BTS-III(R/S)-01-23-1433 Reg. No [redacted]

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B.Tech. Degree III Semester Regular/Supplementary Examination January 2023

CE/CS/EC/EE/IT/ME/SE 19-200-0301 LINEAR ALGEBRA AND TRANSFORM TECHNIQUES

(2019 *Scheme*)

Time: 3 Hours

Maximum Marks: 60

Course Outcomes

On successful completion of the course, the students will be able to:

CO1: Solve linear system of equations and to determine eigen values and eigen vectors of a matrix.
CO2: Understand the concept of vector space and subspace.
CO3: Determine Fourier series expansion of functions and transform.
CO4: Solve linear differential equation and integral equation using Laplace transform.
Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create
PO – Programme Outcome

PART A

(Answer ***ALL*** questions)

			Marks	BL	CO	PO
		$(8 \times 3 = 24)$				
I.	3 (a)	Find eigen values and eigen vectors of $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.	3	L2, L3	1	1
	(b)	Form quadratic form corresponding to $A = \begin{bmatrix} 5 & -3 \\ -3 & 8 \end{bmatrix}$.	3	L1, L2	1	2
	3 (c)	Find a non zero vector W that is orthogonal to (1, 3, 2) and (1, 2, 3) in $\mathbb{R}^3$.	3	L3	2	2
	(d)	Find the value of λ for which the following set of vectors (λ, 0, 2) (2, 1, 0) (0, 3, 6) form a basis of $\mathbb{R}^3$.	3	L3, L4	2	1
	(e)	Obtain the Fourier series expansion of $f(x)$ if $f(x) = \begin{cases} 1 \text{ for } 0 \le x \le 1 \\ x \text{ for } 1 < x < 2 \end{cases}$ and $f(x+2) = f(x)$.	3	L2, L3	3	2
	(f)	Obtain half range sine series for e^x in $0<x<1$.	3	L2, L3	3	2
	(g)	Find the Laplace transform of $f(t)$ where $f(t) = \begin{cases} \cos t & 0 < t < \pi \\ \sin t & t > \pi \end{cases}$.	3	L3	4	2
	(h)	Find $L^{-1}\left(\dfrac{e^{-2s}}{s-3}\right)$.	3	L4	4	3

PART B

			Marks	BL	CO	PO
		$(4 \times 12 = 48)$				
II.	6 (a)	Find the values of λ and μ for which the equation $x+y+z=3$; $x+2y+2z=6$; $x+\lambda y+3z=\mu$ have (i) no solution (ii) unique solution (iii) more than one solution.	6	L4	1	2
	6 (b)	State Cayley-Hamilton theorem. Using this theorem find inverse of the matrix $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$.	6	L2, L3	1	2

OR

			Marks	BL	CO	PO
III.	(a)	Find the rank of the matrix. $$A=\begin{bmatrix}1&1&2&3\\3&4&7&10\\5&7&11&17\\6&8&13&16\end{bmatrix}$$	6	L2, L3	1	2
	(b)	Diagonalise the matrix $A=\begin{bmatrix}2&1&-1\\1&1&-2\\-1&-2&1\end{bmatrix}$ by means of an orthogonal transformation.	6	L4	1	3
IV.	(a)	Let V consists of all real polynomials of degree ≤ 4 with usual polynomial addition and scalar multiplication. Let W = {polynomials of degree ≤ 4 with coefficient of $x^2 = 0$ }. Then verify W is a subspace or not.	6	L4	2	2
	(b)	$T : \mathrm{R}^3 \to \mathrm{R}^2$ be a transformation defined by $T\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}x+y\\z\end{bmatrix}$. Verify T is a linear transformation or not.	6	L3	2	2
		OR				
V.	(a)	Find the dimension and basis of the vector space V = set of all 2 × 2 matrices.	6	L4	2	2
	(b)	Using Gram Schmidtz orthonormalisation process find an orthogonal and orthonormal basis $V = P_2(x),\ x \in [0,1]\ B = \{1, x, x^2\}$	6	L3	2	2
VI.	(a)	Find the Fourier series to represent the function $$f(x)=\begin{cases}x & \text{for } 0 \leq x \leq \pi\\ 2\pi - x & \text{for } \pi \leq x \leq 2\pi\end{cases}$$ and deduce that $$\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots=\frac{\pi^2}{8}.$$	6	L4, L3	3	2
	(b)	Find the Fourier cosine transform of e^{-x^2}.	6	L4	3	2
		OR				
VII.	(a)	Develop $x\sin x$ in half range cosine series in the range $0 < x < \pi$.	6	L4, L3	3	2
	(b)	Using Fourier integral show that $$\int_0^{\infty}\frac{1-\cos\pi\lambda}{\lambda}\sin x\lambda\, d\lambda=\begin{cases}\frac{\pi}{2} \text{ in } 0 < x < \pi\\ 0 \text{ in } x > \pi\end{cases}$$	6	L4	3	2

(Continued)

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VIII.	(a)	Solve the integral equation $y(t) = 1 + \int_0^t y(u)\sin(t-u)\,du$.	6	L4, L5	4	3
	(b)	State convolution theorem. Find $L^{-1}\frac{1}{(s^2+4)^2}$ using convolution theorem.	6	L1, L3	4	2
		OR				
IX.	(a)	(i) Prove the symmetric property of beta function.	3	L1, L3	4	2
		(ii) Define gamma function and prove that $\Gamma\left(\tfrac{1}{2}\right) = \sqrt{\pi}$.	3	L1, L3	4	2
	(b)	Solve the equation $y''-3y'+2y = 4t + e^{3t}$ when $y(0) = 1$ and $y'(0) = -1$.	6	L4, L5	4	3

Bloom's Taxonomy Levels
L1 = 6%, L2 = 12%, L3 = 38%, L4 = 40%, L5 = 4%.

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