Total No. of Printed Pages: 02

PRN No.	

PAPER CODE	U313 - 2111-ESE

December 2023 (ENDSEM) EXAM

TY (SEMESTER - I)

COURSE NAME: NUMERICAL METHODS Branch: MECHANICAL COURSE CODE: MEUA31201

(PATTERN 2020)

Time: [1Hr. 30 Min] **[Max. Marks: 40]**

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data wherever required**
4) **All questions are compulsory. Solve any one sub question from Question 3 and any two sub questions each from Questions 4,5 and 6 respectively.**

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Round 5387.9874 to 1 significant figure.	**[2]**	1	2
Q.2	a) The goal of forward elimination steps in the Gauss elimination method is to reduce the coefficient matrix to a (an) ___________ matrix. a) Diagonal b) Identity c) Lower triangular d) Upper triangular	**[2]**	2	1
Q.3	a) Using Newton 's forward difference interpolation, find the value of $f(2.2)$, if x: 2, 2.4, 2.8, 3.2 y: 8.5, 9.75, 10, 11.5	**[6]**	3	3
	b) Using Lagrange's interpolation, find the value of $f(2.2)$, if x: 2, 2.4, 2.8, 3.2 y: 8.5, 9.75, 10, 11.5	**[6]**	3	3
Q.4	a) Evaluate the given integral by Trapezoidal Rule. $(Assume\ n = 12)$: $\int_1^4 (cos(x) - e^x)dx$	**[5]**	4	3
	b) Evaluate the given integral by Simpson's 1/3rd Rule. $(Assume\ n = 12)$: $\int_1^4 (cos(x) - e^x)dx$	**[5]**	4	3
	c) Evaluate the given integral by Simpson's 3/8th Rule. $(Assume\ n = 12)$:	**[5]**	4	3

<table>
<tr><td></td><td>$$\int_1^4 (cos(x) - e^x)dx$$</td><td></td><td></td><td></td></tr>
<tr><td>Q.5</td><td>a) Solve $\frac{dy}{dx} = \tan(x) + (y)$, $y(0) = 1$ by Euler's method.
Hence find the values of y at $x = 1$. (take $h = 0.2$)</td><td>[5]</td><td>5</td><td>3</td></tr>
<tr><td></td><td>b) Solve $\frac{dy}{dx} = \sin(x) + \cos(y)$, $y(0) = 1$ by Runge-Kutta 2nd order method.
Hence find the values of y at $x = 0.99$. (take $h = 0.33$)</td><td>[5]</td><td>5</td><td>3</td></tr>
<tr><td></td><td>c) Solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ by Runge-Kutta 4th order method.
Hence find the values of y at $x = 0.1$. (take $h = 0.5$)</td><td>[5]</td><td>5</td><td>3</td></tr>
<tr><td>Q.6</td><td>a) Classify the equation:
$$2\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 2\frac{\partial^2 u}{\partial y^2} - 10\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$$</td><td>[5]</td><td>6</td><td>3</td></tr>
<tr><td></td><td>b) Given the values of $u(x,y)$ on the boundary of the square in the Figure 1, evaluate the function $u(x,y)$ satisfying the Laplace equation at the pivotal points of this figure by Gauss-Seidel method. *(Show detail calculations for interaction no. 0, 1 and 2)*

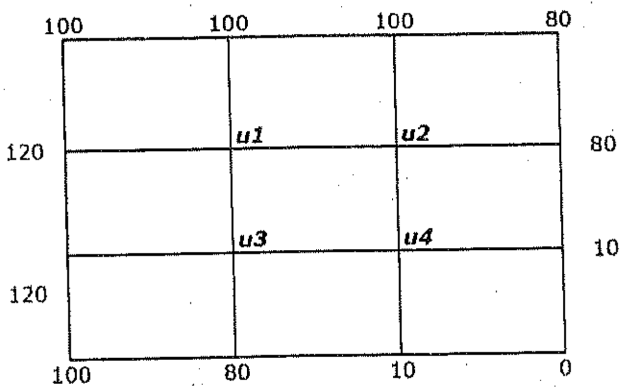

Figure 1</td><td>[5]</td><td>6</td><td>3</td></tr>
<tr><td></td><td>c) Solve the equation $\frac{\partial u}{\partial x} = \frac{\partial^2 u}{\partial x^2}$
subject to the conditions
$0 < x < 5; t \geq 0$ given that $u(x,0) = 20, u(0,t) = 0, u(5,t) = 100$. Compute u for the time-step with $h = 1$ by the Crank-Nicholson method.</td><td>[5]</td><td>6</td><td>3</td></tr>
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