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

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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]

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 $\begin{aligned} f(x) &= 1 \; in \; [0,1] \\ &= x \; in \; [1,2] \end{aligned}$. [15]

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Code No: A109210101 **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

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1. Determine diagonal matrix orthogonally similar to the real symmetric matrix
$$A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 2 & 2 \\ 0 & 2 & 3 \end{bmatrix}$$ [15]

2. (a) Form the partial differential equation from
z = y f($x^2 + y^2$)
   (b) Solve the partial differential equation
$z^2(p^2x^2 + q^2) = 1$ [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
$$f(x) = \pi + x \ in \ -\pi < x < 0$$
$$= \pi - x \ in \ 0 < x < \pi$$
   (b) Find the half range Sine series for
$$f(x) = \tfrac{1}{4} - x \ if \ 0 < x < \tfrac{1}{2}$$
$$= x - \tfrac{3}{4} \ if \ \tfrac{1}{2} < x < 1 \ .$$ [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]

8. (a) Find the Fourier cosine Transform of
   F(x) = x . $0 < x < \frac{1}{2}$
   = 1 - x , $\frac{1}{2} < x < 1$
   = 0, $x > 1$

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

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Code No: A109210101 **R09** **Set No. 1**

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

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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 $\int\limits_0^\infty \frac{1-\cos\pi\lambda}{\lambda} \sin x\lambda dy \quad = \frac{\pi}{2}, 0 < x < \pi$
$\qquad = 0 \; if \; x > \pi$

   (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) $u \to 0, ast \to \infty$
   (b) $\frac{\partial u}{\partial x}$ = 0 when x = ±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 (-π, π)
   (b) Find the half range cosine series for f(x) = x Sin x in [0, π] [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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Code No: A109210101 **R09** **Set No. 3**

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

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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) = I 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 [-π, π]
   Deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5-7} - \frac{1}{7.9} + ... = \frac{1}{4}(\pi - 2)$
   (b) Find the half range Sine series for f(x) = πx - x^2 in (0, π) [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, π) = 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 λ =1, λ = -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]

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