[4063] – 215

T.E. (Mech.) (Semester – I) Examination, 2011
COMPUTER ORIENTED NUMERICAL METHODS
(2008 Pattern) (New)

Time: 3 Hours Max. Marks: 100

Instructions : *1) Answer **3** questions from Section **I** and **3** questions from Section **II**.*

*2) Answers to the **two** Sections should be written in **separate** books.*

*3) **Neat** diagrams must be drawn **wherever** necessary.*

*4) Black figures to the **right** indicate **full** marks.*

*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*

*6) Assume suitable data, **if necessary**.*

SECTION – I

1. a) Solve using Newton Raphson method the equation $\sin x - x \cos x = 0$.

Assume initial guess value for $x = \frac{3\pi}{2}$, accuracy of function should be within 0.00001. **8**

b) Draw flow-chart for numerical integration using Simpson's 1/3 rd rule, of given function y = f(x) between the limits a & b. **8**

OR

2. a) Solve by 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**

b) Draw flow chart for solution of roots of equation using successive approximation method. **8**

P.T.O.

3. a) What are cubic splines ? State the conditions for a spline to be cubic. **6**

   b) The velocity distribution of a fluid near a flat surface is given below

x	0.1	0.3	0.5	0.7	0.9
v	0.72	1.81	2.73	3.47	3.98

   x is the distance from the surface (cm) and v is the velocity (cm/sec.) Using Newton's forward difference method obtain the velocity at x = 0.2, 0.4, 0.6 and 0.8. **10**

OR

4. a) Explain the terms Interpolation', 'Extrapolation' and 'Inverse interpolation'. **4**

   b) Draw flow-chart for interpolation using Newton's Backward difference formula. **12**

5. a) Solve the following tridiagonal system with the Thomas algorithm **8**

$$\begin{bmatrix} 2.04 & -1 & & \\ -1 & 2.04 & -1 & \\ & -1 & 2.04 & -1 \\ & & -1 & 2.04 \end{bmatrix} \begin{Bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \end{Bmatrix} = \begin{Bmatrix} 40.8 \\ 0.8 \\ 0.8 \\ 200.8 \end{Bmatrix}$$

   b) Draw a flow chart for Gauss Seidal method with relaxation. **10**

OR

6. a) Using Gauss-Seidel Method solve the following set of simultaneous equations.

   $x_1 + 20x_2 + 9x_3 = -23$

   $2x_1 - 7x_2 - 20x_3 = -57$

   $20x_1 + 2x_2 + 6x_3 = 28$

   Show four iterations in the tabular form. **8**

   b) Draw a flow chart for Gauss -Elimination method. **10**

SECTION – II

7. a) The pressure (P) and volume (V) of a gas are related by the equation $PV^W = C$, where C & W being constants : Fit this equation to the following set of observations.

P	0.5	1	1.5	2	2.5	3
V	1.62	1	0.75	0.62	0.52	0.46

Derive the fomulaes used. **10**

b) State the various criteria used for curve fitting. Why least square technique is preferred ? **6**

OR

8. a) The volume of a cone having base circle radius r and height h is calculated as $V = \frac{\pi}{3} r^2 h$, If $r = 3.5 \pm 0.01$ and $h = 12.5 \pm 0.01$, then compute the absolute accuracy. **6**

b) Draw a flow-chart to fit an equation, $y = ax + b$. **6**

c) Explain :

i) Round off errors ii) Truncation errors. **4**

9. a) Solution of equation $\frac{dy}{dx} = 1 + xy$ is tabulated as,

x	0	0.1	0.2	0.3
y	1	1.1	1.211	1.3352

Use Adam-Bash forth-Moulton method to find y at x = 0.4 and 0.5. **8**

b) Draw a flow-chart for modified Euler's method. **8**

OR

10. a) Solve the equation

$$2\frac{d^2y}{dx^2} = 3x\frac{dy}{dx} - 9y + 9$$

Subject to the conditions $y(0) = 1$, $y'(0) = -2$, using Runge-Kutta 2nd order method and compute y for x = 0.1 and 0.2. **8**

b) Draw a flow-chart for Runge Kutta 4th order method. **8**

11. a) Initial temperature within an insulated cylindrical metal rod of 4 cm length is given by, $T = 50(4 - x)$, $0<x<4$, where x is distance from one end in cm. Both the ends are maintained at 0° C. Find the temperature as a function of x and t ($0 \leq t \leq 1.5$) if the heat flow is governed by $\frac{\partial T}{\partial t} = 2\frac{\partial^2 T}{\partial x^2}$, $\Delta x = 1$ and $\Delta t = 0.25$. **10**

b) Draw a flow-chart for sol^{n} of 1D unsteady heat conduction equation. **8**

OR

12. a) Solve the boundary value problem $\frac{d^2y}{dx^2} - 64y + 10 = 0$. Initial conditions, $y(0) = 1$, $y(1) = 1$, take step size, h = 1/3 compute $y(\frac{1}{3})$ and $y(\frac{2}{3})$. **10**

b) Draw a flow-chart for solution of wave equation. **8**
