

Total No. of Questions : 12]

SEAT No. :

P2404

[Total No. of Pages : 3

[5253] -116

T.E. (Mechanical/Automobile) (Semester - II)
NUMERICAL METHODS AND OPTIMIZATION
(2012 Pattern)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of programmable calculator is not permitted.*
- 5) *Assume suitable data if necessary.*

Q1) An approximate value of π is given by $x_1 = \frac{22}{7} = 3.1428571$ & its true value is $x = 3.1415926$. Find the absolute & relative errors and define. [6]

OR

Q2) Find the root of equation $\log_{10} x - x^2 + 2 = 0$ by regula - falsi method correct to two decimal places. [6]

Q3) Draw the flowchart for Gauss elimination method. [6]

OR

Q4) Solve the following equations with Thomas algorithm. [6]

$$\begin{aligned}x_1 + 2x_2 &= 4 \\-x_1 + x_2 + 2x_3 &= 1 \\x_2 + 3x_3 + x_4 &= 7 \\2x_3 + 2x_4 &= 8\end{aligned}$$

P.T.O.

- Q5) a)** Minimize $Z = 80x_1 + 120x_2$ [5]
 Subject to $x_1 + x_2 \leq 9$
 $x_1 \geq 2$
 $x_2 \geq 3$
 $20x_1 + 50x_2 \leq 300$
 $x_1, x_2 \geq 0$
 (use graphical method)
- b)** Using Newton's method calculate the maximum value of the equation $2\sin x - 0.1x^2$. Take initial guess 2.5 and do 3 iterations. [3]

OR

- Q6)** Maximize $z = 1600x + 1500y$ [8]
 Subject to $5x + 4y \leq 500$
 $15x + 16y \leq 1800$
 $x \geq 0, y \geq 0$
 (use simplex method)

- Q7) a)** Using the method of least square, fit the curve $y = ax^2 + \frac{b}{x}$ to the following data. [8]

x	1	2	3	4
y	-1.51	0.99	8.88	7.66

- b)** Find the value of y for $x = 0.5$ for the following table of x, y values using Newton's forward difference formula. [8]

x	0	1	2	3	4
y	1	5	25	100	250

OR

- Q8) a)** For the data given in following table find the equation to best fitting curve of the form $xy^a = b$. [8]

x	200	150	100	60	40	10
y	1	1.5	1.8	2.4	4.1	6.5

b) Draw the flow chart for Lagrange's interpolation. [8]

Q9) a) Use Simpson's 1/3rd rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. [8]

b) Using Trapezoidal rule, evaluate $I = \int_1^2 \int_1^2 \frac{dx dy}{x+y}$ taking four sub-intervals. [8]

OR

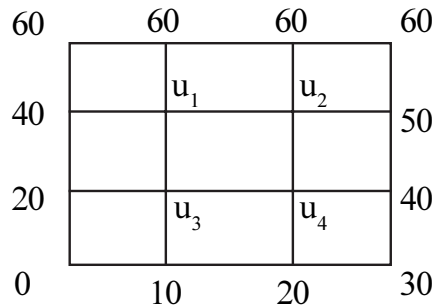
Q10) a) Draw flowchart for Gauss Legendre 2 point and 3 point method. [8]

b) Use Trapezoidal rule with four steps to estimate the value of integral

$$\int_0^2 \frac{x}{\sqrt{2+x^2}} dx \quad [8]$$

Q11) a) Draw flow chart for Euler method. [8]

b) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for the square mesh as shown in diagram below. [10]



Q12) a) Write down step by step procedure for solution of PDE of Laplace equation and develop a flowchart to write a program. [8]

b) A second order ODE is transformed into first order ODE as,

$$\frac{dy}{dx} = z, y(0) = 2 \text{ and } \frac{dz}{dx} = 0.5x - y, z(0) = 0. \text{ Estimate the value of } y \text{ and } z \text{ at } x = 0.2 \text{ take } h = 0.1. \quad [10]$$

