

I B. Tech I Semester Regular Examinations, January - 2020
MATHEMATICS-II

(Com. to CE, ME, Chem E, Auto E, Min E, Pet E, Agri E)

Time: 3 hours

Max. Marks: 75

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

1. a) Find the rank of $\begin{bmatrix} 2 & -4 & 3 & -1 & 0 \\ 1 & -2 & -1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$ using Normal form. (8M)

b) Prove that the two Eigen values vectors corresponding to the two different Eigen values are linearly independent. (7M)

Or

2. a) Test for consistency and solve $5x + 3y + 7z = 4, 3x + 26y + 2z = 9, 7x + 2y + 10z = 5$. (8M)

b) Prove that The Eigen values of real symmetric matrix are real. (7M)

3. a) Reduce the quadratic form $x^2 + 3y^2 + 3z^2 - 2yz$ in to canonical form by orthogonal transformation find rank, index and signature. (8M)

b) Verify Cayley -Hamilton theorem for $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & -2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ also find A^4 (7M)

Or

4. a) Diagonalize the matrix $A = \begin{bmatrix} 3 & 2 & 2 \\ 1 & 2 & 1 \\ -2 & -2 & -1 \end{bmatrix}$ hence find A^4 (8M)

b) Reduce the quadratic form $x^2 + y^2 + 2z^2 - 2xy + 4zx + 4yz$ in to canonical form using diagonalization method hence find rank, index and signature. (7M)

5. a) Find the positive value of $\sqrt[3]{17}$ using Newton Raphson method. (8M)

b) Find the positive value of $x \log_{10} x = 4.77$ using false position method. (7M)

Or

6. a) Solve the system of equations by Gauss -Seidel method. (8M)
 $20x + 2y + 6z = 28; x + 20y + 9z = -23; 2x - 7y - 20z = -57$

b) Find the positive value of $x^3 - 2x^2 - 4 = 0$ using Iteration method. (7M)

7. a) Using Lagrange's formula calculate $f(5)$ from the following table. (8M)

x	0	1	3	8
f(x)	1	3	13	128

- b) Estimate $f(1.75)$ from the following table. (7M)

X	1.7	1.8	1.9	2.0
Y	5.474	6.050	6.686	7.389

Or

8. a) Fit a cubic polynomial for the following data. (8M)

$$y_0 = -5, y_1 = -1, y_2 = 9, y_3 = 25, y_4 = 55, y_5 = 105$$

- b) Find the $y(4)$ using Newton's divide difference formula. (7M)

x	3	6	8	9
y	2	13	18	23

9. a) Evaluate $\int_0^{\pi} \sin x dx$ using Trapezoidal rule, Simpson's 1/3rd and 3/8th rule. (8M)

- b) Find $y(0.1)$ by Picard's method given that $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ (7M)

Or

- 10 a) Find $y(0.1)$ & $y(0.2)$ using Runge-Kutta 4th order formula, given that (8M)

$$y' = x^2 - y, y(0) = 1.$$

- b) Evaluate $y(0.1)$ by Euler's method for $\frac{dy}{dx} = \frac{x+y}{y-x}$, $y(0) = 1$. (7M)

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1. a) Find the Eigen values and Eigen vectors $\begin{bmatrix} 8 & -8 & 2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ (8M)

b) Find the rank of using $\begin{bmatrix} 1 & 4 & 3 & -2 & 1 \\ -2 & -3 & -1 & 4 & 3 \\ -1 & 6 & 7 & 2 & 9 \\ -3 & 3 & 6 & 6 & 12 \end{bmatrix}$ Echelon form. (7M)

Or

2. a) Solve the equations (8M)

$$\begin{aligned} x + y + z - w &= 2, & 7x + y + 3z + w &= 12, \\ 8x - y + z - 3w &= 5, & 10x + 5y + 3z + 2w &= 20. \end{aligned}$$

by Gauss-elimination method.

