

Total No. of Questions : 12]

SEAT No. :

P3480

[5560]-116

[Total No. of Pages : 4

T.E. (Mechanical/Automobile)

NUMERICAL METHODS & OPTIMIZATION

(2012 Pattern) (Semester - II) (End Semester) (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 Q12.
- 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) Draw the flowchart for Bisection method. **[6]**

OR

Q2) If $x = 3.26426$, find absolute, relative and percentage error, if **[6]**

- a) x is truncated to 4 decimal places.
- b) x is rounded off to 4 decimal places.

Q3) Solve by Gauss seidel method. **[6]**

$$2x_1 + 3x_2 + 10x_3 = 27.1$$

$$5x_1 + x_2 - x_3 = 4.7$$

$$x_1 + 8x_2 + 2x_3 = 15.7$$

OR

Q4) Draw the flowchart for Gauss Elimination method. **[6]**

Q5) a) Minimize : $Z = 6000x_1 + 4000x_2$ **[5]**

Subjected to the constraints

$$3x_1 + x_2 \geq 40$$

$$x_1 + 2.5x_2 \geq 22$$

$$x_1 + x_2 \geq 40/3$$

$$x_1, x_2 > 0$$

(Use Graphical Method)

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

OR

P.T.O.

Q6) Using simplex method

[8]

$$\text{Maximize } Z = 1600x + 1500y$$

Subject to

$$5x + 4y \leq 500$$

$$15x + 16y \leq 1800$$

$$x_1, x_2 \geq 0$$

Q7) a) Using least square criteria, fit a equation $y = ax^2 + bx + c$; to the following data: [8]

X	1	2	3	4	5	6	7
Y	-5	-2	5	16	31	50	73

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) Equation of the best fitting curve is of the type $y = ab^x$. Find the values of constants a and b by fitting a curve through the following points: [8]

X	1	3	4	6	9
Y	0.84	0.4116	0.2888	0.141	0.048

b) Draw the flowchart for Newton's Forward Difference Interpolation. [8]

- Q9) a)** Time required for cooling an object is given by the relation [8]

$$Time = \int_{400}^{700} \frac{9.085 \times 10^3 dT}{7.895(T - 293) + 3.4 \times 10^{-8}(T^4 - 293^4)}$$

Compute the time using Simpson's 1/3rd method and taking four intervals.

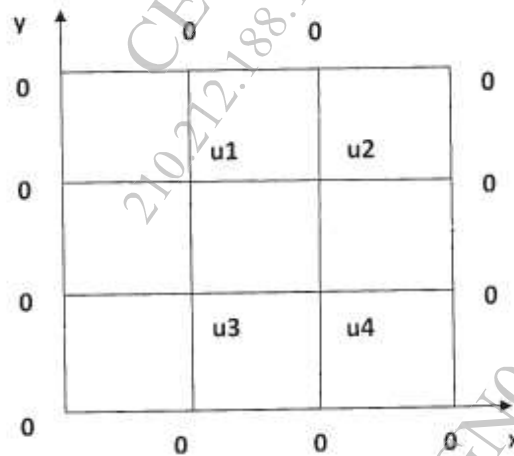
- b) Solve using Trapezoidal rule $\int_0^1 \int_0^1 x^2 y^2 dx dy$. Taking step length in x and y as 0.25. [8]

OR

- Q10)a)** Draw the combine flowchart for Simpson's 1/3rd and Simpson's 3/8th rule. [8]

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

- Q11)a)** Solve the equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = y = 0$ and $x = y = 3$. with $u = 0$ on the boundary and mesh length = 1. [10]



- b) Solve the equations $\frac{dy}{dx} = (x + yz)$ and $\frac{dz}{dx} = (x^2 - y^2)$ using Runge Kutta method under the boundary conditions $x = 0.0$, $y = 0.1$ and $z = 0.5$. Find y and z and $x = 0.2$. [8]

Q12)a) Solve for $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ the following explicit finite scheme is given by, [12]

- i) $u = \sin(\pi x)$ for $t = 0$ where $0 \leq x \leq 1$,
- ii) $u = 0$ for $x = 0$ and $x = 1$ for $t = 0$ to 0.06, and
- iii) increment in t is $k = 0.02$ and in x is $h = 0.2$,

Calculate values of u for $t = 0$ to 0.06 at $x = 0$ to 1.

b) Draw the flowchart for Euler's method. [6]

x x x