Reg. No.												

Question Paper Code	11750

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022 (MARCH 2023)

First Semester

Artificial Intelligence and Data Science

(Common to all branches except Computer Science and Business Systems)

20BSMA101 - ENGINEERING MATHEMATICS - I

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	If 1 and 2 are the eigenvalues of a 2×2 matrix A, what are the eigenvalues of A^2 and A^{-1}?	2,K3,CO1
2.	State Cayley- Hamilton theorem.	2,K1,CO1
3.	If $x = r\cos\theta, y = r\sin\theta$, then find $\frac{\partial(x,y)}{\partial(r,\theta)}$.	2,K3,CO2
4.	State the conditions for the function $f(x,y)$ to be an extremum.	2,K1,CO2
5.	Evaluate $\int_0^{\frac{\pi}{2}} cos^5 x\, dx$.	2,K3,CO3
6.	Evaluate $\int e^x sinx\, dx$.	2,K3,CO3
7.	Evaluate $\int_2^3\int_1^2 \frac{1}{xy} dxdy$.	2,K3,CO4
8.	Evaluate $\int_0^{\pi}\int_0^{\sin\theta} r dr d\theta$.	2,K3,CO4
9.	State Dirichlet's conditions for a given function to be expanded in Fourier series.	2,K1,CO5
10.	Find the value of b_n in the Fourier series corresponding to $f(x) = \cos x$ in $(-\pi,\pi)$.	2,K3,CO5

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a)

(i) Find the eigenvalues and eigenvectors of $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$. 8,K3,CO1

(ii) Verify Cayley Hamiltonian theorem for the matrix $A = \begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. 8,K3,CO1

OR

b) Reduce the quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4xz$ into a canonical form by an orthogonal reduction. Hence find its rank, index, signature and nature. 16,K3,CO1

12. a) (i) If $u = x + y + z, uv = y + z, uvw = z$, then prove that $\frac{\partial(x,y,z)}{\partial(u,v,w)} = u^2 v$. 8,K3,CO2

(ii) A rectangular box, open at the top, is to have a volume of 32cc. Find the dimensions of the box which requires least amount of material for its construction. 8,K3,CO2

OR

b) (i) Expand $e^x \cos y$ in powers of x and y upto third degree term using Taylor's series method. 8,K3,CO2

(ii) Examine $f(x, y) = x^3 + y^3 - 12x - 3y + 20$ for its extreme values. 8,K3,CO2

13. a) (i) Evaluate $\int e^{ax} \cos bx\, dx$ using integration by parts. 8,K3,CO3

(ii) Evaluate using partial fraction method $\int \frac{10dx}{(x-1)(x^2+9)}$. 8,K3,CO3

OR

b) Prove that the reduction formula for $I_n = \int \sin^n x\, dx$ is $I_n = -\frac{1}{n}\sin^{n-1} x \cos x + \frac{n-1}{n} I_{n-2}$. Hence find $\int_0^{\frac{\pi}{2}} \sin^n x\, dx$. 16,K3,CO3

14. a) (i) Using double integral, find the area bounded by $y = x, y = x^2$. 6,K3,CO4

(ii) Change the order of Integration in the integral $\int_0^1 \int_{x^2}^{2-x} xy\,dx\,dy$ and hence evaluate it. 10,K3,CO4

OR

b) (i) Evaluate by changing to polar coordinates $\int_0^a \int_y^a \frac{x}{x^2 + y^2}\, dx\,dy$. 8,K3,CO4

(ii) Find the volume of the tetrahedron bounded by the coordinate planes and $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. 8,K3,CO4

15. a) (i) Find the Fourier series for $f(x)=x^2$ in $(-\pi,\pi)$. 8,K3,CO5

(ii) Find the radius of convergence and interval convergence of the series $\sum_{n=1}^{\infty}\frac{n!}{n^n}x^n$. 8,K3,CO5

OR

b) Find the half range cosine series for $f(x)=x(\pi-x)$ in $(0,\pi)$. Hence deduce that $\frac{1}{1^4}+\frac{1}{2^4}+\frac{1}{3^4}+\ldots=\frac{\pi^4}{90}$. 16,K3,CO5