22STU103N/22STU103

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 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	A square matrix is called ________ if its determinant is zero. a. null matrix b. singular matrix c.non-singular matrix d.symmetric matrix	K1	CO1
	2	If 2 and 8 are the eigenvalues of $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ then the third eigenvalue is a. 3 b. 2 c. 4 d. 1	K2	CO1
2	3	If α, β, γ are the roots of $2x^3 + 3x^2 + 5x + 6 = 0$, then the value of $\alpha\beta$ and $\alpha\beta\gamma$ *are* a. $\frac{5}{2}, -3$ b. $-3, \frac{5}{2}$ c. $-\frac{3}{2}, 3$ d. $\frac{3}{2}, 5$	K1	CO2
	4	The root of the reciprocal equation of odd degree with like signs for its coefficients is a. 1 b. 2 c. -1 d. -2	K2	CO2
3	5	The n^{th} derivative of e^{ax} is a. ae^{ax} b. $a^{n-1}e^{ax}$ c. $a^n e^{ax}$ d. e^{ax}	K1	CO3
	6	A function $f(x,y)$ is said to be a homogeneous function in x and y of degree 'n' if a. $t^n f(x,y)$ b. $t^{n-1} f(x,y)$ c. $nf(x,y)$ d. $t^{n+1} f(x,y)$	K2	CO3
4	7	The radius of curvature formula is useful when the tangent is _______ to the Y-axis. a. Perpenticular b. parallel c.equal d. unequal	K1	CO4
	8	The relation between s *and* ψ for any curve is called the _____ of the curve. a. Parametric equation b.Cartesian equation c.Intrinsic equation d.Characteristic equation	K2	CO4
5	9	The value of $\int (2x+1)^3 \, dx$ is a. $\frac{(2x+1)^4}{4}$ b. $\frac{(2x+1)^4}{2}$ c. $\frac{(2x+1)^4}{8}$ d. $\frac{(2x+1)^4}{3}$	K1	CO5
	10	The value of $\int_0^{\pi} cos^3 x \, dx =$ _____ a. -1 b. 1 c. 0 d. π	K2	CO5

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.	Find the rank of the matrix $\begin{bmatrix} 4 & -5 & 1 & 2 \\ 3 & 1 & -2 & 9 \\ 1 & 4 & 1 & 5 \end{bmatrix}$	K2	CO1
		(OR)		
	11.b.	Find the eigenvalues and eigenvectors of $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.		

Cont...

2	12.a.	Solve $2x^3 - x^2 - 22x - 24 = 0$, two of the roots being in the ratio 3:4.	K3	CO2
		(OR)		
	12.b.	Solve $x^5 + 4x^4 + x^3 + x^2 + 4x + 1 = 0$.		
3	13.a.	If $y = cos(mcos^{-1}x)$, show that $(1 - x^2)y_{n-2} - (2n + 1)xy_{n+1} + (m^2 - n^2)y_n = 0$.	K4	CO3
		(OR)		
	13.b.	Verify Euler's theorem for the function (i) $u = x^2 + y^2 + 2xy$, (ii) $u = x^3 + y^3 + z^3 + 3xyz$.		
4	14.a.	Find the radius of curvature of the curve $xy^2 = a^3 - x^3$ at $(a, 0)$.	K3	CO4
		(OR)		
	14.b.	Find the equation of the evolute of the parabola $y^2 = 4ax$.		
5	15.a.	Evaluate $\int \frac{3x+1}{2x^2-x+5} dx$.	K4	CO5
		(OR)		
	15.b.	If $I_n = \int_0^{\frac{\pi}{4}} tan^n x \, dx$ where n is a positive integer, show that $I_n = \frac{1}{n-1} - I_{n-2}$ and hence evaluate $\int_0^{\frac{\pi}{4}} tan^6 x \, dx$.		

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	Verify Cayley-Hamilton Theorem and hence find A^{-1} and $A^4, A = \begin{bmatrix} 3 & 1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$.	K4	CO1
2	17	If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$, form the equation whose roots are (i) $\alpha + \beta, \beta + \gamma, \gamma + \alpha$ (ii) $\frac{1}{\alpha^2}, \frac{1}{\beta^2}, \frac{1}{\gamma^2}$ (iii) $\frac{\alpha}{\beta+\gamma}, \frac{\beta}{\gamma+\alpha}, \frac{\gamma}{\alpha+\beta}$.	K4	CO2
3	18	If $u = \frac{1}{r}$ where $r^2 = (x - a)^2 + (y - b)^2 + (z - c)^2$, prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$	K4	CO3
4	19	Show that the evolute of the cycloid $x = a(\theta - sin\theta)$; $y = a(1 - cos\theta)$ is another equal cycloid.	K4	CO4
5	20	Evaluate $\int_0^1 \frac{log\,(1+x)}{1+x^2} dx$.	K4	CO5

Z-Z-Z END