

Total No. of Questions : 12]

SEAT No. :

P3974

[Total No. of Pages : 3

[5353]-516

T.E. (Mechanical Sandwich) (Semester - II)
NUMERICAL METHODS AND OPTIMIZATION
(2015 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) Using Newton Raphson method solve the equation $f(x) = e^{(x)} \cdot \cos(x) - 1.4 = 0$ upto accuracy of 0.01. take initial guess 0.2 **[6]**

OR

Q2) What do you mean by convergence? Explain its importance in brief. **[6]**

Q3) Solve by Jacobi's iteration method, the equations **[6]**

$$2x - 3y + 20z = 25;$$

$$20x + y - 2z = 17;$$

$$3x + 20y - z = -18$$

OR

Q4) Explain advantages of partial pivoting for solving simultaneous equations using Gauss elimination and Gauss Seidal method. **[6]**

Q5) a) Maximize $Z = 2x + 3y$ **[5]**

subjected to the constraints

$$x + y \leq 30$$

$$y \geq 3$$

$$0 \leq y \leq 12$$

$$x - y \geq 0$$

$$0 \leq x \leq 20,$$

Use graphical method.

P.T.O.

- b) Determine the maximum value of root of equation $0.51x - \sin(x)$ by Newton's method. Take the initial guess as 2 and do 4 iterations. [3]

OR

Q6) Maximize $Z = 6x + 11y$ [8]

subjected to the constraints

$$2x + y \leq 104$$

$$x + 2y \leq 76$$

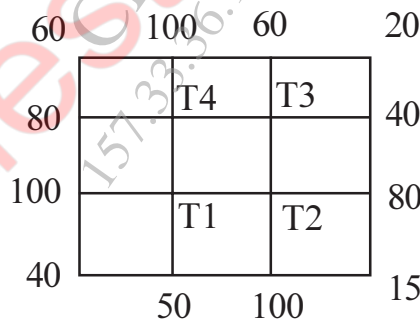
$$x, y \geq 0$$

Use Simplex method.

Q7) a) Temperature at one surface of slab of thickness, $x = 20 \text{ cm}$ is $T = 500^\circ\text{C}$. Find the temperature of the other surface of slab by taking step size in thickness, $\Delta x = 4 \text{ cm}$. Heat flux is 1000 W/m^2 . Use the following governing

relation of heat flow, $\frac{dT}{dx} = -\frac{q}{A} \left[\frac{1}{0.5(0.01T + 1)} \right]$ where q is a heat flow through slab (in Watt) and A is cross-sectional area of slab (m^2). [8]

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



OR

Q8) a) Draw the flowchart for Simultaneous Equations by RK 2nd order method. [6]

b) Solve the heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subjected to the condition $u(0,t) = u(1,t) = 0$ and $u(x,0) = 2x$ for $0 \leq x \leq \frac{1}{2}$ and $u(x,0) = 2(1-x)$ for $\frac{1}{2} \leq x \leq 1$. Take $h = 1/4$ and $k = 1$. [12]

- Q9) a)** Draw the flow chart for $y = ab^x$. [8]
- b) Find the values 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

- Q10) a)** Using the method of least squares, fit the curve $y = ax^2 + \frac{b}{x}$ to the following data: [10]

x:	1	2	3	4
y:	-1.51	0.99	3.88	7.66

- b) Find the polynomial $f(x)$ by using Lagrange's interpolation formula and hence find $f(3)$ for the following series : [6]

x	0	1	2	5
y=f(x)	2	3	12	147

- Q11) a)** Draw the combine flowchart for Simpson's $\frac{1}{3}^{rd}$ and Simpson's $\frac{3}{8}^{th}$ rule. [8]

- b) Using Gauss Legendre three point formula, find $\int_0^2 e^x + 4x - 3$. [8]

OR

- Q12) a)** Find the integral $I = \int_0^{\pi} \sin(x) \cdot dx$ using Trapezoidal rule. [8]

- b) Find double integral $f(x, y) = 2x + y + 1$ for $n = 0$ to 2 and $y = 0$ to 2. Use Simpson's $\frac{1}{3}^{rd}$ rule. [8]

