Code.No: 09A1BS04 | R09 | SET-1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I B.TECH – REGULAR EXAMINATIONS, JUNE - 2010
MATHEMATICAL METHODS
(COMMON TO EEE, ECE, CSE, EIE, BME, IT, ETE, E.COMP.E, ICE)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Find the Rank of the Matrix, by reducing it to the normal form $\begin{bmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & k \end{bmatrix}$.

b) Solve the system of linear equations by matrix method.
x + y + z = 6, 2x + 3y - 2z = 2, 5x + y + 2z = 13. [8+7]

2. Verify Cayley Hamilton theorem and find the inverse of $\begin{bmatrix} 1 & 0 & 3 \\ 2 & -1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ [15]

3. Prove that the following matrix is Hermitian. Find the eigen values and the corresponding eigen vectors of the matrix $\begin{bmatrix} 4 & 1-3i \\ 1+3i & 7 \end{bmatrix}$ [15]

4.a) Find a real root of the equation $x^3 - x - 4 = 0$ by bisection method.
b) Use Newton's forward difference formula to find the polynomial satisfied by (0, 5), (1, 12), (2, 37) and (3, 86). [8+7]

5.a) Derive the normal equation to fit the parabola $y = a + bx + cx^2$.
b) By the method of least squares, find the straight line that best fits the following data: [7+8]

x	1	2	3	4	5
y	14	27	40	55	68

6. Using Taylor series method, find an approximate value of y at x=0.2 for the differential equation $y' - 2y = 3e^x$ for $y(0) = 0$. [15]

7.a) Find the Fourier Series to represent the function f(x) given:

$$f(x) = \begin{cases} 0 & for \quad -\Pi \le x \le 0 \\ x^2 & for \quad 0 \le x \le \Pi \end{cases}$$

b) Find the Fourier series in $[-\Pi, \Pi]$ for the function $f(x) = \begin{cases} \frac{-1}{2}(\Pi + x) & for \quad -\Pi \le x \le 0 \\ \frac{1}{2}(\Pi - x) & for \quad 0 \le x \le \Pi \end{cases}$

[8+7]

8.a) Form a partial differential equation by eliminating a,b,c from $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$.

b) Form the partial differential equation by eliminating the constants from $(x - a)^2 + (y - b)^2 = z^2 \cot^2 \alpha$ where α is a parameter. [8+7]

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MATHEMATICAL METHODS
(COMMON TO EEE, ECE, CSE, EIE, BME, IT, ETE, E.COMP.E, ICE)

Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Find the Rank of the Matrix, $\begin{bmatrix} 2 & 3 & 7 \\ 3 & -2 & 4 \\ 1 & -3 & -1 \end{bmatrix}$ by reducing it to the normal form.

b) Find all the non-trivial solutions of $2x - y + 3z = 0$, $3x + 2y + z = 0$, $x - 4y + 5z = 0$. [7+8]

2. Find the eigen values and the corresponding eigen vectors of $\begin{bmatrix} 1 & 3 & 7 \\ 1 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$. [15]

3.a) Prove that $\frac{1}{2}\begin{bmatrix} 1+i & -1+i \\ 1+i & 1-i \end{bmatrix}$ is unitary.

b) Prove that the eigen values of a real skew symmetric matrix are either zero or purely imaginary. [8+7]

4.a) Find a real root of the equation $3x = e^x$ by bisection method.

b) Using Lagrange's formula find y(6) given: [7+8]

x	3	5	7	9	11
y	6	24	58	108	74

5.a) Fit a straight line y = a + bx from the following data:

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

b) Fit a straight line to the form y = a + bx for the following data:

x	0	5	10	15	20	25
y	12	15	17	22	24	30

[7+8]

6. Find y(0.1), y(0.2),z(0.1), z(0.2) given $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y^2$ and $y(0) = 2$, $z(0) = 1$ by using Taylor's series method. [15]

7.a) Express f(x)=x as a Fourier Series in $(-\Pi, \Pi)$.

