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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

M.Code : 71085

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****Q1. Answer the following :**

- a) Define least square interpolation.
- b) Find an interval containing a root of the equation  $x - \cos(x) = 0$ .
- c) Explain Implicit solutions.
- d) Determine the Lagrange interpolating polynomial passing through the points (2, 4) and (5, 3).
- e) Explain Explicit solutions.
- f) Explain briefly the Newmarks procedure.
- g) What is the order of convergence when Newton Raphson's method is applied to the equation  $x^2 - 6x + 9 = 0$  to find its multiple root.
- h) Use the forward-difference formula to approximate the derivative of  $f(x) = \ln x$  at  $x_0 = 1.8$  using  $h = 0.01$ .
- i) Write a short note on bisection method.
- j) Define initial value problem with a suitable example.

### SECTION-B

- Q2. Use the Runge-Kutta method of order 4 to approximate the solution of the following initial value problem

$$y' = y - t^2 + 1, 0 \leq t \leq 2, y(0) = 0.5.$$

- Q3. Apply Gauss Jordan method to find the inverse of the matrix

$$\begin{bmatrix} -2 & -3 \\ 6 & 7 \end{bmatrix}$$

- Q4. The following data is given :

1.0	1.3	1.6	1.9	2.2
0.7651977	0.6200860	0.4554022	0.2818186	0.1103623

Use Lagrange interpolation to approximate  $f(1.5)$  with  $x_0 = 1.6$ .

- Q5. Find a real root, correct to three decimal places of the equation  $2x - 3 = \cos(x)$  lying in the interval  $\left[\frac{3}{2}, \frac{\pi}{2}\right]$ .
- Q6. Use Newton's iterative method to find the root of the equation  $3x - \cos(x) + 1 = 0$  starting with an initial guess 0.6.

### SECTION-C

- Q7. Determine the values of  $h$  that will ensure an approximation error of less than 0.00002 when approximating  $\int_0^\pi \sin x dx$  and employing :
- Composite trapezoidal rule.
  - Composite Simpson's rule.
- Q8. The function  $f(x) = \tan \pi x - 6$  has a zero at  $\pi \arctan 6 \approx 0.447431543$ . Let  $p_0 = 0$  and  $p_1 = 0.48$ . Use ten iterations of the secant method to approximate this root.
- Q9. A certain stimulus administered to each of the 12 patients resulted in the following increase in blood pressure :

$$5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6.$$

Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure.

**NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC case against the Student.**