Total No. of Questions : 12]

SEAT No. :

P2550

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[5153]-516

T. E. (Mechanical / Automobile)

NUMERICAL METHODS & OPTIMIZATION

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

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q 12.***
2) ***Neat diagram must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of programmable calculator is not permitted.***
3) ***Assume suitable data if necessary.***

Q1) Determine the maximum relative error for the function

$$F = 3x^2y^2 + 5y^2z^2 - 7x^2z^2 + 38$$

For x=y=z=1 and Δx = -0.05, Δy = 0.001 and Δz = 0.02. **[6]**

OR

Q2) Find real root of cos(x)-3(x)+5=0. Correct to four decimal places using the False Position method. **[6]**

Q3) Solve the following equations by Thomas Algorithm. **[6]**

$$3x_1 - x_2 = 5$$
$$2x_1 - 3x_2 + 2x_3 = 5$$
$$x_2 + 2x_3 + 5x_4 = 10$$
$$x_3 - x_4 = 1$$

OR

Q4) Draw a flow chart for Gauss-Seidal Method. **[6]**

Q5) Two products A and B are to be manufactured by a firm. Each of these product has to be processed on two machines M1 and M2. Product A requires 4 hours on machine M1 and 5 hours on machine M2. Product B requires 5 hours on machine M1 and 2 hours on machine M2. The available capacity per

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month is 100 hours and 80 hours for machine M1 and M2 respectively. The profit per unit is Rs.10 and Rs.5 on product A and B respectively. Estimate the number of units of each type to be produced per month for maximum profit by simplex Method. **[8]**

OR

Q6) a) Minimize $Z = 80x_1 + 120x_2$ **[6]**

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) Explain following terms used in graphical method of optimization. **[2]**

i) Constraints ii) Optimal solution

Q7) a) From the given table find the value of x for y(x) = 0.390 **[8]**

x	20	25	30	35
f(x)	0.342	0.423	0.5	0.65

b) Fit the curve $pv^{\gamma} = k$ to the following data: **[8]**

p(kg/cm^2)	0.5	1	1.5	2	2.5	3
v(litres)	1620	1000	750	620	520	460

OR

Q8) a) For the following data calculate difference and obtain forward difference polynamials. Interpolate at x= 0.25 and x= 0.35 **[8]**

x	0.1	0.2	0.3	0.4	0.5
y=f(x)	1.4	1.56	1.76	2.0	2.28

b) Fit a parabola $y = ax^2 + bx + c$ in least square sense to the data. **[8]**

x	10	12	15	23	20
y	14	17	23	25	21

Q9) a) Evaluate $\int_2^6 \log_{10} x dx$ by using trapezoidal rule, taking n=8, correct to five decimal places. **[8]**

b) Explain Simpon's 1/3 rule graphically and drive formula for integration of a function. **[8]**

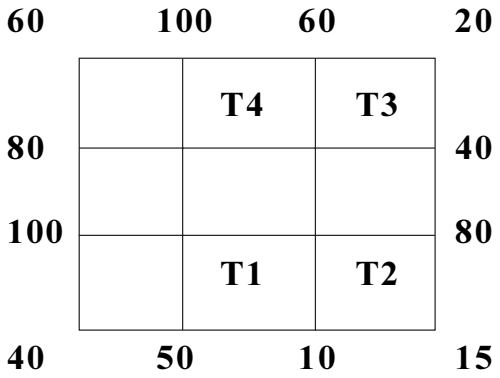
OR

Q10)a) Explain what is meant by Simpson's strip for 1/3rd and 3/8th rule. Explain why Simpson's 3/8th rule give more accuracy compared to Trapezoidal and Simpson's 1/3rd rule with same number of strips. **[8]**

b) Solve the Trapezoidal rule $\int_0^1 \int_0^1 x^2 y^2 .dx.dy$ Taking step length in x and y as 0.25. **[8]**

Q11)a) Draw flowchart for modified Euler's method. **[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

Q12)a) Draw the flowchart for solving the Laplace equation. **[8]**

b) Use Runge- Kutta method of fourth order to obtain the numerical solution of $\frac{dy}{dx} = \sqrt{(x^2 + y)}$, Find y at x=0.4 given y(0) = 1, take h = 0.2. **[10]**

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