Reg. No.												

Question Paper Code	12454

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Third Semester

CIVIL ENGINEERING

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

		Marks, K-Level, CO
1.	Show that the vectors (1,2,3),(3,-2,1),(1,-6,-5) in R^3 are linearly dependent over R.	*2,K2,CO1*
2.	State the necessary and sufficient condition for a subset W to be subspace of a vector space V over F.	*2,K1,CO1*
3.	State Dimension theorem for Linear transformation.	*2,K1,CO2*
4.	Let $x = (2,\ 1+i,\ i)$ and $y = (2-i,\ 2,\ 1+2i)$ be vectors in C^3. Compute $\langle x, y\rangle$.	*2,K2,CO2*
5.	Solve $[D + D' - 1][D - 2D' + 3]z = 0$.	*2,K2,CO3*
6.	Solve $\sqrt{p} + \sqrt{q} = 1$.	*2,K2,CO3*
7.	Define Fourier sine transform pair.	*2,K1,CO4*
8.	If $F(s)$ is the Fourier Transform of $F(x)$, prove that $F\{f(ax)\} = \frac{1}{a}F\left(\frac{s}{a}\right), a \neq 0$.	*2,K2,CO4*
9.	Find the Z-transform of $\frac{1}{n!}$.	*2,K2,CO5*
10.	Form a difference equation from $y_n = A.3^n$.	*2,K2,CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11.	a)	Prove that the set of all $m \times n$ matrices over F denoted by $M_{m\times n}(F)$ is a vector space over F with respect to matrix addition and scalar multiplication.	*16,K3,CO1*

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 $P_3(R)$. 8,K3,CO1

(ii) Determine whether the given vector $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, is in the span of S, where $S = \left\{ \begin{pmatrix} 1 & 0 \\ -1 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 1 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix} \right\}$. 8,K3,CO1

12. a) Find an orthogonal 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. Also find the Fourier coefficients of the vector $(2,1,3)$ relative to orthonormal basis. 16,K3,CO2

OR

b) (i) If $T: R^2 \to R^3$ is a linear transformation such that $T(1,1) = (1,0,2)$, $T(2,3) = (1,-4,4)$ 10,K3,CO2

1. Determine T
2. $T(2\ ,\ 5)$ & $T(8,11)$
3. Rank T
4. Is T one-to-one?

(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 $\langle f,g\rangle$, $\|f\|$ and $\|g\|$. 6,K3,CO2

13. a) (i) Solve $(3z - 4y)p + (4x - 2z)q = 2y - 3x$. 8,K3,CO3

(ii) Form the partial differential equation by eliminating f from $f(x^2 + y^2 + z^2, x + y + z) = 0$. 8,K3,CO3

OR

b) (i) Solve $\left[D^3 - 7DD'^2 - 6D'^3\right] z = \sin(x + 2y) + e^{2x+y}$. 8,K3,CO3

(ii) Solve $z = px + qy + \sqrt{1 + p^2 + q^2}$. 8,K3,CO3

14. a) Find the Fourier transform of $f(x) = \begin{cases} 1 & if\ |x| < a \\ 0 & if\ |x| \geq a \end{cases}$. Hence deduce that $\int_0^\infty \frac{sint}{t} dt = \frac{\pi}{2}$ and $\int_0^\infty \left(\frac{Sin\,t}{t}\right)^2 dt = \frac{\pi}{2}$. 16,K3,CO4

OR

b) (i) Evaluate $\int_0^\infty \frac{x^2 dx}{(x^2+1)^2}$ using Parseval's identity. *8,K3,CO4*

(ii) Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$ using Fourier transforms. *8,K3,CO4*

15. a) (i) Find the inverse Z-transform of $\frac{10z}{z^2-3z+2}$ using partial fraction method. *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 $\frac{z^2}{(z-a)(z-b)}$. *8,K3,CO5*

(ii) Find the Z-transform of $a^n sin\, n\theta$ and $a^n cos\, n\theta$. Hence find Z-transform of $\cos n\theta$ and $\sin n\theta$. *8,K3,CO5*