

SECTION - E

9. Briefly answer all the following questions:

- (a) What are the possible sources of error in the numerical solution of PDEs?
- (b) What is the advantage of banded storage mode in Gauss elimination method?
- (c) What is the condition for the convergence of Gauss - Seidal method?
- (d) Find the next iterative value of the root of $x^2 - 4 = 0$ using the Newton-Raphson method, if the initial guess is 3.0. How round off errors are caused?
- (e) Explain what is truncation error?
- (f) What is the relationship between relaxation methods and Gauss Seidel method?
- (g) What is the difference between elliptic and parabolic partial differential equations?
- (h) Classify the partial differential equation:
 - (i) $5 \frac{\partial^2 u}{\partial x^2} + 6 \frac{\partial^2 u}{\partial y^2} = xy$
 - (ii) $x^2 \frac{\partial^2 u}{\partial x^2} - 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \sin\left(\frac{\partial u}{\partial x}\right)$
- (i) Define predictor-corrector method.
- (j) Define artificial neural networks. (10×2=20)

[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2124)

1636

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 sections A, B, C, D and all the subparts of question in section E.

SECTION - A

1. (a) What is the condition for the convergence of Gauss - Seidal method? (8)
 - (b) Solve the following system of equations using Gaussian elimination:

$$2x + y + 3z = 1$$

$$2x + 6y + 8z = 3$$

$$6x + 8y + 18z = 5$$
(12)
2. (a) If $f(x) = 0$ has root between $x = a$ and $x = b$, then write the first approximate root by the method of false position. (10)
 - (b) Find the real root of the equation

$$x \log_{10} x - 1.2 = 0$$
 correct to decimal places by the method of False Positions. (10)

[P.T.O.]

SECTION - B

3. (a) What a differential equation and how are these classified?
(3+3=6)
- (b) Give the recursive algorithm to obtain numerical solution of ordinary differential equation by Euler's method. (14)
4. (a) Using modified Euler's method, compute $y(0.1)$ with $h=0.05$ from

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

- (b) Given $\frac{dy}{dx} = x^3 + y$, $y(0) = 2$, Compute $y(0.2)$, $y(0.4)$ and $y(0.6)$ by Runge-Kutta method of fourth order. (10)

SECTION - C

5. (a) Explain the general procedure of approximating the derivatives in a PDE at discrete points and then use the table

x	0.5	0.6	0.7
Sin(x)	0.47943	0.56464	0.64420

to estimate the first derivative of $\sin(x)$ at each mesh point. Compare your estimates with the exact answer. Estimate the 2nd derivative of $\sin(x)$ at $x = 0.6$. Take $h = 0.1$. (6+6=12)

- (b) Given the value of function f at the points $(x-h)$, $(x+\theta h)$ where $(0 < \theta < 1)$, find the first order formula for the derivative of function f at x . (8)
6. (a) How the partial differential equations are classified? Give two examples of linear homogeneous partial differential equations. (8)

- (b) Consider the homogeneous linear PDE

$$c \frac{du}{dx} + \frac{du}{dt} = 0, \text{ subject to initial conditions:}$$

$$x(s=0)=x_0; t(s=0)=0 \text{ and}$$

$$u(x,0) = f(x); u(s=0) = f(x_0)$$

Show that the characteristics curves arc lines given by

$$t = \frac{1}{c} (x - x_0). \text{ Sketch the characteristics in } (x, t) \text{ space.} \quad (12)$$

SECTION - D

7. (a) Explain the difference between explicit and implicit finite difference schemes. (8)
- (b) Considering the initial boundary value problem:

$$u_{xx} = \frac{1}{c} u_t, u = u(x, t): 0 < x < 1; t > 0$$

$$u(0, t) = u(1, t) = 0; u(x, 0) = f(x)$$

where c is a constant. Using explicit finite difference scheme, obtain recursive relationship giving u in a given row (time) in terms of three consecutive values of u in the row below (one time step earlier). (12)

8. (a) What is the basic processing unit in artificial neural network? Discuss its properties. (10)
- (b) With the help of a diagram explain the architecture of a simple neuron network. (10)