Exam Date & Time: 10-May-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, APRIL/MAY 2024

INTRODUCTION TO QUALITY CONTROL [MME 4306]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions. Section Duration: 180 mins

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Distinguish between Products and Services with examples. (2)

A)

B) Explain trial control limits, revised control limits and variable control limits with regard to *p* chart. (3)

C) The receiving inspection department for a manufacturer of certain product has taken a random sample of components and measured the length of each component. The length in millimeters has been arranged in the following frequency distribution:

Cell boundaries (mm)	Frequency
66.5-68.5	2
68.5-70.5	7
70.5-72.5	13
72.5-74.5	22
74.5-76.5	25
76.5-78.5	44
78.5-80.5	40
80.5-82.5	24
82.5-84.5	16
84.5-86.5	5
86.5-88.5	2

(5)

Find Sample mean and Sample standard deviation. What percentage of Normal distribution falls outside the limits 69.5 mm and 83.5 mm?

2) Briefly discuss the Shewhart's Normal Bowl experiment and the conclusions drawn. (3)

A)

B) Discuss Failure costs and Appraisal costs with regard to Quality costs. (3)

C) A process has demonstrated that when held in control it can maintain a σ of 0.15 cm. A certain part has specifications of 15 ± 0.5 cm.

(i) Using a target mean of 15 cm find control limits for $\bar{X}$ and R charts based on a subgroup size of 5 units.
In answering the following questions, assume that the actual mean setting μ is 14.97 cm. (4)
(ii) What is the probability that any value of $\bar{X}$ will fall below the lower control limit?
(iii) Compute Process capability index C_{pk}

3) Discuss the classification of ways in which a process lacks control. (3)

A)

B) Sketch and explain any two control charts for attributes which permit only constant subgroup size. (3)

C) A Double sampling plan is as follows: n_1 = 30, c_1 = 1, n_2 = 60, c_2 = 3. Compute the Probability of acceptance at a fraction defective of 0.02. Assume the incoming lot size is large in comparison with sample size. (4)

4) With an example, describe Conventional tolerancing and Statistical tolerancing. (3)

A)

B) Explain the Operating Characteristic curve (O.C. Curve) with a sketch. (3)

C) How the Process capability analysis is carried out for a process under control? (4)

5) With an example, explain the computation of ATI for a Single sampling plan. (2)

A)

B) Describe the AOQ curve and AOQL. (3)

C) A manufacturing process uses a *c* chart to control imperfections on large orders for single items. Thirty items constitute an inspection unit. After 20 inspection units have been inspected and the data recorded, the total count of imperfections is 35. (5)

(i) Calculate the control limits for the process.
(ii) What is the probability of Type I error for this chart?
(iii) Find the probability of a Type II error should the process shift to a μ_c of 4.0.

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