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Question Paper Code	13887
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Third Semester

**Mechanical Engineering**

(Common to Mechanical and Automation Engineering)

**24BSMA304 - TRANSFORMS AND NUMERICAL METHODS**

Regulations - 2024

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

	Marks	K- Level	CO
1. Which of the following is not a sufficient condition for the existence of Laplace transform? (a) a function $f(t)$ should be of exponential order (b) a function $f(t)$ should be of absolutely integrable in $(-\infty, \infty)$ (c) a function $f(t)$ should be piecewise continuous (d) a function $f(t)$ should be continuous	1	K1	CO1
2. If $L[f(t)] = F(s)$ , then the value of $L[f(t)e^{at}]$ is (a) $F(s)$ (b) $F(a)$ (c) $F(s-a)$ (d) $F(s+a)$	1	K2	CO1
3. Inverse Laplace transform of $F[s] = 1/s^2$ is (a) $t$ (b) $t^2$ (c) $1$ (d) $1/t$	1	K2	CO2
4. If $f(t) = t$ and $g(t) = 1$ , then find the value of $f(t)*g(t)$ . (a) $t^2/2$ (b) $(-t^2)/2$ (c) $t/2$ (d) $(-t^2)$	1	K3	CO2
5. To which form is the coefficient matrix is transformed when $AX = B$ is solved by Gauss elimination method? (a) Inverse matrix                      (b) Zero matrix (c) Unit matrix                              (d) Upper triangular matrix	1	K1	CO3
6. In Gauss Jordan method which of the following transformations are allowed? (a) Diagonal transformation                      (b) Column transformation (c) Row transformation                      (d) Square transformation	1	K2	CO3
7. Using Newton's forward formula, the value of $f(5)$ is $x : 4 \quad 6 \quad 8 \quad 10$ $y : 1 \quad 3 \quad 8 \quad 10$ (a) 1.25                              (b) 1.75                              (c) 2.25                              (d) 2.75	1	K2	CO4
8. The 'n+1'th divided difference of a polynomial of degree 'n' is (a) zero                              (b) one                              (c) a constant                      (d) a variable	1	K1	CO4
9. The error involved in Trapezoidal rule is (a) $ E  < \frac{(b-a)}{12} h^2 M$ (b) $ E  > \frac{(b-a)}{12} h^2 M$ (c) $ E  < \frac{(b-a)}{12} hM$ (d) $ E  = \frac{(b-a)}{12} h^2 M$	1	K1	CO5
10. What is the data type of $x = 1.5$ ? (a) int                              (b) float                              (c) str                              (d) complex	1	K2	CO6

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

11. Find $L[e^{-3t} + \cosh 3t + \sin 4t]$ .	2	K2	CO1
12. State change of scale property.	2	K1	CO1
13. Determine $L^{-1} \left[ \frac{s}{s^2+4s+8} \right]$ .	2	K2	CO2
14. State initial value theorem on Laplace transforms.	2	K1	CO2

15. State the order of convergence and condition for convergence of Newton-Raphson method. 2 K1 CO3
16. Find the values of x and y from  $3x + 2y = 4$ ,  $2x - 3y = 7$  by Gauss elimination method. 2 K2 CO3
17. Write a forward difference table for the following data. 2 K2 CO4

X	0	1	2	3
Y	-1	0	3	8

18. Given  $f(2) = 5$ ,  $f(2.5) = 5.5$ . Find the linear interpolating polynomial using Lagrange interpolation. 2 K2 CO4
19. Write the formula for first two derivatives of Newton's method at  $x = x_0$ . 2 K1 CO5
20. Compare Simpson's 1/3 rule with Trapezoidal method. 2 K2 CO5
21. Differentiate between mutable and immutable data type. 2 K2 CO6
22. How can you find velocity from displacement data using NumPy? 2 K2 CO6

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

23. a) (i) Find the Laplace transform of  $t^2 e^{-t} \cos t$ . 6 K3 CO1
- (ii) Find the Laplace transforms of  $\frac{1 - \cos t}{t}$ . 5 K3 CO1

**OR**

- b) Find the Laplace transforms of the periodic function 11 K3 CO1
- $$f(t) = \begin{cases} t & \text{for } 0 < t < a \\ 2a - t & \text{for } a < t < 2a \end{cases} \quad \text{and } f(t + 2a) = f(t).$$

24. a) Using convolution theorem find the inverse Laplace transform of  $\left[ \frac{s}{(s^2 + a^2)(s^2 + b^2)} \right]$ . 11 K3 CO2

**OR**

- b) Use Laplace Transform to solve  $(D^2 - 3D + 2)y = e^{3t}$  with  $y(0) = 1$  and  $y'(0) = 0$ . 11 K3 CO2

25. a) Find an iterative formula to find  $\sqrt{N}$ , where N is a positive number. Hence find  $\sqrt{5}$ . 11 K3 CO3

**OR**

- b) Solve the following system of equation by Gauss- Jacobi method  $27x + 6y - z = 85$ ,  $x + y + 54z = 110$ ,  $6x + 15y + 2z = 72$ . 11 K3 CO3

26. a) From the data given below, find  $\theta$  at  $x = 43$  and at  $x = 84$ . 11 K3 CO4

x	40	50	60	70	80	90
$\theta$	184	204	226	250	276	304

**OR**

- b) Find  $f(x)$  by Newton's divided difference formula for the following data: 11 K3 CO4
- |      |   |   |    |    |   |   |    |
|------|---|---|----|----|---|---|----|
| x    | : | 0 | 1  | 2  | 4 | 5 | 6  |
| f(x) | : | 1 | 14 | 15 | 5 | 6 | 19 |
- Hence find  $f(3)$ .

27. a) Find the first three derivatives of  $f(x)$  at  $x = 1.5$  and  $x = 4.0$  by using Newton's forward and backward interpolation formula to the data given below: 11 K3 CO5

x	1.5	2	2.5	3	3.5	4
y	3.375	7	13.625	24	38.875	59

**OR**

b) Using Simpson's rule, evaluate  $\int_1^2 \int_1^2 \frac{dxdy}{x^2+y^2}$  numerically with  $h = 0.2$  along  $11 \quad K3 \quad CO5$   
x- direction and  $k = 0.25$  along y- direction.

28. a) Explain the features of matplotlib. Write a Python program to plot a line and bar  $11 \quad K4 \quad CO6$   
chart using matplotlib.

**OR**

b) Explain NumPy arrays with examples. Write a program to create a 2 x 3 array and  $11 \quad K4 \quad CO6$   
compute its sum.