



P.E.S. College of Engineering, Mandya - 571 401
 (An Autonomous Institution affiliated to VTU, Belagavi)
Sixth Semester, B.E. - Industrial and Production Engineering
Semester End Examination; August - 2023
Quality Assurance and Reliability

Time: 3 hrs

Max. Marks: 100

Course Outcomes

The Students will be able to:

CO1: Understanding the fundamentals of quality function and concept of quality assurance.

CO2: Demonstrate the concept of statistical process control and control charts for variables.

CO3: Analyze the controls chart for fraction non-confirming (defective) development and operation of control chart.

CO4: Analyze the various sampling inspection.

CO5: Estimate the reliability and life testing.

Note: I) PART - A is compulsory. **Two** marks for each question.**II) PART - B:** Answer any **Two** sub questions (from a, b, c) for a Maximum of **18** marks from each unit.

Q. No.	Questions	Marks	BLs	COs	POs																																																														
I : PART - A		10																																																																	
1 a.	Define quality from producer concept and as well as consumer concept.	2	L1	CO4	PO1																																																														
b.	What happens when sample size increases to mean connect charts limit.	2	L1	CO2	PO1																																																														
c.	Differentiate between defect and defective.	2	L1	CO3	PO1																																																														
d.	Define producer basic and consumer risk.	2	L1	CO4	PO1																																																														
e.	Differentiate between Series and parallel device configurations.	2	L1	CO5	PO1																																																														
II : PART - B		90																																																																	
UNIT - I		18																																																																	
2 a.	Explain briefly the dimensions of quality measured in manufacturing industries.	9	L2	CO1	PO1																																																														
b.	Discuss the quality cost categories briefly.	9	L2	CO1	PO1																																																														
c.	Explain briefly the steps in structuring as audit program.	9	L2	CO1	PO1																																																														
UNIT - II		18																																																																	
3 a.	With an example differentiate between choice and assignable causes of variation and also show the control chart pattern of variation in both.	12	L2	CO2	PO1																																																														
b.	A machine is working to a specification of 12.58 ± 0.05 mm. A study of 50 consecutive pieces shows the following measurement put in to 10 group of 5 each.																																																																		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Sub group No</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> </tr> </thead> <tbody> <tr> <td rowspan="5">Dimension of each sample of 5</td> <td>12.63</td> <td>12.62</td> <td>12.60</td> <td>12.61</td> <td>12.59</td> <td>12.59</td> <td>12.59</td> <td>12.61</td> <td>12.58</td> <td>12.54</td> </tr> <tr> <td>12.60</td> <td>12.56</td> <td>12.56</td> <td>12.66</td> <td>12.57</td> <td>12.59</td> <td>12.60</td> <td>12.62</td> <td>12.57</td> <td>12.58</td> </tr> <tr> <td>12.62</td> <td>12.61</td> <td>12.59</td> <td>12.63</td> <td>12.58</td> <td>12.61</td> <td>12.60</td> <td>12.60</td> <td>12.60</td> <td>12.62</td> </tr> <tr> <td>12.60</td> <td>12.59</td> <td>12.58</td> <td>12.60</td> <td>12.56</td> <td>12.56</td> <td>12.63</td> <td>12.65</td> <td>12.61</td> <td>12.54</td> </tr> <tr> <td>12.65</td> <td>12.60</td> <td>12.63</td> <td>12.61</td> <td>12.59</td> <td>12.57</td> <td>12.57</td> <td>12.60</td> <td>12.60</td> <td>12.56</td> </tr> </tbody> </table>	Sub group No	1	2	3	4	5	6	7	8	9	10	Dimension of each sample of 5	12.63	12.62	12.60	12.61	12.59	12.59	12.59	12.61	12.58	12.54	12.60	12.56	12.56	12.66	12.57	12.59	12.60	12.62	12.57	12.58	12.62	12.61	12.59	12.63	12.58	12.61	12.60	12.60	12.60	12.62	12.60	12.59	12.58	12.60	12.56	12.56	12.63	12.65	12.61	12.54	12.65	12.60	12.63	12.61	12.59	12.57	12.57	12.60	12.60	12.56	12	L2	CO2	PO1
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i) Determine the 3 σ limits for \bar{x} chart

iii) Does it appear that the machine is capable of meeting the specification requirements? Assume normal distribution.

c. Define process capability. With an example differentiate control limit and specification limit.

