Code No: RR210101

Set No. 1

II B.Tech I Semester Supplementary Examinations, November 2006
MATHEMATICS-II
(Common to Civil Engineering, Electrical & Electronic Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Metallurgy & Material Technology, Electronics & Computer Engineering, Production Engineering, Aeronautical Engineering, Instrumentation & Control Engineering and Automobile Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) For what value of K the matrix
$\begin{bmatrix} 4 & 4 & -3 & 1 \\ 1 & 1 & -1 & 0 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{bmatrix}$ has rank 3. [8]

   (b) Find whether the following set of equations are consistent if so, solve them.

$$x_1 + x_2 + x_3 + x_4 = 0$$
$$x_1 + x_2 + x_3 - x_4 = 4$$
$$x_1 + x_2 - x_3 + x_4 = -4$$
$$x_1 - x_2 + x_3 + x_4 = 2.$$

[8]

2. Verify that the sum of eigen values is equal to the trace of A for the matrix
$A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ and find the corresponding eigen vectors. [16]

3. (a) Show that the eigen value of an orthogonal matrix is of unit modulus. [5]

   (b) Show that $\begin{bmatrix} 3 & 7-4i & -2+5i \\ 7+4i & -2 & 3+i \\ -2-5i & 3-i & 4 \end{bmatrix}$ is a Hermitian matrix. [6]

   (c) Prove that the matrix
$\begin{bmatrix} \frac{-2}{3} & \frac{1}{3} & \frac{2}{3} \\ \frac{2}{3} & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{-2}{3} & \frac{2}{3} \end{bmatrix}$ is orthogonal. [5]

4. (a) Expand f(x) = e^{-x} as a Fourier series in (-1, 1). [8]
   (b) Expand x sin x as sine series in $0 < x < \pi$. [8]
5. (a) Form the partial differential equation by eliminating the arbitrary function from
   z = x f(y) + y ϕ (x). [5]
   (b) Solve the partial differential equation $p^2 + q^2 = z^2(x^2 + y^2)$ [5]
   (c) Solve the partial differential equation (3y + 2z) p + (4z 3x) q + (zx + 4y) = 0. [6]
6. A taut string of length L is fastened at both ends. The midpoint of the string is taken to a height "b" and then released from rest in that position .Find the displacement of the string at any position x at any time t . [16]
7. (a) Find the finite cosine transform of $\{f(x) = \frac{\pi}{3} \; - \; x \; + \; \frac{x^2}{2\pi}$ [8]
   (b) Find the Function if its Fourier sine transform is e^{-as}. [8]
8. (a) Find the Z-Transform of e^n coshan $(a > 0)$ [8]
   (b) Find $Z^{-1}\frac{2z^2-10z+3}{(z-3)^2(z-2)}$ [8]

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Code No: RR210101 **Set No. 2**

II B.Tech I Semester Supplementary Examinations, November 2006
MATHEMATICS-II
(Common to Civil Engineering, Electrical & Electronic Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Metallurgy & Material Technology, Electronics & Computer Engineering, Production Engineering, Aeronautical Engineering, Instrumentation & Control Engineering and Automobile Engineering)

Time: 3 hours **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. [8]

$$\begin{bmatrix} 1 & 2 & 1 & 2 \\ 1 & 3 & 2 & 2 \\ 2 & 4 & 3 & 4 \\ 3 & 7 & 5 & 6 \end{bmatrix}$$

(b) Find whether the following set of equations are consistent if so, solve them.

$$x + y + z = 9, \quad 2x + 5y + 7z = 52, \quad 2x + y - z = 0.$$

[8]

2. Find the eigen values and the corresponding eigen vectors of the matrix A= $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$

[16]

3. (a) If X =x cosα -y sinα , Y = x Sin α +y cos α write the matrix A of the transformation and prove that $A^{-1} = A^T$, Hence write the inverse transformation.

[8]

(b) A transformation from the variables x_1, x_2, x_3 to y_1, y_2, y_3 is given by Y=AX and another transformation from y_1, y_2, y_3, to z_1, z_2, z_3, is given Z=BY where

$$A = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 1 & -2 \\ -1 & 2 & 1 \end{bmatrix} \; B = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 5 \end{bmatrix}$$

Obtain the transformation from x_1, x_2, x_3, to z_1, z_2, z_3 [8]

4. (a) Obtain the Fourier series to represent f (x) = $\frac{1}{4}(\pi - x)^2, 0 < x < 2\pi$. [8]

(b) Find the half range cosine series for the function $f(x) = x^2$, in $0 \leq x \leq \pi$ and hence find the sum of the series $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots$ [8]

5. (a) Form the partial differential equation by eliminating the arbitrary function from $z = f(x^2 - y^2)$. [5]

   (b) Solve the partial differential equation $(y + z)p + (z + x)q = x + y$ [6]

   (c) Solve the partial differential equation $(x + pz)^2 + (y + qz)^2 = 1$ [5]

6. A bar 10cm long with insulated sides , has its ends A and B kept at 20^0C and 40^0C, respectively until steady state conditions prevail. The temperature at end A is then suddenly raised to 50^0C and at the same instant , that of the end B reduced to 10^0C. Find the subsequent temperature function u (x , t). [16]

7. (a) Find the Fourier cosine transforms of $e^{-ax}\cos ax$ [8]

   (b) Prove that the Fourier transform of the convolution of f(x) and g(x) is the product of their Fourier transforms. [8]

8. (a) If $Z(u_n)=[\frac{2z^2+3z+4}{(z-3)^3}]$. Find u_1 and u_2. [8]

   (b) Find $Z^{-1}[\frac{8z^2}{(2z-1)(4z-1)}]$ [8]

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Code No: RR210101 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, November 2006
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Find the value of λ for which the system of equations [8]
3x - y + 4z = 3, x + 2y - 3z = -2
6x + 5y + λz = -3 will have infinite no of solutions and solve them with that λ value.

