

# **ASSIGNMENT BOOKLET**

## **Post Graduate Diploma in Applied Statistics**

**(Specialisations in Industrial Statistics/Biostatistics)**

**MST-003**

**(Valid from 1<sup>st</sup> January 2025 to 31<sup>st</sup> December, 2025)**

**It is compulsory to submit the assignment before filling the Examination Form. Candidate should submit the latest assignment for the course for which they filled the examination form. Only Work books/Lab Record Books are needed to be submitted for the Lab Courses.**



**School of Sciences  
Indira Gandhi National Open University  
Maidan Garhi, New Delhi-110068  
(2025)**

Dear Student,

Please read the information on assignments in the Programme Guide that we have sent you after your enrolment. A weightage of 30%, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment for the theory course MST-003 has been given in this booklet.

### Instructions for Formatting Your Assignments

Before attempting the assignment, please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

---

ENROLLMENT NO : .....

NAME : .....

ADDRESS : .....

.....

.....

PROGRAMME CODE: .....

COURSE CODE: .....

COURSE TITLE: .....

STUDY CENTRE: ..... DATE: .....

---

**PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.**

- 2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
- 4) Your answers should be precise.
- 5) This assignment is to be submitted at the Study Centre.

**We strongly suggest that you should retain a copy of your answer sheets.**

- 6) This assignment is valid from January 1<sup>st</sup>, 2025 up to December 31, 2025.
- 7) The latest assignments should be submitted by the candidate.
- 8) **You cannot fill the Exam Form for this course** till you have submitted this assignment. So solve it and **submit it to your study centre at the earliest**. If you wish to appear in the **TEE, June 2025**, you should submit your TMAs by **March 31, 2025**. Similarly, If you wish to appear in the **TEE, December 2025**, you should submit your TMAs by **September 30, 2025**.

We wish you good luck.

## TUTOR MARKED ASSIGNMENT

### MST-003: Probability Theory

Course Code: MST-003

Assignment Code: MST-003/TMA/2025

Maximum Marks: 100

**Note: All questions are compulsory. Answer in your own words.**

1. State whether the following statements are **True** or **False** and also give the reason in support of your answer: (5×2=10)
  - (a) Sample space of a (i) random experiment tossing two coins simultaneously and (ii) One coin two times is the same.
  - (b) Standard deviation of a random variable  $X$  may take any real value, i.e. its value lies in the interval  $(-\infty, \infty)$ .
  - (c) If events  $E_1, E_2, E_3, E_4, \dots, E_n$  are mutually exclusive and exhaustive then  $P(E_1 \cup E_2 \cup E_3 \cup \dots \cup E_n)$  will be greater than  $1/2$  but less than 1.
  - (d) If  $S$  is sample space of a random experiment and  $E$  is an event defined on this sample space then  $P(S|E) = 1$ .
  - (e) If  $X$  is a random variable having range set  $\{0, 1, 2, 3\}$  then the set  $\{x \in S : X(x) = 0\}$  is an event having at least one outcome of the random experiment.
2. There are 4 black, 3 blue and 8 red balls in an urn. Three balls are selected one by one without replacement. What is the probability that:
  - (i) First ball drawn is black, second one is red and third one is blue
  - (ii) All the three balls are of the same colour(5+5)
3. A random 5-card poker hand is dealt from a standard deck of cards. Find the probability (in terms of binomial coefficients) of getting a flush (all 5 cards being of the same suit: do not count a royal flush, which is a flush with an ace, king, queen, jack and 10). (10)
4. Show that  $f(x) = \left(\frac{1}{2}\right)^{x+1}$ ,  $x = 0, 1, 2, 3, 4, 5, \dots$  is a valid PMF for a discrete random variable. Also find out its CDF. (10)
5. A group of 100 people are comparing their birthdays (as usual, assume their birthdays are independent and not on February 29, etc.). Find the expected number of pairs of people with the same birthday, and the expected number of days in the year on which at least two of these people were born. (10)
6. Random variable  $X$  follows Beta distribution with parameters  $a = 3$ ,  $b = 2$  and has pdf

$$f(x) = \begin{cases} 12x^2(1-x), & 0 < x < 1 \\ 0, & \text{otherwise} \end{cases}$$

Find (i) CDF of  $X$  (ii)  $P[0 < X < 1/2]$  (iii) mean and variance of  $X$  without using direct formula for mean and variance. (10)

7. Consider the joint PDF for the type of customer service  $X$  ( $0 = \text{telephonic hotline}$ ,  $1 = \text{Email}$ ) and of satisfaction score  $Y$  ( $1 = \text{unsatisfied}$ ,  $2 = \text{satisfied}$ ,  $3 = \text{very satisfied}$ ):

	Y		
X	1	2	3
0	0	$1/2$	$1/4$
1	$1/6$	$1/12$	0

- (a) Determine and interpret the marginal distributions of both  $X$  and  $Y$ .
- (b) Calculate the 75 % quantile for the marginal distribution of  $Y$ .
- (c) Determine and interpret the conditional distribution of satisfaction level for  $X = 1$ .
- (d) Are the two variables independent?
- (e) Calculate and interpret the covariance of  $X$  and  $Y$ . (20)
8. State Monty Hall problem and solve it. (20)