b) Expand the function $f(x) = x^2$ as a Fourier series in $(-\Pi, \Pi)$. [8+7]

8.a) Form the partial differential equation by eliminating a and b from $\log(az-1) = x + ay + b$

b) Find the differential equation of all spheres whose centres lie on z-axis with a given radius r. [7+8]

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Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

- - -

1.a) Find the Rank of the Matrix, by reducing it to the normal form $\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$

b) Find whether the following system of equations are consistent. If so solve them.
x + y + 2z = 9, x - 2y + 2z = 3, 2x - y + z = 3, 3x - y + z = 4. [8+7]

2. Verify Cayley Hamilton theorem and find the inverse of $\begin{bmatrix} 1 & 3 & 7 \\ 1 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$ [15]

3. Reduce the quadratic form to the canonical form $x^2 + y^2 + 2z^2 - 2xy + 4zx + 4yz$ [15]

4.a) Find a real root of the equation $e^x \sin x = 1$ using Newton Raphson method.
b) Find y(10), Given that y(5) = 12, y(6) = 13, y(9)=14, y(11) = 16 using Lagrange's formula. [8+7]

5.a) Using the method of least squares find the constants a and b such that $y = ae^{bx}$ fits the following data:

x	0	0.5	1	1.5	2	2.5
y	0.10	0.45	2.15	9.15	40.35	180.75

b) Obtain a relation of the form $y=ab^x$ for the following data by the method of least squares. [7+8]

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	127.4

6. Solve $\frac{dy}{dx} = xy + 1$ and $y(0) = 1$ using Taylor's series method and compute y(0.1). [15]

7.a) If f(x)=cosh ax expand f(x) as a Fourier Series in $(-\Pi, \Pi)$.
b) Expand the Function $f(x) = x^3$ as a Fourier Series in $-\Pi < x \le \Pi$. [7+8]

8.a) Solve $(z^2-2yz-y^2)p + (xy + zx)q = xy - zx$.
b) Find the integral surface of $x(y^2 + z)p - y(x^2 + z)q = (x^2 + y^2)z$. [7+8]

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Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

- - -

1.a) Find the Rank of the Matrix, by reducing it to the normal form $\begin{bmatrix} 1 & 3 & 4 & 5 \\ 1 & 2 & 6 & 7 \\ 1 & 5 & 0 & 10 \end{bmatrix}$

b) Find whether the following system of equations are consistent. If so solve them.
$x + 2y + 2z = 2$, $3x - 2y - z = 5$, $2x - 5y + 3z = -4$, $x + 4y + 6z = 0$. [7+8]

2. Find the eigen values and the corresponding eigen vectors of $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ [15]

3. Reduce the quadratic form to the canonical form $3x^2 + 2y^2 + 3z^2 - 2xy - 2yz$ [15]

4.a) Prove that the newton's method has quadratic convergence.
b) Find y(5) given that y(0)=1, y(1)=3, y(3)=13, and y(8) = 123 using Lagrange's formula. [8+7]

5.a) Find $\frac{dy}{dx}$ at x=7.5 from the following table.

x	7.47	7.48	7.49	7.5	7.51	7.52	7.53
y	.193	.195	.198	.201	.203	.206	.208

b) Find the first two derivative at x=1.4 from the following data: [8+7]

x	1.0	1.2	1.4	1.6	1.8	2.0
y	0	.128	.544	1.296	2.432	4.0

6. Using Euler's method, solve for y at x=2 from $\frac{dy}{dx} = 3x^2 + 1$, $y(1) = 2$ taking step size:

a) h = 0.5
b) h = 0.25. [8+7]

7.a) Expand f(x)= cosx for $0 < x < \Pi$ in half range sine series.
b) Find cosine and sine series for $f(x) = \Pi - x$ in $[0, \Pi]$. [7+8]

8.a) Solve (mz - ny) p + (nx - lz)q = (ly - mx).
b) Solve $(x^2 - y^2 - yz)\,p + (x^2 - y^2 - zx)\,q = z(x - y)$. [7+8]

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