Total No. of Questions – [06] Total No. of Printed Pages: 2

G.R. No.	

DECEMBER 2021 - ENDSEM EXAM

T. Y. B. TECH. (MECHANICAL) (SEMESTER - I)

COURSE NAME: Numerical Methods

COURSE CODE: ES31181ME

(PATTERN 2018)

Time: [1 Hour] [Max. Marks: 30]

( ) Instructions to candidates:

1) **Answer Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6.**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data wherever required**

Q.1) a) Solve using Gauss Legendre 2 Point rule: [4 marks]

$$\int_4^8 log_{10}(x^2)dx$$

b) Using trapezoidal rule evaluate: (*Assume* $h = k = 0.5$) [6 marks]

$$I = \int_0^1 \int_0^1 (\sin(x) + \cos(x) + e^x)\, dx\, dy$$

OR

Q.2) a) Using Gauss Legendre 3 Point rule evaluate: [4 marks]

$$I = \int_1^3 \left(1 + log_{10}(x)\right) dx$$

b) Solve using suitable Newton's Cotes Method: [6 marks]

$$\int_0^{11} sin(x)\, dx \quad (Assume\ n = 11)$$

Q.3) a) Using Euler's method, find an approximate value of y corresponding to $x = 3$, given that [4 marks]

$$dy/dx = \sqrt[5]{x+y}, \qquad take\ y(0) = 1\ and\ h = 1$$

b) Find the value of y at $x = 1.3$ by Runge-Kutta 2nd order method, given that [6 marks]

$$\frac{dy}{dx} = log_e x \times \sin x \ , \qquad take\ y(1) = 1.5\ and\ h = 0.1$$

OR

Q.4) a) Using Modified Euler's method, find an approximate value of y corresponding to $x = 0.1$, given that [4 marks]

$$\frac{dy}{dx} = 1 + \tan h(x), take\ y(0) = 1\ and\ h = 0.1$$

b) Calculate the value of y at $x = 0.2$ by Runge-Kutta 4th order method, given that [6 marks]

$$\frac{dy}{dx} = 2x + y^3 \ , \qquad take\ y(0) = 2\ and\ h = 0.1$$

Q.5) a) Classify the given partial differential equation: [4 marks]

$$2\frac{\partial^2 u}{\partial x^2} + 8\frac{\partial^2 u}{\partial x\,\partial y} + 1\frac{\partial^2 u}{\partial y^2} + 2\frac{\partial u}{\partial x} - 2\frac{\partial u}{\partial y} = 8$$

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. *(Do only 1 iteration)* [6 marks]

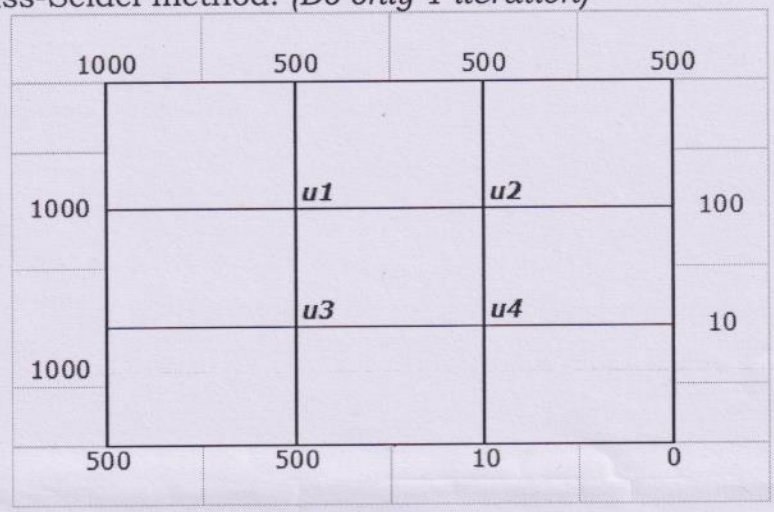

Figure 1

OR

Q.6) a) Classify the given partial differential equation: [4 marks]

$$4\frac{\partial^2 u}{\partial x^2} + 8\frac{\partial^2 u}{\partial x\,\partial y} + 4\frac{\partial^2 u}{\partial y^2} + 8\frac{\partial u}{\partial x} - 6\frac{\partial u}{\partial y} = 69$$

b) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5, t \geq 0$ given that [6 marks]

$$u(0,t) = 50; u(5,t) = 200, u(x,0) = 80.$$

Compute u by Crank-Nicholson method.

$$(Assume h = k = 1)$$