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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.

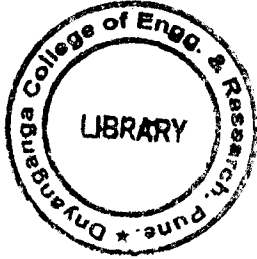
2) Answers to the two Sections should be written in separate books.

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

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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 formulae 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

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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 solution 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 $y(1/3)$ and $y(2/3)$. 10

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