

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BSc DEGREE EXAMINATION DECEMBER 2024
(Second Semester)
Branch - STATISTICS
PROBABILITY THEORY

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 the exhaustive number of outcomes of the random experiment is infinite, then we can't apply ----- a) classical probability b) empirical probability c) axiomatic probability d) subjective probability	K1	CO1
	2	The total number of conditions for mutual independence of $A_1, A_2, \dots, A_n$ is a) $2^n + n - 1$ b) $2^n - n - 1$ c) $2^n - n + 1$ d) $2^n + n + 1$	K1	CO1
2	3	Let X be a continuous random variable and c is any fixed value then a) $P(X=c) < 1$ b) $P(X=c) = 1$ c) $P(X=c) = 0$ d) $P(X=c) > 0$	K3	CO2
	4	The condition for two random variables X and Y are independent is a) $E(X/Y) = E(X)/E(Y)$ b) $E(X+Y) = E(X) + E(Y)$ c) $E(X-Y) = E(X) - E(Y)$ d) $E(XY) = E(X)E(Y)$	K1	CO1
3	5	Let $F(x,y)$ be the joint distribution of x and y. The marginal distribution of x can be obtained by taking the limit a) $x \rightarrow -\infty$ and $y \rightarrow \infty$ b) $x \rightarrow \infty$ c) $y \rightarrow \infty$ d) $x \rightarrow \infty$ and $y \rightarrow -\infty$	K4	CO2
	6	If the joint p.d.f of X and Y is $f(x,y) = 3 - x - y$; $0 < x < 1$, $0 < y < 1$ then the marginal distribution of y is a) $f(y) = 2.5 - y$ b) $f(y) = y - 2.5$ c) $f(y) = 3 - y$ d) $f(y) = 3$	K5	CO2
4	7	If $M_X(t)$ be moment generating function of the random variable X and c is any constant, then $M_{cX}(t) =$ a) $M_X(ct)$ b) $M_c(Xt)$ c) $M_t(xc)$ d) none	K1	CO4

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	8	For the existence of WLLN, the necessary condition is a) $E(X_i)$ exists for all i b) $V(X_1+X_2+\dots+X_n)$ exists c) $V(X_1+X_2+\dots+X_n)/n^2$ tends to zero d) none of the above	K2	CO4
5	9	If $F(x)$ be the cumulative distribution function of a continuous random variable X , then the cumulative distribution of $Y = X+a$ is a) $F(y-a)$ b) $F(x-a)$ c) $F(y+a)$ d) $F(x+a)$	K3	CO2
	10	If $V(X) = 1$, then $V(2x \pm 3)$ is a) 13 b) 5 c) 4 d) 1	K3	CO2

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.	Write a short note on: (i) Statistical Probability (ii) Axiomatic Probability	K3	CO1
		(OR)		
	11.b.	State and prove Baye's theorem.		
2	12.a.	A continuous random variable X has the pdf $f(x) = 3x^2$, $0 < x < 1$ Find a and b such that (i) $P(X \leq a) = P(X > a)$ (ii) $P(X > b) = 0.5$	K4	CO2
		(OR)		
	12.b.	Define Expectation of a random variable. State any five of its properties.		
3	13.a.	Define bi-variate distribution function. State its properties.	K5	CO3
		(OR)		
	13.b.	Let X and Y be jointly distributed with pdf: $f(x,y) = \begin{cases} \frac{1}{4}(1+xy) & ; x < 1, y < 1 \\ 0 & \text{otherwise} \end{cases}$ Show that X^2 and Y^2 are independent		
4	14.a.	Define MGF. State its properties.	K3	CO4
		(OR)		
	14.b.	State and prove weak law of large numbers.		
5	15.a.	Let X follow uniform over $(0,1)$. Find the distribution of $Y = 2X+4$.	K5	CO5
		(OR)		
	15.b.	Define conditional expectation. Show that $E[E(X/Y)] = E(X)$		

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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	In a bolt factory, machine M_1 , M_2 , and M_3 manufacture respectively 25, 35, and 40 percent of the total output. Of these output 5, 4 and 2 percent respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured in the machine M_3 ?	K5	CO1
2	17	The diameter, say X of an electric cable, is assumed to be a continuous random variable with p.d.f : $f(x) = 6x(1-x)$; $0 \leq x \leq 1$ (i) Check the above is a p.d.f ? (ii) Obtain an expression for the c.d.f of X (iii) Determine the number k such that $P(X < k) = P(X > k)$	K5	CO2
3	18	A two dimensional random variable (X, Y) have a bivariate distribution given by : $P(X=x, Y=y) = \frac{y+x^2}{32}$, for $x=0,1,2,3$ and $y=0,1$ Find the marginal distributions of X and Y .	K5	CO3
4	19	State and prove Chebychev's inequality.	K3	CO5
5	20	Let $f(x,y) = 8xy$; $0 < x < y < 1$ 0 otherwise Find (i) $E(Y/X=x)$ (ii) $Var(Y/X=x)$	K5	CO4

Z-Z-Z

END