Reg. No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

MANIPAL INSTITUTE OF TECHNOLOGY
A Constituent Institute of Manipal University, Manipal

VI SEMESTER B.TECH (INDUSTRIAL AND PRODUCTION ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: QUALITY CONTRO L 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. How do you describe patterns of variation? **(02)**

1B. Explain the quality of design and quality of conformance. **(03)**

1C. Find mean and standard deviation of the following frequency distribution. What percent of normal distribution with this average and standard deviation will fall above the limit of 4.6?

Cell boundaries	Frequency
2.7 - 2.9	2
3.0 - 3.2	16
3.3 - 3.5	46
3.6 - 3.8	88
3.9 - 4.1	138
4.2 - 4.4	113
4.5 - 4.7	71
4.8 - 5.0	22
5.1 - 5.3	4

(05)

2A. Explain the classification of Quality costs. **(03)**

2B. What proportion of a frequency distribution would you expect to fall outside $\overline{X} \pm 2.4\sigma$ limits:

(i) If it is known to be approximately normal ?

(ii) If it is known only that it satisfies the conditions for Camp-Meidell inequality?

(iii) If nothing is known about the form of the distribution? **(03)**

2C. Control charts for $\overline{X}$ and R, based on a subgroup size of 4, are to be used to control a process. The standard deviation of this process is 10. An aimed at value of the mean ($\overline{X}_0$) is to be 250.

(i) Determine the control limits for $\overline{X}$ and R charts.

(ii) Determine the probability of a point falling within the $\overline{X}$ chart control limits if the actual μ is 0.5σ above the aimed-at value of 250.

(iii) If the actual μ is 1.0σ above 250.

(iv) If the actual μ is 2.5σ above 250. **(04)**

3A. Write a note on s chart. **(02)**

3B. Explain the Normal bowl experiment and the conclusions drawn. **(04)**

3C. A p chart is to be used to analyse the record for 100% inspection of a certain radio transmitting tubes. The total number inspected during the month was 2196 and the total number of defectives was 158. Compute the central line. Compare the individual 3 sigma control limits for the following three days and state whether the fraction defectives fell within the control limits for each day.

Day	No. of units inspected	No. of defectives
14	54	8
15	162	24
16	213	3

(04)

4A. Explain (i) LTPD (ii) ASN (iii) ATI **(03)**

4B. Explain the process capability analysis. **(03)**

4C. A producer of electronic components for the automobile industry uses the following double sampling plan to inspect batches of incoming integrated circuits:

$$n_1 = 20, \, c_1 = 0, \, n_2 = 40, \, c_2 = 3$$

Use Poisson distribution table and compute the probability of acceptance. Batches contain 5% rejectable units. Assume the lot size is large in relation to the sample size. **(04)**

5A. Discuss α and β errors in connection with control chart analysis. **(03)**

5B. With a sketch explain the "Bathtub Curve". **(03)**

5C. Two mating parts A and B have an average clearance of 0.015 cm. Control charts indicate the standard deviations of the dimensions A and B to be 0.002 cm and 0.006 cm respectively. Find the probability of interference between the two distributions. Also find the probability of clearance being lesser than 0.018 cm. Assume the distributions to be normal and assembly at random. **(04)**