I B. Tech II Semester Regular/Supplementary Examinations, July/August-2023
MATHEMATICS-II
(Common to All Branches**)**

Time: 3 hours   Max. Marks: 70

Answer any FIVE Questions One Question from Each Unit
All Questions Carry Equal Marks
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UNIT -I

1. a) Find the rank of the matrix by reducing into echelon form $\begin{bmatrix} 1 & 2 & 3 & 4 \\ -2 & -3 & 2 & 2 \\ -3 & -4 & 5 & 8 \\ 1 & 3 & 10 & 14 \end{bmatrix}$ [7M]

    b) Solve the following equations by Gauss Elimination method   [7M]
        $2x + 4y + 2z = 15$; $2x + y + 2z = = - 5$; $4x + y - 2z = 0$.

(OR)

2. a) Discuss for what values of λ, μ the simultaneous equations $x + y + z = 6$; $x + 2y +$ [7M]
        $3z = 10$; $x + 2y + \lambda z = \mu$ have (i) no solution (ii) a unique solution and (iii) an
        infinite number of solutions.

    b) Find the eigen values and the corresponding eigen vectors of the matrix   [7M]
        $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$.
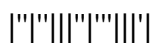
UNIT- II

3. a) Verify Cayley – Hamilton theorem for the matrix $\begin{bmatrix} 2 & 1 & 2 \\ 5 & 3 & 3 \\ -1 & 0 & -2 \end{bmatrix}$.   [7M]

    b) Find the nature of the quadratic form, index and signature of $10x^2 + 2y^2 + 5z^2 -$ [7M]
        $4xy - 10xz + 6yz$.

(OR)

4. a) Find the A^{-1} and A^4 of the matrix A = $\begin{bmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{bmatrix}$. Cayley – Hamilton   [7M]
        theorem

    b) Diagonalize the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$.   [7M]

UNIT- III

5. a) Find the root of the equation $x^3 - 9x + 1 = 0$ by Bisection Method   [7M]

    b) Solve the system of equations using Gausss Seidal method   [7M]
        $8x - y + z - 18= 0$; $2x + 5y - 2z - 3 = 0$; $x + y - 3z + 6 = 0$

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(OR)

6. a) Find the root of the equation f(x) = x + logx – 2 using Newton Raphson method.   [7M]

    b) Find the real root of x.e^x = 3 using Regula falsi method.   [7M]

UNIT- IV

7. a) Using Newton's forward interpolation formula find the value of f (1.6) for the following data   [7M]

X	1	1.4	1.8	2.2
Y	3.49	5.96	5.96	6.5

    b) Using Newton's Backward difference formula to find the area of a circle when the diameter is 105, the area for different values of diameter is given.   [7M]

d	80	85	90	95	100
A	5026	5674	6362	7088	7854

(OR)

8. a) Prove that$\Delta \left[\dfrac{f(x)}{g(x)}\right] = \dfrac{g(x)\Delta f(x) - f(x)\Delta g(x)}{g(x)g(x+h)}$.   [7M]

    b) Apply Lagrange's formula to find f(5) given that f(1) =2, f(2)=4, f(3) =8, f(4) = 16 and f(7) = 128.   [7M]

UNIT- V

9. a) Evaluate $\int_0^1 \dfrac{dx}{1+x^2}$ using Trapezoidal rule by taking i) h=0.2,ii) 0.25,iii) 0.125.   [7M]

    b) Using simple Euler's method, solve for y at x = 0.1 from $\dfrac{dy}{dx} = x + y + xy$, y(0) = 1 taking h = 0.025   [7M]

(OR)

10 a) Find y(0.1) and y(0.2) using Picard's method given that $\dfrac{dy}{dx} = x + y, y = 1 \, when \, x = 0$ [7M]

    b) Using Runge Kutta method of fourth order find y(0.2) ,given $\dfrac{dy}{dx} = y - x$, y(0) = 2 taking h = 0.1   [7M]

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UNIT -I

1. a) Find the rank of the matrix by reducing into normal form $\begin{bmatrix} 1 & 3 & 6 & -1 \\ 1 & 4 & 5 & 1 \\ 1 & 5 & 4 & 3 \end{bmatrix}$.   [7M]

   b) Solve the following equations by Gauss Elimination method   [7M]
   $2x + 4y + 2z = 15$; $2x + y + 2z = = - 5$; $4x + y - 2z = 0$

(OR)

2. a) Define consistency. Solve the system of equations x+y+z=6, x-y+2z=5, 3x+y+z= -8.   [7M]

   b) Find the eigen values and the corresponding Eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ [7M]

UNIT- II

3. a) Verify Cayley-Hamilton theorem and hence find A^{-1}, if A= $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ -1 & 2 & 2 \end{bmatrix}$.   [7M]

   b) Find the nature of the quadratic form, index and signature of   [7M]
   $10x^2 + 2y^2 + 5y^2 - 4xy - 10xz + 6yz$.

