

24291

B. Tech. 5th Semester (Civil Engg.) Examination,

December-2012

**NUMERICAL METHODS AND COMPUTING
TECHNIQUES**

Paper-CE-309-F

Time allowed : 3 hours]

[Maximum marks : 100

Note : *Question 1st is compulsory. Attempt total 5 questions selecting one question from each Section. All questions carry equal marks.*

1. (a) What are direct methods and iterative methods ?
- (b) State Trapezoidal Rule.
- (c) Define Interpolation and Extrapolation.
- (d) State Newton's backward Interpolation formula.
- (e) Describe Numerical differentiation and Numerical integration.
- (f) Write the finite difference approximations to partial derivatives in x and y directions.
- (g) Find by Taylor's series method, the value of y at $x = 0.1$ and $x = 0.2$ from

$$\frac{dy}{dx} = x^2y + 1, y(0) = 1.$$

- (h) State Lagrange's polynomial.

Section-A

2. (a) Determine $f(x)$ as a polynomial in x for the following data :

$x :$	-4	-1	0	2	5
$f(x) :$	1245	33	5	9	1335

by using Divided Diff. Table. Hence evaluate $f(4)$.

- (b) Find the cubic splines to fit the data and predict $y(1.5)$.

$x :$	0	1	2	3
$y :$	1	-1	-1	0

3. (a) Find a real root of the equation $x^3 + x^2 - 1 = 0$ by Fixed Point Method.
- (b) Find a real root of the equation $3x = \cos x + 1$ by Newton Raphson Method.

Section-B

4. (a) Solve the system

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 100$$

by using Iterative method.

- (b) Solve the system

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

$$3x + 2y + 2z = 8$$

$$5x + 10y - 8z = 10$$

by using Gauss elimination method.

5. (a) Given that

$$x: \quad 1.0 \quad 1.1 \quad 1.2 \quad 1.3 \quad 1.4 \quad 1.5 \quad 1.6$$

$$y: \quad 7.909 \quad 8.403 \quad 8.781 \quad 9.129 \quad 9.451 \quad 9.750 \quad 10.031$$

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$ and $x = 1.6$.

- (b) Evaluate

$$\int_0^1 \frac{dx}{1+x^2} \text{ using (i) Trapezoidal rule taking } h = \frac{1}{4}$$

$$(ii) \text{ Simpson's rule taking } h = \frac{1}{6}$$

Section-C

6. (a) Find the largest Eigen value of the matrix, using power method

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

- (b) Using modified Euler's method, obtain a solution of the equation

$$\frac{dy}{dx} = x + |y|,$$

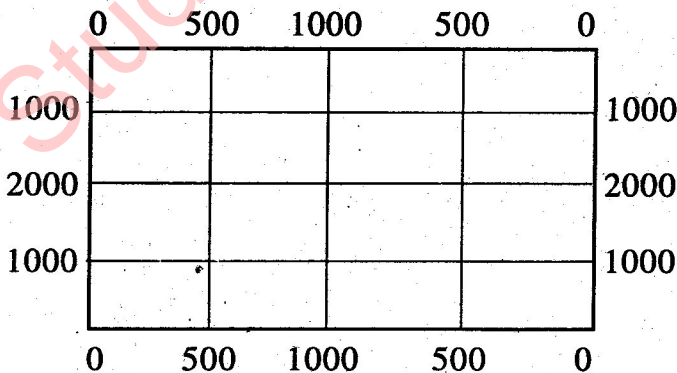
with initial conditions $y = 1$ at $x = 0$, for the range $0 \leq x \leq 0.6$ in steps of 0.2.

7. Using Runge-Kutta Method of order 4, find y for $x = 0.1, 0.2, 0.3$.

Given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$. Continue the solution at $x = 0.4$ using Milne's Method.

Section-D

8. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown :



9. (a) Solve the equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

subject to the conditions

$$u(x, 0) = \sin \pi x, \quad 0 \leq x \leq 1; \quad u(0, t) = u(1, t) = 0,$$

using Crank Nicolson Method.

- (b) Fit a parabola, by the method of least squares, to the following data :

x :	1	2	3	4	5
y :	5	12	26	60	97.