

R07

SET-1

Code No:43063

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
II.B.TECH - I SEMESTER REGULAR EXAMINATIONS NOVEMBER, 2009**

MATHEMATICS-II

(Common to CE, CHEM, MMT, AE, BT)

Time: 3hours

Max.Marks:80

Answer any FIVE questions
All questions carry equal marks

1. a) Find the rank of the matrix.

$$A = \begin{pmatrix} 2 & 1 & 2 & 1 \\ 4 & 3 & 3 & -3 \\ 2 & 2 & -1 & 1 \\ 6 & -6 & 6 & 12 \end{pmatrix} \text{ by reducing it to normal form}$$

b) Test for consistency of the equation

$$2x - 3y + 7z = 5$$

$$3x + y - 3z = 13$$

$$5x - 2y + 4z = 18$$

And hence solve them.

[8+8]

2. Verify Cayley-Hamilton theorem for the matrix

$$\begin{pmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix} \text{ and find its inverse.}$$

[16]

3. a) Find a, b, c, so that the matrix.

$$A = \begin{pmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{pmatrix} \text{ is orthogonal.}$$

b) Find the nature, index and signature of the quadratic form

$$2x_1x_2 + 2x_1x_3 + 2x_2x_3.$$

[8+8]

4. Develop Fourier series for the function

$f(x) = x + x^2$ in $-\pi < x < \pi$. Hence deduce that

$$\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots \infty = \frac{\pi^2}{6}.$$

[16]

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5. a) Eliminate the arbitrary function f from $Z = f\left(\frac{y}{x}\right)$ and form a, P, D, E .

b) Find the complete integral $yzp + zxq = xy$

c) Find the complete integral $Z = p^2 - q^2$ [5+5+6]

6. Solve by the method of separation of variable the PDES.

a) $\mu_{xx} = \mu_y + 2\mu$

b) $\mu_x = 4\mu_y$ and $\mu(0, y) = 8e^{-3y}$ [8+8]

7. a) Find the Fourier transform of $f(x) = \begin{cases} x & \text{if } |x| \leq a \\ 0 & \text{if } |x| > a \end{cases}$

b) Find the sin transform of $f(x) = \begin{cases} \cos x & \text{if } 0 < x < a \\ 0 & \text{if } x \geq a \end{cases}$ [8+8]

8. a) State and prove Damping rule

b) Find $z\{1\}$

c) Find $z^{-1}\left\{\frac{z}{z^2 + 7z + 10}\right\}$ [5+5+6]

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SET-2

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MATHEMATICS-II

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Time: 3hours

Max.Marks:80

Answer any FIVE questions
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1. a) Find the rank of $A = \begin{bmatrix} 3 & 2 & -1 \\ 5 & 1 & 0 \\ 1 & 3 & 2 \\ 4 & -2 & 1 \end{bmatrix}$ by reducing it to normal form.

b) Test for consistency of the equation $x + 2y = 3, y - z = 2, x + y + z = 1$ and hence solve them if possible. [8+8]

2. Verify Cayley Hamilton theorem for $A = \begin{pmatrix} 1 & 2 & -2 \\ 2 & 5 & -4 \\ 3 & 7 & -5 \end{pmatrix}$ and hence find A^{-1} . [16]

3. a) Prove that the Eigen values of a Hermitian matrix are all real .

b) Reduce the quadratic form $2x^2 + 2y^2 + 3z^2 + 2xy - 4yz - 4zx$ to canonical form. Find the rank index and signature. [8+8]

4. a) Obtain the Fourier series to represent

$$f(x) = \frac{1}{4}(\pi - x)^2 \text{ in } 0 < x < 2\pi$$

b) Develop a Fourier series for the function

$$f(x) = x \text{ in } 0 < x < \frac{\pi}{2}$$

$$= \pi - x \text{ in } \frac{\pi}{2} < x < \pi$$

[8+8]

5. a) Obtain the partial differential equation form $z = f(\sin x + \cos y)$

b) Solve the PDE for $xp - yq = y^2 - x^2$

c) Solve the PDE for $p(1+q) = qz$ [6+5+5]

6. a) Solve $\mu_{xx} - \mu_y = 0$ by separation of variables

b) Solve $2xz_x - 3yz_y = 0$ by separation of variables [8+8]

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7. a) Find the Fourier cosine and sin transform of

$$f(x) = \begin{cases} =\cos x & \text{if } 0 < x < a \\ 0 & \text{if } x \geq a \end{cases}$$

b) Prove that $e^{-x^2/2}$ is self reciprocal with respect to Fourier transform. [8+8]

8. a) Find i) $Z\{a^n\}$ ii) $Z\left\{\frac{1}{n!}\right\}$

b) If $Z(\mu_n) = \bar{\mu}(z)$ prove that $Z(a^n \mu_n) = \bar{\mu}\left(\frac{z}{a}\right)$. [8+8]

