[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2125)

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M. Tech 1st Semester Examination

Computational Methods in Water Resources Engineering

WRE-103

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each section A, B, C, D and all the subparts of question in Section E.

SECTION - A

1. (a) Solve the system of equations using Gauss Elimination method:

$5x - 2y + z = 4$

$7x + y - 5z = 8$

$3x + 7y + 4z = 10$ (10)

(b) The population of a town in census was as shown below. Estimate the population for the year 1896 using Newton's interpolation method. (10)

Year: x	1891	1901	1911	1921	1931
Population: y (in 1000s)	50	68	83	95	109

2. (a) Using Euler's method, solve the following equations:

$\frac{dy}{dx} - 1 = y^2$ $\quad y(0) = 1$

Choose h = 0.2. Compute y(0.2), y(0.4), y(0.6) (10)

[P.T.O.]

(b) Obtain a root of the equation correct to 3 decimal places, using Newton Raphson method:

$4(x - \sin x) = 1$ (10)

SECTION - B

3. (a) Find the solution to three decimal places by Gauss-Seidel method:

$82x + 11y - 4z = 95$

$7x + 52y + 13z = 104$

$3x + 8y + 29z = 71$ (10)

(b) Use Runge - Kutta method to solve:

$10\frac{dy}{dx} = x^2 + y^2,\ y(0) = 1$

For the interval $0 < x \leq 0.4$ with h = 0.1 (10)

4. (a) Solve the hyperbolic equation

$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$

for the following conditions:

$\left.\begin{matrix} u(0,t) = 0 \\ u(1,t) = 0 \end{matrix}\right\}$ $(t > 0)$

$\frac{\partial u}{\partial t}(x,0) = 0$ and $u(x, 0) = \sin^3 \pi x$ for all x in $0 < x \leq 1$ (12)

(b) Find f (3) using Lagrange's interpolation method:

X	0	1	2	4	5	6
f	1	14	15	5	6	19

(8)

SECTION - C

5. (a) Solve the boundary value problem by shooting method

$y''(x) = y(x)$

$y(0) = 0$ and $y(1) = 1$ (10)

(b) Find the approximate value of the real root of $x \log_{10} x = 2$ by Regula Falsi method (10)

6. (a) Tabulate the solution of

$$\frac{dy}{dx} = x + y, \qquad y(0) = 0$$

$0.4 < x \leq 1.0$ with $h = 0.1$ using predictor corrector formulae. (10)

(b) Solve:

$$\frac{dy}{dx} = \log_{10}(x + y), \qquad y(0) = 2$$

by Euler modified method to find the values of y(0.2), y(0.4) and y(0.6) by taking h = 0.2. (10)

SECTION - D

7. (a) Explain the back propagation and conjugate gradient algorithm. (12)

(b) Discuss the application of artificial neural networks in water resource engineering giving examples. (8)

8. (a) Using Runge-kutta method of 4^{th} order solve,

$$\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$$

given that $y(0) = 1$ at $x = 0.2$ and 0.4 (10)

(b) Compute the solution of parabolic equation at $x = 0.1$ and $t = 0.01$

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

Given that $u = 1$ at $t = 0$,

$u = 0$ at $x = 0$ and $x = 1$ (10)

SECTION - E

9. Answer in brief the following:

(a) State the condition & order for convergence of Newton Raphson method.

(b) Differentiate between Gauss Jordan and Gauss Elimination methods.

(c) State Adam's and Milne's predictor formulae.

(d) Write down the finite difference scheme for the differential equation

$$\frac{d^2y}{dx^2} - 3y = 2$$

(e) Solve the system of equations $3x + 2y = 9$, $5x - y = 2$ by Gaussian elimination method.

(f) Give a comparison between initial and boundary conditions.

(g) State the procedure of shooting method used for solution of ordinary differential equations.

(h) Differentiate between elliptic and hyperbolic partial differential equations.

(i) How does Modified Euler method differ from Euler method?

(j) What is the model advection diffusion equation?

(2×10=20)