Reg. No. : | | | | | | | | | | |

Question Paper Code: 50042

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Civil Engineering

15UMA422 - NUMERICAL METHODS

(Common to Electrical and Electronics Engineering,
Electronics and Instrumentation Engineering and Chemical Engineering)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Newton's formula converges if

   (a) $|f'(x).f''(x)| < \{f(x)\}^2$ (b) $|f(x).f''(x)| < \{f'(x)\}^2$
   (c) $|f(x).f'(x)| < \{f'(x)\}^2$ (d) None of these

2. In Gauss Elimination method, the coefficient matrix is transformed to which form?

   (a) Lower Triangular matrix (b) Upper Triangular matrix
   (c) Diagonal matrix (d) Identity matrix

3. Find $\Delta(\log x)$

   (a) log x (b) log x+1 (c) $\log\left(\frac{x+1}{x}\right)$ (d) $\log\left(\frac{x}{x+1}\right)$

4. Given $y_o = 2$, $y_1 = 4$, $y_2 = 8$, $y_4 = 32$, find y_3

   (a) 1 (b) 16 (c) 64 (d) 128

5. What is the order of the error in Simpson's formula?

   (a) 2 (b) 3 (c) 4 (d) 5

6. Using Trapezoidal rule evaluate $\int_0^{\pi} \sin x \, dx$ by dividing the range into 6 equal parts

(a) 0.2312 (b) 0.4332 (c) 0.6514 (d) 0.8614

7. By Taylors series method, Find y (1.1). Given y'= x + y, y (1) = 0.

(a) 0.1103 (b) 0.3214 (c) 0.5413 (d) 0.6213

8. The error term in Adam-Bashforth predictor formula is

(a) $\frac{14h}{45}\Delta^2 y_0$ (b) $\frac{14h}{45}\Delta^4 y_0$ (c) $\frac{-19h}{720}\Delta^4 f$ (d) $\frac{251h}{720}\Delta^5 f$

9. The PDE $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x, y)$ is called as

(a) Heat equation (b) Wave equation
(c) Laplace equation (d) Poisson equation

10. In solving equation $u_t = \alpha^2 u_{xx}$ by Crank-Nicholson method to simplify method we take $\frac{(\Delta x)^2}{\propto^2 k}$ as

(a) 0 (b) $\frac{1}{2}$ (c) 1 (d) 2

PART - B (5 x 2 = 10 Marks)

11. Find an iterative formula to find $\sqrt{N}$, where N is a positive number.

12. Write divided difference table for:

X	0	1	2	4
Y	443	384	397	467

13. Why Simpson's one third rule is called a closed formula?

14. Solve: $\frac{dy}{dx} = 1 - y, y(0) = 0 \; for \; x = 0.1$ by Euler's method.

15. What is the classification of $f_{xx} + 2f_{xy} + f_{yy} = 0$?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Compute the real root of $x log_{10} x = 1.2$ correct to three decimal places using Newton-Raphson Method. (8)

(ii) Solve the following system of equations by Gauss-Elimination method.
$10x - 2y + 3z = 2; 2x + 10y - 5z = -33; 3x - 4y + 10z = 41.$ (8)

Or

(b) (i) Using power method find Eigen value and Eigen vector of

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$ (8)

(ii) Solve the system of equations: $x + y + 54z = 110; 27x + 6y - z = 85;$ $6x + 15y + 2z = 72$ by Gauss siedel method. (8)

17. (a) (i) The following table gives certain corresponding values of $x \; and \; log_{10} x$. Compute the value of $log_{10} 323.5$, by using Lagrange's interpolation formula. (8)

x	321.0	322.8	324.2	325.0
$\log_{10}$x	2.50651	2.50893	2.51081	2.51188

(ii) Find the cubic polynomial from the following table using Newton's divided difference formula and hence find f(4). (8)

x	0	1	2	5
f(x)	2	3	12	147

Or

(b) (i) The following values of x and y are given :

X	1	2	3	4
Y	1	2	5	11

Find the cubic spline and evaluate y(1.5). (8)

(ii) Find the value of $e^{1.85}$, given $e^{1.7} = 5.4739, e^{1.8} = 6.0496, e^{1.9} = 6.6859,$ $e^{2.0} = 7.3891, e^{2.1} = 8.1662, e^{2.2} = 9.0250,$ $e^{2.3}$ = 9.9742. (8)

18. (a) (i) From the given data, find $\frac{dy}{dx} \; and \; \frac{d^2y}{dx^2}$ at x=1.1. (8)

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
f(x)	7.989	8.403	8.781	9.129	9.451	9.750	10.031

(ii) Evaluate: $\int_0^1 \frac{dx}{1+x}$ correct to three decimal places using Romberg's method. Hence find the value of $log2$. (8)

Or

(b) (i) Evaluate: $\int_1^2 \frac{dx}{1+x^3}$ using Gauss three point formula. (8)

(ii) Evaluate: $\int_1^2 \int_1^2 \frac{dxdy}{x^2+y^2}$ using Trapezoidal rule by taking h=0.2 and k=0.25. (8)

19. (a) Using Runge-Kutta method of order four, find y for x=0.1, 0.2, 0.3; given that $\frac{dy}{dx} = xy + y^2, y(0) = 1$ and also find the solution at x=0.4 using Milne's method. (16)

Or

(b) (i) Given: $\frac{dy}{dx} = x^2\ (1 + y)$,

$y(1) = 1,\ y(1.1) = 1.233,\ y(1.2) = 1.548,\ y(1.3) = 1.979$, evaluate $y(1.4)$ by Adam's-Bashforth method. (8)

(ii) Find the Taylor series solution of $y(0.1)$ given that $\frac{dy}{dx}+y^2 = e^x,\ y(0) = 1.$ Compute using first five terms. (8)

20. (a) Solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ given $u(0,t) = u(5,t) = 0, u(x,0) = x^2(25 - x^2)$ find u in the range taking h=1 and upto 3 seconds using Bender-Schmidt recurrence equation. (16)

Or

(b) Solve the Poisson's equation $\Delta^2 u = 10(x^2 + y^2 + 10)$ over the square mesh with sides x=0, y=0, x=3, y=3 with u=0 on the boundary and mesh length 1 unit. (16)

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