Reg. No. : ....

Name : ....

II Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2023
(2019 Admission Onwards)
CORE COURSE IN STATISTICS
2B02STA : Probability Theory and Mathematical Expectation

Time : 3 Hours

Max. Marks : 48

PART – A

Short Answer (Answer **all** questions **1** mark **each**).

1. Define sample point.
2. What do you meant by equally likely events ?
3. Give an example for probability mass function.
4. Let X be a continuous random variable with pdf $f(x) = e^{-x}$, x > 0 and be a random variable with pdf $g(y) = e^{-y}$, y > 0. If X and Y are independent, find the joint pdf of X and Y.
5. If a random variable X has mean 5, find the mean of Y = 4X – 20.
6. Define variance of a random variable.

$(6 \times 1 = 6)$

PART – B

Short Essay (Answer **any 7** questions **2** marks **each**).

7. Give the axiomatic definition of probability.
8. What will you say that two events are independent ? Can mutually exclusive events be independent.
9. Distinguish between discrete and continuous random variables.
10. Define distribution function of a random variable and discuss its properties.
11. Discuss the properties of mathematical expectation.
12. Give an example of a random variable for which expectation does not exist.
13. Distinguish between raw moments and central moments of a random variable.
14. A random variable X has mean 0, variance 4 and moment measure of kurtosis 2. Find the value of its fourth central moment.
15. State any two properties of moment generating function.

$(7 \times 2 = 14)$

P.T.O.

PART – C

Essay (Answer **any 4** questions **4** marks **each**).

16. If A, B, C are any three events, find the expressions for the events (i) only A occurs (ii) at least one occurs (iii) exactly two occurs (iv) none occurs.
17. State and prove addition theorem for any three events.
18. Find the distribution of a random variable having the following pmf.

X	−2	−1	0	1	2
f(x)	0.1	0.2	0.25	0.3	0.15

19. Let X be a random variable with pdf $f(x) = \frac{2}{9}(x + 1)$, −1 < x < 2. Find the distribution function of X and write down the pdf of Y = X + 1.
20. State and prove multiplication theorem on expectation.
21. Define probability generating function. Obtain the pgf of a random variable having pmf $f(x) = \frac{1}{4}, x = 0, 1, 2, 3$

$(4 \times 4 = 16)$

PART – D

Essay (Answer **any 2** questions **6** marks **each**).

22. State and prove Bayes' theorem.
23. The joint pdf of (X, Y) is $f(x, y) = \frac{8}{9}xy, 1 \le x \le y \le 2$. Find marginal pdf of X and Y. Also find the conditional pdfs.
24. Let (X, Y) be a pair of random variables having the following joint pmf.

x \ y	1	2	3
1	0.1	0.1	0.1
2	0.1	0.2	0.1
3	0.1	0.3	0.1

Find E(X), E(Y), V(X), V(Y), Cov (X, Y).

25. Establish the relation between first three cumulants and moments.

$2 \times 6 = 12$