Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐ **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(CE) (2011 Onwards)   (Sem.–6)
NUMERICAL METHODS IN CIVIL ENGINEERING
Subject Code : BTCE-604
Paper ID : [A2291]

Time : 3 Hrs.   **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. **Write briefly :**

    (a) Write a short note on Initial value problems.

    (b) Find the interval in which the root of equation $x^3 - x - 11 = 0$ lies.

    (c) Write a short note on Bisection method.

    (d) Classify the equation $\dfrac{\partial^2 f}{\partial x^2} + 2\dfrac{\partial^2 f}{\partial x \partial y} + \dfrac{\partial^2 f}{\partial y^2}$.

    (e) Find the polynomial which takes following data (0, 1), (1, 2) and (2, 1).

    (f) Write a short note on Galerkin's method of least squares.

    (g) Using iterative method find the inverse of $\begin{bmatrix} 1 & 10 \\ 2 & 0 \end{bmatrix}$.

    (h) Find Eigen values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.

    (i) Write an example of civil engineering related real life problem.

    (j) Write various techniques for approximating interpolating polynomials.

SECTION-B

2.   Use Newton iterative method to find the root of equation $3x - \cos(x) + 1$, by taking initial guess 0.6.

3.   Solve the following equations by elimination method

$2x + y + z = 10$, $3x + 2y + 3z = 18$ and $x + 4y + 9z = 16$.

4.   Using Newton's forward formula, find value of $f(1.6)$, if

$$\begin{vmatrix} x: & 1 & 1.4 & 1.8 & 2.2 \\ f(x): & 3.49 & 4.82 & 5.96 & 6.5 \end{vmatrix}.$$

5.   Using Runge-Kutta method of order 4, find $y(0.2)$ for the equation $\dfrac{dy}{dx} = \dfrac{y-x}{y+x}$ $y(0) = 1$, take $h = 0.2$.

6.   By the method of least squares, find the straight line that best fits the following data :

$$\begin{vmatrix} x: & 1 & 2 & 3 & 4 & 5 \\ y: & 14 & 27 & 40 & 55 & 68 \end{vmatrix}$$

SECTION-C

7.   Fit a second degree polynomial to the following data :

$$\begin{vmatrix} x: & 1.0 & 1.5 & 2 & 2.5 & 3 & 3.5 & 4 \\ y: & 1.1 & 1.3 & 1.6 & 2.0 & 2.7 & 3.4 & 4.1 \end{vmatrix}$$

8.   Solve the equation $y'' = x + y$ with the boundary conditions $y(0) = y(1) = 0$.

9.   Solve the equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides $x = y = 0$, $x = y = 3$ with $u = 0$ on the boundary and mesh length $(h) = 1$.