

**I B. Tech I Semester Regular Examinations, April - 2022**  
**MATHEMATICS-II**  
 (Only EEE)

Time: 3 hours

Max. Marks: 70

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

**UNIT-I**

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

b) Find the Eigen values and Eigen vectors of  $A = \begin{bmatrix} 3 & -6 & 3 \\ 1 & 0 & -1 \\ 1 & 2 & -3 \end{bmatrix}$ . (9M)

Or

2. a) Solve the system of equations by Gauss -elimination method (8M)

$$2x + y + 2z + w = 6, 6x - 6y + 6z + 12w = 36, 4x + 3y + 3z - 3w = -1,$$

$$2x + 2y - z + w = 10.$$

b) Prove that the eigen vectors corresponding to distinct eigenvalues of a matrix are independent. (6M)

**UNIT-II**

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

b) Find Singular values and singular value decomposition of a matrix  $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 1 \end{bmatrix}$ . (7M)

Or

4. Reduce the quadratic form  $3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2zx$  to the canonical form by orthogonal transformations and find rank, index, signature, nature of the quadratic form. (14M)

**UNIT-III**

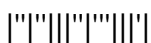
5. a) Find a real root of  $xe^x = 3$  using Regula-Falsi method. (5M)

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 Newton Raphson method, find real root of  $\cos x = xe^x$  and correct to four decimal places. (7M)

b) Solve the system  $10x - 2y - z - w = 3; -2x + 10y - z - w = 15; -x - y + 10z - 2w = 15; -x - y - 2z + 10w = -9$  using Gauss Seidel method. (7M)



## UNIT-IV

7. a) The population of a nation in the decimal census was given below. Estimate the population in the year 1925 using appropriate interpolation formula (7M)

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

- b) 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

Or

8. a) Evaluate i).  $\Delta^2 \sin(px+q)$  ii)  $\Delta \left[ \frac{f(x)}{g(x)} \right]$ . (6M)

- b) Using Newton's divided difference formula, evaluate  $f(8)$  given (8M)

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

## UNIT-V

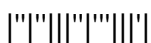
9. a) Find  $y(1.1)$  by Taylor's series method given that  $y' = y + x$ ,  $y(1) = 0$ . (7M)

- b) Compute the value of  $\int_{0.2}^{1.4} (\log x + e^x) dx$  using Simpson's 3/8<sup>th</sup> rule. (7M)

Or

10. a) Using Euler method find  $y(0.2)$   $y(0.4)$  and  $y(0.6)$  given  $y' = y + e^x$ ,  $y(0) = 0$ . (7M)

- b) Find  $y(0.1)$  using Runge-Kutta fourth order formula given that  $y' = x + x^2 y$ ;  $y(0) = 1$ . (7M)



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**UNIT-I**

1 a) Find rank of matrix  $A = \begin{bmatrix} 2 & 3 & 4 & -1 \\ 5 & 2 & 0 & -1 \\ -4 & 5 & 12 & -1 \\ 2 & 4 & 0 & 3 \end{bmatrix}$  using Echelon form (5M)

b) Find the Eigen values and Eigen vectors of  $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$  (9M)

Or

2 a) Solve the system of equations by Gauss -elimination method (8M)  
 $x + y + z - w = 2$ ,  $7x + y + 3z + w = 12$ ,  $8x - y + z - 3w = 5$ ,  
 $10x + 5y - 3z + 2w = 20$ .

b) Prove that the eigen vectors corresponding to distinct eigenvalues of a real symmetric matrix are orthogonal. (6M)

**UNIT-II**

3 a) Verify Cayley Hamilton theorem for the matrix  $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 6 & 1 \\ 2 & 3 & 1 \end{bmatrix}$  and hence find  $A^{-1}$ . (7M)

b) Find Singular values and singular value decomposition of a matrix  $\begin{bmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{bmatrix}$ . (7M)

Or

4 Reduce the quadratic form  $3x^2 + 2y^2 + 3z^2 - 2xy - 2yz$  to the canonical form by orthogonal transformations and find rank, index, signature, nature of the quadratic form. (14M)

