

Code No: A109210101

R09**Set No. 2**

II B.Tech I Semester Examinations, MAY 2011

MATHEMATICS-II

Common to CE, CHEM, AE, BT, MMT

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) i. Show that the product of the eigen values of a matrix A is equal to its determinant.
ii. Show that the sum of the eigen values of a matrix is the trace of the matrix.

(b) Find the eigen values and eigen vectors of $A = \begin{bmatrix} -1 & 1 & 0 \\ 1 & -1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$. [15]

2. (a) Find the skew-Hermitian form for $A = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix}$ with $X = \begin{bmatrix} 1 \\ i \end{bmatrix}$.

(b) Find the Hermitian form of $A = \begin{bmatrix} 3 & 2-i \\ 2+i & 4 \end{bmatrix}$ with $X = \begin{bmatrix} 1+i \\ 2i \end{bmatrix}$. [15]

3. (a) Find the Fourier Transform of $\begin{cases} \cos x & 0 < x < a \\ 0 & x \geq a \end{cases}$

(b) Find $f(x)$ if $F_C[f(x)] = 16 \frac{(-1)^{n-1}}{n^3}$ if $0 < x < 8$ [15]

4. (a) Form the partial differential equation from $F(x-y-z, x^2-z^2) = 0$

(b) Solve the partial differential equation $\left(\frac{p}{2} + x\right)^2 + \left(\frac{q}{2} + y\right)^2 = 1$ [15]

5. Reduce the quadratic form $5x^2 + 26y^2 + 10z^2 + 4yz + 6xy + 14xz$ to canonical form by orthogonalization. [15]

6. (a) Find non-singular matrices P and Q so that PAQ is in the normal form,

where $A = \begin{bmatrix} 3 & 2 & -1 & 5 \\ 5 & 1 & 4 & -2 \\ 1 & -4 & 11 & -19 \end{bmatrix}$.

(b) Find the rank of the matrix A by reducing it to the normal form,

where $A = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & -4 \\ 2 & 3 & 5 & -5 \\ 3 & -4 & -5 & 8 \end{bmatrix}$. [15]

7. Solve the boundary value problem $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, with $u(0, y) = 0$

$u(x, b) = 0$ and $u(x, 0) = 0$

$u(a, y) = Ky(b-y)$, $0 < y < b$ [15]

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8. (a) Obtain the Fourier series for the function $f(x) = x \sin x$ in $[0, 2\pi]$
(b) Find the half range cosine series for $f(x) = 1$ in $[0, 1]$
 $= x$ in $[1, 2]$. [15]

FIRSTRANKER

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R09**Set No. 4**

II B.Tech I Semester Examinations, MAY 2011

MATHEMATICS-II

Common to CE, CHEM, AE, BT, MMT

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. Determine diagonal matrix orthogonally similar to the real symmetric matrix

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 2 & 2 \\ 0 & 2 & 3 \end{bmatrix} \quad [15]$$

2. (a) Form the partial differential equation from

$$z = y f(x^2 + y^2)$$

- (b) Solve the partial differential equation

$$z^2(p^2x^2 + q^2) = 1 \quad [15]$$

3. (a) Find the rank of the matrix by reducing it to Echelon form from the matrix

$$\begin{bmatrix} 1 & 2 & -4 & 5 \\ 2 & -1 & 3 & 6 \\ 8 & 1 & 9 & 7 \end{bmatrix}.$$

- (b) Reduce the matrix $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$ into Echelon form and hence find its rank. [15]

4. A string is stretched and fastened to two points L apart. Motion is started by displacing the string in the form $y = K x(L - x)$ from which it is released at time $t = 0$. Find the displacement of the string at any point x at any time t. [15]

5. (a) Obtain the Fourier series for the function

$$f(x) = \pi + x \text{ in } -\pi < x < 0 \\ = \pi - x \text{ in } 0 < x < \pi$$

- (b) Find the half range Sine series for

$$f(x) = \frac{1}{4} - x \text{ if } 0 < x < \frac{1}{2} \\ = x - \frac{3}{4} \text{ if } \frac{1}{2} < x < 1. \quad [15]$$

6. Diagonalize the matrix $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ and hence find A^4 . [15]

7. Reduce the quadratic form $3x_1^2 - 2x_2^2 - x_3^2 - 4x_1x_2 + 12x_2x_3 + 8x_1x_3$ by orthogonal transforms and hence find rank, index and signature. [15]

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8. (a) Find the Fourier cosine Transform of

$$\begin{aligned} F(x) &= x, 0 < x < \frac{1}{2} \\ &= 1 - x, \frac{1}{2} < x < 1 \\ &= 0, x > 1 \end{aligned}$$

