Reg. No.											

Question Paper Code	12902

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Third Semester

Civil Engineering

(Common to Computer and Communication Engineering, Electrical and Electronics Engineering, Electronics and Communication Engineering, Electronics and Instrumentation Engineering & Instrumentation and Control Engineering)

20BSMA301 - LINEAR ALGEBRA, PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

	Question	*Marks*	*K – Level*	*CO*
1.	Define linear combination.	*2*	*K1*	*CO1*
2.	Show that the vectors (1,2,3),(3,-2,1),(1,-6,-5) in R^3 are linearly dependent over R.	*2*	*K2*	*CO1*
3.	State Dimension theorem	*2*	*K1*	*CO2*
4.	Is there a linear transformation $T : R^3 \to R^2$ such that $T(1,0,3)=(1,1)$ and $T(-2,0,-6)=(2,1)$? Justify.	*2*	*K2*	*CO2*
5.	Solve $\left[D^2 - 4DD' + 3D'^2\right]z = 0.$	*2*	*K2*	*CO3*
6.	Form the PDE by eliminating the arbitrary constants a, b from $(x-a)^2 + (y-b)^2 + z^2 = 1.$	*2*	*K1*	*CO3*
7.	Find the Fourier sine transform of $f(x) = \frac{1}{x}$.	*2*	*K2*	*CO4*
8.	Define convolution theorem for Fourier transforms.	*2*	*K1*	*CO4*
9.	Find Z$[n^2]$.	*2*	*K2*	*CO5*
10.	Form the difference equation from the relation $y_n = a + b.3^n$	*2*	*K1*	*CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

		Question	*Marks*	*K – Level*	*CO*
11.	a) i)	Show that $F^n = \{(a_1, a_2, \dots, a_n): a_i \in F\}$ is a vector space over F with respect to addition and scalar multiplication defined component wise.	*10*	*K3*	*CO1*
	ii)	Determine whether the set $W = \{(a_1, a_2): 2a_1 + 3a_2 = 0: a_1, a_2 \in R^2\}$ is subspace or not.	*6*	*K3*	*CO1*
		OR			
	b) i)	Check whether $2x^3 - 2x^2 + 12x - 6$ is a linear combination of $x^3 - 2x^2 - 5x - 3$ and $3x^3 - 5x^2 - 4x - 9$.	*8*	*K3*	*CO1*
	ii)	Test whether the set of vectors $\{(1,-3,-2), (-3,1,3), (-2,-10,2)\}$ in R^3 form a basis of R^3 over R.	*8*	*K3*	*CO1*

12.	a) i) If $T:R^2 \to R^3$ is a linear transformation such that $T(1,1)=(1,0,2)$, $T(2,3)=(1,-4,4)$ (a) Determine T. (b) $T(2,5), T(8,11)$. (c) Rank T. (d)Is T one-to-one or onto?	8	K3	CO2
	ii) Let $V=P(R)$, the vector space of polynomials over R with inner product defined by $\langle f,g\rangle=\int_0^1 f(t)\,g(t)\,dt$, where $f(t)=t+2$, $g(t)=t^2-2t-3$. Find $\|f\|$, $\|f+g\|$ and $\|g\|$.	8	K3	CO2
	OR			
	b) Find an Orthonormal basis of the inner product space $R^3(R)$ with the standard inner product, given the basis $\{(1,0,1),(0,1,1),(1,3,3)\}$ using Gram-Schmidt process. Also find the Fourier coefficients of the vector $(1,1,2)$ relative to the Orthonormal basis.sa	16	K3	CO2
13.	a) i) Solve $(mz-ny)p+(nx-lz)q=ly-mx$.	8	K3	CO3
	ii) Solve $z=px+qy+p^2-q^2$.	8	K3	CO3
	OR			
	b) i) Solve $\left[D^2-D'^2\right]z=e^{x+2y}+\sin(2x-y)$.	8	K3	CO3
	ii) Solve $(x^2-yz)p+(y^2-xz)q=(z^2-xy)$.	8	K3	CO3
14.	a) Find the Fourier transform of the function $f(x)$ defined by $f(x)=\begin{cases}1-x^2 & in\ \lvert x\rvert\le 1\\ 0 & in\ \lvert x\rvert>1\end{cases}$. Hence prove that $$\int_0^{\infty}\frac{sins-scoss}{s^3}cos\left(\frac{s}{2}\right)ds=\frac{3\pi}{16}$$ Also show that $\int_0^{\infty}\left(\frac{xcosx-sinx}{x^3}\right)^2dx=\frac{\pi}{15}$.	16	K3	CO4
	OR			
	b) i) Evaluate $\int_0^{\infty}\frac{x^2}{(x^2+a^2)(x^2+b^2)}dx$ using Fourier Transform.	8	K3	CO4
	ii) Evaluate $\int_0^{\infty}\frac{x^2dx}{\left(x^2+1\right)^2}$ using Parseval's identity.	8	K3	CO4

15. a) i) Find the inverse Z-transform of $\frac{z^2+z}{(z-1)(z^2+1)}$ using partial fraction. 8 K3 CO5

ii) Using Z-transform, solve $y_{n+2}+6y_{n+1}+9y_n=2^n$ given that $y_0=0, y_1=0$ 8 K3 CO5

OR

b) i) Using convolution theorem, find inverse Z-transform of $\frac{8z^2}{(2z-1)(4z-1)}$. 8 K3 CO5

ii) Find the Z transform of $\{\frac{1}{(n+1)!}\}$ and $\{\cos\frac{n\pi}{2}\}$. 8 K3 CO5