PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2023
(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 is a skew-symmetric matrix then _____ a. $A' = -A$ b. $A' = A$ c. $A' \neq -A$ d. $A' \neq A$	K1	CO1
	2	Infer that a square matrix A which satisfies the relation _____ is called nilpotent. a. $A^2 = A$ b. $A^n = A$ c. $A^n = 0$ d. $A^2 = I$	K2	CO1
2	3	If α *and* β *are the roots of* $2x^2 + 3x + 5 = 0$, *what are the values of* $\alpha + \beta, \alpha\beta$? a. $\frac{5}{2}, -\frac{3}{2}$ b. $-\frac{3}{2}, \frac{5}{2}$ c. $-\frac{5}{2}, \frac{3}{2}$ d. $-\frac{5}{2}, -\frac{3}{2}$	K1	CO2
	4	Transformation of the equation $3x^3 + 4x^2 + 5x - 6 = 0$ in which the coefficient of x^3 is unity is a.$3x^3 + 4x^2 + 5x - 6 = 0$ b.$x^3 + 4x^2 + 15x - 54 = 0$ c.$x^3 + 3x^2 + 15x - 6 = 0$ d.$3x^3 + 4x^2 - 5x - 54 = 0$	K2	CO2
3	5	If $y = \frac{x+1}{x+2}$ then find the value of $\frac{dy}{dx}$ a. $\frac{1}{(x+2)^2}$ b. $\frac{(x+1)}{(x+2)^2}$ c. $\frac{1}{(x+2)^3}$ d. $\frac{(x+1)^2}{(x+2)^3}$	K1	CO3
	6	Relate $D^n[\cos(2-5x)]$ with the correct choice. a. $5^n cos(2 - 5x + \frac{n\pi}{2})$ b. $(-5)^n cos(2 - 5x + \frac{n\pi}{2})$ c. $5^n cos(2 - 5x + n\pi)$ d. $(-5)^n cos(2 - 5x + n\pi)$	K2	CO3
4	7	Tell the name of the locus of the centre of curvature for a curve a. Radius of curvature b. Chord of curvature c. Evolute d. Chord	K1	CO4
	8	Relate the relation between s *and* ψ for any curve with correct choice. a. Parametric equation b. Cartesian equation c. Intrinsic equation d. Characteristic equation	K2	CO4
5	9	Find the value of $\int tan^2 x \, dx$ a. $sec\ x$ b. $sec\ x - x$ c. $tan\ x - x$ d. $sec^2 x$	K1	CO5
	10	If $f(x)$ is an even function then, infer that $\int_{-a}^{a} f(x)\,dx =$ _____ a. $2\int_{-a}^{a} f(x)\,dx$ b. $\int_{-a}^{a} f(a-x)\,dx$ c. $2\int_{0}^{a} f(x)\,dx$ d. $\int_{0}^{a} f(x)\,dx$	K2	CO5

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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.	Show that the matrix $\frac{1}{3}\begin{bmatrix} 2 & 2 & 1 \\ -2 & 1 & 2 \\ 1 & -2 & 2 \end{bmatrix}$ is orthogonal.	K2	CO1
		(OR)		
	11.b.	If $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$, then find the eigenvalues of $3A^3 + 5A^2 - 6A + 2I$.		
2	12.a.	Solve the equation $3x^3 - 26x^2 + 52x - 24 = 0$ whose roots are in G.P.	K3	CO2
		(OR)		
	12.b.	Solve $4x^4 - 20x^3 + 33x^2 - 20x + 4 = 0$.		
3	13.a.	Find n^{th} derivative of $\frac{x-2}{(x+2)(x-1)^2}$.	K4	CO3
		(OR)		
	13.b.	Find $\frac{du}{dx}$ if $u = tan^{-1}\left(\frac{x}{y}\right)$ where $x^2 + y^2 = a^2$.		
4	14.a.	Find the radius of curvature for the curve $\sqrt{x} + \sqrt{y} = 1$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$	K3	CO4
		(OR)		
	14.b.	Find the centre of curvature of the curve $y = 3x^3 + 2x^2 - 3$ at $(0, -3)$.		
5	15.a.	Evaluate $\int \sqrt{x^2 + a^2}\, dx$.	K4	CO5
		(OR)		
	15.b.	Evaluate $\int \sqrt{\frac{x-1}{2x+3}}\, dx$.		

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	Examine the validity of Cayley-Hamilton theorem and hence find the inverse for $\begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$.	K4	CO1
2	17	*If* α, β, γ *are the roots of* $x^3 - px^2 + qx - r = 0$, *find the values of* (i) $\sum \frac{\beta^2 + \gamma^2}{\beta\gamma}$ (ii) $\sum(\beta - \gamma)^2$ (iii) $\sum(\beta^2 + \beta\gamma + \gamma^2)$.	K4	CO2
3	18	For $u = tan^{-1}\frac{y}{x} + sin^{-1}\frac{x}{y}$, *conclude that* $xu_x + yu_y = 0$.	K4	CO3
4	19	Find the evolute of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$.	K4	CO4
5	20	Examine the value of $\int_0^{\frac{\pi}{2}} log(sin\, x)\, dx$.	K4	CO5

Z-Z-Z END