K21U 3485

Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (CBCSS-OBE-Reg./Sup./Imp.)
Examination, April 2021
(2019 Admission Onwards)
Complementary Elective Course in Statistics
2C02STA : PROBABILITY THEORY AND RANDOM VARIABLES

Time : 3 Hours Max. Marks : 40

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

PART – A (**Short Answer**)

Answer **all** questions. **(6×1=6)**

1. Give the mathematical definition of probability.
2. If $A \cap B = \phi$ then show that $P(A) \leq P(B^c)$.
3. Define independent events.
4. What is meant by prior probabilities ?
5. State Baye's theorem.
6. Obtain the p.d.f of the r.v X with distribution function $f(x) = 1 - e^{-2x}$, $x \geq 0$.

PART – B (**Short Essay**)

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

7. Define the terms 'Random experiment' and 'probability space'.
8. What is the probability of getting 53 Sundays in a leap year ?
9. State and prove multiplication theorem for probability.
10. If A and B are independent events, show that A^c and B are independent.

P.T.O.

11. What are the properties of a distribution function ?

12. A random variable X has p.m.f.

X :	0	1	2	3	4	5	6	7
P(x) :	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Find (1) the value k (2) $P(X \geq 6)$.

13. The p.d.f of a random variable X is given by $f(x) = 2x$, $0 < x < 1$. Find the p.d.f of $Y = 3X + 1$.

14. Define marginal and conditional distributions.

PART – C (Essay)

Answer **any 4** questions. **(4×3=12)**

15. Define frequency approach of probability. What are its limitations ?

16. For any two events A and B, show that $P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$.

17. It is 8:5 against the wife who is 40 years old living till she is 70 and 4:3 against her husband now 50 living till he is 80. Find the probability that

    1) both will alive

    2) non will be alive

    3) only wife will be alive.

18. If A and B are who independent events such that $P(A^c) = 0.7$, $P(B^c) = k$ and $P(A \cup B) = 0.8$. Find the value of k.

19. A random variable X has p.d.f $f(x) = 6x(1 - x)$, $0 < x < 1$. Compute $P\left(X \leq \frac{1}{2} \middle| \frac{1}{3} \leq X \leq \frac{2}{3}\right)$.

20. The joint p.m.f of (X, Y) is given by $f(x, y) = \frac{x^2 + y}{32}$, $x = 0, 1, 2, 3$ and $y = 0, 1$. Find the distribution of X + Y.

PART – D (**Long Essay**)

Answer **any 2** questions. **(2×5=10)**

21. For any n events $A_1, A_2, \ldots, A_n$ prove that $P\left(\bigcap_{i=1}^{n} A_i\right) \geq \sum_{i=1}^{n} P(A_i) - (n-1)$.

22. Define conditional probability. Show that the conditional probability is a probability measure.

23. A random variable X has p.d.f $f(x) = 3x^2$, $0 < x < 1$. Find a and b such that

    1) $P(X \leq a) = P(X > a)$

    2) $P(X > b) = 0.05$.

24. The joint p.d.f of (X, Y) is given by $f(x, y) = 4xye^{-(x^2 + y^2)}$, $x, y \geq 0$. Check whether X and Y are independent.

____