[Total No. of Questions - 9] [Total No. of Pr[illegible]d Pages - 4]
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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) Apply Gauss Seidel method to solve system of equations

$$30x - 2y + 3z = 75$$
$$2x + 2y + 18z = 30$$
$$x + 17y - 2z = 48 \quad (10)$$

(b) Find f(2), f(8) and f(15) from the following using Newton's divided difference formula

x	4	5	7	10	11	13
y	48	100	294	900	1210	2028

(10)

2. (a) Solve

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

y (0.1) and y(0.2) by Euler's method (10)

(b) Find the positive real root of $2x - \log_{10} x - 6 = 0$ using Newton - Raphson method. (10)

SECTION - B

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

$$2x + y + z + 2u = 7$$
$$x - 2y - u = 2$$
$$3x - y - 2z - u = 3$$
$$x - 2u = 0 \quad (10)$$

(b) Use Runge - Kutta method to solve:

$$\frac{dy}{dx} = \left[\frac{4t}{y} - t.y\right]$$

Given y(0) =3, calculate y at x =0.1 and 0.2. (10)

4. (a) Find the solution of initial boundary value problem

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} \quad 0 \le x \le 1$$

Subject to initial conditions u (0,t) = 0, u (1,t) = 0, u_t (x,0) = 0, u (x,0) = sin $\prod$ x, $0 \le x \le 1$. (12)

(b) Using Lagrange's method, Find the polynomial f(x) and hence find f(5)

x	1	3	4	6
y	–3	0	30	132

(8)

SECTION - C

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

$$y'' - 64y + 10 = 0$$
$$y(0) = 0 \text{ and } y(1) = 0 \quad (10)$$

[P.T.O.]

(b) Find the real root of $x^3 - 2x^2 + 3x - 5 = 0$ by Regula Falsi method. (10)

6. (a) Using predictor corrector formulae, tabulate the solution of

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

for $0.4 < x \leq 1.0$. (10)

(b) Using modified Euler methods find y(0.1) and y(0.2)

$$\frac{dy}{dx} = x^2 + y^2 \qquad y(0) = 1,\ h = 0.1$$ (10)

SECTION - D

7. (a) Using Runge Kutta method of 4th order, find the value of y when x=1 given that y=1 when x=0

$$\frac{dy}{dx} = \frac{y - x}{y + x}$$ (10)

(b) Compute the solution of parabolic equation at x = 0.2 and t = 0.02

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

Given that u = 1 at t = 0,

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

8. (a) Highlight the applications of artificial neural networks in water resource engineering (give and explain using examples) (8)

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

SECTION - E

9. Answer in brief the following:

(a) Compare initial and boundary conditions.

(b) Differentiate between hyperbolic and parabolic partial differential equations.

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

(d) What is the model advection diffusion equation?

(e) What is the Criterion for the convergence of Newton's - Raphson method?

(f) Compare Gauss Seidel method, Gauss Jordan method.

(g) State the procedure of relaxation method used for solution of partial differential equations.

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

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

(j) What are the advantages of iterative methods over direct method of solving a system of linear algebraic equations? (2×10=20)