Total No. of Questions :12]

SEAT No. :

P3920

[Total No. of Pages :5

[4958]-1019

T.E. (Mechanical / Automobile)

NUMERICAL METHODS AND OPTIMIZATION

(2012 Course) (End Semester) (Semester - II) (302047)

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) Volume of cylinder is calculated after measuring its diameter as (2.5 ± 0.02) m and its height as (4.8 ± 0.05) m respectively. Estimate the absolute error in calculation of volume. **[6]**

OR

Q2) Determine the real root of the equation $e^x = 5x$ using method of successive approximation. Assume initial guess x = 0.15 and solve upto 5 iterations. **[6]**

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

OR

Q4) Using Gauss Seidal method, solve the following set of equations up to 3 decimal places. **[6]**

$3x + y - z = 0,$

$x + 2y + z = 0,$

$x - y + 4z = 3$

Q5) A company is manufacturing two different types of products A and B. Each product has to be processed on two machines M1 and M1. Product A requires 2 hours on machine M1 and 1 hour on machine M2. Product B

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requires 1 hour on machine M1 and 2 hours on machine M2. The available capacity of machine M1 is 104 hours and that of machine M2 is 76 hours Profit per unit for product A is Rs.6 and that for product B is Rs. 11. **[8]**

i) Formulate the problem.

ii) Find the optimal solution by simplex method.

OR

Q6) a) Determine the maximum value of root of equation. **[5]**

0.51 (x) - sin (x)

by Newton's method. Take initial guess as 2 and do 4 iterations.

b) Write a short note on Genetic Algorithm. **[3]**

Q7) a) Fit the exponential curve $y = ae^{bx}$ to the following data: **[8]**

x	2	4	6	8
y	25	38	56	84

b) The values of x,Y and y' are given below. Use Hermit interpolation to find the value of y at x = 0.25. **[8]**

x	Y	y'
0	0	0
1	1	1

OR

Q8) a) Using least square technique, fit the following curve $Nu = a.\ Re^{b}$ to the below mentioned data. Find the values of 'a' and 'b.' **[8]**

Re [x]	900	1500	2700	3000
Nu [y]	89	110	120	125

b) Using suitable interpolation formula to find a polynomial which passes the points (0,-12), (1,0,), (3, 6), (4, 12) **[8]**

Q9) a) The total mass of the variable density rod is given by. **[8]**

$$m = \int_0^L \rho(x) A_c(x)\, dx$$

Where m is mass, ρ (x) is density, Ac (x) is cross- sectional area , x is distance along the rod and L is the total length of the rod. The following data is measured for a 10m length rod. Determine the mass in kg using trapezoidal rule to best possible accuracy.

x, m	0	2	3	4	6	8	10
ρ,g/cm^3	4.00	3.95	3.89	3.80	3.60	3.41	3.30
A_c cm^2	100	103	106	110	120	133	150

b) Draw the flowchart to find integral. **[8]**

$$I = \int_{x1}^{xn} \int_{y1}^{yn} f(x, y).\, dxdy$$

Using Trapezoidal rule.

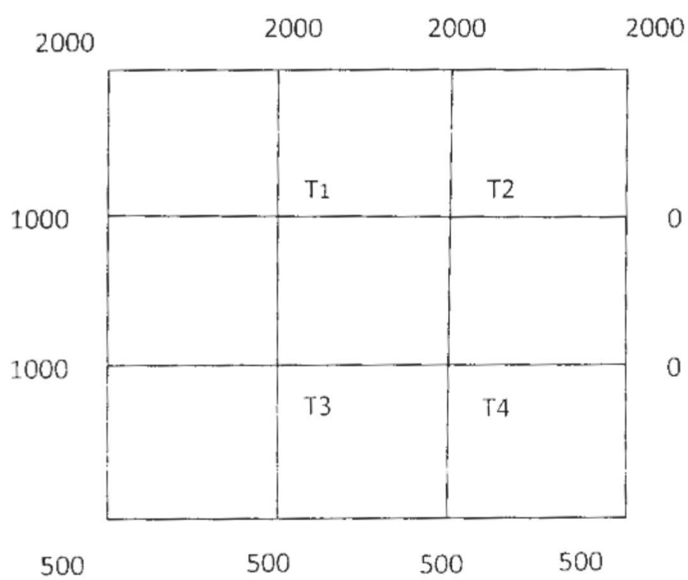
OR

Q10) a) Use three point Gauss-Legendre formula to solve. $\int_0^3 \left(\frac{e^x}{2+x^2} \right) dx$ **[8]**

b) Using the following data to calculate the work done by stretching the spring that has a spring constant of k = 300 N/m to x = 0.30 m. Use simpson's 1/3rd and 3/8th rule. **[8]**

F (10^9N)	0	0.01	0.028	0.046	0.063	0.082	0.11
x, m	0	0.05	0.10	0.15	0.20	0.25	0.30

Q11) a) The edges of a stell plate of 750 × 750 mm has maintained at temperatures as shown in fig. What will be steady state temperatures at the interior points? **[12]**



b) Draw the flowchart for Runge-Kutta fourth order method. **[6]**

OR

Q12) a) Solve the following set of differential equations using Runge-Kutta fourth order method for $x = 1$. Take x0 = 0, y0 = 4 and z0 = 6. Use step size of 0.5. **[10]**

$$\frac{dy}{dx} = -0.5\, y$$

$$\frac{dz}{dx} = 4 - 0.3z - 0.1\, y$$

b) Use Euler's method with h = 0.5 to solve the initial value problem over the interval $x = 0$ to 2. **[8]**

$$\frac{dy}{dx} = yx^2 - 1.1y \qquad \text{Where } y(0) = 1.$$