

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2023
(First Semester)

Branch - STATISTICS

ADVANCED 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	For any two events A and B, $P(A-B)$ is equal to a) $P(A)-P(B)$ b) $P(B)-P(A)$ c) $P(B)-P(AB)$ d) $P(A)-P(AB)$	K1	CO1
	2	A probability distribution satisfies the conditions are a) $f(x) \geq 0$ and $\sum f(x)=1$ b) $f(x) < 0$ and $\sum f(x)=1$ c) $f(x)=0$ and $\sum f(x)=1$ d) $f(x) \geq 0$ and $\sum f(x) < 1$	K2	CO1
2	3	By uniqueness property the correlation between T_1 and T_2 is a) not linear b) linear c) unity d) not unity	K1	CO2
	4	Check about nature of continuity of $f(x) = x/(x+1)$ in $[0,2]$? a) Not continuous b) continuous but uniformly continuous c) not uniformly continuous d) uniformly continuous	K2	CO2
3	5	The word 'stochastic' is derived from a) Greek b) Latin c) Rome d) German	K1	CO3
	6	Borel- cantelli lemma is also known as a) zero – two law b) zero – one law c) one – zero law d) converse	K2	CO3
4	7	Convergence in the r^{th} mean is a) $r \geq 1$ b) $r < 1$ c) $r > 1$ d) $r = 1$	K1	CO4
	8	X_n convergence to X almost surely, $X_n \rightarrow X$, if there is a set $B \subset \Omega$ such that $P(B) =$ a) -1 b) ∞ c) 1 d) 0	K2	CO4
5	9	The differential form of Kolmogorov equation is known a) Differential equation b) State equation c) Chain equation d) Master equation	K1	CO5
	10	The one step transition probabilities are denoted by a) $P_{jk}^{(1)}$ b) $P_{jk}^{(m)}$ c) $P_{ij}^{(1)}$ d) $P_{ij}^{(n)}$	K2	CO5

Cont...

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 X and Y are independent random variables, then $E(X + Y) = E(X) + E(Y)$	K1	CO1
		(OR)		
	11.b.	Write a short note on chebychev's inequality.		
2	12.a.	If the distribution function of a random variable X is symmetrical about zero, i.e., $1 - F(x) = F(-x) \rightarrow f(-x) = f(x)$, then $\phi_X(t)$ is real valued and even function of t.	K2	CO2
		(OR)		
	12.b.	Explain uniqueness theorem with an example.		
3	13.a.	What is the probability that in a sequence of bernoulli trails with probability of success p for each trail, the pattern SFS appears infinitely often?	K1	CO3
		(OR)		
	13.b.	Explain the Borel function theorem.		
4	14.a.	Explain the Relation between different modes of convergence .	K2	CO4
		(OR)		
	14.b.	Explain the properties of convergence in r^{th} mean.		
5	15.a.	Derive the Weak law of large numbers.	K2	CO5
		(OR)		
	15.b.	Derive the Laplace distribution.		

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	Derive the conditional expectation and conditional variance.	K1	CO1
2	17	State and prove Lindeberg-Levy theorem.	K2	CO2
3	18	State and prove Borel - cantelli Lemma (0-1 law).	K1	CO3
4	19	Derive the Helly Bray lemma.	K2	CO4
5	20	i) Define Central limit theorem and it's Application ii) Define De-Moivre's Laplace theorem	K1	CO5

Z-Z-Z END