



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH (AUE)/SEM-6/AUE-605/2012

2012

**QUALITY CONTROL AND RELIABILITY
ENGINEERING**

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Any missing data may be assumed properly.

*N.B. : 2 Nos. ordinary graph papers should be provided by the
Institution on demand.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) Quality is
 - a) excellence
 - b) conformity to requirements
 - c) meeting our own requirements
 - d) all of these.



- ii) Kaizen is a technique for
 - a) gradual improvement
 - b) continuous improvement
 - c) does not require capital investment
 - d) all of these.
- iii) Juran's trilogy includes
 - a) Quality planning b) Quality control
 - c) Quality improvement d) All of these.
- iv) Tool that helps prioritization include
 - a) Histogram b) Pareto chart
 - c) Tally chart d) None of these.
- v) Tool suitable to capture process variation is a
 - a) Cause and Effect diagram
 - b) Flow chart
 - c) Control chart
 - d) None of these.



- vi) Random variations in a process are due to
- a) Special causes
 - b) Common causes
 - c) Internal causes
 - d) All of these.
- vii) What is the C_p index given that $\sigma = 0.001$, $USL = 0.758$ and $LSL = 0.75$?
- a) 1.33
 - b) 0.75
 - c) 1
 - d) None of these.
- viii) Measures of dispersion include
- a) Mean
 - b) Mode
 - c) Variance
 - d) All of these.
- ix) Failure rate is equal to
- a) $\frac{1}{MTBF}$
 - b) MTBF.
 - c) $\frac{2}{MTBF}$
 - d) None of these.



- x) If two systems with failure rates λ_1 and λ_2 are in series, then their overall system reliability is

- a) $e^{-\lambda_1 \lambda_2 t}$ b) $e^{-(\lambda_1 + \lambda_2)t}$
c) $e^{-\lambda_1 / \lambda_2 t}$ d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Explain Juran's model of quality trilogy.
3. What are the chance and assignable causes of variability ?
What part do they play in the operation and interpretation of a Shewhart control chart ?
4. What is quality circle ? What are its benefits ?
5. What will be the expression of reliability of system where items are connected in series ? If components are having identical failure rate, what will be the MTTF of the system ?
6. What is failure density function ? Is it a probability density function ? Explain.

**GROUP – C****(Long Answer Type Questions)**

Answer any *three* of the following. $3 \times 15 = 45$

7. A machine fills boxes with dry cereals. 15 samples of 4 boxes are drawn randomly. The weight of the sample boxes are shown as follows –

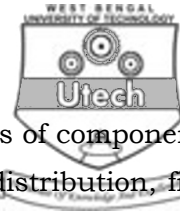
Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wt. Of boxes	10.0	10.3	11.5	11.0	11.3	10.7	11.3	12.3	11.0	11.3	12.5	11.9	12.1	11.9	10.6
	10.2	10.9	10.7	11.1	11.6	11.4	11.4	12.1	13.1	12.1	11.9	12.1	11.1	12.1	11.9
	11.3	10.7	11.4	10.7	11.9	10.7	11.1	12.7	13.1	10.7	11.8	11.6	12.1	13.1	11.7
	12.4	11.7	12.4	11.4	12.1	11.0	10.3	10.7	12.4	11.5	11.3	11.4	11.7	12.0	12.1

Draw the control charts for the sample mean and sample range and determine whether the process is in a state of control. (Take $A_2 = 0.729$, $D_3 = 0$, $D_4 = 2.282$ for $n = 4$)

8. a) Explain the difference between control limit and specification limit. How does a process capability index incorporate both of them ? 2 + 4

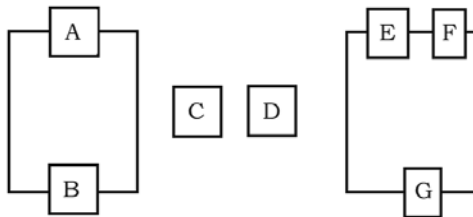
- b) Discuss the advantages and disadvantages of sampling. 5

- c) Find the probability of a lot being accepted if it has a coming quality of 5% defective, a sample size of 40 and an acceptance number 1. 4



9. a) What is system reliability ? If the failures of components of a parallel system follow exponential distribution, find out an expression for the system reliability. 5
- b) Consider the seven component system shown in Figure. Assume that the time to failure for each component has an exponential distribution. The failure rates are as follows : $\lambda_A = 0.0005/h$, $\lambda_B = 0.0005/h$, $\lambda_C = 0.0003/h$, $\lambda_D = 0.0008/h$, $\lambda_E = 0.0004/h$, $\lambda_F = 0.006/h$, $\lambda_G = 0.0064/h$. Find the reliability of the system after 1000h. What is the mean time to failure of the system ?

10



- 10 a) In a failure data analysis following data are obtained :

Time	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	Total
No of failures	130	83	75	68	62	56	50	46	570

Find out Cumulative failures, Failure density, Failure rate, Reliability for each time period by the help of the table.

- b) What is Mean Time To Failure (MTTF) ? If failure rate (λ) is constant then prove that $MTTF = \frac{1}{\lambda}$. 10 + 5



11. Write short notes any *three* of the following :

3 × 5

- i) Fish bone diagram
 - ii) Kaizen concept
 - iii) Quality assurance
 - iv) Hazard rate
 - v) Availability.
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