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 $f(x) = e^{(x)}.\cos(x) - 1.4 = 0$ upto accuracy of 0.01.take initial gauss 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

$2x + y \leq 104$

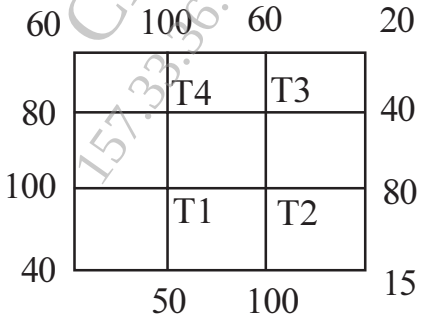
$x + 2y \leq 76$

$x, y \geq 0$

Use Simplex method.

Q7) a) Temperature at one surface of slab of thickness, $x = 20$ *cm* is $T = 500°C$. Find the temperature of the other surface of slab by taking step size in thickness, $\Delta x = 4cm$. 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≤ x≤ ½ and u(x,0)=2(1–x) for ½≤x≤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 $f(3)\,dx$ 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 $1/3^{rd}$ and Simpson's $3/8^{th}$ rule. **[8]**

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

OR

Q12)a) Find the integral $I = \int_0^{\pi} \sin(x).dx$ 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 $1/3^{rd}$ rule. **[8]**