13BS1003 AR13/SET-2

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)

I B. Tech II Semester Supplementary Examinations, April-2017

ENGINEERING MATHEMATICS-III

(Common to CE, ME, CSE, IT, ECE &EEE)

Time: 3 hours **Max Marks: 70**

PART- A

Answer all questions [10 x 1=10M]

1. a) Define the rank of a matrix with suitable example.

   b) Represent the following system as matrix form
   $4x+2y+z=-3w$; $6x+3y+4z+7z=0$; $2x+w=-y$.

   c) If $A=\begin{bmatrix}1 & 2 & 3\\ 0 & 2 & 5\\ 0 & 0 & 3\end{bmatrix}$ then determine the Eigen values of A^{-1}.

   d) Write the quadratic form corresponding to the symmetric matrix $\begin{bmatrix}1 & 3\\ 3 & -4\end{bmatrix}$.

   e) Test the function for even and odd $f(x)= \begin{cases} x^2 & -\pi\leq x \leq 0 \\ -x^2 & 0\leq x \leq \pi. \end{cases}$

   f) If the Fourier transform of e^{-x^2} is $\sqrt{\pi}e^{-\frac{s^2}{4}}$, then find Fourier transform of e^{-3x^2}.

   g) Find the Z-transform of $\frac{1}{(n+1)!}$.

   h) Find the inverse Z-transform of $z/(z^2-1)$.

   i) Determine $\Gamma(1)$.

   j) Write the relation between beta and gamma functions.

PART-B

Answer one question from each unit **[5 X 12 = 60 M]**

UNIT - I

2. a) Reduce the matrix $\begin{bmatrix}1 & 1 & 2\\ 1 & 2 & 3\\ 0 & -1 & -1\end{bmatrix}$ in to its normal form and hence find its rank. [6M]

   b) Investigate for what values of λ and μ the simultaneous equations [6M]
   $x+ y+ z = 6$; $x+2y+3z = 10$; $x+2y+ \lambda z = \mu$, have
   (i) No solution (ii) a unique solution, (iii) an infinite number of solutions.

(OR)

3. a) Reduce to echelon form and hence find the rank of the matrix A= [6M]

$$\begin{bmatrix} 1 & -1 & -2 & -3 \\ 4 & 1 & 0 & 2 \\ 0 & 3 & 1 & 4 \\ 0 & 1 & 0 & 2 \end{bmatrix}.$$

b) Using the loop current method on a circuit, the following equations are obtained: [6M]

$7i_1-4i_2=12$, $-4i_1+12i_2-6i_3=0$, $-6i_2+14\,i_3=0$, by matrix method, solve for i_1, i_2 and i_3.

UNIT-II

4. a) Determine the characteristic values and characteristic vectors of the matrix [6M]

$$A=\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

b) Verify Cayley-Hamilton theorem and hence find A^4 of the matrix A = [6M]

$$\begin{bmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{bmatrix}.$$

OR)

5. Reduce the quadratic form $2x_1x_2+2x_1x_3-2x_2x_3$ into canonical form by orthogonal transformation. Also identify its nature, rank, signature and index [12M]

UNIT-III

6. a) Obtain the Fourier series for [8M]

$$f(x) = \begin{cases} x & ; \ -1<x \le 0 \\ x+2 & ; \ 0<x \le 1 \end{cases}$$

and hence deduce the sum of the series $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+----$.

b) Solve the integral equation $\int_0^\infty f(x)\sin px\,dx = \begin{cases} 1 & 0<p<1 \\ 2 & 1<p<2 \\ 0 & p>2 \end{cases}$. [4M]

(OR)

7. a) Expand f(x)= 2-x in a half range Fourier sine and cosine series in the interval 0<x<4. [8M]

b) Find the Fourier transform of $f(x) = \begin{cases} 1-|x|; & |x|<1 \\ 0; & |x|>1 \end{cases}$. [4M]

UNIT-IV

8\. a) Using initial value theorem find u_2, from $U(z) = \dfrac{z(z-\cos a\theta)}{z^2 - 2z\cos a\theta + 1}$. [6M]

Where U(z) is the Z-transform of u_n.

b) Find the response of the systems $y_{n+2} - y_{n+1} + 6\,y_n = u_n$ with $y_0 = 0$, $y_1 = 1$ and $u_n = 1$ for n=0, 1, 2, 3, … by Z-transform technique. [6M]

(OR)

9\. a) Using damping rule, find (i) $Z(n\,2^n)$, (ii)$Z(n^2\,4^n)$. [6M]

b) Evaluate inverse Z-transform of $\dfrac{(2z^2+3z)}{(z+2)(z-4)}$ [6M]

UNIT-V

10\. a) Evaluate the following using beta- gamma functions [6M]

$$\int_0^{\pi/2} \sin^{\frac{9}{2}}\vartheta \cos^5\vartheta \; d\vartheta.$$

b) Prove the following (i) $\beta(m, \frac{1}{2}) = 2^{2m-1}\beta(m,m)$ [6M]

$$\text{(ii)}\ \Gamma(m)\Gamma(m+\frac{1}{2}) = \frac{\sqrt{\pi}}{2^{2m-1}}\Gamma(2m).$$

(OR)

11\. a) Prove that $\displaystyle\int_0^1 \frac{x^2}{\sqrt{1-x^4}}dx \times \int_0^1 \frac{dx}{\sqrt{1+x^4}} = \frac{\pi}{4\sqrt{2}}$. [8M]

b) Evaluate $\displaystyle\int_0^\infty x^{11/3} e^{-x^3} dx$. [4M]

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