Reg. No.															

Question Paper Code	13706

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Third Semester

Civil Engineering

(Common to Electronics and Communication Engineering, Electrical and Electronics 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 (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Let $S = \{(-1,0,1).(2,1,4)\}$. The value of k for which the vector $(3k+2,3,10)$ belongs to the linear span of S is (a) 3 (b) -2 (c) 2 (d) 8	1	K2	CO1
2.	The dimension of set of all polynomials of degree at most 10 over set of real is (a) 10 (b) 13 (c) 12 (d) 11	1	K2	CO1
3.	Let $T: V \to W$ be a linear transformation and T is one-to-one. Then $Ker\ T$ is (a) $\{0\}$ (b) $\{1\}$ (c) V (d) W	1	K1	CO2
4.	If $u = (2,\ 1+i,\ i), v = (2-i,\ 2,\ 1+2i)$, then $\langle u, v\rangle =$ (a) $8-5i$ (b) $8+5i$ (c) $8+3i$ (d) $8-3i$	1	K2	CO2
5.	The partial differential equation of all planes having equal intercepts on *x* and *y* axis is (a) $pq = z$ (b) $pqz = 1$ (c) $q = p$ (d) $p = qz$	1	K2	CO3
6.	What are the Lagrange's multipliers while solving the partial differential equation? $p(3z-4y)+q(4x-2z)=(2y-3x)$ (a) 2,3,4 (b) 1,1,1 (c) 3,4,2 (d) 4,2,3	1	K1	CO3
7.	$F[af(x)+bg(x)]$ = (a) $aF(s)+bG(s)$ (b) $bG(s)+aF(s)$ (c) $aF(s)-bG(s)$ (d) $G(s)-aF(s)$	1	K1	CO4
8.	The Fourier Cosine transform of $f(3x)$ is (a) $\frac{1}{3}F_c\left(\frac{s}{3}\right)$ (b) $F_c\left(\frac{s}{3}\right)$ (c) $-\frac{1}{3}F_c\left(\frac{s}{3}\right)$ (d) - $F_c\left(\frac{s}{3}\right)$	1	K2	CO4
9.	Z-transform of $\left[\frac{1}{n!}\right]$ is (a) $e^{\frac{1}{z}}$ (b) $e^{\frac{-1}{z}}$ (c) $\frac{1}{e^z}$ (d) $\frac{1}{e^{-z}}$	1	K2	CO5
10.	The Z-transform of the function $\{(-2)^k\}$ is (a) $\frac{z}{z+1}$ (b) $\frac{z}{z+k}$ (c) $\frac{z}{z+2}$ (d) $\frac{z}{z-1}$	1	K2	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	State the necessary and sufficient condition for a subset W to be subspace of a vector space V over F.	2	K1	CO1
12.	Check whether the vectors (1,2,3),(2,3,1) in R^3(R) are linearly independent or not.	2	K2	CO1
13.	Define vector space.	2	K1	CO1
14.	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
15.	State Dimension theorem.	2	K1	CO2
16.	Find the norm of (3,-4,0) in R^3(R) with the standard inner product.	2	K2	CO2
17.	Find the complete integral of $\sqrt{p}+\sqrt{q}$ =1.	2	K2	CO3
18.	Solve $(D+D'-1)(D-2D'+3)z=0$.	2	K2	CO3

19.	Define Fourier Transform pair.		2	K1	CO4
20.	State and prove change of scale property on Fourier transforms.		2	K2	CO4
21.	Find $Z[na^n]$.		2	K1	CO5
22.	State convolution theorem on Z-transform.		2	K1	CO5

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	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.	11	K3	CO1
		OR			
	b)	Check whether $2x^3 - 2x^2 + 12x - 6$ is a linear combination of $x^3 - 2x^2 - 5x - 3$ and $3x^3 - 5x^2 - 4x - 9$.	11	K3	CO1
24.	a)	Find an orthonormal basis of the inner product space $R^3(R)$ with standard inner product, given the basis $B = \{(1,1,0),(1,-1,1),(-1,1,2)\}$ using Gram-Schmidt orthogonalization process.	11	K3	CO2
		OR			
	b)	Let $T: R^2 \to R^3$ be defined by $T(x,y) = (x + 3y, 0, 2x - 4y)$. Compute the matrix of the transformation with respect to the standard basis of R^2 and R^3. Find $N(T)$ and $R(T)$.	11	K3	CO2
25.	a)	Solve the following equation $(D^2 + 2DD' + D'^2)z = e^{x-y} + xy$.	11	K3	CO3
		OR			
	b)	Solve the equation $x(y-z)p + y(z-x)q = z(x-y)$.	11	K3	CO3
26.	a)	Find the Fourier transform of $f(x)$ given by $f(x) = \begin{cases} a^2 - x^2; & \lvert x\rvert < a \\ 0; & \lvert x\rvert > a > 0 \end{cases}$. Hence prove that $\int_0^\infty \frac{\sin x - x\cos x}{x^3} dx = \frac{\pi}{4}$.	11	K3	CO4
		OR			
	b)	Apply Fourier transform to find the value of $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$.	11	K3	CO4
27.	a)	Apply convolution theorem to find inverse Z-transform of $\frac{8z^2}{(2z-1)(4z-1)}$.	11	K3	CO5
		OR			
	b)	Solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ given that $u_0 = 0, u_1 = 1$ using the Z transform.	11	K3	CO5
28.	a) (i)	Find the basis for the subspace $W_2 = \{(a_1, a_2, a_3, a_4, a_5) \in F^5 / a_2 = a_3 = a_4 \text{ and } a_1 + a_5 = 0\}$ of F and hence find dimension of W_2.	6	K3	CO1
	(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 $\lVert f\rVert$ and $\lVert g\rVert$.	5	K3	CO2
		OR			
	b) (i)	Determine if the set $\{x^3 + 2x^2, -x^2 + 3x + 1, x^3 - x^2 + 2x - 1\}$ is linearly dependent or linearly independent in $R^3(R)$.	6	K3	CO1
	(ii)	Let $T: R^3 \to R^2$ be defined by $T(x,y,z) = (2x - y, 3z)$. Verify whether T is linear or not. Also find $N(T)$.	5	K3	CO2