TB222420W **Reg. No :.....**

Name :.....

B. Sc. DEGREE (C.B.C.S.) EXAMINATION, MARCH 2023

2022 Admissions Regular & 2021 Admissions Supplementary / Improvement And 2020, 2019 And 2018 Admissions Supplementary

SEMESTER II - COMPLEMENTARY COURSE 1 (STATISTICS)

(For Mathematics and Physicis)

ST2C01B18 - PROBABILITY AND RANDOM VARIABLES

Time : 3 Hours **Maximum Marks : 80**

Part A

I. Answer any Ten questions. Each question carries 2 marks (10x2=20)

1. What is the effect of change of origin and scale on correlation coefficient.
2. Show that $2r\sigma_x\sigma_y = \sigma_x^2 + \sigma_y^2 - \sigma_{x-y}^2$
3. Distinguish between univariate and bivariate data.
4. Give the standard error estimates of two regression lines.
5. Show that correlation coefficient is the G.M of two regression coefficients .
6. Write down the normal equations used for fitting a curve $y = ae^{bx}$.
7. Explain the terms sample space and events.
8. If A, B, C are three events such that P(A) = P(B) = P(C) = $1/2$, P(AB) = P(AC) = $1/3$ and P(BC) = 0 Find P(AU BU C).
9. If P(A) = P_1, P(B) = P_2 and P(AB)= P_3, find P(A/B)
10. If f(x,y) = ke^{-x-2y} ; x>0, y>0 is the joint p.d.f. of (X,Y), find k.
11. If f(x,y) = $\frac{xy^2}{30}$; x = 1,2,3; y = 1,2 is the joint p.d.f. of (X,Y), find the marginal p.d.f. of Y.
12. For the density function f(x) = k $e^{-\theta x}$; x ≥0 and $\theta \geq 0$ and 0 elsewhere, find the value of k

Part B

II. Answer any Six questions. Each question carries 5 marks (6x5=30)

13. If x and y are independent variables such that $\bar{x} = \bar{y} = 0$, $s_x = 9$ and $s_y = 12$, find the value of k so that $x + 2y$ and $kx - y$ are uncorrelated.
14. Find the value of k so that the correlation between X+kY and X+Y is a maximum where X and Y are independent variables each with mean 0 and variance unity
15. How can the two regression lines be identified?
16. Fit an equation of the form $y = ax^b$ to the following data

x	0	1	2	3	4
y	32	47	65	92	132

17. Distinguish between probability density function and distribution function of a continuous random variable. Give their properties.
18. Define joint probability distribution function and give its properties.
19. An unbiased die is tossed till an odd number appears. Obtain the probability distribution of the number of tosses.

20. A discrete random variable has the following probability function

x	0	1	2	3	4	5	6	7	8
p(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

Find (i) the value of 'a' (ii) P (x < 3)

21. A random variable X has p.d.f. f(x) = $\frac{1}{2a}$; $-a \le x \le a$. Find *a* so that P[|X|<1] = P[|X|>1].

Part C

III. Answer any Two questions. Each question carries 15 marks **(2x15=30)**

22. Calculate the coefficient of correlation from the following data

x	10	15	12	17	13	16	24	14	22
y	30	42	45	46	33	34	40	35	39

23. Fit a curve of the form $y = a + bx + cx^2$ to the following data

x	1	2	3	4	5	6	7
y	2.3	5.2	9.7	16.5	29.4	35.5	54.4

24. (a) State and prove the Baye's theorem on probability. (b) A textile shop buys clothes from three different mills, say A, B & C. 20% of the cloth bought are from mill A, 50% from mill B and 30% from mill C. From past experience it is known that 2%, 3% and 2% of the clothes of mills A, B and C respectively are defective. On general inspection of the entire production a specimen cloth is selected at random and is found to be defective. Find the probability that it was produced by mill B.

25. The joint p.d.f of (X,Y) is given in the following table. Find (a) The marginal distributions.
    (b) f(x/ y = 3) and f(y/x= 2)
    (c) P(X $\geq$ 2)
    (d) Examine whether X and Y are independent.

X / Y	1	2	3
1	0.10	0.20	0.10
2	0.15	0.10	0.18
3	0.02	0.05	0.10