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63/2 (SEM-3) MAT 304(N&O)

2022

(Held in 2023)

MATHEMATICS

(Theory Paper)

Paper Code : MAT-304 (New)

(Numerical Analysis and Computer Applications)

Full Marks – 60

Pass Marks – 24

Time – Three hours

The figures in the margin indicate full marks
for the questions.

(Calculator may be allowed.)

1. Answer any *two* of the following questions :

10×2=20

- (a) Apply Crout's method to obtain the inverse
of a matrix

$$A = \begin{bmatrix} -2 & 4 & 8 \\ -4 & 18 & -16 \\ -6 & 2 & -20 \end{bmatrix}$$

[Turn over

- (b) Solve the following equations using Doolittle's method :

$$3x + 2y + 7z = 4 ; 2x + 3y + z = 5 ; 3x + 4y + z = 7$$

- (c) Solve the following equations using Relaxation method :

$$9x - 2y + z = 50 ; x + 5y - 3z = 18 ; \\ -2x + 2y + 7z = 19.$$

2. Answer any *two* of the following questions :
10×2=20

- (a) Write in detail about QR algorithm for eigen value problem.
- (b) Using Given's method, reduce the following matrix to the tri-diagonal form :

$$A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 3 & 2 & 3 \end{bmatrix}$$

- (c) Using Jacobi's method, find all the eigen values and the eigen vectors of the matrix :

$$\begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$$

3. Answer any *two* of the following questions :
10×2=20

- (a) Using Bairstow's method, find a quadratic factor of the polynomial

$$f(x) = x^3 - x - 1$$

- (b) Using Graeffe's root squaring method, find the real roots of the equation

$$x^3 - 6x^2 + 11x - 6 = 0$$

- (c) Write a short note on Euler-Maclaurin formula. Using Euler-Maclaurin formula find

$$\text{the value of } \log_e 2 \text{ from } \int_0^1 \frac{dx}{1+x}$$

- (d) Write a short note on Romberg's method. Use

$$\text{Romberg's method to compute } \int_0^1 \frac{dx}{1+x^2}.$$

(Theory Paper)
Paper Code : MAT-304 (Old)

(Numerical Analysis)

Full Marks - 80

Pass Marks - 32

Time - Three hours

The figures in the margin indicate full marks for the questions.

1. Answer any *two* of the following questions :
10×2=20

(a) Write in detail about Cholesky's triangularisation method.

(b) Solve, by Jacobi's iteration method, the equations $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$.

(c) Solve, by Relaxation method, the equations: $9x - 2y + z = 50$; $x + 5y - 3z = 16$; $-2x + 2y + 7z = 19$.

2. Answer any *two* of the following questions :
10×2=20

(a) Write in detail about Power method. Determine the largest eigen value and the corresponding eigen vector of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$$

(b) Using Given's method, reduce the following matrix to the tri-diagonal form :

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

(c) Write in detail about House-holder method.

3. Answer any *two* of the following questions :
10×2=20

(a) Write in detail about Euler's method. Given

$\frac{dy}{dx} = 2 + \sqrt{xy}$ with initial conditions $y=1$ at $x=1$; find y for $x=2$ in steps of 0.2, by Euler's method.

(b) Write in detail about Runge's method. Apply Runge's method to find an approximate value of y when $x=1.1$, given that $\frac{dy}{dx} = 3x + y^2$ and $y=1.2$ when $x=1$.

(c) What is a Predictor-corrector method? Using Runge-Kutta method of order 4, find y for $x=0.1, 0.2, 0.3$ given $\frac{dy}{dx} = xy + y^2$, $y(0)=1$. Continue the solution at $x=0.4$ using Milne's method.

4. Answer any *two* of the following questions :

$$10 \times 2 = 20$$

(a) Write about the Method of least squares.

(b) Prove that $\frac{(1-x^2)^{1/2}}{1-2tx+t^2} = \sum_{n=0}^{\infty} U_{n+1}(x)t^n$.

(c) In some determinations of the value of v of carbon dioxide dissolved in a given volume of water at different temperatures θ , the following pairs of values were obtained :

$\theta :$	0	5	10	15
$V :$	1.80	1.45	1.18	1.00

Obtain by the method of least squares, a relation of the form $v = a + b \theta$ which but fits to these observations.