Reg. No.												

Question Paper Code	11712

B.E./B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Third Semester

Civil Engineering

(Common to ECE, EEE, EIE, ICE & CCE)

20BSMA301 - LINEAR ALGEBRA, PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS

(Regulation 2020)

Duration: 3 Hours Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

Marks, K-Level,CO

1. Show that $x, y \, and \, z$ are vectors in a vector space V such that $x + y = y + z$ then $x = y$. 2,K2,CO1
2. Let $V = R^3, S = \{(1,2,0),(0,-5,-7)\}$ and $V = (2,-5,7) \in V$. Verify whether V is a linear combination of S or not. 2,K2,CO1
3. Show that T is linear when $T : R^2 \to R^2$ is defined by $T(a_1, a_2) = (2a_1 + a_2, a_1)$. 2,K2,CO2
4. If u and v are vectors in an inner product space. Prove that $\|u+v\|^2 + \|u-v\|^2 = 2(\|u\|^2 + \|v\|^2)$. 2,K2,CO2
5. Find the PDE of all planes having equal intercepts on the x and y axis. 2,K1,CO3
6. Form the partial differential equation by eliminating the arbitrary constants 'a' and 'b' from $z = ax + by$. 2,K2,CO3
7. Find Fourier Sine Transform of e^x, $for \, x > 0$ 2,K2,CO4
8. State Parsevel's Identity. 2,K1,CO4
9. Define Z- transform. 2,K1,CO5
10. Find $Z\{na^n\}$. 2,K2,CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) (i) In $R^3(R)$, show that the vectors (1, 4,-2) (-2, 1, 3) and (-4, 11, 5) are linearly dependent and find the relation between them. 8,K3,CO1

(ii) Show that the intersection of two subspaces of a vector space is a subspace 8,K3,CO1

OR

b) (i) Let W_1 and W_2 be subspaces of a vector space V. Prove that V is the direct sum of W_1 and W_2 if and only if each vector in V can be uniquely written as $x_1 + x_2$ where $x_1 \in W_1 \, and \, x_2 \in W_2$. 8,K3,CO1

(ii) Prove that $S = \{(1,2,3),(2,3,1)\}$ *in* $R^3(R)$ is linearly independent over R. 8,K3,CO1

12. a)

(i) Test the matrix $A = \begin{pmatrix} 3 & 1 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{pmatrix}$ for diagonalizability. 8,K2,CO2

(ii) Let V be an inner product space over F. Then for all $u, v \in V$. Show that $|\langle u, v \rangle| \leq \|u\|.\|v\|$. 8,K2,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. 16,K3,CO2

13. a) (i) Form the partial differential equation by eliminating the arbitrary functions f and g in $z = x^2 f(y) + y^2 g(x)$. 8,K3,CO3

(ii) Find the singular solution of $z = px + qy + \sqrt{p^2 + q^2 + 1}$. 8,K3,CO3

OR

b) (i) Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$. 8,K3,CO3

(ii) Solve $(D^2 + 3DD' + 2D'^2)z = \sin(2x + y) + x$. 8,K3,CO3

14. a)

Evaluate $\int_0^\infty \frac{dx}{(x^2 + a^2)(y^2 + b^2)}$ using Fourier cosine transform of e^{ax} and e^{bx}. 16,K3,CO4

OR

b)

Find the Fourier transform of f(x) if $f(x) = \begin{cases} 1 - |x| & for\, |x| > 1 \\ 0 & for\, |x| < 1 \end{cases}$. Hence deduce that $\int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}$. 16,K3,CO4

15. a)

(i) Find $Z^{-1}\left[\frac{8z^2}{(2z-1)(4z-1)}\right]$ using convolution. 8,K3,CO5

(ii) Find $Z[n(n-1)(n-2)]$ 8,K3,CO5

OR

b) Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z-transforms. 16,K3,CO5