T.E. (Mechanical) (Semester – I) Examination, 2010
COMPUTER ORIENTED NUMERICAL METHODS (New)
(2008 Course)

Time: 3 Hours Max. Marks: 100

*Instructions : 1) Answers to the **two** Sections should be written in separate books.*
*2) Black figures to the **right** indicate **full** marks.*
*3) Assume suitable data, **if necessary**.*

SECTION – I

Unit – I

1. a) Apply Newton Raphson method to determine the roots of the equation $f(x) = \cos x - xe^{x} = 0$ to an accuracy of 0.0001. 8

b) Draw a flow chart for Gauss Quadrature 2 point formula. 6

c) Represent Successive approximation method graphically. 2

OR

2. a) Draw a flowchart for Modified Newton Raphson method to determine the root of equation correct up to three decimal places. 6

b) Evaluate the double integration of $f(x,y) = x^2+y^2+5$ for x = 0 to 1 and y = 0 to 2 taking step size in x as 0.25 and y as 0.5 using Simpson's $1/3^{rd}$ rule. 10

Unit – II

3. a) Values of X in degrees and Sin X are given in following table. Using that data estimate value of Sin 38. 8

X	15	20	25	30	35	40
Sin X	0.258819	0.3420201	0.4226183	0.5	0.573576	0.642787

b) Distance travelled by a car is as shown in the table. Estimate the Distance traveled, Velocity and acceleration of car when t = 4.5 hrs. 10

t in hrs	1	2	3	4	5
X in Km	14	30	62	116	198

OR

4. a) Find Cubic spline curve for the following data and hence determine y(5). 10

X	3	4.5	7
Y	2.5	1.0	2.5

b) Following table gives angular displacement θ (in Radian) at different intervals of time t(in second). Calculate angular velocity at instant t = 0.06. 8

θ	0.052	0.105	0.168	0.242	0.327	0.408	0.489
t	0	0.02	0.04	0.06	0.08	0.10	0.12

Unit – III

5. a) Solve using Gauss Seidal method with relaxation parameter of 0.99 correct up to an accuracy of 0.001. 10

$7x + 20y + 3z = 111$

$23x - 11y + 7z = 161.5$

$10x + 13y + 22z = 190.5$

b) Draw a flow chart for Thomas Algorithm for Tri-diagonal Matrix. 6

OR

6. a) Solve the following system of equation using Gauss elimination with partial pivoting.

$4x + y + z = 4$

$x + 4y - 2z = 4$

$3x + 2y - 4z = 6$ 8

b) Draw a flowchart for Gauss Seidal method with partial pivoting. 8

SECTION – II

Unit – IV

7. a) Kinematic viscosity of water (v) is related to temperature (T) in the following manner :

T(°C)	0	4	8	12	16	20	24
v, 10^{-2} cm^2/sec	1.7923	1.5676	1.3874	1.2396	1.1168	1.0105	0.9186

Use method of least squares to fit the parabolic equation of the form $v = a+bT+cT^2$ for the data. Use the Gauss Elimination method to solve the silultaneous equations for a, b &c. 10

b) Derive the expressions for absolute and relative error in
i) Addition ii) Multiplication iii) Division. 6

OR

8. a) A material is tested for cyclic fatigue failure whereby a stress in MPa, is applied to the material and the number of cycles needed to cause failure is measured. The results are in the table below :

N, Cycles	1	10	100	1000	10000	100000	1000000
Stress, MPa	1131	1058	993	801	651	562	427

When a log-log plot of stress versus cycles is generated, the data trend shows a linear relationship (straight line). Use the method of least squares to find the equation of that straight line. 7

b) Draw a flowchart for straight line curve fit. 5

c) Round off the number 665250 to four significant figures and compute absolute, relative and percentage error. 4

Unit – V

9. a) The rate of cooling of a metal ball can be expressed as

$$\frac{dT}{dt} = -k(T - Ta)$$

k = Constant of proportionality $= 0.2\ \text{min}^{-1}$,
T = Temperature of metal ball (°C),
Ta = Temperature of surrounding medium (°C),
If a metal ball heated to 90°C is dropped into water that is held to Ta=20°C, find :

i) temperature of ball after 1 min by using Modified Euler method correct to two decimal place accuracy,
ii) temperature of ball after 2 min by using Runge Kutta of 2^{nd} order method,
iii) temperature of ball after 3 min by using Runge Kutta of 4^{th} order method,
iv) temperature of ball after 4 min by using Milne Simpson's method correct to four decimal places. 12

b) Draw a flowchart for Euler's method. 4

OR

10. a) Solve the second order differential equation $\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} + y = 0$

Given that at x = 0, y = 0.5 and $\frac{dy}{dx} = 0.1$, find :

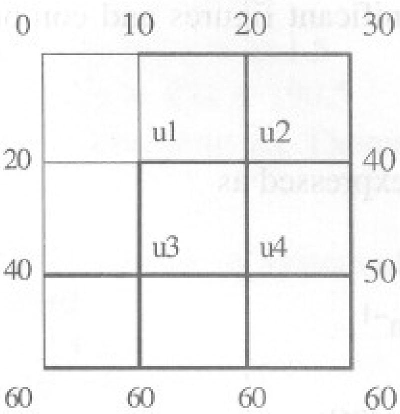
i) y at x = 0.1 by using Runge Kutta of 2nd order method,

ii) y at x = 0.2 by using Taylor Series method. Take series upto 3rd derivative (y'''). Take $h = \Delta x = 0.1$. **10**

b) Draw a flowchart for Modified Euler Method. **6**

Unit – VI

11. a) Solve the Laplace equation $\nabla^2 u = 0$ for the given boundary conditions shown in fig. 11a. **10**



b) Draw a flowchart for Parabolic equation solved by Bender Schmidt method. **8**

OR

12. a) Solve $25u_{xx} = u_{tt}$, given $u_t(x, 0) = 0$, $u(0, t) = 0$, $u(5,t) = 0$ and

$u(x, 0) = (25 - 5x)\ 1 \le x \le 2$

$u(x, 0) = 5(5 - x)\ 2 \le x \le 4$

Solve the equation numerically for $0 \le t \le 0.3$ taking $\Delta x = 1$, $\Delta t = 0.1$. **10**

b) Draw a flowchart for Poisson's equation $\nabla^2 u = f(x, y)$. **8**
