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B.Tech. (CE) (Sem.–6)

NUMERICAL METHODS IN CIVIL ENGINEERING

Subject Code : BTCE-604

M.Code : 71085

Date of Examination : 09-07-22

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. Answer the following :

a) Evaluate $\Delta^n(e^{3x+5})$.

b) Determine the Lagrange interpolating polynomial passing through the points (2,4) and (5,3).

c) Define initial value problem with a suitable example.

d) Explain various techniques for interpolation.

e) Write a short note on bisection method.

f) Explain briefly the Newmarks procedure.

g) Explain implicit and explicit solutions.

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) Find an interval containing a root of the equation $x^3 - x - 11 = 0$.

j) Define Least Square Interpolation.

SECTION-B

2) Use Euler's method to approximate the solution of the following initial value problem

$$y' = y/t - (y/t)^2, \qquad 1 \le t \le 2, \qquad y(t) = 1,\ h = 0.1.$$

3) Solve the following system of equations using Gauss elimination method

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

4) 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's formula to approximate $f(1.5)$.

5) Explain the Gauss Jordan method and use it to find the inverse of the following matrix :

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

6) 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

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

8) Draw the graph of $4x = \tan x$. Use Newton's method to find the first two positive roots of $4x = \tan x$.

9) Fit a curve of the form $y = \frac{a}{x} + bx$ by the method of least square to the following data :

(1,5.43), (2,6.28), (4,10.32), (6,14.86), (8,19.51).

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.