

QP Code: 22/PT/9/XIV (Old)

POST-GRADUATE COURSE

Term End Examination — June, 2022/December, 2022

COMMERCE (Old Syllabus)

**Paper-XIV : ADVANCED STATISTICAL CONCEPTS &
TOOLS**

(Up to January 2021 Enrolment Session)

Time : 2 hours]

[Full Marks : 50

Weightage of Marks : 80%

Special credit will be given for accuracy and relevance in the answer. Marks will be deducted for incorrect spelling, untidy work and illegible handwriting. The weightage for each question has been indicated in the margin.

Use of scientific calculator is strictly prohibited.

Module - I

Answer any *two* of the following questions : 12½ × 2 = 25

1. (a) State axiomatic definition of probability. 2
- (b) Given that $P(A)=\frac{3}{4}, P(B)=\frac{3}{5}$ and $P(A/B)=\frac{5}{8}$. Calculate $P(A \cap B)$, $P(A \cup B)$ and $P(B/A)$. 3
- (c) A candidate is selected for interview for 3 posts. For the first there are 5 candidates, for the second there are 4 and for the third there are 3. What are the chances of his getting at least one post ? 3½
- (d) There are three identical boxes of one dozen eggs each. They contain 1, 2 and 3 spoiled eggs respectively. One box is selected at random and then an egg is taken at random from the box. What is the probability that the egg is spoiled ? 4

2. (a) A continuous random variable X has a density function given by

$$f(x) = \frac{1}{2} - ax, \quad 0 \leq x \leq 4$$

$$= 0. \quad \text{elsewhere,}$$

where ' a ' is a constant.

Find (i) the value of ' a ', and

$$(ii) P(1 < X < 2). \quad 2 + 2$$

- (b) A perfect die is thrown twice. Find the expected values of the sum and the product of the number of points obtained in the two throws. 2 + 2

- (c) If X and Y are two jointly distributed random variables, then prove that

$$V(X+Y) = V(X) + V(Y) + 2\text{cov}(X, Y). \quad 4\frac{1}{2}$$

3. (a) The mean and variance of a binomial variable X are 8 and 6. Find the binomial distribution of X and hence find $P[X \geq 2]$.

$$3 + 3$$

- (b) A factory employing a large number of workers finds that over a period of time, the average absentee rate is 3 workers per shift. Calculate the probability that in a given shift (a) exactly two workers will be absent, (b) more than four workers will be absent. 3 + 3\frac{1}{2}

4. (a) A continuous random variable X follows the normal distribution with mean = 12 and variance = 25.

- (i) Write down the normal distribution of X . 2

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(ii) A variable Z is defined by $Z = \frac{X-12}{5}$. What will be the

expectation and standard deviation of the variable Z ? 1 + 1

(iii) What will be the median and mode of the variable Z ? 1 + 1

(b) The mean purchases per day a customer in a large is Rs. 300 with the standard deviation of Rs. 100. If on a particular day, 150 customers purchased for Rs. 428 or more, estimate the total number of customers. Who purchased from the store that day ? [Given that $\Phi(1.28)=0.9$]. 6½

Module - II

Answer any *two* of the following questions : 12½ × 2 = 25

5. (a) What are the differences between sampling error and non-sampling error? 2
- (b) Briefly describe two types of non-probabilistic sampling schemes and give some applications in each case. 5
- (c) Define simple random sampling and stratified random sampling. What are random numbers and how can you use them? 5½
6. (a) The values of a characteristic X of a population containing four units are given as 22, 24, 26, 28. Consider all possible samples of size two which can be drawn with replacement from this population and verify that the mean of the population is exactly equal to the mean of the sample means. 6½
- (b) A wholesaler of apples claims that only 4% of the apples supplied by him are defective. A random sample of 600 apples contained 36 defective apples. Is the claim of the wholesaler acceptable?

6

7. (a) A machine puts out 16 imperfect articles in a sample of 500. After the machine is overhauled, it puts out 3 imperfect articles in a batch of 100. Has the machine improved ? 6
- (b) A certain drug is claimed to be effective in curing cold. In an experiment on 328 people with cold, half of them were given the drug and half of them given sugar pills. The patients' reaction to the treatment are recorded in the following table. Test the hypothesis that the drug is no better than sugar pills for curing colds.
[Given that $\chi_{0.05,2}^2 = 5.99$] 6½
8. (a) Distinguish between the following : 2½ × 2
- (i) Point estimation and interval estimation.
- (ii) Two-tailed and one-tailed test of hypothesis.
- (b) What do you mean by best linear unbiased estimator ? Give an example. 2½
- (c) Construct 95% confidence interval for mean of a normal population. 5

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