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

December-2013

NUMERICAL METHODS AND COMPUTING
TECHNIQUES

Paper-CE-309-F

Time allowed : 3 hours]

[Maximum marks : 100

Note : Question No. 1 is compulsory and attempt 05 questions in total.

1. (i) State the Intermediate value Theorem. 4
(ii) Show that Newton Raphson method has quadratic rate of convergences. 4
(iii) Define the Runge-Kutta Method of order 4. 4
(iv) Discuss the power method for eigen value. 4
(v) State the necessary and sufficient condition that fixed point method converges. 4
2. (a) Find the polynomial of the lowest possible degree which assume that the values 3, 12, 15, -21 when x has the values 3, 2, 1, -1 respectively.

10

- (b) Define the interpolation. Using Lagrange formula, find the form of the function, given

x : 0 1 2 3 4

f(x): 3 6 11 18 27 10

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3. (a) Perform four iteration of the Newton-Raphson method to obtain the approximate value of $(17)^{\frac{1}{3}}$ starting with the initial approximation $x_0 = 2$. 10
- (b) Find a real root of $2x - \log_{10} x = 7$ correct to four decimal places using fixed point method. 10
4. (a) Apply Gauss Elimination method to solve the equations

$$x + 4y - z = -5$$

$$x + y - 6z = -12$$

$$3x - y - z = 4 \quad 10$$

- (b) Apply Gauss-Seidel iteration method to solve the equations

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25 \quad 10$$

5. (a) Evaluate $I = \int_0^6 \frac{dx}{1+x^2}$ by using Simpson $\frac{1}{3}$ Rule taking six number of subinterval. 10
- (b) Calculate the approximate value of $\int_0^{\frac{\pi}{2}} \sin x \, dx$ by the trapezoidal rule. 10

6. (a) Solve $\frac{dy}{dx} = x + y$ numerically using Taylor series method. Start from $x = 1$, $y = 0$ and carry to $x = 1.2$ with $h = 0.1$. 10

- (b) Discuss the Euler's method as well as Euler modified method. 10

7. (a) Fit a straight line to the following data regarding x as the independent variable

$x :$	0	1	2	3	4	
$y :$	1	1.8	3.3	4.5	6.3	10

- (b) Show that n th order divided difference

$$f(x_0, x_1, \dots, x_n) \text{ for the function } f(x) = \frac{1}{x}$$

$$\text{is equal to } \frac{(-1)^n}{x_0 x_1 \dots x_n}. \quad 10$$

8. Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the condition

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

$$u(0, t) = u(1, t) = 0 \text{ using}$$

- (i) Schmidt method

- (ii) Crank - Nicolson methods

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(4)

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9. Fit the least square approximation of second degree for the discrete data

$x:$ -2 -1 0 1 2

$f(x):$ 15 1 1 3 19 20

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