


Name:			
Enrolment No:			
<b>UPES</b> <b>End Semester Examination, December 2024</b>			
<b>Course: Mathematical &amp; Statistical Methods</b> <b>Program: MSc Physics</b> <b>Course Code: MATH8023P</b>		<b>Semester : 3</b> <b>Time : 03 hrs</b> <b>Max. Marks : 100</b>	
<b>Instructions: Use scientific calculator as allowed.</b>			
<b>SECTION A</b> <b>(5Qx4M=20Marks)</b>			
S. No.		Marks	CO
Q 1	Discuss the concept of convergence in context of estimating roots using numerical methods. Name two methods for each order of convergence that you could recall.	4	CO3
Q 2	Describe Regula-Falsi method of finding roots with the help of legible plots and equations.	4	CO2
Q 3	Explain Parseval's Theorem and its physical significance.	4	CO4
Q 4	Solve the ordinary differential equation $y' = 1 + 4y^2$ , given $y(1) = 0$ .	4	CO1
Q 5	Determine the root of the function $f = 2x \times 2 \cos x$ , taking $x_0 = 1$ as starting point.	4	CO2
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
Q 6	How would you solve a partial differential equation using the finite element method?	10	CO4
Q 7	Derive the Laplace transform of the Heavyside step function given by $u(t-a)$ .  OR Evaluate Inverse Laplace transform of the function - $\frac{3s - 137}{s^2 + 2s + 401}$	10	CO3
Q 8	Evaluate $J = \int_0^1 e^{-x^2} dx$ by Simpson's rule with $2m = 10$ . Make a table with all the intermediate calculated values.	10	CO2
Q 9	Discuss briefly the concept and applications of Monte Carlo method.	10	CO4
<b>SECTION-C</b> <b>(2Qx20M=40 Marks)</b>			
Q 10	Evaluate Laplace transforms of the given functions- a). $e^{-t}(\cos 4t - 2 \sin 4t)$ b). $12t \times e^{-t}$	20	CO4

	c). $e^{\frac{t}{2}}u(t - 2)$ d). $t \times \cos t + \sin t$		
Q 11	Determine the Fourier series of the function a). $f(x) = x + \pi$ if $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$ b). $f(x) = x^2$ if $-1 < x < 1$ given its period $p = 2$ OR a). Find the Fourier transform using the first principles of the function $f(x) = 1$ if $ x  < 1$ and $f(x) = 0$ otherwise. b). Discuss 5 properties of Fourier transform.	<b>20</b>	<b>CO3</b>