AR13 **Set-01**

Code: 13BS1003

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)
I B.Tech II Semester Regular / Supplementary Examinations, July 2015
ENGINEERING MATHEMATICS-III
(Common to CE, EEE ME, ECE, CSE & IT)

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

PART-A

Answer all questions **[10x1M=10M]**

1.
a) Define Echelon Form of a Matrix
b) Define rank of a Matrix
c) Give an example for sum of the Eigen values of a matrix is Trace of that Matrix.
d) State Cayley- Hamilton theorem.
e) Write Dirichlet conditions for Fourier series.
f) Write shifting property for Fourier transforms of $f(x)$.
g) State Convolution theorem for Z- Transforms
h) Find $Z(n^2)$
i) Compute $\beta\left(\frac{9}{2},\frac{7}{2}\right)$
j) Define Gamma function.

Part-B

Answer one question from each unit **[5X12=60M]**

Unit-I

2. a) Reduce the following matrix into normal form and hence find its rank

$$A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

b) If the following System has non- Trivial solution, prove that $a+b+c=0$ or $a=b=c$;
if $ax+by+cz=0; bx+cy+az=0; cx+ay+bz=0$ [6M+6M]

(OR)

3. a) Determine the Rank of the Matrix: $\begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 1 \end{bmatrix}$

b) Apply Gauss-Seidel method to solve the equations
$20x+y-2z=17; 3x+20y-z=-18; 2x-3y+20z=25$ [6M+6M]

Unit-II

4. a) Find the Eigen values and Eigen Vectors of the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$

b) Verify Cayley- Hamilton theorem for the Matrix A, and find it's inverse. $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ [6M+6M]

(OR)

5. Reduce the Quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ the Canonical form by an orthogonal reduction and find its Index and Signature. [12M]

Unit-III

6. a) Expand $f(x) = \sqrt{1 - \cos x}$; $0 < x < 2\pi$ in a Fourier series.
   Hence evaluate $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \cdots$
   b) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2; |x| \le 1 \\ 0; |x| > 1 \end{cases}$
   Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cos\frac{x}{2}\, dx$ [6M+6M]

(OR)

7. If $f(x) = |\cos x|$ expand f(x) as a Fourier Series in the interval $(-\pi, \pi)$ [12M]

Unit-IV

8. a) Find $Z[(\cos\theta + i\sin\theta)^n]$.
   b) Using Z-Transform solve $y_{n+2} - 4y_{n+1} + 9y_n = 3^n$ with $y_0 = 0$ and $y_1 = 1$ [6M+6M]

(OR)

9. a) Find the Z- transform of $\sin(\frac{n\pi}{2} + \theta)$
   b) Find the inverse Z-Transform of $f(Z)$ is given by $f(Z) = \frac{z+1}{z^2 - 3z + 2}$ [6M+6M]

Unit-V

10. a) Show that $\beta(m,n) = \frac{\Gamma m \Gamma n}{\Gamma(m+n)}$
    b) Prove that $\Gamma(1/2) = \sqrt{\pi}$ [6M+6M]

(OR)

11. a) Prove that $\beta(m, 1/2) = 2^{2m-1}\beta(m,m)$
    b) Express the following integral $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ in terms of Gamma functions. [6M+6M]