Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (MTT)/SEM-2/MTT-206/2010

2010

STATISTICAL QUALITY CONTROL

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) A product is assembled from three components X, Y & Z, the probability of these components being defective is respectively 0·01, 0·02 & 0·05. What is the probability that the assembled product will not be defective ?

   b) Is the following a probability density function ?

$$f(x)=\begin{cases}2x, & 0<x\le 1\\ 4-2x, & 1<x\le 2\\ 0, & \text{elsewhere}\end{cases}$$

   c) If the random variable X has the probability density function

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

   obtain $p\{(2x+3)>5\}$. Here p denotes probability.

5 + 5 + 4

2. a) Explain the conditions under which Poisson distribution may be obtained as a limiting case of binomial distribution.

   b) Explain clearly the concept of sampling distribution of a statistic.

   c) Show that the mean and standard error of sample mean $(\bar{x})$ from simple samples of size 'n' are

   $E(\bar{x}) = \mu$ & $S.E(\bar{x}) = \frac{\sigma}{\sqrt{n}}$ 5 + 4 + 5

3. a) The mean of a certain normal distribution is equal to the standard error of the mean of samples of 25 from the distribution. Find the probability that the mean of a sample of 49 from the distribution will be negative.

   (Given :- Area under standard normal curve to the left of the ordinate at 1·4 is 0·9192).

   b) Explain briefly the two terms – standard deviation & standard error.

   c) Describe the important characteristics of 't' & F distributions. 6 + 4 + 4

4. a) Distinguish between point estimation & interval estimation.

   b) A random sample of 100 ball bearings selected from a shipment of 2000 ball bearings has an average diameter of 0·354 inch with a S.D. = 0·048 inch. Find 95% confidence interval for the average diameter of these 2000 ball bearings.

   c) A machine produced 20 defective articles in a batch of 400. After overhauling it produced 10 defectives in a batch of 300. Has the machine improved ? 4 + 6 + 4

5. a) Distinguish between process control & product control.

   b) Explain the theoretical background of a control chart and also explain the construction of P-chart & C-chart.

   c) Describe how you construct a $\overline{X}$ chart and explain its uses. 3 + 7 + 4

6. a) Explain the logic of setting the control limits at $\sigma \pm 3$.

   b) A drilling machine bores holes with a mean diameter of 0·5230 cm and S.D. of 0·0032 cm. Calculate the 2 sigma and 3 sigma upper and lower control limits for means of samples 4, and prepare a control chart. 6 + 8