Roll No. ....

24291

B. Tech. 5th Sem. (Civil Engg.)

Examination – December, 2014

NUMERICAL METHODS AND COMPUTING TECHNIQUES

Paper : CE-309-F

Time : Three hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question No. **1** is *compulsory*. All questions carry equal marks.

1. (a) What is a divided difference table ? How is it useful ?

   (b) What is Crank Nicolson Method ? Why is it known as implicit method ?

   (c) Using Euler's method, find approximate value of y when $x = 1$ of $\frac{dy}{dx} = x + y, y(0) = 1$ (take $h = 0.2$)

   (d) Define forward differences and backward differences.

(e) What are direct methods and iterative method to solve the system of linear equations ?

(f) Write the finite difference approximations to partial derivatives in x and y directions.

(g) What is spline interpolation ?

(h) What are the limitations of Taylor's series method for solving ordinary differential equations ?

SECTION – A

2. (a) Given $f(0) = -18$, $f(1) = 0$, $f(3) = 0$, $f(5) = -248$, $f(6) = 0$ and $f(9) = 13104$, find $f(x)$.

(b) Find the cubic splines to fit the data and evaluate $y\,(1.5)$ and $y'\,(3)$

x :	1	2	3	4
y :	1	2	5	11

3. (a) Find a real root of the equation $x^3 - 3x - 5 = 0$ by using Muller's Method. 4

(b) Solve the non linear equation $x \log_{10} x = 1.2$ by Newton Raphson Method.

SECTION – B

4. (a) Solve the equations :

$$2x + y + z = 10;$$
$$3x + 2y + 3z = 18;$$
$$x + 4y + 9z = 16$$

by Gauss elimination method.

(b) Solve the equations :

$$10x - 2y - 3z = 205;$$
$$-2x + 10y - 2z = 154;$$
$$-2x - y + 10z = 120$$

by Relaxation method.

5. (a) Given that

x	: 1.96	1.98	2.00	2.02	2.04
$f(x)$	: 0.7825	0.7739	0.7651	0.7563	0.7473

find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 2.03$

(b) Use Romberg's method to compute $\int_0^1 \frac{dx}{1+x^2}$ correct to 4 decimal places.

SECTION – C

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

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$$

(b) Using Runge-Kutta method, compute y (0.2) and y (0.4) from.

$$\frac{dy}{dx} = 3x + \frac{1}{2}y, y(0) = 1$$

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

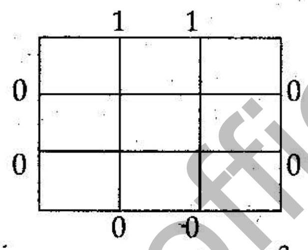
$y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979$

Evaluate y (1.4) by using Milne's Method.

(b) Using modified Euler's method, obtain a solution of the equation $\frac{dy}{dx} = 2 + \sqrt{xy}$, with initial conditions y = 1 when x = 1 at x = 2 in steps of 0.2.

SECTION – D

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



9. (a) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial^2 x}$ subject to the conditions $u(x, 0) = \sin \pi x, 0 \le x \le 1; u(0,t) = u(1,t) = 0$, using Crank Nicolson Method.

(b) Fit a second degree parabola to the following data :

x :	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y :	1.1	1.3	1.6	2 0	2.7	3.4	4.1