I B. Tech II Semester Regular Examinations, December - 2020
MATHEMATICS-II
(Com. to EEE, ECE, CSE, EIE, IT)

Time: 3 hours Max. Marks: 75

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

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1. a) Find the rank of $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ after reducing it to echelon form. (8M)

   b) Prove that If λ is an eigen value of a non singular matrix A, then $\frac{|A|}{\lambda}$ is an eigen value of the matrix adj A. (7M)

Or

2. a) Find the eigenvalues and eigen vectors of $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. (8M)

   b) Show that the system x + 2y – 5z = –9, 3x – y + 2z = 5, 2x + 3y – z = 3, 4x – 5y + z = –3 is consistent and solve it. (7M)

3. a) Verify Cayley-Hamilton theorem for A = $\begin{bmatrix} 10 & 1 & 1 \\ 1 & 10 & -1 \\ 1 & -2 & 10 \end{bmatrix}$ and find A^{-1}. (8M)

   b) Find a singular value decomposition for the matrix $\begin{bmatrix} 1 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$. (7M)

Or

4. Reduce the quadratic form $2x^2 + 2y^2 + 2z^2 - 2xy + 2zx - 2yz$ to orthogonal transformation. Also find signature and rank of the quadratic form. (15M)

5. a) Find a real root of $x \tan x + 1 = 0$ using iteration method. (6M)

   b) Perform two iterations of the Newton-Raphson method to solve the system of equations $x^2 + y^2 + xy = 7$ and $x^3 + y^3 = 9$. (9M)

Or

6. a) Using Gauss Seidel method to solve 25x + 2y + 2z = 69, 2x + 10y + z = 63, x + y +z = 43. (9M)

   b) Find a real root of the equation $x^3 - 4x - 9 = 0$ using false position method correct to three decimal places. (6M)
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7. a) The population of a nation in the decennial census is given below. Estimate the population in the year 1925 using appropriate interpolation formula. (9M)

Year x	1891	1901	1911	1921	1931
Population y (thousands)	46	66	81	93	101

b) Evaluate (i) $\Delta^2 \sin(px+q)$ (ii) $\Delta^n e^{ax+b}$ (6M)

Or

8. a) Find Interpolating polynomial by Lagrange's method and hence find f(2) for the following data. (6M)

x	0	1	3	4
f(x)	-12	0	6	12

b) Determine f(x) as a polynomial in x for the following data using Newton's divided difference formula. (9M)

x	1	3	6	9	11
f(x)	12	33	41	55	133

9. a) Evaluate $\int_0^1 \frac{x}{x^3+5}dx$ using Trapezoidal rule. (7M)

b) Solve $y^1 = x - y^2, y(0) = 1$ using Taylor's series method and compute $y(0.1), y(0.2)$. (8M)

Or

10. a) Using Euler's method, solve for y(2), from $\frac{dy}{dx} = 3x^2 + 1$, y(1) = 2, taking h = 0.5 (7M)

b) Find $y(0.1)$ using Runge-Kutta fourth order formula given that $y^1 = x + x^2 y; y(0) = 1$. (8M)

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1. a) Find the rank of the matrix by reducing it to normal form $\begin{bmatrix} 1 & 2 & 2 & 4 \\ 2 & 3 & 4 & 6 \\ 3 & 5 & 6 & 10 \\ -1 & 1 & -2 & -2 \end{bmatrix}$. (8M)

   b) Prove that the sum of the eigenvalues of a square matrix is equal to its trace and product of the eigenvalues is equal to its determinant. (7M)

Or

2. a) Find the eigenvalues and the corresponding eigen vectors of $\begin{bmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$. (8M)

   b) Solve the system of equations x + 2y + 3z = 1, 2x + 3y + 8z = 2, x + y + z = 3 using Gauss elimination method. (7M)

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

   b) Find a singular value decomposition for the matrix $\begin{bmatrix} 1 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$. (7M)

Or

4. Reduce the quadratic form $2x^2 + 2y^2 + 2z^2 - 2xy + 2zx - 2yz$ to orthogonal transformation. Also find signature and rank of the quadratic form. (15M)

5. a) Find a real root of $x^2 - log_e x = 1.2$ using Regula falsi method. (6M)

   b) Perform two iterations of the Newton-Raphson method to solve the system of equations $x^2 + 3y^2 = 4$ and $x^2 + 3x + y = 5$. (9M)

Or

6. a) Solve the system of equations 20x+2y +6z =28, x+20y+9z = -23 and 2x-7y -20z = - 57 using Gauss Seidel method. (9M)

   b) Find a real root of x $tan\ x + 1 = 0$ using iteration method. (6M)
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7. a) Find f(2.4) from the following data using appropriate interpolation method. (9M)

x	1.0	1.5	2.0	2.5
f(x)	3	3.375	5.0	12.072

b) Prove that (i) $\Delta\nabla = \Delta - \nabla$ (ii) $\frac{\Delta}{\nabla} - \frac{\nabla}{\Delta} = \Delta + \nabla$. (6M)

Or

8. a) Find Interpolating polynomial by Lagrange's method and hence find f(2) for the following data. (7M)

x	0	1	3	4
f(x)	-12	0	6	12

b) Determine f(x) as a polynomial in x for the following data using Newton's divided difference formula. (8M)

x	0	2	3	5	8
f(x)	1	3	5	9	11

9. a) Evaluate $\int_0^1 \frac{x}{x^3+5}dx$ using Simpson's 1/3rd rule. (8M)

b) Solve $y^1 = xy + 1$ and $y(0) = 1$ using Taylor's series method compute $y(0.01), y(0.02)$. (7M)

Or

10. a) Using Euler's method, solve $y^1 = y^2 + x$, $y(0) = 1$, compute $y(0.1), y(0.2)$ (8M)

b) Using Runge-Kutta fourth order formula, Find $y(0.2)$ for the equation (7M)

$y^1 = \frac{y-x}{y+x}$ $y(0) = 1$.

