18103101 (Pages : 4) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.) EXAMINATION, JUNE 2018

Second Semester

Complementary Course

ST2CMT02—Statistics—PROBABILITY THEORY

(Common to M I Mathematics, M I Physics, Model III Computer Applications and B.A. Sociology M I)

[2017 Admissions only]

Time : Three Hours Maximum : 80 Marks

Part A

Answer any **ten** *questions.*
Each question carries 2 marks.

1. Define :
   (a) Random experiment.
   (b) Sample space.
2. Distinguish between simple and Compound event.
3. State the classical definition of probability, what are its limitations.
4. Distinguish between p.m.f. and p.d.f.
5. If X has p.d.f. $f(x) = 1$ if $0 < x < 1$
   $= 0$, otherwise
   then find the distribution $-2 \log x$.
6. Find k if $f(x) = kx^2 e^{-x}$; $x \geq 0$ is a p.d.f. of a continuous random variable.
7. Define marginal distributions of two random variables X and Y.
8. For the joint p.d.f. $f(x, y) = 2, 0 < y < x$. What is the marginal p.d.f. of y ?
9. What are the properties of joint p.d.f. ?
10. State the principle of least squator.
11. Why there are two regression lines ?
12. Define simple, multiple and partial correlation.

(10 × 2 = 20 marks)

Turn over

Part B

Answer any **six** *questions.*
Each question carries 5 *marks.*

13. State and prove Bayes Theorem on an probability.

14. If A, B, C are pairwise independent and A is independent of $B \cup C$, then show that A, B, C are mutually independent.

15. A bag contains 5 white and 7 black balls. Another bag contains 6 white and 4 black balls. One ball is randomly transferred from 1st bag to 2nd bag and then a ball is drawn from the 2nd bag. Find the probability that the ball drawn is white ?

16. Find the distribution function of a random variable X with p.d.f. given by :

$$f(x) = \begin{cases} x/2 ; & 0 \le x < 1 \\ 1/2 ; & 1 \le x < 2 \\ (3-x)/2 ; & 2 \le x < 3 \\ 0 ; & \text{otherwise.} \end{cases}$$

17. $f(x)\, Ax^2, 0 < x < 10$ is a p.d.f. :

    (a) Evaluate A.

    (b) Find $P(2 < X < 5)$.

    (c) Find $P(X < 3/X > -1)$.

18. Given $f(x/y) = \frac{c, x}{y^2} ; 0 < x < y < 1$ and

    $f_2(y) = c_2 y^4, 0 < y < 1.$

    Obtain c_1 and c_2 and the joint p.d.f. of X and Y.

19. If $f(x, y) = \frac{x+y}{21}, \begin{matrix} x = 1, 2, 3 \\ y = 1, 2 \end{matrix}$

    Find :

    (a) $P(X/Y = 2)$.

    (b) $P(Y/X = 1)$.

20. Briefly explain the fitting of the curve :

$y = ab^x$.

21. Find the Karl Pearson's Co-efficient of Correlation of the data given :

x :	5	8	12	18	7
y :	12	10	22	17	4

(6 × 5 = 30 marks)

Part C

Answer any **two** *questions.*
Each question carries 15 *marks.*

22. (a) State the total probability law.

(b) The probability that a female worker in an IT company is affected with vision problem is 0.07 and that for a male worker is 0.09. Out of 2,000 workers in the Company, 800 are females. One worker is selected at random and is found affected with vision problem. What is the probability that the worker is a male ?

23. Given that :

$$f(x) = \begin{cases} x/3 & \text{if } 0 < x < 1 \\ \dfrac{5(4-x)}{27} & \text{if } 1 < x < 4 \\ Q & \text{; elsewhere} \end{cases}.$$

(a) Check whether it is a p.d.f.

(b) Determine the distribution function.

(c) Find the probability of :

(i) $P(X < 3/X > 2)$.

(ii) $P(1.5 < X \leq 2.5)$.

24. Two dice are thrown. Define X = maximum of numbers turns up and y = sum of numbers turns up. Find :

(a) The joint distribution of (X, Y).

(b) Marginal distributions of X and Y.

(c) Conditional distribution of X given Y = 5.

25. (a) Show that $-1 \leq r \leq +1$.

(b) Find the angle between two regression lines.

(c) Given the two regression lines :

$3x + 2y - 80 = 0$

$2x + 3y - 70 = 0$.

Obtain means of X and Y and the correlation co-efficient.

(2 × 15 = 30 marks)