QP CODE: 26021345

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Reg No : .....

Name : .....

B.A/B.SC DEGREE (CBCS) REAPPEARANCE/ MERCY CHANCE EXAMINATIONS, APRIL 2026

Second Semester

Complementary Course - ST2CMT02 - STATISTICS - PROBABILITY THEORY

(Common for B.A Sociology Model I, B.Sc Computer Applications Model III Triple Main, B.Sc Mathematics Model I, B.Sc Physics Model I)

2017 Admission Onwards

8316CF8C

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Define sample space. Write the sample space when three unbiased coins are tossed together.
2. Define sigma field of events.
3. State multiplication theorem of probability for two events.
4. If A and B are independent events, show that A' and B are independent.
5. Define discrete random variable. Give an example.
6. Let the pmf of X be f(x) = $\frac{m^x}{x!}\, e^{-\mathrm{m}}$; $x = 0, 1, 2, \ldots$ Find the pmf of Y = X^2
7. Mention the properties of joint probability mass function of a pair of discrete random variables.
8. Mention the properties of joint pdf of a pair of continuous random variables.
9. Distinguish between direct correlation and inverse correlation.
10. Define rank correlation coefficient.
11. What do you mean by normal equations in curve fitting?
12. Find the y on x regression line if n = 12, $\Sigma x = 30$, $\Sigma x^2 = 670$, $\Sigma y = 5$, $\Sigma y^2 = 285$, $\Sigma xy = 334$.

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. State (1) axiomatic definition (2) classical definition and (3) frequency definition of probability.

14. A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls from the box at random.Find the probability that among the balls drawn, there is at least one ball of each colour.

15. There are 4 boys and 2 girls in a room No.1 and 5 boys and 3 girls in room No. 2. A girl from one of the rooms laughed loudly. What is the probability that the girl who laughed loudly was from room No.2 ?

16. Examine whether the following is a pdf. If yes, obtain its distribution function

$f(x) = x \; ; \; 0 < x < 1$

$= 2 - x \; ; \; 1 < x < 2$

$= 0 \; ;$ elsewhere

17. If the p.d.f. of X is $f(x) = \frac{1}{2}$; $-1 \leq x \leq 1$ and 0 elsewhere, find the pdf of $Y = X^2$

18. Two unbiased coins are tossed . Let X = 1 if the first coin shows head and X = 0 if it shows tail and let Y denotes the number of heads obtained. Obtain the joint probability mass function of (X, Y) .

19. Given $f(x,y) = 2 \; ; \; 0 < x < y < 1$ and 0 elsewhere as the joint pdf, obtain the conditional pdf of Y given X and X given Y .

20. Find Pearson's coefficient of correlation for the following data

x	5	8	12	18
y	12	10	14	15

21. Identify the regression lines from the equations $14x + 12y - 3 = 0$ and $12x + 21y + 10 = 0$.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. 1) State and prove addition theorem on probability for two events and deduce it for three events

2) If $P(A) = 0.3$, $P(B) = 0.2$, $P(A \cap B) = 0.1$ then find the probability of (a) at least one of the events occur (b) exactly one of the events occur (c) none of the events occur.

23. Given the probability mass function as follows :

$f(x) = k$; if $x = 0$,

$= 2k$; if $x = 1$,

$= 3k$; if $x = 2$

$= 0$; elsewhere

(1) Find the value of k (2) Determine the distribution function and sketch it graphically (3) Find the probabilities $P[X \geq 2]$, $P[X \leq 1]$ and $P[0 < X < 2]$ (4) What is the smallest value of m such that $P[X \leq m] > 0.5$.

24. Given $f(x,y) = c\,(xy^2 + e^x)$; $0 < x < 1$, $0 < y < 1$ and 0 elsewhere as a joint pdf, (1) find c (2) find $P(\frac{1}{2} < X < \frac{2}{3})$ (3) find $P(\frac{1}{2} < X < \frac{2}{3}\ ,\ \frac{1}{4} < Y < \frac{1}{2})$.

25. (1) Explain the fitting of curve of the form $y = a\,e^{bx}$

(2) Fit a curve of the form $y = a\,e^{bx}$ to the following data

x	1	2	3	4	5	6
y	1.6	4.5	13.8	40.2	125	300

(2×15=30)