

Reg. No.

Question Paper Code

12105

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

- | | <i>Marks,
K-Level, CO</i> |
|---|-------------------------------|
| 1. Define Subspace of a vector space. | 2,K1,CO1 |
| 2. Is $\{(1,4,-6), (1,5,8), (2,1,1), (0,1,0)\}$ is a linearly independent subset of R^3 ? | 2,K2,CO1 |
| 3. Find the norm of $v = (3,4) \in R^2$ with respect to the usual product. | 2,K2,CO2 |
| 4. State the dimension theorem. | 2,K1,CO2 |
| 5. Find the complete integral of $p + q = pq$. | 2,K2,CO3 |
| 6. Solve $(D^2 - 7DD' + 6D'^2)z = 0$. | 2,K2,CO3 |
| 7. State Fourier integral theorem. | 2,K1,CO4 |
| 8. Find the Fourier cosine transform of e^{-2x} . | 2,K2,CO4 |
| 9. Find $Z(3^{n+2})$. | 2,K2,CO5 |
| 10. State Convolution theorem in Z – transforms. | 2,K1,CO5 |

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) Identify whether the set $\{x^3 + 2x^2, -x^2 + 3x + 1, x^3 - x^2 + 2x - 1\}$ in $P_3(R)$ is linearly independent or not. 16,K3,CO1
- OR**
- b) Determine the basis and dimension of the solution space of the linear homogeneous system $x + y - z = 0, -2x - y + 2z = 0, -x + z = 0$. 16,K3,CO1
12. a) Let $T: P_2(R) \rightarrow P_3(R)$ be defined by $T[f(x)] = 2f'(x) + \int_0^x 3f(t)dt$. 16,K3,CO2
Prove that T is linear, find the bases for $N(T)$ and $R(T)$. Compute the nullity and rank of T.

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

12105

OR

- b) Apply the Gram-Schmidt process to the vectors $u_1 = (1, 0, 1)$, $u_2 = (1, 0, -1)$, $u_3 = (0, 3, 4)$ to obtain an orthonormal basis for $R^3(R)$ with standard inner product. 16.K3.CO2

13. a) (i) Form the partial differential equation by eliminating arbitrary function Φ from $\Phi(x^2 + y^2 + z^2, ax + by + cz) = 0$. 8.K3.CO3
(ii) Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$. 8.K3.CO3

OR

- b) (i) Find the singular integral of $z = px + qy + p^2 - q^2$. 8.K3.CO3
(ii) Solve $(D^2 - 3DD' + 2D'^2)$. 8.K3.CO3

14. a) Find the Fourier Transform of the function 16.K3.CO4

$$f(x) = \begin{cases} 1 - |x|, & \text{if } |x| \leq 1 \\ 0, & \text{if } |x| > 1 \end{cases} \quad \text{Hence deduce that } \int_0^{\infty} \left(\frac{\sin t}{t} \right)^2 dt = \frac{\pi}{2} .$$

OR

- b) Using Parseval's Identity evaluate $\int_0^{\infty} \frac{dx}{(x^2 + 25)(x^2 + 9)}$. 16.K3.CO4

15. a) Using convolution theorem find inverse Z transform of $\frac{8z^2}{(2z-1)(4z+1)}$. 16.K3.CO5

OR

- b) Using Z transforms, solve $u_{n+2} - 3u_{n+1} + 2 = 0$ given that $u_0 = 0, u_1 = 1$. 16.K3.CO5