b) Determine the characteristic roots and the corresponding characteristic vectors of (7M)

the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

3. a) Find Rank index and signature of quadratic $10x^2 + 2y^2 + 5z^2 - 4xy - 10xz + 6yz$ form using diagonalization method (8M)

b) Diagonalize the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ -4 & 4 & 3 \end{bmatrix}$ hence find A^4 (7M)

Or

4. a) Reduce the quadratic form $2xy + 2zx - 2yz$ in to canonical form by orthogonal reduction form hence find rank, index and signature. (8M)

b) Verify Cayley -Hamilton theorem for the matrix $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ also find A^{-1} (7M)

5. a) Solve the system of equations by Gauss –Seidel method. (8M)
 $8x-3y+2z = 20; 4x+11y-z = 33; 6x+3y+12z = 36.$

- b) Find the positive value of $3x = \sqrt{1 + \sin x}$ using Iteration method. (7M)

Or

6. a) Find the positive value of $x \sin x + \cos x = 0$ using Newton Raphson method. (8M)

- b) Find the positive value of $\cos x = xe^x$ using bisection method. (7M)

7. a) Evaluate $\sqrt{5.5}$ given that $\sqrt{5} = 2.236, \sqrt{6} = 2.449, \sqrt{7} = 2.646$ & $\sqrt{8} = 2.828$ (8M)

- b) Using Lagrange's formula calculate $f(10)$ from the following table. (7M)

x	5	6	9	11
f(x)	12	13	14	16

Or

8. a) Find $f(2.1)$ defined by the set of values (2,2),(6,3),(9,4),(10,6) using Newton's divide difference formula. (8M)

- b) Estimate $f(2.5)$ from the following table. (7M)

X	1.7	1.8	1.9	2.0
Y	5.474	6.050	6.686	7.389

9. a) Evaluate $\int_0^6 \frac{e^x}{1+x} dx$ using Trapezoidal rule, Simpson's 1/3rd and 3/8th rule. (8M)

- b) Using Taylor's series Evaluate $y(0.1)$ given that $y' = yx^2 - 1, y(0) = 1$. (7M)

Or

10. a) Find $y(1.2)$ By modified Euler's method for $h = 0.2, \frac{dy}{dx} = \log(x + y), y(1) = 0$ (8M)

- b) By Picard's method find $y(0.1)$ given that $\frac{dy}{dx} = x^2 + y^2, y(0) = 0$ (7M)

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1. a) Test for consistency and solve $x + y + z = 6,$ (8M)
 $x + 2y + 3z = 14,$
 $x + 4y + 9z = 36.$

- b) Find the Eigen values and Eigen vectors of $\begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ (7M)

Or

2. a) Solve the system of equations (8M)
 $x+2y+(2+k)z=0, 2x+(2+k)y+4z = 0, 7x+13y+(18+k)z = 0,$ for all values of k.

- b) Find the rank of the matrix by reduce into Echelon form $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ (7M)

3. a) Verify Cayley -Hamilton theorem for $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ also find A^{-1} (8M)

- b) Reduce the quadratic form $2x^2 + 2y^2 + 2z^2 - 2yz + 2zx - 2xy$ in to canonical form (7M)
 by orthogonal transformation hence find rank, index and signature.

Or

4. a) Reduce the quadratic form $x^2 - 2y^2 + 3z^2 - 4yz + 6zx$ in to canonical form using (8M)
 diagonalization method hence find rank, index and signature.

- b) Diagonalize the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ hence find A^4 (7M)

5. a) Find the positive value of $e^x = 3x$ using false position method. (8M)

- b) Find the positive value of $x^3 - 2x + 5 = 0$ using secant method. (7M)

