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B.Tech. Degree III Semester Supplementary Examination April 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)

$(10 \times 2 = 20)$

I. (a) Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$

(b) Explain linear system of equations and when this system has unique solution and no solution.

(c) Explain linearly independent and dependent set of vectors in a vector space with example.

(d) State and prove one property of Eigen value of a square matrix

(e) Determine whether the following set of vectors form a basis in R^3 .

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

(g) Find the Fourier transform of $e^{-a|t|}$

(h) Find Laplace transform of $\frac{1-\cos 2t}{t}$

(i) Apply convolution theorem to evaluate $L^{-1} \frac{s}{(s^2+a^2)^2}$

(j) Find the inverse Laplace transform of $log\left(\frac{s+1}{s-1}\right)$

PART B

$(4 \times 10 = 40)$

II. (a) Define augmented matrix .Check whether the given system of equations is consistent or not.If consistent, solve it

$3x + y + z = 2, x - 3y + 2z = 1, 7x - y + 4z = 5$

(b) Define linear combination of vectors. If possible, write $V = (2, -5, 3)$ in R^3 as a linear combination of the vectors $e_1 = (1, -3, 2), e_2 = (2, -4, -1)$, $e_3 = (1, -5, 7)$

OR

III. (a) State Cayley Hamilton theorem. Using it, find the inverse of

$$\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

(b) Define linear transformation of a mapping T.Let $T: R^3 \to R^3$ defined by $T\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} x+y \\ z \\ x-y \end{bmatrix}$.Find Range of T, kernel of T , rank of T

(P.T.O.)

IV. (a) Find Eigen values and Eigen vectors of $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

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

OR

V. (a) If x, y, z are linearly independent vectors of a vector space V .Prove that $x, x + y, x + y + z$ are also linearly independent.

(b) Find a basis and dimension of $M_{2\times2}$

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

(b) Find Fourier cosine and sine transform of $f(x) = e^{-ax}$

OR

VII. (a) Using Fourier integral show that $\int_0^\infty \frac{\lambda \sin \lambda x}{\lambda^2 + k^2} d\lambda = \frac{\pi}{2} e^{-kx}, x > 0, k > 0$

(b) Expand $f(x) = x$ as a half range sine series in $0 < x < 2$

VIII. (a) Obtain (i) $L\left(\frac{\cos at - \cos bt}{t}\right)$ (ii) $L^{-1}\left(\frac{(s+2)^2}{(s^2+4s+8)^2}\right)$

(b) Solve $y''' + 2y'' - y' - 2y = 0, y(0) = y'(0) = 0, y''(0) = 6$

OR

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

(b) Find the inverse Laplace transform of (i) $\log \frac{s+1}{s-1}$ (ii) $\frac{e^{-2s}}{s-3}$

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