22U241 (Pages: 2) Name: .....

Reg.No: .....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2023

(CBCSS - UG)

(Regular/Supplementary/Improvement)

CC19U STA2 C02 - PROBABILITY THEORY

(Statistics - Complementary Course)

(2019 Admission onwards)

Time : 2.00 Hours Maximum : 60 Marks

Credit : 3

Part A (Short answer questions)

Answer ***all*** questions. Each question carries 2 marks.

1. Define random experiment.
2. Mention the a priori definition of probability.
3. Prove that $P(A) + P(A^c) = 1$.
4. State Baye's rule.
5. Define probability density function.
6. If the cumulative distribution function of X is $F(x)$, find the cumulative distribution function of $Y = X + a$
7. Prove that for a random variable X, $E(aX + b) = aE(X) + b$.
8. Prove that for a random variable X,$V(aX) = a^2V(x)$.
9. Mention any two properties of mgf.
10. What is skewness?
11. Define joint probability mass function
12. What do you mean by independence of two r.v.s?

(Ceiling: 20 Marks)

Part B (Short essay questions - Paragraph)

Answer ***all*** questions. Each question carries 5 marks.

13. Given $P(A) = 0.30, P(B) = 0.78, P(A \cap B) = 0.16$. Find the probability of:
    (i) At least one of the event occurs.
    (ii) Exactly one of the event occurs.
    (iii) None of the events.
14. State the probability conditions for which three events A, B and C are mutually independent.

15. Distinguish between discrete and continuous random variables.

16. Let X be the number of years before a certain kind of pump needs replacement. Let X have the probability function $f(x) = kx^3;\ \ x = 0, 1, 2, 3, 4$. Find k.

17. Explain characteristic function with its properties.

18. Given the joint pdf $f(x, y) = \frac{1}{3}(x + y), 0 < x < 2; 0 < y < 1$. Obatin the marginal pdf's of X & Y.

19. Give an example to show that pairwise independence does not imply mutual independence.

(Ceiling: 30 Marks)

Part C (Essay questions)

Answer any ***one*** question. The question carries 10 marks.

20. Let X be a continuous random variable with probability density function

$$f(x) = \begin{cases} \frac{x^2}{9}, & 0 \leq x < 3 \\ 0, & \text{elsewhere.} \end{cases}$$

Find the pdf of $Y = X^2$.

21. Let $f(x, y) = \begin{cases} 8xy, & 0 < x < y < 1 \\ 0, & \text{elsewhere} \end{cases}$ Find $\text{Var}(Y|X = x)$.

(1 × 10 = 10 Marks)

****