(OR)

4. a) Find the A^{-1} and A^4 of the matrix A $= \begin{bmatrix} 1 & -2 & -1 \\ -2 & -1 & 2 \\ -1 & 2 & -1 \end{bmatrix}$. Cayley – Hamilton theorem   [7M]

   b) Diagonalize the matrix A $= \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$.   [7M]

UNIT- III

5. a) Find the root of the equation $x^3 - 9x + 1 = 0$ by Bisection Method.   [7M]

   b) Solve the system of equations using Gausss Seidal method   [7M]
   $8x - y + z - 18= 0$; $2x + 5y - 2z - 3 = 0$; $x + y - 3z + 6 = 0$

(OR)

6. a) Find the root of the equation $x=e^x$ using Newton Raphson method   [7M]

   b) Find the positive root of xtanx = -1 using false position method.   [7M]

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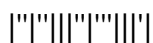
UNIT- IV

7. a) Write the forward differences, and the backward differences up to the fourth order.   [7M]

    b) In the   table below the values of y are consecutive terms of a series of which the number   [7M]
       21.6 is the 6 th term. Find the first and tenth terms of the series.

X	3	4	5	6	7	8	9
y	2.7	6.4	12.5	21.6	34.3	51.2	72.9

(OR)

8. a) Prove any four relations between Δ and E   [7M]

    b) Apply Lagrange's formula to find f (5) given that f (1) =2, f (2) =4, f (3) =8, f (4) = 16 and   [7M]
       f (7) = 128.

UNIT- V

9. a) A rocket is launched from the ground. It acceleration measured every 5 second I tabulated   [7M]
       below. Find the velocity and the position of the rocket at t=4 second. Use trapezoidal rule
       as well as Simpson's rule.

t	0	5	10	15	20	25	30	35	40
a(t)	40.0	40.25	48.50	51.25	54.35	59.48	61.5	64.3	68.7

    b) Compute y at x=0.25 by Euler Method given $\frac{dy}{dx} = 2xy$, y(0)=1   [7M]

(OR)

10 a) Find y (0.1) and y (0.2) using Picard's method given that $\frac{dy}{dx} = x + y, y = 1 \ when \ x = 0$.   [7M]

    b) Solve $\frac{dy}{dx} = y + 1$ and y (0) =1 using Taylors series method. Also compute y(0.1).   [7M]

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UNIT -I

1. a) Find the rank of the matrix by reducing it to echelon form $A=\begin{bmatrix} 1 & 3 & 6 & -1 \\ 1 & 4 & 5 & 1 \\ 1 & 5 & 4 & 3 \end{bmatrix}$.   [7M]

   b) Solve completely the system of equations.   [7M]
   $$3x + 3y + 2z = 1;$$
   $$x + 2y = 4;$$
   $$10y + 3z = -2;$$
   $$2x - 3y - 2 = 5;$$

(OR)

2. a) Write any seven properties of eigen values and eigen vectors.   [7M]

   b) Explain the general procedure for Gauss Elimination Method.   [7M]

UNIT- II

3. a) State Cayley Hamilton theorem and verify the Same for the Matrix   [7M]
   $$\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

   b) Reduce the quadratic form, to the canonical form: [7M]
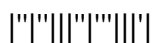 $$8x^2 + 7y^2 + z^2 - 12xy - 8yz + 4xz$$

(OR)

4. a) Find a Matrix P which diagonalizes the matrix $\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$.   [7M]

   b) Using Cayley hamilton theorem find inverse and A^4 $\begin{bmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{bmatrix}$.   [7M]

UNIT- III

5. a) Find the root of the equation $x^3 - x - 11 = 0$ by Bisection Method.   [7M]

   b) Solve the system of equations using Jacobi method   [7M]
   $8x - y + z - 18 = 0; 2x + 5y - 2z - 3 = 0; \quad x + y - 3z + 6 = 0$

(OR)