Or

6. a) Solve the following system of equations using Gauss-jacobi iteration method (8M)
 $27x+6y-z = 85$; $x+y+54z = 110$; $6x+15y+2z = 72$.
- b) Find the positive value of $2x^3 - 3x - 6 = 0$ using Newton Raphson method. (7M)
7. a) If y_x is polynomial for which fifth difference is constant and $y_1+y_7 = -7845$, (8M)
 $y_2+y_6 = 686$, and $y_3+y_5 = 1088$, then find y_4 .
- b) Find the value of $y(4)$ using Newton's divide difference formula. (7M)

x	0	1	2	5
y	2	3	12	147

Or

8. a) Find $y(0.5)$ using from the following data. (8M)

x	0	1	2	3	4	5	6
y	0	1	16	81	256	625	1296

- b) Using Lagrange's formula calculate $f(6)$ from the following table. (7M)

x	3	5	7	9	11
f(x)	6	24	58	108	74

9. a) Evaluate $\int_0^9 \frac{1}{1+x^3} dx$ using Trapezoidal rule Simpson's 1/3rd and 3/8th rule. (8M)
- b) By RK method of fourth order find $y(0.1)$ given that $\frac{dy}{dx} = xy^{\frac{1}{3}}$, $y(1) = 1$ (7M)

Or

10. a) By modified Euler's formula find $y(0.2)$ given that $\frac{dy}{dx} = 2xy^2$, $y(0) = 1$ (8M)
- b) Find $y(0.1), y(0.2)$ If $\frac{dy}{dx} = xy + 1$, $y(0) = 1$ using Taylor's series method. (7M)

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1. a) Test the consistency and solve $x + y + z = 6$, $x - y + 2z = 5$, $2x - 2y + 3z = -7$. (8M)

b) Find the rank of the matrix by reduce into normal form $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ (7M)

Or

2. a) Solve the system of equations $4x + 2y + z + w = 0$, $6x + 3y + 4z + 7w = 0$, $2x + y + w = 0$. (8M)

b) Find the Eigen values and Eigen vectors of $\begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ (7M)

3. a) Verify Cayley Hamilton theorem for $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$, hence compute A^4 . (7M)

b) Reduce the quadratic form $3x^2 - 2y^2 + z^2 - 4xy + 12yz + 8xz$ in to canonical form (8M)
 by orthogonal transformation find rank, index and signature.

Or

4. a) Find Rank index and signature of quadratic form using diagonalization method. (7M)
 $7x^2 + 6y^2 + 5z^2 - 4xy - 4yz$

b) Diagonalize the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ hence find A^4 (8M)

5. a) Solve the following system of equations using Gauss-jacobi iteration method. (8M)
 $5x - y + z = 10$; $2x + 4y = 12$; $x + y + 5z = -1$

b) Find the positive value of $3x = 1 + \cos x$ using secant method. (7M)

Or

6. a) Find the positive value of $x^3 + x^2 - 1 = 0$ using Iteration method. (8M)
 b) Find the positive value of $x = \cos x$ using bisection method. (7M)

7. a) Find $y(1.2)$ from the following table. (8M)

x	1	1.4	1.8	2.2
y	3.49	4.82	5.96	6.5

- b) Using Lagrange's formula calculate $f(3)$ from the following table. (7M)

x	0	1	2	4	5	6
f(x)	1	14	15	5	6	19

Or

8. a) Find $f(3.0)$ from the following table. (8M)

X	1.6	1.8	2.0	2.2	2.4	2.6
Y	4.95	6.05	7.39	9.03	11.02	13.46

- b) Fit the polynomial defined by the set of values (5, 12), (6, 13), (9, 14), (11, 16) using Newton's divide difference formula. (7M)

9. a) Evaluate $\int_1^2 \frac{1}{x} dx$ using Trapezoidal rule, Simpson's 1/3rd and 3/8th rule. (8M)
 b) Using Modified Euler's method evaluate $y(0.1)$ given that $y' = 3x + y^2$, $y(0) = 1$ (7M)

Or

- 10 a) By RK method of second order find $y(0.1)$, $y(0.2)$ given that (8M)
 $\frac{dy}{dx} = 1 - 2xy^2$, $y(0) = 1$

- b) By Picard's find $y(0.1)$, $y(0.2)$ given that $\frac{dy}{dx} = \frac{-y}{x}$, $y(1) = 0$ (7M)