6 L2 CO2 PO1

UNIT - III

18

4 a. In a manufacturing process the number of defective found in the inspection of 20 lots of 100 samples is given below.

Lot no.	No. of defectives	Lot No.	No. of defectives
1	5	11	7
2	4	12	6
3	3	13	3
4	5	14	5
5	4	15	4
6	6	16	2
7	9	17	8
8	15	18	7
9	11	19	6
10	6	20	4

12 L3 CO3 PO1

i) Determine the control limit of p chart and state whether the process is in control

ii) Determine the new value of mean fraction defective if some points are out of control. Compute the corresponding control limits and state whether the process is still in control or not

iii) Determine the sample size when a quality limit not worse than 9% is desirable and a 10% bad product will not be permitted more than three times in thousand

b. The following details collected from 100 meter pieces of woolen cloths.

Purchaser's Inspection no	Number of defects	Purchaser's Inspection no	Number of defects
1	14	13	12
2	5	14	9
3	10	15	3
4	19	16	22
5	0	17	7
6	6	18	1
7	2	19	1
8	9	20	6
9	8	21	4
10	6	22	12
11	7	23	5
12	3	24	8
		25	8

12 L3 CO3 PO1

i) Compute the value of \bar{C}_c and its control limit ii) Draw C chart

iii) Compute value of \bar{C}_c for the future production, if you deem it necessary

- c. Compare control chart for attributes and control chart for variable in terms of its advantages and disadvantages.

6 L2 CO3 PO1

UNIT - IV

18

- 5 a. Explain the OC curve with reference to sampling inspection and the meaning of the terms AQL, LTPD, IQL, producer's risk and consumer's risk.
- b. Design a single sampling plan inspection plan by attributes which will meet or nearly meet the following requirements:

12 L2 CO4 PO1

$\alpha = 0.05, \beta = 0.01, P_1 = 0.008, P_2 = 0.04$

12 L3 CO4 PO1

- c. The mobile phone company produces mobile phones in lots of 400 phones each to check the quality of the lots, the quality inspector of the company uses a double sampling plan with $n_1 = 15; c_1 = 1; n_2 = 30$ and $c_2 = 3$.

6 L3 CO4 PO1

What is the probability of accepting the lot on the first sample? What is the probability of first sample acceptance? The average incoming quality of the lot is 0.05. Use Binomial distribution.

UNIT - V

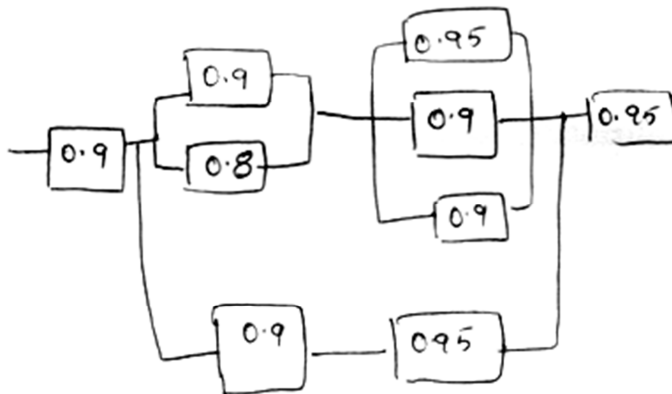
18

- 6 a. A system consists of three sub system A, B and C. The system is primarily used on a certain mission that last 8 hours. The information is given below.

Sub system	Required operating time during mission in hours	Type of failure distribution	Reliability Information
A	8	Exponential	500% of subsystem will last at least 14 hours
B	3	Normal	Any life is 6 hrs with S.D of 1.5 hours
C	4	Weibull with $\beta = 1.0$	Any life in 40hrs

12 L3 CO5 PO1

- b. Consider a mixed mode system comprise of serial and parallel components as shown in figure. Calculate overall reliability of system.



12 L3 CO5 PO1

- c. Compare MTBF versus MTTF.

6 L2 CO5 PO1