Question Paper

Exam Date & Time: 25-Jan-2023 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

THIRD SEMESTER M. Sc. MEDICAL RADIATION PHYSICS DEGREE EXAMINATION - JANUARY 2023
SUBJECT: MRP5101 - MATHEMATICAL METHODS IN PHYSICS
(2021 SCHEME)

Marks: 100 **Duration: 180 mins.**

Answer all the questions.

1A)	If the sides and angles of triangle ABC vary in such a way that its circum radius remains constant Prove that $\frac{\delta a}{cosA}+\frac{\delta b}{cosB}+\frac{\delta c}{cosC}=0$ where $\delta a, \delta b$ and δc are small increments in the sides a, b and c respectively.	(8)
1B)	Derive the integration of Cotx.	(7)
1C)	Suppose X is a Random variable which is uniformly distributed over (1,3) obtain pdf of the following $i.\ \ y=3x+4$ $ii.\ \ z=e^x$	(8)
1D)	If x has Cauchy's distribution, then show that pdf of y=1/x also has Cauchy's distribution.	(7)
2A)	Find by Taylor's series method, the value of y at x=0.1 and x=0.2 to five decimal places given $\frac{dy}{dx}=x^2y-1,\ y(0)=1.$	(10)
2B)	Using Euler's modified method, find y(0.02) given $y'=x^2+y,\ \ y(0)=1\ take\ h=0.01$	(10)
2C)	Find $y(0.3)$ given $\frac{dy}{dx}+y+xy^2=0,\ \ y(0)=1.$ By taking h=0.1 using Runge-Kutta method.	(10)
3A)	Evaluate $\int_0^{\frac{\pi}{2}} sinxdx$ by i) Trapezoidal Rule and ii) Simpson's 1/3rd Rule and compare with exact value.	(10)
3B)	Find the extreme value of $f(x,y)=sinx+siny+\sin(x+y)\ \ 0\le x\ and\ y\le\frac{\pi}{2}$	(10)
4A)	Divide 24 as a sum of 3 numbers such that the continued product of the first square of the second and cube of the third is maximum.	(10)
4B)	A random variable x has the following function	(10)

x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	K^2	$2k^2$	$k+7k^2$

Find

i) K

ii) $p(x < 6),\ \ p(x \geq 6) and\ p(0 < x < 5)$

iii) $p(x \leq a) > \frac{1}{2}$ find the minimum value of a

iv) calculate cdf

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Question Paper

Exam Date & Time: 27-Jan-2023 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION - JANUARY 2023
SUBJECT: MRP5102- ELECTRONICS
(2021 SCHEME)

Marks: 100 **Duration: 180 mins.**

Answer all the questions.

1)	With Neat diagram Explain the working of Cathode ray oscilloscope, Liquid crystal display and Light emitting diode. Compare its merits and demerits.	(20)
2)	Define Ohms law and Kirchhoff's law with necessary examples. Give the concept and star to delta transformation.	(20)
3A)	Explain series resonance and parallel resonant circuits with examples.	(10)
3B)	Discuss IC fabrication Technology with neat diagram.	(10)
3C)	Explain the working of Varactor diode and tunnel diode with its characteristic curve.	(10)
3D)	With neat diagram Explain the working of LVDT. Compare its merits and demerits with other type of transducers.	(10)
4A)	Explain Klystron and magnetron with necessary diagrams. Discuss its applications.	(5)
4B)	For a self bias circuit R_1=6.8KΩ. R_2=1 KΩ, R_c=3.3K R_e=1K V_{cc}=30V compute V_{ce} and I_c. Plot load line and mark the q point on it. assume npn transistor with V_{BE}=0.7V and β=100.	(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.	(5)
4D)	Design a adder circuit using OPAMP to get the output expression as $Vo= -(0.1V_a+V_b+10V_c)$ where, V_a , V_b and V_c are the inputs.	(5)

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Question Paper

Exam Date & Time: 30-Jan-2023 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER M.Sc. (MEDICAL RADIATION PHYSICS) DEGREE EXAMINATION - JANUARY 2023
SUBJECT: MRP5121- MODERN PHYSICS
(2021 SCHEME)

Marks: 100 **Duration: 180 mins.**

Answer all the questions.

1)	Discuss the application of schrodinger equation to a particle in a box of finite height and sketch the wavefunctions for the lowest 3 states. Explain the tunneling of a particle with the help of a neat diagram	(20)
2)	Explain the method to determine the size of nucleus by i) alpha scattering experiment ii) mirror nuclei method	(20)
3)	What are the experimental observations in the study photoelectric effect? Explain how these observations cannot be explained using classical approach. Elucidate how Einstein interpreted these results.	(10)
4)	Explain alpha decay paradox and quantum mechanical tunneling effect	(10)
5)	**Explain the following terms related to the nuclear reactor:** i) Controlled chain reaction ii)Thermal utilization factor iii) critical size iv) Effect of reflectors v) moderators	(10)
6)	Explain Pauli's neutrino hypothesis and mention the properties of neutrino	(10)
7A)	Explain the construction and principle of gas filled counters	(5)
7B)	The lifetime of an excited atom is given as $\Delta t = 1.0 \times 10^{-8}$ s. Using the uncertainty principle, compute the line width Δf produced by this finite lifetime?	(5)
7C)	In neutron induced fission of a U^{235} nucleus, unstable energy of 185MeV is released. If a U^{235} reactor is continuously operating at a power level of 100 MW, how long will it take for 1 kg of uranium to be consumed in this reactor	(5)
7D)	An alpha particle of energy 5.48 MeV is completely stopped in an ionization chamber. What is the pulse height in an external resistance of 1 MΩ? Given: Energy required to produce an ion pair is 35 eV and the capacitance of the chamber is 50pF	(5)

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