Total No. of Questions : 12]

SEAT No. : ____

P3253

[Total No. of Pages : 3

[5353] - 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) Moment at a point in a cantilever carrying a uniformly distributed load is, $M = \frac{Pl^2}{2}$, where P is the intensity of UDL and l is the distance. If the error in the calculation of P is 0.0 1 kN/m and l is 0.02 m, find the error in calculation of M at l = 3.5 and P = 2 kN/m. **[6]**

OR

Q2) Using five iteration of bi-section method determine root of the following equation **[6]**

$f(x) = x^3 - x^2 - x - 1 = 0$ Take initial guess $x_1 = 1.7$ and $x_2 = 1.9$.

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

OR

Q4) Using Gauss - Seidal method solve the following set to simultaneous equations. Solve upto four iterations. **[6]**

$x_1 + 20x_2 + 9x_3 = -23$

$2x_1 - 7x_2 - 20x_3 = -57$

$20x_1 + 2x_2 + 6x_3 = 28$

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) Write a short note on Simulated Annealing. **[3]**

OR

Q6) Maximize $Z = 50{,}000x_1 + 12{,}000x_2$

Subject to $75x_1 + 15x_2 \leq 1000$

$100x_1 + 30x_2 \leq 1500$

$45x_1 + 10x_2 \leq 750$

And $x_1, x_2 \geq 0$

(Use simplex method) **[8]**

Q7) a) Using the following points, fit a polynomial using Lagrange's method and find the value of y at $x = 2.7$ **[8]**

(2.10,5.14) (2.50,6.78) (3.10,10.29) (3.50,13.58)

b) Determine the values of a and b so that the equation $y = ax^b$ best fits the following data by the method of least squares. **[8]**

x	25	20	12	9	7	5
y	0.22	0.2	0.15	0.13	0.12	0.1

OR

Q8) 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) Draw the flowchart for Newton's forward difference interpolation. **[8]**

Q9) a) Use Simpson's 1/3rd rule to find $\int_0^{0.8} (\log_e (x+1) + \sin (2x)).dx$ where x is in radians. Divide the entire interval in 8 strips. **[8]**

b) Find $\int_0^1 \int_0^1 e^{(x+2y)} dx.dy$, using Simpson's 1/3rd rule. Take $h = k = 0.5$. **[8]**

OR

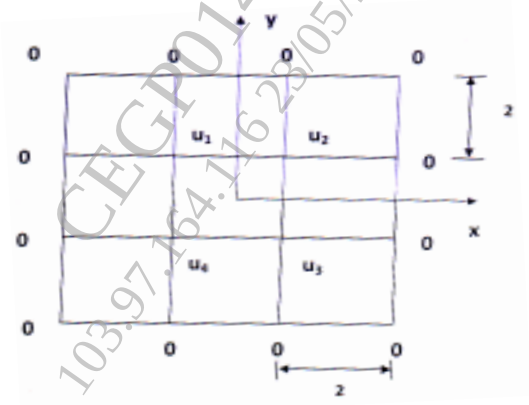
Q10)a) Draw flowchart for Gauss Legendre 2 point and 3 point method. **[8]**

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

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

Q11)a) Solve the differential equation $\frac{dy}{dx} = \sqrt{(x+\sqrt{y})}$ using Euler's method under the boundary conditions $x = 2$ and $y = 4$ find y at $x = 2.5$ in 10 steps. **[8]**

b) Solve the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{1}{xy}$ corresponding to grid shown in following fig **[10]**



OR

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) Initial temperature within an insulated cylindrical metal rod of 4 cm length is given by, T = 50 (4 - x), $0 \le x \le 4$, where x is distance from one end in cm. Both the ends are maintained at 0°C. Find the temperature as a function of x and t ($0 \le t \le 1.5$) if the heat flow is governed by

$$\frac{\partial T}{\partial y} = 2\frac{\partial^2 T}{\partial x^2}. \Delta x = 1, \Delta t = 0.25$$ **[10]**