B.Sc. 2nd Semester (General) Examination, 2022
Subject: Statistics
Paper: GE-II/CC-II
(Introductory Probability)

Time: 2 Hrs **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answer in their own words as far as practicable.
Notations have their usual meaning.

1. Answer any five from the following questions: 2×5= 10

   (a) Give the definition of the sample space.
   (b) Write down the classical definition of probability.
   (c) What do you mean by a random variable?
   (d) Give an example of a continuous random variable.
   (e) State weak law of large numbers.
   (f) Give the *p.m.f* of a hypergeometric distribution.
   (g) Define the moment generating function of a random variable.
   (h) If $P(A_1)= 0.5$, $P(A_2)= 0.3$ and $P(A_1 \cap A_2) = 0.20$, find $P[(A_1 \cup A_2)^C]$

2. Answer any two from the following questions: 5×2= 10

   (a) State and prove Chebyshev's inequality.
   (b) Suppose that the arithmetic mean and the standard deviation of a binomial distribution (with parameters *m* and *p)* are respectively 4 and $\frac{\sqrt{8}}{3}$. Find the value of *m* and *p*.
   (c) A card is drawn from a well-shuffled pack of playing cards. What is the probability that it is either a spade or an ace?
   (d) Derive the moment generating function of geometric distribution.

3. Answer any two from the following questions: 10×2= 20

   (a) (i) State and prove Bayes' theorem.

(i) (ii) If A_1 and A_2 are mutually exclusive events and $P(A_1 \cap A_2) \neq 0$, then prove that

$$P[A_1 \mid A_1 \cup A_2] = \frac{P(A_1)}{P(A_1) + P(A_2)}$$ 5+5= 10

(b) Suppose that A_1 and A_2 are two independent events. Then show that,

(i) A_1 and $A^c{}_2$ are independent

.(ii) $A^c{}_1$ and $A^c{}_2$ are independent. 5+5= 10

(c) (i) Show that the mean and variance of a Poisson distribution are equal.

(ii) Suppose x is a Poisson variate with parameter 2. Find $P(X = 3)$, $P(X \leq 2)$ and $P(X>1)$. [Given $e^{-2} = 0.1365$] 5+5= 10

(d) (i) Define a standard normal variable X. Also show that the distribution of X is symmetric. Z

(ii) If Z is a standard normal variate, find the values of $P[1< Z \leq 2]$ and $P[Z \geq 2]$.

5+5= 10