Code No: R19BS1202 **R19** SET - 3

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1\. a) Reduce the matrix to normal form and hence find the rank of the matrix. (8M)

$$\begin{bmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{bmatrix}.$$

b) If λ is an eigenvalue of A, then prove that the eigenvalue of $B = a_0A^2 + a_1A + a_2I$ is $a_0\lambda^2 + a_1\lambda + a_2$. (7M)

Or

2\. a) Find the eigenvalues and the corresponding eigen vectors of $\begin{bmatrix} 6 & 3 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ (9M)

b) Solve x – y + 2z = 4, 3x + y + 4z = 6, x + y + z = 1 using Gauss elimination method. (6M)

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

b) Find a singular value decomposition for the matrix $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. (7M)

Or

4\. Reduce the quadratic form $4x^2 + 3y^2 + z^2 - 8xy - 6yz + 4zx$ to orthogonal transformation. Also find signature and rank of the quadratic form. (15M)

5\. a) Find a real root of x sinx +cos x=*0* using Regula falsi method. (6M)

b) Solve the system of nonlinear equations $x^2 + y = 11$ and $x + y^2 = 7$ By Newton-Raphson method. (9M)

Or

6\. a) Solve the system of equations 10x+2y +z =9, 2 x+20y-2z = - 44 and -2x+3 y +10z = 22 using Gauss Seidel method. (9M)

b) Solve $x = 1 + \tan^{-1} x$ by iteration method. (6M)
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7. a) Consider following data. (9M)

X	0.2	0.5	0.8	1.1	1.4
g(x)	9.9833	4.9696	3.2836	2.4339	1.9177

Calculate approximately g(0.15) using Newton's Forward Interpolation.

b) Prove that $\Delta \tan^{-1}\left(\frac{n-1}{n}\right) = \tan^{-1}\left(\frac{1}{2n^2}\right)$ (6M)

Or

8. a) Evaluate f (10) given that the value of f(x) at x = 2, 6, 12 are 16, 19, 33 respectively. (8M)

b) Determine f(x) as a polynomial in x for the following data using Newton's divided formula. (7M)

x	3	7	9	10
f(x)	160	120	72	63

9. a) Evaluate $\int_0^2 e^{-x^2} dx$ using Simpson's 1/3 rd rule taking h = 0.25. (7M)

b) Solve $y^1 = 5x - y$ and $y(1) = 1$ by Picard's method compute $y(1.1)$. (8M)

Or

10. a) Using Euler's method, solve for y(2), from $y^1 = 3x^2 + 1; y(1) = 2$, taking step size h=0.5. (6M)

b) Using Runge-Kutta fourth order formula, Find $y(0.2)$ for the equation (9M)

$y^1 = \frac{y-x}{y+x}$ $y(0) = 1$.

Code No: R19BS1202 **R19** SET - 4

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Answer any five Questions one Question from Each Unit
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1. a) Find the rank of the matrix by reducing it to normal form $\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$. (8M)

   b) If λ is an eigen value of a matrix A, then λ^n is an eigen value of the matrix A^n. (7M)

Or

2. a) Find the eigen values and eigen vectors of $\begin{bmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}$. (9M)

   b) Find the value of 'b' such that the system of homogeneous equations 2x+y+2z=0, x+y+3z =0 ,4x+3y+ bz =0 has (i) trivial solution (ii) Non-trivial solution. Find the non trivial solution. (6M)

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

   b) Find a singular value decomposition for the matrix $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$. (7M)

Or

4. Reduce the quadratic form $4x^2+3y^2+z^2-8xy-6yz+4zx$ to orthogonal transformation. Also find signature and rank of the quadratic form. (15M)

5. a) Find a real root of x *tan x +1=0* using iteration method. (6M)

   b) Solve the system of nonlinear equations $xy = x+9$ and $y^2 = x^2+7$. By Newton-Raphson method. (9M)

Or

6. a) Solve the system of equations 10x+2y +z =9, 2 x+20y-2z = - 44 and -2x+3 y +10z = 22 using Jacobi method. (7M)

   b) Find a real root of the equation $x^3-4x-9=0$ using false position method correct to three decimal places. (8M)
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7. a) The population of a nation in the decimal census was given below. Estimate the population in the year 1975 using appropriate interpolation formula. (9M)

Year x	1961	1971	1981	1991	2001
Population y (thousands)	66	76	81	93	105

b) Evaluate (i) $\Delta\left[\frac{f(x)}{g(x)}\right]$ (ii) Prove that $\nabla E = E\Delta = \Delta$. (6M)

Or

8. a) Using Lagrange's Interpolation formula find the value of y(10) from the following table. (8M)

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

b) Determine f(x) as a polynomial in x for the following data using Newton's divided formula. (7M)

x	-4	-1	0	2	5
f(x)	1245	33	5	9	1335

9. a) Evaluate $\int_0^1 \sqrt{1+x^4}\,dx$ using Simpson's 3/8 rule. (8M)

b) Solve $y^1 + y = e^x$ and $y(0) = 0$ using Picard's method compute $y(0.1)$ (7M)

Or

10. a) Using Euler's method, find y(0.2) and y(0.4), given $y' = x + y$, y(0) = 1. (6M)

b) Find $y(0.1)$, $y(0.2)$ using Runge-Kutta fourth order formula given that $y^1 = x + x^2 y; y(0) = 1$. (9M)