**UNIT-III**

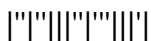
5 a) Find a real root for  $e^x \sin x = 1$ , using Regula Falsi method. (5M)

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) Using Newton-Raphson method find the root of the equation  $x + \log_{10} x = 3.375$  corrected to four significant figures. (7M)

b) Solve the system of equations  $x + y + 5z = 110$ ;  $27x + 6y - z = 85$ ;  $6x + 15y + 2z = 72$  using Gauss Seidel method. (7M)



## UNIT-IV

- 7 a) From the following table of half yearly premium for policies, estimate the premium for policies at the age of 63. (7M)

Age x	45	50	55	60	65
Premium y	114.84	96.16	83.32	74.48	68.48

- b) Using Lagrange's Interpolation formula find the value of  $y(10)$  from the following table (7M)

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

Or

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

- b) Given the values, find  $f(9)$ , using divided difference formula (8M)

x	5	7	11	13	18
f(x)	150	392	1452	2366	5202

## UNIT-V

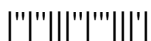
- 9 a) Evaluate  $y(1.1)$  from  $y' = y - x^2$ ,  $y(0) = 1$ , by using Taylor series method. (7M)

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

Or

- 10 a) Apply the fourth order Runge-Kutta method, to find an approximate value of  $y$  when  $x = 1.2$ , given that  $y' = x^2 + y^2$ ,  $y(1) = 1.5$ . (7M)

- b) Evaluate  $\int_0^1 \sqrt{1+x^4} dx$  using Simpson's 3/8 rule. (7M)



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**UNIT-I**

1 a) Find rank of matrix  $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$  by reducing it to Echelon form. (5M)

b) Find the Eigen values and Eigen vectors of  $A = \begin{bmatrix} 1 & 0 & 3 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$  (9M)

Or

2 a) Solve the system of equations by Gauss -elimination method (8M)  
 $5x + y + z + w = 4, x + 7y + z + w = 12, x + y + 6z + w = -5, x + y + z + 4w = -6.$

b) Prove that the eigenvalues of a real symmetric matrix are real. (6M)

**UNIT-II**

3 a) Verify Cayley Hamilton theorem for the Matrix  $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 1 & 1 \end{bmatrix}$  and hence find  $A^{-1}$ . (7M)

b) Find Singular values and singular value decomposition of a matrix  $\begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$ . (7M)

Or

4 Reduce the quadratic form  $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$  to the canonical form by orthogonal transformations and find rank, index, signature, nature of the quadratic form. (14M)

**UNIT-III**

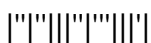
5 a) Using Regula-falsi method, find the real root of  $2x - \log x = 6$  correct to three decimal places. (5M)

b) Solve  $\sin x - y + 1.32 = 0$  and  $x - \cos y - 0.85 = 0$  starting with  $x_0 = 0.6$  and  $y_0 = 1.9$  using Newton Raphson method. (9M)

Or

6 a) Find a real root of  $x^4 - x - 9 = 0$  using Newton-Raphson method. (7M)

b) Solve the system  $10x - 2y - z - w = 3; -2x + 10y - z - w = 15; -x - y + 10z - 2w = 15; -x - y - 2z + 10w = -9$  using Gauss Seidel method. (7M)



## UNIT-IV

- 7 a) Find  $f(2.5)$  using Newton's forward formula from the following table: (7M)

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

- b) Using Lagrange's interpolating formula, find  $y(10)$  from the following table (7M)

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

Or

- 8 a) Prove that i)  $\Delta\nabla = \Delta - \nabla$  ii)  $\frac{\Delta}{\nabla} - \frac{\nabla}{\Delta} = \Delta + \nabla$ . (7M)

- b) Using Newton's divided difference formula, find  $y(8)$  from the following table (7M)

x	5	6	9	10
f(x)	12	13	14	16

## UNIT-V

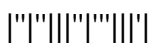
- 9 a) Solve  $y' = y - x^2$ ,  $y(0) = 1$ , by Picard's method up to the fourth approximation. Hence, find the value of  $y(0.1)$ . (7M)