   (b) Find the rank of the matrix A by reducing it to the normal form
Where A= $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & -4 \\ 2 & 3 & 5 & -5 \\ 3 & -4 & -5 & 8 \end{bmatrix}$ [8]

2. For the matrix A = $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ find A^4 using cayley Hamilton theorem. [16]

3. (a) Define : [6]
      i. Spectral Matrix
      ii. Quadratic Form
      iii. Canonical form.

   (b) Reduce the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to the canonical form. [10]

4. (a) Find a Fourier series to represent $x - x^2$ from $x = -\pi \ to \ x = \pi$. Hence show that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + ...$ [10]

   (b) Find the half range sine series for the function
f (x) = $\begin{cases} \frac{1}{4} - x, & 0 < x < \frac{1}{2} \\ x - \frac{3}{4}, & \frac{1}{2} < x < 1 \end{cases}$ [6]

5. (a) Form the partial differential equation by eliminating the arbitrary constants a, b from z = ax + by + (a / b) - b. [5]

(b) Solve the partial differential equation $x^2(y^2-z^2)p+y^2(z^2-x^2)q = z^2(x^2-y^2)$. [6]

(c) Solve the partial differential equation (2z - y) p + (x + z) q + (2 x + y) = 0. [5]

6. A string is stretched and fastened to two points L apart. Motion is started by displacing the string in the form $y = asin(\pi x/L)$ from which it is released at time t = 0. Find the displacement of any point at a distance x from one end at time t. [16]

7. Solve the diffusion equation
$\frac{\partial u}{\partial t}$ = K$\frac{\partial^2 u}{\partial x^2}$ $-\infty < x < \infty, t > 0$ $\quad \frac{\delta u}{\delta t}(o, t) = 0, t > 0.$
with the conditions,
u (x, 0) = f(x) and $\frac{\partial u}{\partial x}$, u tends to zero as x tend to $\pm\infty using Fourier Transforms.$ [16]

8. (a) Find $Z[(n+1)^2]$ [6]

(b) Solve the difference equation using z-transforms $u_{n+2}-5u_{n+1}+6u_n = 4^n$ given that $u_0 = 0 \quad u^1 = 1.$ [10]

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Code No: RR210101

Set No. 4

II B.Tech I Semester Supplementary Examinations, November 2006
MATHEMATICS-II
(Common to Civil Engineering, Electrical & Electronic Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Chemical Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Metallurgy & Material Technology, Electronics & Computer Engineering, Production Engineering, Aeronautical Engineering, Instrumentation & Control Engineering and Automobile Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Determine the rank of the matrix.
$$A = \begin{bmatrix} -2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$$ by reducing it to normal form. [8]

   (b) Determine the values of λ for which the following set of equations may posses non-trivial solution and solve them in each case.
$$3x_1 + x_2 - \lambda x_3 = 0;\;\; 4x_1 - 2x_2 - 3x_3 = 0;\;\; 2\lambda x_1 + 4x_2 + \lambda x_3 = 0.$$
[8]

2. Diagomalize the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ -4 & 4 & 3 \end{bmatrix}$ and hence find A^4. [16]

3. (a) Identify the nature, index, signature of the quadratic form $2x_1x_2 + 2x_2x_3 + 2x_3x_1$. [10]

   (b) Prove that transpose of a unitary matrix is unitary. [6]

4. (a) Find a Fourier series to represent $x - x^2$ from $x = -\pi \;\; to \;\; x = \pi$. Hence show that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + ...$ [10]

   (b) Find the half range sine series for the function
$$f(x) = \begin{cases} \frac{1}{4} - x, & 0 < x < \frac{1}{2} \\ x - \frac{3}{4}, & \frac{1}{2} < x < 1 \end{cases}$$ [6]

5. (a) Form the partial differential equation by eliminating the arbitrary function $z = f_1(y + 2x) + f_2(y - 3x)$. [5]

   (b) Solve the partial differential equation $p^2x^2 = z(z - qy)$ [6]

   (c) Solve the partial differential equation $z = px + qy + \sqrt{(1 + p^2 + q^2)}$ [5]

6. Two parallel edges and an end at right angles bound an infinitely long plane uniform plate. The width is Π this end is maintained at a temperature u_o at all points and other edges are at zero temperature. Determine the temperature at any point of the plate in the study state. [16]

7. Solve $\frac{\delta u}{\delta t} = \frac{\delta^2 u}{\delta t^2}$ for $x > 0, t > 0$, given that using Fourier transforms.

   (a) u (0, t) = 0 for $t > 0$

   (b) u (x, 0) = $\begin{cases} 1 & for\ 0 < x < 1 \\ 0 & for\ x \geq 1 \end{cases}$ and

   (c) u (x, t) is bounded. [16]

8. (a) Find $Z[C^n cos(an),]n > 0$ [8]

   (b) Find Z^{-1} $\frac{1}{(z-1/2)(z-1/3)}$ if $1/3 < |z| < 1/2$ [8]

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