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

Question Paper Code : X67616

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2020.

Fourth/Fifth/Sixth Semester

Civil Engineering

MA 1251 — NUMERICAL METHODS

(Common to Aeronautical Engineering, Computer Science and Engineering, Electrical and Electronics Engineering, Electronics and Communication Engineering, Chemical Engineering, Information Technology, Petrochemical Technology)

(Regulations 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you mean by the order of convergence of an iterative method for finding the root of the equation $f(x)=0$?

2. Solve the equations $x+2y=1$ and $3x-2y=7$ by Gauss-Elimination method.

3. Define cubic spline.

4. State Newton's backward difference formula.

5. State two point Gaussian quadrature formula.

6. Evaluate $\int_{\frac{1}{2}}^{1}\frac{1}{x}dx$ by Trapezoidal rule, dividing the range into 4 equal parts.

7. State the advantages of RK-method over Taylor series method.

8. Using Euler's method find $y(0.2)$ from $\frac{dy}{dx} = x + y$, $y(0) = 1$, with $h = 0.2$.

9. Obtain the finite difference scheme for the differential equation $2y''+y=5$.

10. Write Liebmann's iteration process formula.

PART B — $(5 \times 16 = 80$ marks)

11. (a) (i) Solve $e^x - 3x = 0$ by the method of fixed point iteration. (8)

(ii) Solve the following system by Gauss-Seidal iterative procedure : $10x - 5y - 2z = 3, 4x - 10y + 3z = -3, x + 6y + 10z = -3$. (8)

Or

(b) (i) Using Gauss-Jordan method, find the inverse of $\begin{bmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & -8 \end{bmatrix}$. (8)

(ii) Using power method, find all the eigenvalues of $A = \begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$. (8)

12. (a) Find the natural cubic spline to fit the data :

x :	0	1	2
$f(x)$:	–1	3	29

Hence find $f(0.5)$ and $f(1.5)$. (16)

Or

(b) (i) The following table gives the values of density of saturated water for various temperatures of saturated steam.

Temperature °C :	100	150	200	250	300
Density hg/m^3 :	958	917	865	799	712

Find by interpolation the density when the temperature is 275°. (8)

(ii) Use Lagrange's formula to find the value of y at $x = 6$ from the following data : (8)

x :	3	7	9	10
y :	168	120	72	63

13. (a) (i) Find the value of $\sec 31^\circ$ using the following data : (8)

θ (in degrees) :	31°	32°	33°	34°
$\tan\theta$:	0.6008	0.6249	0.6494	0.6745

(ii) Evaluate $\int_1^2 \int_1^2 \frac{dx\,dy}{x^2 + y^2}$ with $h = 0.2$ along x-direction and $k = 0.25$ along y-direction. (8)

Or

(b) (i) Evaluate $\int_{0.2}^{1.5} e^{-x^2}\,dx$ using three point Gaussian quadrature formula. (8)

(ii) Using Romberg's method evaluate $\int_{0}^{1} \frac{dx}{1+x}$ correct to three decimal places. (8)

14. (a) (i) Using Modified Euler's method, find $y(4.1)$ and $y(4.2)$ if $5x\frac{dy}{dx} + y^2 - 2 = 0$; $y(4) = 1$. (8)

(ii) Given that $\frac{dy}{dx} = 1 + y^2$; $y(0.6) = 0.6841$, $y(0.4) = 0.4228$, $y(0.2) = 0.2027$, $y(0) = 0$, find $y(-0.2)$ using Milne's method. (8)

Or

(b) Solve for $y(0.1)$ and $z(0.1)$ from the simultaneous differential equations $\frac{dy}{dx} = 2y + z$; $\frac{dz}{dx} = y - 3z$; $y(0) = 0$, $z(0) = 0.5$ using Runge-Kutta method of the fourth order. (16)

15. (a) Solve $\nabla^2 u = 8x^2y^2$ over the square $x = -2, x = 2, y = -2, y = 2$ with $u = 0$ on the boundary and mesh length h = 1. (16)

Or

(b) (i) Solve $u_{xx} = 32u_t, h = 0.25$ for $t \geq 0, 0 < x < 1, u(0,t) = 0, u(x,0) = 0, u(1,t) = t$. (8)

(ii) Solve $4u_{tt} = u_{xx}, u(0,t) = 0, u(4,t) = 0, u(x,0) = x(4-x), u_t(x,0) = 0, h = 1$ upto $t = 4$. (8)

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