6. a) Find the root of the equation $f(x) = x\tan x + 1$ using Newton Raphson method.   [7M]

   b) Explain Secant method. With Example.   [7M]

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UNIT- IV

7. a) Define i) Interpolation ii) Finite difference iii) Forward and Back ward differences   [7M]
   with examples.

   b) Find F(22)   [7M]

X	20	25	30	35	40	45
F(X)	354	332	291	26	231	204

(OR)

8. a) Find Newton's divided differences polynomial for the data in the table given   [7M]
   below

X	-3	-1	0	3	5
F(X)	-30	-22	-12	330	3458

   b) Apply Lagrange's formula to find f(3) given that f(0) =1, f(1)=14, f(2) =15, f(4) =   [7M]
   5 and f(5) = 6, f(5) = 19.

UNIT- V

9. a) Find $\dfrac{dy}{dx}$ at x= 7.5 from the following table   [7M]

X	7.47	7.48	7.49	7.50	7.51	7.52	7.53
F(X)	0.193	0.195	0.198	0.201	0.203	0.206	0.208

   b) Using Euler's method, solve for y at x = 0.1, x = 0.2, x = 0.3 from $\dfrac{dy}{dx} = x^2 - y$,   [7M]
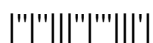   y(0) = 1.

(OR)

10 a) Find y(0.1) and y(0.2) using Picard's method given that $\dfrac{dy}{dx} = 1 + xy, y = 1\,when\ x = 0$.   [7M]

   b) Using Runge Kutta method of fourth order find y(0.1) given that $\dfrac{dy}{dx} = e^x - 1$,   [7M]
   y(0) = 0.

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UNIT -I

1. a) If $A = \begin{bmatrix} 1 & 5 & 4 \\ 1 & 3 & 2 \\ 2 & 13 & 10 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$ then find the rank of A , Rank of B and rank of A+B. [7M]

   b) Test the consistency and solve the equations. [7M]

   $x + 2y + 2z = 2;$
   $3x - 2y - z = 5;$
   $2x - 5y + 3z = -4;$
   $x + 4y + 6z = 0;$

(OR)

2. a) Fid the eigen values and eigen vectors of A = $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ [7M]

   b) Solve the following equation by Gauss Elimination Method. [7M]

   $x + 2y - z = 3;$ $3x - y + 2z = 1;$ $2x - 2y + 3z = 2;$ $x - y + z = -1;$

UNIT- II

3. a) Verify Cayley Hamilton theorem for A= $\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$. Find A^{-1} *and* A^8 [7M]

   b) Reduce the quadratic form, to the canonical form: [7M]
   $2x^2 + 2y^2 + 2z^2 - 2xy - 2yz + 2xz$ by orthogonal transformation.

(OR)

4. a) Find a Matrix P which diagonalizes the matrix $\begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$ hence find A^6. [7M]

   b) Using Cayley hamilton theorem find inverse and A^4 $\begin{bmatrix} 8 & -8 & 2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$. [7M]

UNIT- III

5. a) Find the root of the equation $x^3 - 4x - 9 = 0$ by Regula falsi Method. [7M]

   b) Explain i) Gauss- seidel method and ii) Jacobi method. [7M]

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(OR)
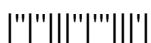
6. a) Find the root of the equation $x^4 - x = 10$ using Newton Raphson method.   [7M]

    b) Explain Bisection method.   [7M]

UNIT- IV

7. a) Fit a polynomial of degree three which take the following values.   [7M]

X	3	4	5	6
F(X)	6	24	60	120

    b) Estimate the population in 1895 from the following table.   [7M]

X	1891	1901	1911	1921	1931
F(X)	46	66	81	93	101

(OR)

8. a) Using Newton's divided differences formula find F (8).   [7M]

X	4	5	7	10	11	13
F(X)	48	10	294	900	1210	2028

    b) Apply Lagrange's formula to find y(-2) given that   [7M]

X	-1	0	2	3
F(X)	-8	3	1	2

UNIT- V

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

    b) Using Taylor's method, find for y at x = 0.1, x=0.2 from $\frac{dy}{dx} = y^2 + x$, y(0) = 1 .   [7M]

(OR)

10 a) Find y (1) using Picard's method given that $\frac{dy}{dx} = \frac{x^2}{y^2+1}, y = 0 \, when \, x = 0.$ [7M]

    b) Using Runge Kutta method of fourth order find y(0.1) given that $\frac{dy}{dx} = x + y,$ y(0) = 1   [7M]

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