| Reg. No. | | | | | | | | | | |
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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

**VI SEMESTER B.TECH. (INDUSTRIAL AND PRODUCTION ENGINEERING)**

**END SEMESTER EXAMINATIONS, APRIL 2018**

SUBJECT: QUALITY CONTROL AND RELIABILITY ENGINEERING

[MME 3212]

**REVISED CREDIT SYSTEM**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Use of SQC tables permitted.

**1A.** Explain the effect of assignable causes on a process. **(02)**

**1B.** Explain the inequality theorems. **(03)**

**1C.** Calculate mean, standard deviation, median and mode for the following frequency distribution:

| Characteristic value | 3 | 6 | 9 | 12 | 15 | 18 | 21 |
|---|---|---|---|---|---|---|---|
| Frequency | 4 | 7 | 10 | 15 | 9 | 8 | 7 |

**(05)**

**2A.** What is Type II error with regard to control charts? How it is minimized? **(02)**

**2B.** Explain the graphical methods of representing a frequency distribution. **(03)**

**2C.** Samples of 6 items are taken from a manufacturing process at regular intervals. A normally distributed quality characteristic is measured and $\overline{X}$ and $s$ values are calculated for each sample. After 50 subgroups have been analyzed, we have $\sum \overline{X}$ = 1000 and $\sum s$ = 75.

(i) Calculate 3 sigma control limits for $\overline{X}$ and $s$ control charts.

(ii) Assume that all points on both charts fall within the control limits. Compute the Natural tolerance and Natural tolerance limits of the process.

(iii) If the specification limits are 19.0 $\pm$ 4.0, what percentage of product does not meet the specifications? **(05)**

**3A.** Write a note on system reliability. **(03)**

**3B.** Explain the control charts for fraction rejected and rejects. **(03)**

**3C.** A $c$ chart is used to monitor the number of nonconformities on sheets of photographic film. The chart is presently set up based on $\bar{c}$ of 2.6.

(i) Find 3 sigma control limits for this process.

(ii) Use Poisson's distribution table to determine the probability that a point will fall outside these limits while the process is actually operating at a $\mu_c$ of 2.6.

(iii) If the process average shifts to 4.8, what is the probability of not detecting the shift? **(04)**

**4A.** Explain (i) AQL (ii) AFI (iii) AOQL **(03)**

**4B.** With a neat sketch explain the Normal curve. How it is useful in quality control? **(03)**

**4C.** A double sampling plan is as follows:

$$n_1 = 150,\ c_1 = 2,\ n_2 = 300,\ c_2 = 3.$$

Assuming the lot size is large in comarison to sample size, compute the probability of acceptance of a 2% defective lot. **(04)**

**5A.** Explain the theory of extreme runs of points. **(03)**

**5B.** Write a note on O.C.Curve. **(03)**

**5C.** Two mating parts A and B have normal distributions and are assembled at random. The standard deviations of the dimensions A and B are 0.0025 inch and 0.0075 inch respectively. What should be the average clearance if the probability of interference between the parts should not exceed 0.001? **(04)**