(b) Find $f(x)$ if its finite Fourier Sine transform is $\frac{(1 - \cos n\pi)}{n^2\pi^2}$ [15]

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R09**Set No. 1**

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Answer any FIVE Questions
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1. Diagonalize the matrix $A = \begin{bmatrix} 2 & 2 & -2 \\ 2 & 1 & 2 \\ 0 & 1 & -3 \end{bmatrix}$ and hence find A^4 . [15]

2. (a) Using Fourier integral show that $\int_0^{\infty} \frac{1-\cos \pi \lambda}{\lambda} \sin x \lambda dy = \frac{\pi}{2}, 0 < x < \pi$
 $= 0$ if $x > \pi$
 (b) Find the finite Fourier sine and cosine transforms of
 $f(x) = 1$ in $0 < x < \frac{\pi}{2}$
 $= -1$ in $\frac{\pi}{2} < x < \pi$ [15]

3. (a) Solve: $x+y+z=6$; $x-y+2z=5$; $2x-2y+3z=7$.
 (b) Test for consistency and solve $2x+3y+7z=5$; $3x+y-3z=12$; $2x+19y-47z=32$. [15]

4. (a) Prove that eigen values of a real symmetric matrix are always real.
 (b) Express the matrix A as the sum of a symmetric and a skew symmetric matrices, where $A = \begin{bmatrix} 4 & 2 & -3 \\ 1 & 3 & -6 \\ -5 & 0 & -7 \end{bmatrix}$. [15]

5. Solve the partial differential equation $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$ with the conditions
 (a) $u \rightarrow 0, ast \rightarrow \infty$
 (b) $\frac{\partial u}{\partial x} = 0$ when $x = \pm a, t > 0$
 (c) $u = x$, when $t = 0$ and $-a < x < a$ [15]

6. (a) Obtain the Fourier series for the function $f(x) = \cos x$ in $(-\pi, \pi)$
 (b) Find the half range cosine series for $f(x) = x \sin x$ in $[0, \pi]$ [15]

7. Reduce the quadratic form $4x^2 + 3y^2 + z^2 - 8xy - 6yz + 4xz$ to canonical form by orthogonal transformation and hence find the nature of the quadratic form. [15]

8. (a) Form the partial differential equation from
 $z = e^{ny} f(x - y)$ [n is a constant]
 (b) Solve the partial differential equation
 $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$ [15]

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R09**Set No. 3**

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MATHEMATICS-II

Common to CE, CHEM, AE, BT, MMT

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Find the Fourier Transform of $F(x) = e^{ikx}$ $a < x < b$
 $= 0, x < a, x > b$
- (b) Find the finite Fourier sine transforms of $f(x) = 1$ if $0 < x < \frac{\pi}{2}$
 $= -1$ if $\frac{\pi}{2} < x < \pi$ [15]
2. (a) Obtain the Fourier series for the function
 $F(x) = x \sin x$ in $[-\pi, \pi]$
Deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \frac{1}{7.9} + \dots = \frac{1}{4}(\pi - 2)$
- (b) Find the half range Sine series for $f(x) = \pi x - x^2$ in $(0, \pi)$ [15]
3. (a) i. Prove that the transpose of unitary matrix is unitary.
ii. Prove that the inverse of unitary matrix is unitary.
- (b) Show that the matrix $\begin{bmatrix} 3 & 7-4i & -2+5i \\ 7+4i & -2 & 3+i \\ -2-5i & 3-i & 4 \end{bmatrix}$ is a Hermitian matrix. [15]
4. Diagonalize $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and hence find A^8 . [15]
5. Reduce the quadratic form $x^2 + y^2 + 2z^2 - 2xy + 4xz + 4yz$ to the canonical form. [15]
6. Solve the boundary value problem $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ with $\frac{\partial u}{\partial x}(0, y) = \frac{\partial u}{\partial x}(\pi, y) = u(x, \pi) = 0$ and $u(x, 0) = x^2, 0 < x < \pi$ [15]
7. (a) Show that the system of equations $2x_1 - 2x_2 + x_3 = \lambda x_1; 2x_1 - 3x_2 + 2x_3 = -\lambda x_2; -x_1 + 2x_2 = \lambda x_3$ can possess a non-trivial solutions only if $\lambda = 1, \lambda = -3$. Obtain the general solution in each case.
- (b) Solve completely the system of equations:
 $2x-2y+5z+3w=0; 4x-y+z+w=0;$
 $3x-2y+3z+4w=0; x-3y+7z+6w=0.$ [15]
8. (a) Form the partial differential equation from $f(xyz, x^2 + y^2 + z^2) = 0$
- (b) Solve the partial differential equation
 $z(p^2 - q^2) = x - y$ [15]
