Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (TT /MCP)/SEM-1/MTT-107/2011-12

2011

APPLIED STATISTICS AND DESIGN EXPERIMENT

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any five questions. 5 × 14 = 70

1. a) If $y_i = \frac{x_i - c}{d} (i = 1, 2, \ldots n)$, where c and d are constants, prove that $\bar{x} = c + d\bar{y}$.

   b) Prove that for a given set of observations the sum of squares of deviation is minimum, when deviations are taken from A.M.

   c) Show that $\sum_{i=1}^{n} | x_i - A |$ is least if A = median. 4 + 5 + 5

2. a) In an industrial establishment, the coefficients of variation of wages of male of female workers were 55% and 70% respectively. The standard deviations are Rs. 22 and Rs. 15.40 respectively. Calculate the combined average wages for all the workers, if 80% of the workers were males.

b) The mean and the variance of a group of 100 observations are 6.5 and 3.0 respectively 55 of these observations have mean 6.6 ad S.D.= 1.5. Find the mean and S.D. of remaining 45 observations.

c) Define coefficient of variation. Point out its importance in statistical data analysis. 6 + 4 + 4

3. a) Obtain the standard deviation of first 'n' natural numbers.

b) In bolt factory, the machines M_1, M_2, M_3 manufacture respectively 25%, 35% and 40% of the total product. Of their output 5%, 4% and 2% respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine M_3 ?

c) A sales man has a 80% chance of making a sale to each customer. The behaviours of successive customers is assumed to be independent. If two customers X and Y centre the shop. What is the probability that the salesman will make a sale ? 4 + 7 + 3

4. a) Given $P(A)=\frac{1}{2}$, $P(B)=\frac{1}{3}$, $P(AB)=\frac{1}{4}$

Find the values of $P(\overline{A})$, $P(A+B)$, $P(A/B)$ and $P(\overline{A}B)$.

b) A machine produces on the average 2% defectives. If 4 articles are chosen randomly, find the probability that there are at least 2 defective articles.

c) Explain the difference between discrete probability distribution and continuous probability distribution. If the random variable X has the *p.d.f.*

$$f(x)=\begin{cases}\frac{1}{4} & -2\le x\le 2\\ 0 & eleswhere\end{cases}$$

obtain $P\{(2x+3)>5\}$ 4 + 5 + 5

5. a) Find the mean and standard deviation of binomial distribution with parameters n and p.

b) Prove that Poisson distribution may be obtained as a limiting case of Binomial distribution.

c) 2% of the items made by a machine are defective. Find the probability that 3 or more items are defective in a sample of 100 items (Given e^{-1} = 0.368, e^{-2} = 0.135, e^{-3} = 0.0498) 5 + 5 + 4

6. a) What is a standard normal distribution ? State some of its important properties.

b) A grinding machine is so set that its production of shafts has an average diameter of 10.10 cms and S.D. of 0.20 cm. The product specifications call for shaft diameters between 10.05 cm and 10.20 cm. What proportion of input meets the specifications presuming normal distribution ?

c) If 20% bolts produced by a machine are defective, determine the probability that out of 4 bolts chosen at random (i) 1 (ii) 0 and (iii) at most 2 bolts will be defective. 4 + 5 + 5