

ME724 : Total Quality Management

Time: 3 hours

Max. Marks: 100

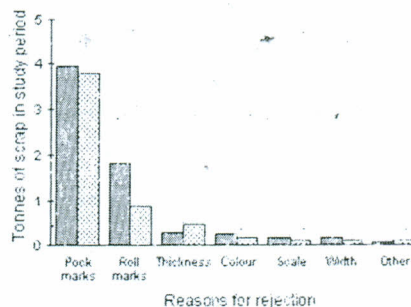
Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Statistical Tables are Permitted

Q.1A Objective type questions (10 questions @ 1 mark)

10

- i. According to Juran, anyone is customer of a product or service if that person
(a) purchases it (b) uses it (c) is affected by it (d) produces it (e) All of these
- ii. Which of the following is not one of the commitments of Total Quality Management?
(a) technical quality (b). understanding and improving the organization's processes (c) data-based decision making (d) employee involvement
- iii. Define type-I and type-II errors relative to the control chart.
- iv. Consider a count variable X following a poisson distribution such that the zero count (that is $X=0$) is not observabl. Based on n observations $x_1, \dots, x_n$ from this distribution the quantity for which $\bar{x}$ is an unbiased estimator is
(a) λ (b) $1/(1-e^{-\lambda})$ (c) $\lambda/(1-e^{-\lambda})$ (d) $\lambda e^{-\lambda}/(1-e^{-\lambda})$ (e) none of these
- v. Which of the following statement is true about the ISO 9000 series?
(a) the ISO 9000 consists of 5 primary parts numbered as 9000 through 9004
(b) there are 20 elements in the ISO 9000 standards that relate to how the system operates and how well it is performing
(c) ISO 9000 places more emphasis on customer satisfaction and business results
(d) there are 3 forms of certification: first, second and third party
- vi. Natural variations are the many sources of variation within a process that
(a) Are in statistical control (b) have several assignable causes of variation
(c) are out of control (d) are not perfect (e) none of the above
- vii. A sampling plan helps in
(a) keeping the process in control (b) keeping workers motivated
(c) turning the machines (d) adjusting ovens in the kitchen
(e) Rejecting lots that are of unacceptable quality
- viii. Of what is this diagram an example?
(a) Pareto curve
(b) control chart
(c) Organigram
(d) cause and defect diagram
(e) Shewhart diagram



- ix. The AQL for a given sampling plan is 1.0% percent. This means that:
- (a) the producer takes a small risk of rejecting product which is 1%
 - (b) all accepted lots are 1% defective or better
 - (c) the average quality level of the plan is 1%
 - (d) the average quality limit is 1%
- x. The main purpose of the Taguchi methods is to:
- (a) reduce costs and prevent any unnecessary costs before producing the product or service
 - (b) articulate the 'voice of the customer'
 - (c) Test the robustness of a design
 - (d) Create a 'house of quality'
- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10
- a Define quality cost and give the primary categories of quality cost.
 - b Draw flow chart for double sampling plan.
 - c Write a note on six sigma.
 - d What is a QFD? What are the benefits of QFD?
- Q.3A List seven QC tools and explain 05
- (a) Histogram and (b) cause and effect diagram
- Q.3B Differentiate between Quality Planning, Quality Assurance, Quality Control and Quality Improvement. 05
- Q.4A What are the ten conditions for the selection and evaluation of suppliers? 05
- Q.4B The diameter of a shaft used in a disk-drive unit is normally distributed with mean 6.37 mm and standard deviation 0.013 mm. The specifications on the shaft have been established as 6.35 ± 0.0038 mm. what fraction of the shafts produced conform to specifications? 05
- Q.5A Explain sensitizing rules for Shewhart control charts 05
- Q.5B Explain ISO 9000 series of standards 05
- Q.6A Construct AOQ curve for the sampling plan $N=2000$, $n=50$, $c=2$ 05
- Q.6B Find a single sampling plan that satisfies a producer's risk of 5% for lots that are 1.5% nonconforming. 05
- OR
- Q.6B Explain with figure, effect of the sample size and acceptance number on the shape of the OC curve. 05
- Q.7A Construct an OC curve for a single sampling plan where the lot size is 2000, the sample size is 50 and the acceptance number is 2. 05
- Q.7B Discuss the signal-to-noise ratio. How is it used in the Taguchi method? 05
- Q.8A When do you choose the attributes charts (P charts, c charts and u charts)? explain 5
- Q.8B The following data were collected from a process producing bearings. The measurements are made on the inside diameter of bearing, with only the last three decimals recorded (i.e., 34.5 should be 0.50345). 5
- i) Compute trial control limits and draw X and R - chart, Does the process seem

- to be in statistical control?. If necessary, revise the trial control limits.
- ii) Estimate the process standard deviation and estimate three sigma natural tolerance limits.

Sample number	1	2	3	4	5	6	7	8	9	10	11	12
x	34.5	34.2	31.6	31.5	35.0	34.1	32.6	33.8	34.8	33.6	31.9	38.6
R	3	4	4	4	5	6	4	3	7	8	3	9
Sample no	13	14	15	16	17	18	19	20	21	22	23	24
x	35.4	34.0	37.1	34.9	33.5	31.7	34.0	35.1	33.7	32.8	33.5	34.2
R	8	6	5	7	4	3	8	4	2	1	3	2

- Q.9 a) Write the fourteen steps of Deming's philosophy for improving quality, productivity and competitiveness. 7
- b) The data in Table 2, are diameters (in mm) of holes in a group of 12 wing leading edge ribs for a commercial transport airplane. Construct and interpret a box plot of those data. 3

Table 2: Hole diameters (in mm) in wing leading edge ribs

120.5, 120.4, 120.7, 120.9, 120.2, 121.1, 120.3, 120.1, 120.9, 121.3, 120.5, 120.8

- Q.10A A manufacturer of paper used for making grocery bags is interested in improving the tensile strength of the product. Product engineering thinks that tensile strength is a function of the hardwood concentration in the pulp and that of hardwood concentrations of practical interest is in between 5% and 20%. A team of engineers responsible for the study decides to make up six test specimens at each concentration 5%, 10%, 15% and 20%. They decided to make up six test specimens at each concentration level, using a pilot plant. All 24 specimens are tested on a tensile tester, in random order. The data from this experiment are shown in Table 3. Use the analysis of variance to test the hypothesis that different hardwood concentration do not affect the mean tensile strength of the paper.

Table 3: Tensile strength of paper (psi)

HARDWOOD CONCENTRATION (%)	Observations					
	1	2	3	4	5	6
5	7	8	15	11	9	10
10	12	17	13	18	19	15
15	14	18	19	17	16	18
20	19	25	22	23	18	20

OR

- Q.10B 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 were defective. 10
- i) Determine the trial control limits for an np - chart.
- ii) Assume that all points fall within limits. What is your estimate of the process average fraction defectives 'p'?
- iii) What is the probability that the 26th lot will contain (a) exactly 7 defectives? (b) 7 or more defectives?