Reg. No. : ....

Name : ....

**II Semester B.Sc. Degree (CBCSS – O.B.E. – Regular/Supplementary/
Improvement) Examination, April 2022**
(2019 Admission Onwards)
CORE COURSE IN STATISTICS
2B02STA : Probability Theory and Mathematical Expectation

Time : 3 Hours   Max. Marks : 48

Instruction : Use of calculators and statistical tables are **permitted**.

PART – A
(Short Answer)

Answer **all 6** questions.   (6×1=6)

1. Define random experiment.

2. Give the frequency definition of probability.

3. Define probability mass function and state its properties.

4. Define independence of two random variables.

5. State the addition theorem on expectation.

6. Define correlation between two random variables.

PART – B
(Short Essay)

Answer **any 7** questions.   (7×2=14)

7. Give the axiomatic definition of probability.

8. Distinguish between simple event and compound event with suitable examples.

9. Explain conditional probability. If A, B, C are any three events, express P(ABC) in terms of conditional probabilities.

P.T.O.

10. A random variable X has pdf $f(x) = \dfrac{1}{\pi(1+x^2)}$, $-\infty < x < \infty$. Obtain its distribution function.

11. The joint pdf of (X, Y) is $f(x, y) = kxy$, $0 < x < 4$, $1 < y < 5$. Find the value of the constant k and compute $P(X \geq 3, Y \leq 2)$.

12. Write a short note on moment measures of kurtosis of a random variable.

13. Define conditional expectation and state its properties.

14. Define characteristic function of a random variable and state its properties.

15. Define cumulant generating function. How will you obtain the mean and variance of a random variable from it ?

PART – C
(Essay)

Answer **any 4** questions.   (4×4=16)

16. State and prove the addition theorem in probability for any two events.

17. Show that pair wise independence need not imply mutual independence.

18. The probability mass function of a random variable X is $f(x) = \dfrac{c}{3^x}$, $x = 1, 2, 3 \ldots$ Determine c and obtain its distribution function.

19. The pdf of a random variable X is given by $f(x) = \dfrac{x^2}{81}$, $-3 < x < 6$, Find the pdf of $Y = \dfrac{1}{3}(12 - X)$.

20. Establish the relation between raw moments and central moments of a random variable.

21. Find the moment generating function of the random variable having PDF $f(x) = 2e^{-2x}$, $x > 0$. Hence find the mean and variance.

PART – D
(Long Essay)

Answer **any 2** questions.   (2×6=12)

22. State and prove Baye's theorem.

23. Let (X, Y) be a pair of random variables having joint pmf

Y \ X	1	2	3
1	$\dfrac{5}{27}$	$\dfrac{4}{27}$	$\dfrac{2}{27}$
2	$\dfrac{1}{27}$	$\dfrac{3}{27}$	$\dfrac{3}{27}$
3	$\dfrac{3}{27}$	$\dfrac{4}{27}$	$\dfrac{2}{27}$

    i)   Find the marginal distributions of X and Y

    ii) Conditional distribution of X given Y = 2

    iii) Check the independence of X and Y.

24. Let X and Y be random variables with joint pdf $f(x, y) = x + y$, $0 < x, y < 1$. Find the correlation between X and Y.

25. The pgf of a random variable is $P(s) = \dfrac{1 + 2s + 2s^2 + s^3}{6}$. Find the pmf, its mean and variance.

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