T.E. (Mech.) (Sem. – I) Examination, 2010
COMPUTER ORIENTED NUMERICAL METHODS
(Common with Mech. S/W for Sem. – II) (2003 Course)

Time : 3 Hours | Max. Marks : 100

Instructions : *1) Answers to the **two** Sections should be written in **separate** books.*

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

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

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

SECTION – I

UNIT – 1

1. A) Volume of a cylinder is calculated after measuring its diameter as (2.5 ± 0.02) m and its height as (4.8 ± 0.05) m respectively. Estimate the absolute error in calculation of volume. **6**

B) Maximise $z = 6x_1 + 4x_2$, subject to :

$2x_1 + 3x_2 \leq 100$

$4x_1 + 2x_2 \leq 120$

$x_1, x_2 \geq 0$

using Simplex method.

Calculate x_1 , x_2 and maximised value of 'Z'. **12**

OR

2. A) i) Explain the significance of 'round-off errors' and 'truncation errors' in mathematical/numerical computations. 6

ii) Compute the error caused in 'z' due to errors in measurements of 'x' and 'y' as Δx and Δy respectively, in following cases : 6

a) $z = x + y$

b) $z = xy$.

B) Develop a linear programming model for the following system :

A company manufactures 3 different types of articles, viz. A, B, C.

Production of 1 no. of 'A' type of article requires 1 hr. time, 3 operators and 2 machines.

Production of 1 no. of 'B' type of article requires 2 hrs. of time, 5 operators and 1 machine.

Production of 1 no. of 'C' type of article requires 1.5 hrs. of time, 4 operators and 1 machine.

Profits earned by selling A, B, C type of articles are Rs. 200, 300 and 400 per article respectively.

If the total no. of machines available with the company is 10, no. of operators available is 50, then find out the number of articles of A, B and C type, which can be manufactured in a 10 hr. shift for earning maximum profit. 6

UNIT – 2

3. A)

Re [x]	Nu [y]
900	89
1500	110
2700	120
3000	125

Using least square technique, fit the following curve to the above mentioned data. Find the values of 'a' and 'b'.

Curve : $Nu = a\ Re^{b}$. **10**

B) Draw a flow-chart for calculating 'y_g' for given 'x_g' using Newton's forward difference interpolation formula.

Given : 4 data points viz. (x_1, y_1), (x_2, y_2), (x_3, y_3) and (x_4, y_4). **6**

OR

4. A)

Year :	2009	2007	2005	2003
Avg. temp. in Summer in °C :	47	45	40	43

Predict the temperature in year 2004 using Newton's backward difference interpolation formula. **8**

B) Given : A set of 5 readings during an engine trial.

Load (N) vs Fuel consumption (kg/sec)

[x] [y].

Write a program to find the best fitting line through the given data using least square technique. **8**

UNIT – 3

5. A) The distance travelled by a car, as recorded at different time instants is given below : **10**

t (sec.)	0	5	10	15
s (m)	0	20	150	300

Calculate the :

i) speed and

ii) acceleration of the car at time = 2 sec. using forward difference formula.

B) Write notes on : **6**

i) Partial pivoting.

ii) Homogeneous system of linear equations.

OR

6. A) Solve using Gauss-elimination method. **10**

$x + 3y + 5z = 9$

$x - 4y - 6z = -9$

$-x + 2y - 12z = -11$

B) Discuss the step-by-step procedure (algorithm) for solving following equations using Gauss-Seidel iteration method, performing 6 iterations.

$a_{11} x_1 + a_{12}x_2 + a_{13}x_3 + a_{14}x_4 = b_1$

$a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + a_{24}x_4 = b_2$

$a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + a_{34}x_4 = b_3$

$a_{41}x_1 + a_{42}x_2 + a_{43}x_3 + a_{44}x_4 = b_4$ **6**

SECTION – II

UNIT – 4

7. a) Determine the root of the following equation $x\,e^x - \cos 3x - 0.5 = 0$ using Regula Falsi method. Perform 5 iterations. Use initial guess as $x_1 = 0$ and $x_2 = 1$. **8**

b) Write a computer program for double integration of the following function $I = \int_{x_0}^{x_n} \int_{y_0}^{y_n} f(x,y)dx\,dy$ with $\Delta x = h$ and $\Delta y = k$ by Simpson's $1/3^{rd}$ Rule. **8**

OR

8. a) Evaluate $\int_0^1 \frac{\sin x}{2+3\sin x}\,dx$ using Simpson's $3/8^{th}$ Rule. Take 6 strips. **8**

b) Write a computer program for Newton Raphson method to solve $f(x) = 0.51\,x - \sin x$ with initial guess as $x_1 = 2$. Perform 5 iterations. **8**

UNIT – 5

9. a) Solve the differential equation $\frac{dy}{dx} = x - y$ using RK 4^{th} order method under initial conditions $x = 0$, $y = 2$. Estimate $y(0.2)$. Take h as 0.1. **8**

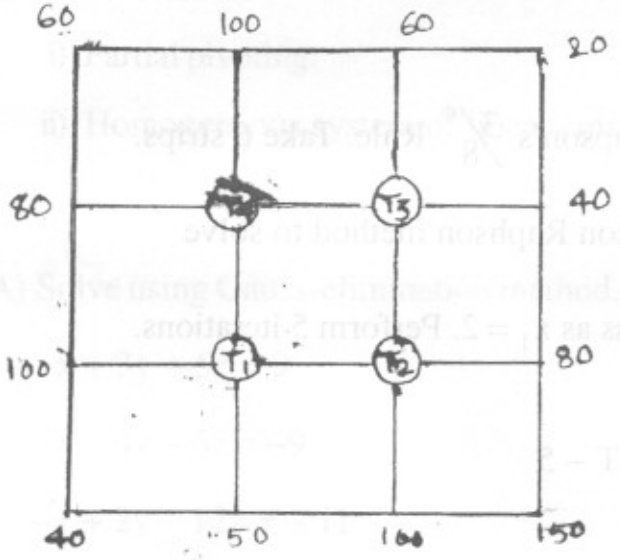
b) Write a computer program for Modified-Euler method to solve an ODE $\frac{dy}{dx} = f(x,y)$ with initial conditions as (x_0, y_0) and increment in x as 'h'. **8**

OR

10. a) Use Taylor's series method to solve equation $\frac{dy}{dx} = x^2 + y^2$. Given initial conditions are x = 0, y = 1. Estimate y (0.5). Take h = 0.25. **8**

b) Write a computer program for $\frac{dy}{dx} = f(x, y)$ with initial guess as (x_0, y_0) and increment in x as 'h' by using RK – 2 method. **8**

11. a) Solve the Laplace equation $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$ for square mesh as shown in diagram below. **10**



b) Draw a flow chart for Q. 11 a). **8**

OR

12. a) Solve the following equation : **10**

$$\frac{\partial^2 u}{\partial t^2} = \left(\frac{100}{9}\right)\frac{\partial^2 u}{\partial x^2}$$

At $t = 0$, $u = 4x$ for $0 < x < 3$

At $x = 0$ and $x = 3$, $u = 1$ for all values of t. Take $h = 1$ and $k = 0.1$.

Find the values of u at $t = 0.3$ and $x = 0$ to $x = 3$

h = Increment in x and k = Increment in t.

b) Draw flow chart for solving Q. (12-a). **8**
