

PSG COLLEGE OF ARTS & SCIENCE  
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024  
(First Semester)

Branch - STATISTICS

MATHEMATICS - I FOR STATISTICS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	If $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 3 & 1 \\ -1 & 1 & 4 \end{bmatrix}$ then the transpose of $A$ (i.e) $A^T =$ _____. a) $\begin{bmatrix} 2 & 1 & -1 \\ 3 & 2 & 1 \\ 1 & -1 & 4 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 2 & -1 \\ 2 & 3 & 1 \\ -1 & 1 & 4 \end{bmatrix}$ c) $\begin{bmatrix} -1 & 1 & 2 \\ 1 & 2 & 3 \\ 4 & -1 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & -1 \\ -1 & 1 & 4 \end{bmatrix}$	K1	CO1
	2	If $A = \begin{pmatrix} 1+i & 1 \\ 2 & 3+i \end{pmatrix}$ then $\bar{A} =$ _____. a) $\begin{pmatrix} 1-i & 1 \\ 2 & 3-i \end{pmatrix}$ b) $\begin{pmatrix} 1-i & 2 \\ 1 & 3-i \end{pmatrix}$ c) $\begin{pmatrix} 1+i & 1 \\ 2 & 3-i \end{pmatrix}$ d) $\begin{pmatrix} 1-i & 1 \\ 2 & 3+i \end{pmatrix}$	K2	CO2
2	3	If $\alpha$ and $\beta$ are the roots of $2x^2 + 3x + 5 = 0$ , then the value of $\alpha + \beta$ is _____. a) $\frac{3}{2}$ b) $\frac{2}{3}$ c) $-\frac{1}{2}$ d) $-\frac{3}{2}$	K1	CO1
	4	The equation after multiplying the roots of $x^3 - 3x + 1 = 0$ by 10 is _____. a) $x^3 - 30x + 100 = 0$ b) $x^3 - 300x + 1000 = 0$ c) $x^3 + 300x - 1000 = 0$ d) $x^3 + 30x - 100 = 0$	K2	CO2
3	5	If $x = a(\cos \theta + \theta \sin \theta)$ then $\frac{dx}{d\theta} =$ _____. a) $a\theta \cos \theta$ b) $a \cos \theta$ c) $\theta \cos \theta$ d) $-a\theta \cos \theta$	K1	CO1
	6	If $u = x^3y^4$ where $x = t^3$ and $y = t^2$ then $\frac{du}{dt} =$ _____. a) $17t^{16}$ b) $t^{16}$ c) $5t^{16}$ d) $2t^{16}$	K2	CO2
4	7	The value $\rho$ for the intrinsic equation $s = a \tan \psi$ is _____. a) $a \sec \psi$ b) $a \sec^2 \psi$ c) $\tan \psi$ d) $-\sec^2 \psi$	K1	CO1
	8	The locus of the centre of curvature for a curve is called its _____. a) chord      b) radius      c) evolute      d) origin	K2	CO2
5	9	$\int (2x+1)^3 dx =$ _____. a) $\frac{2x+1}{8}$ b) $\frac{(2x+1)^2}{8}$ c) $\frac{(2x+1)^{-4}}{8}$ d) $\frac{(2x+1)^4}{8}$	K1	CO1
	10	The value of $\int xe^x dx$ is _____. a) $e^x(x-1)$ b) $e^x(x+1)$ c) $e^{-x}(x-1)$ d) $e^{-x}(x+1)$	K2	CO2

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**SECTION - B (35 Marks)**

Answer ALL questions

ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	If $A = \begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & 1 \\ 1 & -1 & 0 \end{bmatrix}$ , find $A + A'$ and $A - A'$ .	K2	CO3
	11.b.	(OR) Find the rank of the matrix $\begin{pmatrix} 2 & 1 & 2 & 1 \\ 6 & -6 & 6 & 12 \\ 4 & 3 & 3 & -3 \\ 2 & 2 & -1 & 1 \end{pmatrix}$ .		
2	12.a.	Solve the equation $32x^3 - 48x^2 + 22x - 3 = 0$ whose roots are in arithmetic progression.	K2	CO4
	12.b.	(OR) Diminish the roots of $2x^5 - x^3 + 10x - 8 = 0$ by 5 and find the transformed equation.		
3	13.a.	If $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$ , show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \tan u$ .	K2	CO3
	13.b.	(OR) Find $D^n \left[ \frac{1}{(x+1)(x+3)} \right]$ .		
4	14.a.	Prove that the radius of curvature at any point of the cycloid $x = a(\theta + \sin \theta)$ , $y = a(1 - \cos \theta)$ is $4a \cos \frac{\theta}{2}$ .	K2	CO4
	14.b.	(OR) Prove that at the point $x = \frac{\pi}{2}$ of the curve $y = 4 \sin x - \sin 2x$ , $\rho = \frac{5\sqrt{5}}{4}$ .		
5	15.a.	Evaluate $\int \cos x \cos 2x \cos 3x dx$ .	K2	CO3
	15.b.	(OR) Evaluate $\int \frac{3x+4}{(x-7)(2x+3)} dx$ .		

**SECTION - C (30 Marks)**

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Find the eigen values and eigen vectors of the matrix $A = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$ .	K3	CO5
2	17	Solve $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$ .	K3	CO5
3	18	If $u = \frac{1}{r}$ where $r^2 = (x-a)^2 + (y-b)^2 + (z-c)^2$ , prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$ .	K3	CO5
4	19	Find the equation of the evolute of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ .	K3	CO5
5	20	Evaluate $\int \sin^6 x dx$ .	K3	CO5