Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (INDUSTRIAL AND PRODUCTION ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE/JULY 2016

SUBJECT: QUALITY CONTROL AND RELIABILITY ENGINEERING

[MME 322]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Distinguish between variables and attributes. **(02)**

1B. Explain the methods used to describe patterns of variations. **(03)**

1C. A machine shop produces steel pins used in assembly of certain motors. The width of pins was checked after the milling operation. The data recorded is shown in the table below. Find the mean, standard deviation, median and mode.

Characteristic value	Frequency
0.950-0.951	3
0.952-0.953	1
0.954-0.955	10
0.956-0.957	16
0.958-0.959	11
0.960-0.961	4
0.962-0.963	3
0.964-0.965	2

(05)

2A. Why $\overline{X}$ and R charts are always used together? **(02)**

2B. Explain the analysis carried out for a process under control. **(03)**

2C. A process has been operating in control at a μ of 65.00 mm and a σ of 0.15 mm with upper and lower control limits on the $\overline{X}$ chart as 65.225 mm and 64.775 mm respectively. Specifications on the dimension are 65 ± 0.50 mm.

(i) What is the probability of not detecting a shift in the mean to 64.75 mm on the first subgroup sampled after the shift occurs? The subgroup size is 4.

(ii) What proportion of non-conforming product results from the shift described in part (i)? Assume a normal distribution of this dimension.

(iii) Calculate the natural tolerance limits, C_p and C_{pk} for this process considering the shift in the mean. **(05)**

3A. Distinguish between u and ku charts. **(02)**

3B. Write a note on acceptance sampling tables. **(03)**

3C. An item is made in lots of 200 each. The lots are given 100% inspection. The record sheet for the first 25 lots inspected showed that a total of 75 items did not confirm to specifications.

(i) Determine the trial control limits for an np chart.

(ii) Assume that all points fall within the control limits. What is your estimate of the process average fraction non-conforming μ_p?

(iii) If this μ_p remains unchanged, what is the probability that the twenty-sixth lot will contain exactly 8 non-conforming units? **(05)**

4A. Explain β error with regard to control charts. How this error can be minimized? **(02)**

4B. With a sketch explain the Equipment failure pattern. **(03)**

4C. A double sampling plan is n_1= 150, c_1= 2, n_2 = 300, c_2 = 4. Compute the probability of acceptance of a 1.5% defective lot. Assume lot size is large in comparison with sample size. **(05)**

5A. Explain the appraisal costs and prevention costs with regard to cost of quality. **(03)**

5B. Explain (i) Failure rate (ii) Mean life (iii) Product rule **(03)**

5C. A control chart for nonconformities per unit u uses probability limits corresponding to probabilities of 0.975 and 0.025. The central line on the control chart is at μ_u = 2.0. The limits vary with the value of n. Determine the correct position of these upper and lower control limits when n = 5. **(04)**

6A. Write a note on the construction and use of Operating characteristic curves. **(03)**

6B. Explain the Single sampling plan. **(03)**

6C. In a system, groups of two components are connected in parallel. Three such groups are connected in series. If the reliability of each of the component is 0.9, calculate the reliability of the system. **(04)**

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