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SET-3

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MATHEMATICS-II

(Common to CE, CHEM, MMT, AE, BT)

Time: 3hours

Max.Marks:80

Answer any FIVE questions
All questions carry equal marks

1. a) Find the rank of the matrix $A = \begin{pmatrix} 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \\ 2 & 1 & 3 & 1 \\ 4 & 1 & 4 & 4 \end{pmatrix}$ by reducing it to normal form

b) Test for consistency and solve the following equation

$$x + y + z = 3$$

$$x + 2y + 3z = 4$$

$$x + 4y + 9z = 6$$

[8+8]

2. Verify Cayley- Hamilton theorem for the matrix $A = \begin{pmatrix} 1 & 2 & 4 \\ -1 & 0 & 3 \\ 3 & 1 & -2 \end{pmatrix}$ and hence find A^{-1}

and A^4 .

[16]

3. a) Prove that the matrix $A = \frac{1}{3} \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{pmatrix}$ is orthogonal

b) Find the nature, index and signature of

$$x_1^2 + 2x_2^2 + 3x_3^2 + 3x_4^2 + 2x_2x_3 - 2x_3x_1 + 2x_1x_2$$

[8+8]

4. a) Find Fourier series for $\sqrt{1 - \cos x}$ for $-\pi \leq x \leq \pi$

b) Find the half-range cosine series for $f(x) = x$ in $0 < x < T$.

[8+8]

5. a) Form the partial differential equation by eliminating the arbitrary function of from the relation

$$z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$$

b) Solve PDE where $(x + y)zp + (x - y)zq = x^2 + y^2$.

[8+8]

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6. Solve the following partial differential equation by the method of separation of variables.

a) $4\mu_x + \mu_y = 3\mu$ and $\mu(0, y) = e^{-5y}$

b) $Z_{xx} - 2z_x + z_y = 0$

[8+8]

7. a) Find the Fourier transform of

$$F(x) = \begin{cases} a^2 - x^2 & \text{if } |x| < a \\ 0 & \text{if } |x| \geq a \end{cases}$$

b) Find the Fourier transformer of $e^{-ax} \sin ax$.

[8+8]

8. a) Find i) $z\{(-a^n)\}$ ii) $z\{na^n\}$

b) If $z(\mu_n) = \bar{\mu}(z)$ prove that $z(a^{-n}\mu_n) = \bar{\mu}(az)$

[8+8]

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MATHEMATICS-II

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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 $A = \begin{pmatrix} 1 & 4 & 9 & 6 \\ 1 & 2 & 3 & 4 \\ 1 & 1 & 1 & 3 \end{pmatrix}$ by reducing it to normal form.

- b) Test for the consistency of $\begin{matrix} 3x + 3y + 2z = 1 \\ x + 2y = 4 \\ 10y + 3z = -2 \\ 2x - 3y - z = 5 \end{matrix}$ and hence solve them. [8+8]

2. Find the Eigen value and Eigen vectors for the matrix $A = \begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$. Also Verify Cayley-Hamilton theorem for the matrix A. [16]

3. a) Prove that the inverse of an orthogonal matrix is orthogonal and its transpose is also orthogonal.
b) Reduce the quadratic form $2x_1x_2 + 2x_2x_3 + 2x_3x_1$ into canonical form. Classify the quadratic form. [8+8]

4. a) Find the Fourier series to represent $f(x) = e^{ax}$ in $-\pi < x < \pi$
b) Develop $\sin\left(\frac{\pi x}{k}\right)$ in half range cosine series in $0 < x < k$. [8+8]

5. a) Form the partial differential equation by eliminating the arbitrary constants a and b from $z = ax + by + ab$
b) Solve the partial differential equation $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$
c) Solve the P.D.E. for $z = px + qy - 2\sqrt{pq}$. [5+5+6]

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SET-4

6. Solve $\frac{\partial t}{\partial u} = c^2 \frac{\partial^2 \mu}{\partial x^2}$ given that

a) $\mu = 0$ when $x = 0$ and $x = l$ for all t .

b) $\mu = 3 \sin \frac{\pi x}{l}$ when $t = 0$ for all x in $0 < x < l$

[8+8]

7. a) prove that the Fourier transform is linear

b) Find the Fourier cosine transform of $2e^{-3x} + 3e^{-2x}$.

[8+8]

8. a) Find i) $z\{a^n \cos \theta\}$ ii) $z\{a^n \sin \theta\}$

b) Using the z -transform solve

$$\mu_{n+2} + 4(\mu_{n+1}) + 3\mu_n = 3^n \quad \text{given,}$$

That $\mu_0 = 0$ and $\mu_1 = 1$.

[8+8]
