Reg. No.															

Question Paper Code	13693

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

First Semester

Computer Science and Engineering

(Common to All Branches)

20BSMA101 - ENGINEERING MATHEMATICS - I

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	For a singular matrix, the product of the eigenvalues is (a) infinite (b) = 0 (c) = 1 (d) = -1	1	K2	CO1
2.	The nature of the quadratic form $3x^2 + 3y^2 + 2z^2 + 2xy$ is (a) Indefinite (b) +ve semi-definite (c) +ve definite (d) –ve definite	1	K1	CO1
3.	The second-order Taylor expansion of f(x,y)) near (a,b) involves: (a) First or second-order partial derivatives (b) Only second-order partial derivative (c) First and second-order partial derivatives (d) Only first-order partial derivatives	1	K1	CO2
4.	A critical point of f(x,y) is a local minimum if: (a) Hessian determinant > 0 and $f_{xx}>0$ (b) Hessian determinant < 0 (c) Hessian determinant = 0 (d) $f_x=f_y=0$ and $f_{xy}>0$	1	K1	CO2
5.	Evaluate: $\int_0^1 x^2 dx$ (a)1/2 (b)1/3 (c)1/4 (d)1/5	1	K2	CO3
6.	Which of the following is correct for integration by parts? (a) ∫udv=uv − ∫v du (b) ∫udv=∫vdu + uv (c) ∫udv=u + ∫dv (d) ∫udv=u/v	1	K1	CO3
7.	The value of $\int_0^1 \int_0^x dxdy$ = (a) $\frac{1}{2}$ (b) $-\frac{1}{2}$ (c) $\frac{y}{2}$ (d) $\frac{y^2}{2}$	1	K2	CO4
8.	By Changing the order of integration of $\int_0^\infty \int_0^y f(x,y)dxdy$ we get (a) $\int_0^x \int_y^\infty f(x,y)dydx$ (b) $\int_0^\infty \int_x^\infty f(x,y)dydx$ (c) $\int_0^\infty \int_0^x f(x,y)dydx$ (d) $\int_0^\infty \int_0^x f(x,y)dydx$	1	K2	CO4
9.	A sequence $\{u_n\}$is said to be convergent if $\lim_{n\to\infty} u_n$ = ___ (a)Finite (b)∞ (c) -∞ (d) cannot be calculated	1	K1	CO5
10.	If $\lim_{n\to\infty} S_n \to$ more than one limit, then $\sum_{n=1}^{\infty} u_n$ is said to be ____ (a) Infinite (b) Finite (c) Constant (d) Non-convergent	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Find the sum and product of all Eigen values of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 2 \\ 1 & 2 & 3 \end{bmatrix}$.	2	K2	CO1
12.	Use Cayley-Hamilton theorem to find A^{-1}, given that $A = \begin{bmatrix} 2 & 1 \\ 1 & -5 \end{bmatrix}$.	2	K2	CO1
13.	Two of the Eigen values of $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ are 3 and 6. Find the Eigen values of A^{-1} & A^2.	2	K2	CO1
14.	Find the Taylor's series expansion of $e^x siny$ at (0,0) up to 2rd degree.	2	K2	CO2
15.	If $x = u(1-v), y = uv$, verify that $\frac{\partial(x,y)}{\partial(r,\theta)} \cdot \frac{\partial(r,\theta)}{\partial(x,y)} = 1$.	2	K2	CO2
16.	Find the stationary points of $f(x,y) = x^2 - xy + y^2 - 2x + y$.	2	K2	CO2
17.	Define surface area of revolution.	2	K1	CO3
18.	Define volume of revolution.	2	K1	CO3
19.	Evaluate: $\int_0^{\pi/2} \int_0^{\sin\theta} r dr d\theta$.	2	K2	CO4
20.	Evaluate: $\int_0^1 \int_0^{\sqrt{1+x^2}} dx dy$.	2	K2	CO4
21.	State the Cauchy's integral test.	2	K1	CO5
22.	Examine the nature of the series $1 + 2 + 3 + 4 \cdots + n \cdots \infty$.	2	K2	CO5

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Reduce the quadratic form $x_1^2 + 3x_2^2 + 3x_3^2 - 2x_3x_2$ to canonical form through an orthogonal transformation. Also find its nature, rank, index and signature.	11	K3	CO1
		OR			
	b)	Verify Cayley Hamilton theorem and find A^4 when $A = \begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.	11	K3	CO1
24.	a)	Find the dimension of a rectangular box, without top, of maximum capacity and surface area 432 square meters.	11	K3	CO2
		OR			
	b)	Examine $f(x,y) = x^3 + y^3 - 3axy$ for maxima and minima.	11	K3	CO2
25.	a)	Evaluate $\int \frac{x^3}{(x-1)(x-2)} dx$.	11	K3	CO3
		OR			
	b)	Find the surface of the solid formed by revolving the cardioid $r = a(1-\sin\theta)$.	11	K3	CO3
26.	a)	Find the volume of the sphere $x^2 + y^2 + z^2 = 1$ using triple integral.	11	K3	CO4
		OR			
	b)	Evaluate by changing the order of integration in $\int_0^1 \int_y^{2-y} xydxdy$.	11	K3	CO4
27.	a)	Test the convergence of the series $\frac{1}{1.2.3} + \frac{3}{2.3.4} + \frac{5}{3.4.5} + \cdots\cdots\infty$.	11	K3	CO5
		OR			

	b)	Find the nature of the series $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^p}$.	*11*	*K3*	*CO5*
28.	a) (i)	Using double integration, find the area of the circle.	*6*	*K3*	*CO4*
	(ii)	Find the Taylor's series representation of $f(x) = \log(1 + x)$ about $x = 0$.	*5*	*K3*	*CO5*
		OR			
	b) (i)	Using double integral, find the area of the ellipse.	*6*	*K3*	*CO4*
	(ii)	Express $f(x) = x$ in half range sine series of periodicity 2 in the range $0 < x < 1$.	*5*	*K3*	*CO5*