BACHELOR OF SCIENCE EXAMINATION, 2019

(2nd Year, 2nd Semester, Old Syllabus)

MATHEMATICS (SUBSIDIARY)

Introduction to Probability and Statistics

Paper : 10S

Time : Two hours   Full Marks : 50

Use a separate Answer-Script for each part.

The figures in the margin indicate full marks.
(Notations/Symbols have their usual meanings)

PART - I (20 marks)

Answer any *two* questions.

1. (a) Write down the classical definition of probability. Suppose that M and N stand in a line at random with 10 other people. Use classical definition of probability to find the probability that there are 3 people between M and N.

   (b) If $P(X=i)=p_i$ and $P(Y=j)=q_j$ (i, j = 1,2,...,n) where X and Y are two mutually independent random variables, prove that $P(X+Y=n) = \sum_{i=1}^{n-1} p_i q_{n-i}$.

   (c) For n events A_1, A_2, ...,A_n, show that

   $$P\left(\bigcup_{i=1}^{n} A_i\right) \le \sum_{i=1}^{n} P(A_i).$$ 3+3+4

2. (a) State Bayes' theorem.
   (b) Three identical boxes I, II, and III contain respectively 4 white and 3 red balls, 3 white and 7 red balls, and 2 white and 3 red balls. A box is chosen at random and a ball is drawn out of it. If the ball is found to be white, what is the probability that Box II was selected ?
   (c) There is a 50-50 chance that a contractor's firm A will bid for the construction of a multi-storeyed building. Another firm B submits a bid and the probability is 3/4 that it will get the job, provided firm A does not bid. If firm A submits a bid, the probability that firm B will get the job is only 1/3. What is the probability that firm B will get the job ?   2+4+4

3. (a) Find the mean and variance of Poisson distribution with parameter μ.
   (b) The overall percentage of failures in a certain examination is 40. What is the probability that out of a group of 6 candidates at least 6 passed the examination ?
   (c) The mean of a normal distribution is 50 and 5% of the values are greater than 60. Find the standard deviation of the distribution. Given that the area under standard normal curve between $z = 0$ and $z = 1.64$ is 0.45   4+3+3

8. (a) Explain what are regression lines, why are there two such lines. Also, derive their equations.
   (b) Fit a parabola of second degree to the following data :

X :	0	1	2	3	4
Y :	1	1.8	1.3	2.5	6.3

   5+5

—— X ——

Wages in Rs.	No. of labourers
Above 0	685
Above 10	500
Above 20	423
Above 30	389
Above 40	209
Above 50	73
Above 60	50
Above 70	0

(b) Suppose, three are n independent random variables x_1, x_2,....,x_n with same mean and same standard deviation σ. Show that the arithmetic mean of these n variables $u, \bar{x}$ has the standard deviations $\sigma / \sqrt{n}$.   6+4

7. (a) Define correlation coefficient between two random variables. Show that this coefficient always lies between −1 and 1. Deduce the case when equality holds.

(b) Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y) :

X :	65	66	67	67	68	69	70	72
Y :	67	68	65	68	72	72	69	71

PART - II (30 marks)

Answer any *three* questions.

4. (a) Write short notes on the following with illustrative example :
   i) Frequencey distribution
   ii) Histogram
   iii) Ogive.

   (b) Show that sum of absolute deviations about median is least.   6+4

5. The following numbers give the weights of 55 students of a class :

42	74	40	60	82	115	41	61	75	83	63
53	110	76	84	50	67	65	78	77	56	95
68	69	104	80	79	79	54	73	59	81	100
66	49	77	90	84	76	42	84	69	70	80
72	50	79	52	103	96	51	86	78	94	71

   i) Prepare a frequency table with starting weight 40 units and 8 equal class intervals each of length 10 units.

   ii) Calculate the mean, median and mode of the above frequency distribution.   4+6

6. (a) Find out the mean deviation from mean, standard deviation, quartile deviations from the following table :