- b) Evaluate  $\int_0^2 e^{-x^2} dx$  using Simpson's rule taking  $h = 0.25$ . (7M)

Or

- 10 a) Given  $y' = x + \sin y$ ,  $y(0) = 1$ , compute  $y(0.2)$  using Euler's method taking  $h=0.05$  (7M)

- b) Using Runge-kutta method of fourth order, find  $y(0.3)$ , given that (7M)  
 $\frac{dy}{dx} = \frac{1}{2}(1+x)y^2$ ,  $y(0) = 1$ .



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## UNIT-I

1 a) Find rank of matrix  $A = \begin{bmatrix} 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \\ 5 & 6 & 7 & 8 \end{bmatrix}$  using Echelon form (5M)

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

Or

2 a) Solve the system of equations by Gauss -elimination method (8M)

$$2x - y + 2z + 6w = 4, 6x + y + 6z + 12w = 2, 4x + y + 3z - 3w = -1, 2x + 2y - z + w = 1.$$

b) Prove that the eigen vectors corresponding to distinct eigenvalues of a matrix are independent. (6M)

## UNIT-II

3 a) Verify Cayley Hamilton theorem for the Matrix  $A = \begin{bmatrix} 1 & -3 & 1 \\ 6 & 3 & 1 \\ 1 & 3 & 1 \end{bmatrix}$  and hence find  $A^{-1}$ . (7M)

b) Find Singular values and singular value decomposition of a matrix  $\begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix}$ . (7M)

Or

4 Reduce the quadratic form  $3x^2 + 3y^2 + 3z^2 + 2xy - 2yz + 2zx$  to the canonical form by orthogonal transformations and find rank, index, signature, nature of the quadratic form. (14M)

## UNIT-III

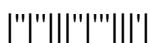
5 a) Using Regular Falsi method, find real root of  $x^3 - 2x - 5 = 0$ . (5M)

b) Solve the system of equations by Newton Raphson method  $x^2 + y^2 - 1 = 0$  and  $y - x^2 = 0$ . (9M)

Or

6 a) Using Newton-Raphson method find the root of the equation  $x + \log_{10} x = 3.375$  corrected to four significant figures. (7M)

b) Solve the system  $10x - 2y - z - w = 3; -2x + 10y - z - w = 15; -x - y + 10z - 2w = 15; -x - y - 2z + 10w = -9$  using Gauss Seidel method. (7M)



## UNIT-IV

- 7 a) Construct difference table for the following data (7M)

x	0.1	0.3	0.5	0.7	0.9	1.1	1.3
f(x)	0.003	0.067	0.148	0.248	0.370	0.518	0.697

and evaluate  $f(0.6)$ .

- b) Using Lagrange's interpolating formula, find  $y(8)$  from the following table (7M)

x	1	4	6	10
f(x)	3	5	9	11

Or

- 8 a) Find the second difference of the polynomial  $x^4 - 12x^3 + 42x^2 - 30x + 9$  with interval of differencing  $h = 2$ . (7M)

- b) Using Newton's divided difference formula, find  $y(8)$  from the following table (7M)

x	3	5	9	11
f(x)	10	13	12	18

## UNIT-V

- 9 a) Evaluate  $\int_0^2 e^{-x^2} dx$  using Trapezoidal rule taking  $h = 0.25$ . (7M)

- b) Given  $y' = x + \sin y$ ,  $y(0) = 1$ , compute  $y(0.2)$  using Euler's method taking  $h=0.05$  (7M)

Or

- 10 a) Find  $y(0.1)$  using Runge-Kutta fourth order formula given that  $y' = x + x^2 y$ ;  $y(0) = 1$ . (7M)

- b) Solve  $y' = y - x^2$ ,  $y(0) = 1$ , by Taylor's method up to the fourth approximation. Hence, find the value of  $y(0.1)$ . (7M)

