BTS–III–11.19 –1396 Reg. No. | | | | | | | | |

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B.Tech. Degree III Semester Examination November 2019

CE/CS/EC/EE/IT/ME/SE
AS 15-1301 LINEAR ALGEBRA AND TRANSFORM TECHNIQUES
(2015 Scheme)

Time : 3 Hours Maximum Marks : 60

PART A
(Answer ***ALL*** questions)

I. (a) By reducing to Echelon-form find the rank of the matrix
$$\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$$

(b) Prove that every square matrix and its transpose have same eigen values.

(c) Show that the vectors (1,2,3), (3,-2,1), (1,-6,-5) are linearly dependent and find the relation connecting them.

(d) Explain basis and dimension of a vector space with example.

(e) Find the eigen values and eigen vectors of $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.

(f) Express $f(x) = |x|, -\pi < x < \pi$ as a Fourier series.

(g) Explain periodic function with two examples.

(h) Find $L\left[t e^{-t} \cos ht\right]$.

(i) Find $L^{-1}\left[\log \frac{s(s+1)}{s^2+1}\right]$.

(j) Prove that $\beta(m,n) = \beta(n,m)$.

PART B

(4 × 10 = 40)

II. (a) Test for consistency and hence solve
$x - 2y + 3z = 2;\quad 2x - 3z = 3;\quad x + y + z = 0$.

(b) State Cayley-Hamilton and verify it for the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.

OR

III. (a) Diagonalize $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ hence find A^6.

(b) Reduce the quadratic form $2xy + 2yz + 2zx$ into canonical form.

(P.T.O.)

IV. (a) Give an example of a vector space with dimension n. Justify your answer.
(b) Explain inner product space with an example.

OR

V. (a) Apply the Gram-Schmidt orthogonalization process to find an orthogonal basis for the subspace V of R^3 spanned by $V_1=(0,1,2)$ $V_2=(1,1,2)$ $V_3=(1,0,1)$.

(b) Find k so that $u=(1, 2, k, 3)$ *and* $v=(3, k, 7,-5)$ in R^4 are orthogonal.

VI. (a) Obtain the half range sine series of the function $f(x)=kx(x-l)$ *in* $0\le x\le l$.

(b) Using Fourier sine integral for $f(x)=e^{-ax}(a>o)$ show that

$$\int_0^\infty \frac{\lambda \sin\lambda x}{\lambda^2+a^2}d\lambda=\frac{\pi}{2}e^{-ax}.$$

OR

VII. (a) Obtain a Fourier expansion for $\sqrt{1-\cos x}$ in the interval $-\pi<x<\pi$.

(b) Find the Fourier sine transform of $f(x)=\begin{cases} x & in\ 0<x<1 \\ 2-x & in\ 1<x<2 \\ 0 & in\ x>2 \end{cases}$

VIII. (a) State convolution theorem and hence find $L^{-1}\left[\frac{s^2}{\left[s^2+a^2\right]\left[s^2+b^2\right]}\right]$.

(b) Solve (using Laplace transform)
$y''+2y'-3y=\sin t$ given $y=0, y'(0)=0$ when $t=0$.

OR

IX. (a) Prove that $\beta(m,n)=\frac{\lfloor m \rfloor n}{\lfloor (m+n)}$.

(b) Evaluate $\int_0^\infty \frac{e^{-2t}-e^{-3t}}{t}dt$.

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