4D) The common base dc current gain of a transistor is 0.967. if the emitter current is 10mA what is the value of base current. Neglect I_{CBO} . (5)

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Question Paper

Exam Date & Time: 20-Apr-2022 (10:00 AM - 01:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER M.Sc. MRP DEGREE EXAMINATION - APRIL 2022
SUBJECT: MRP5101 - MATHEMATICAL METHODS IN PHYSICS
(2021 SCHEME)

Marks: 100

Duration: 180 mins.

Answer all the questions.

- 1A) Find by Taylor's series method, the value of y at $x = 0.5$ from $\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$ (10)
- 1B) Find extreme values of the function : $f(x, y) = x^2 + y^2 + 6x - 12$ (10)
- 2A) Solve the differential equation : $\frac{dy}{dt} - y = e^{-t}$, with $y(0) = 0$ (10)
- 2B) Find $L^{-1} \left\{ \frac{5s-2}{(s-1)(s-3)^2} \right\}$ (10)
- 3A) A coin is tossed three times. Let X denote 0 or 1 according as a tail or a head occurs on the first toss. Let Y denote the number of tails which occur. Determine (5)
- i) a) The distributions of X and Y
b) The joint distribution of X and Y .
- ii) Use Trapezoidal rule with six –sub-divisions to evaluate (5)
- $$\int_0^{\pi} \sqrt{\sin x} dx$$
- 3B) Verify Rolle's theorem for the function $f(x) = \sin x$ in $[0, 2\pi]$ (5)
- i) -
- ii) Evaluate : $\lim_{x \rightarrow 0} \frac{x}{1 - \sqrt{1-x}}$ (5)
- 3C) Find the Laplace transform of $\{te^{-3t}\sin t\}$ (5)
- i) -
- ii) Perform Integration w.r.t x : $\int \frac{x+1}{x^2+2x+7} dx$ (5)
- 3D) (5)

i) Differentiate w.r.t. x : $\left(x^{\frac{5}{6}} + \sqrt{x}\right)^{50}$

ii) Find the Laplace Transform of $\{t^3 + 3e^{-2t} - 6\sin 2t + 8\cos t\}$ (5)

4A) Find the Laplace transform of $\{t \sin t\}$ (5)

4B) Integrate w.r.t x : $\int \frac{x^2}{1+x^6} dx$ (5)

4C) Evaluate : $\int_0^{\frac{\pi}{2}} \sqrt{\tan x} dx$ (5)

4D) If $u = x^3 + y^3 + z^3 - 3xyz$ then find the partial derivatives (5)

$\frac{\partial u}{\partial x}, \frac{\partial u}{\partial y}, \frac{\partial u}{\partial z}$ and hence show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$

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Question Paper

Exam Date & Time: 23-Apr-2022 (10:00 AM - 01:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER M.Sc. MRP DEGREE EXAMINATION - APRIL 2022
SUBJECT: MRP5122 - FUNDAMENTALS OF COMPUTERS AND PROGRAMMING
(2021 SCHEME)

Marks: 100

Duration: 180 mins.

Answer all the questions.

- 1A) Explain the parts of a computer with a neat block diagram. (8)
- 1B) Explain the features of the first and second generation of computers. Give examples. (7)
- 1C) Explain the syntax of the *do -while* statement with an example. (5)
2. Perform the following number system conversions:
- 2A) $(110.101)_2 = (\text{_____})_{10}$ (4)
- 2B) $(4756)_8 = (\text{_____})_{10}$ (4)
- 2C) $(C78E)_{16} = (\text{_____})_8$ (4)
- 2D) $(1B76)_{16} = (\text{_____})_2$ (4)
- 2E) Represent $(-19)_{10}$ using 8-bit 2's complement. (4)
- 3A) Explain the working of a joystick. (4)
- 3B) What is bar code? Explain the working of a bar code reader. (6)
- 4A) What is the difference between a single user and a multi user operating system? (6)
- 4B) What is an assembler? (4)
- 5A) What are the generations of computer programming languages? Give examples. (5)
- 5B) Write a C program to accept a matrix of order M x N. Find the transpose of the matrix and hence determine whether the matrix is a symmetric matrix or not. (5)
- 6A) What is a Computer network? Explain with neat diagrams, the differences between the mesh and ring topologies. (6)
- 6B) What are the essential features of a word processor? Give examples. (4)
- 7A) What is a digital image? What is the purpose of Image Processing? (5)
- 7B) What is Image compression? Differentiate between lossy and lossless Image compression. (5)
- 7C) What are the essential features of the 3rd generation programming languages. Give examples. (5)
- 7D) What are the parts of floppy disk drive? (5)

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