K19U 0281

Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.) Examination, April 2019
(2014 Admission Onwards)
CORE COURSE IN STATISTICS
2B02STA : Probability Theory

Time : 3 Hours — Max. Marks : 48

PART – A
(Short Answer)

Answer **all** the **6** questions. **(6×1=6)**

1. State any two properties of distribution function.
2. When do you say that two random variables are independent ?
3. Write down the range of correlation coefficient.
4. Define conditional variance.
5. Define probability generating function.
6. State any two properties of characteristic function.

PART – B
(Short Essay)

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

7. If A and B are independent events, show that A and B^C are independent events.
8. State and prove multiplication theorem of probability.

9. Give classical definition of probability. Also give an example.

10. Distinguish between marginal and conditional probability density functions.

11. If X has a uniform distribution in [0,1] with p.d.f.
$f(x) = 1, 0 \leq x \leq 1$
$= 0$, otherwise.
Find the p.d.f. of $Y = -2 \log X$.

12. State and prove addition theorem on expectation.

13. Establish the relation between raw and central moments.

14. The moment generating function of a random variable is $\frac{1}{(1-2t)^6}$, $t<\frac{1}{2}$.
Find the mean and variance.

15. Write a short note on the relationship between moments and cumulants.

PART – C
(Essay)

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

16. Two groups are competing for the positions on the Board of Directors of a corporation. The probabilities that the first and second groups will win are 0.6 and 0.4 respectively. Furthermore, if the first group wins the probability of introducing a new product is 0.8 and the corresponding probability if the second group wins is 0.3. What is the probability that the new product will be introduced ?

17. Define conditional probability and show that it satisfies all the axioms of probability.

18. The joint p.d.f. of two random variables X and Y is given by
$f(x, y) = 24x(1-y)$, $0 < x < y < 1$
$= 0$, otherwise.
Find the marginal p.d.f.'s of X and Y.

19. Explain how you can get the joint p.d.f. from the marginal and conditional p.d.f.'s.

20. What do you mean by expectation of functions of random variables ?
Let X be a random variable with probability mass function

X	0	1	2	3
f(x)	1/3	1/2	1/24	1/8

Find the expected value of $Y = (X-1)^2$.

21. Explain how the moment generating function generates moments?

PART – D
(Long Essay)

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

22. Two events A and B are statistically independent. P(A) = 0.39, P(B) = 0.21 and $P(A \cup B) = 0.47$. Find the probability that
i) Neither A nor B will occur.
ii) Both A and B will occur.
iii) B will occur given that A has occurred.
iv) A will occur given that B has occurred.

23. If $f(x, y) = cx(1-y)$, $0 < x < y < 1$ find (i) c (ii) the marginal distributions (iii) conditional distributions. Also examine whether the variables are independent.

24. State and prove Cauchy Schwartz's inequality.

25. If X and Y have the joint p.d.f. given by $f(x,y) = \frac{x+y}{21}$, x = 1, 2, 3; y = 1, 2.
Obtain (i) the correlation coefficient ρ_{xy} (ii) E(X/Y = 2) and V(X/Y = 2).