B.Sc. DEGREE EXAMINATION,NOVEMBER 2019
I Year I Semester
Probability and Random Variables

Time : 3 Hours **Max.marks :60**

Section A $(10 \times 1 = 10)$ Marks

Answer any **TEN** questions

1. Define mutually exclusive.
2. State addition theorem of probability.
3. What do you mean by independent events. Give an example.
4. Define conditional probability.
5. Define random variable.
6. Mention the types of random variable.
7. Define bivariate random variable.
8. State any three properties of mathematical expectations.
9. Find the expectation of the number on a die when thrown.
10. Define conditional expectation.
11. Define characteristic function.
12. Define probability density function.

Section B $(5 \times 4 = 20)$ Marks

Answer any **FIVE** questions

13. State and prove the multiplication theorem of probability.
14. A bag contains 4 white, 3 black and 5 red balls. What is the probability of getting a white or red ball at random in a single draw?
15. A random variable X has the following probability function:

Values of X, x	0	1	2	3	4	5	6	7
$p(x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$

(i) Find k, $P(X<6)\,,\ P(X\geq 6)\,,\ P(0<X<5)$

(ii) If $P(X\leq a)>\frac{1}{2}$, find the minimum value of a.

16. A box contains "a" white and "b" black balls. "c" balls are drawn at random. Find the expected value of the number of white balls drawn.
17. State uniqueness theorem and central limit theorem.
18. Explain convergence in probability and convergence in distribution.
19. Explain the marginal distribution functions.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. State and prove Boole's inequality.
21. State and prove Baye's theorem.
22. A two dimensional random vaiable (X, Y) has joint p.d.f given by

    $$f(x,y) = \begin{cases} 6x^2y;; & 0 < x < 1,\ 0 < y < 1 \\ 0;; & elsewhere \end{cases}$$

    (i) Verify the joint p.d.f

    (ii) Find $P\left(0 < X < \frac{3}{4}, \frac{1}{3} < Y < 2\right),\ \ P(X + Y < 1),\ P(X > Y)$ and $P(X < 1 \mid Y < 2)$.
23. State and prove Chebyshev's inequality.
24. Explain in detail about cumulant generating function. Let the random variable X assume the value 'r' with the probability $P(X = r) = q^{r-1}p$; $r = 1, 2, 3, \ldots.$. Find the mgf of X and hence its mean and variance.

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