GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech (Fourth Semester - Regular) Examinations, April – 2025
23BMEPC24004 - Quality Control and Reliability
(Mechanical Engg.)

Time: 3 hrs   Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A   (2 x 5 = 10 Marks)

Q.1. Answer *ALL* questions

		CO #	Blooms Level
a.	Differentiate between Quality Assurance and Quality Control.	CO1	K1
b.	The following data represents the diameter of 10 parts: 10.2, 10.5, 10.8, 11.1, 10.9, 11.2, 10.6, 11.0, 10.7, 10.4. Calculate the mean and range.	CO1	K2
c.	Explain the meaning and significance of AQL and LTPD.	CO5	K2
d.	A component has a constant failure rate of 0.005 per hour. Calculate the probability that the component will survive for 500 hours.	CO6	K3
e.	Briefly explain product life cycle with diagram.	CO6	K4

PART – B   (10 x 5 = 50 Marks)

Answer *ALL* the questions

		Marks	CO #	Blooms Level
2. a.	Define Statistical Quality Control (SQC). How does SQC contribute to product consistency and customer satisfaction?	5	CO1	K1

b. The XYZ Automobile Company produces engine shafts with a specified diameter of 50 mm. The quality control team collects 5 subgroup samples of 5 shafts each. Calculate the control limits for X bar chart and interpret the result.

Subgroup	Measurements
1	49.8, 50.2, 50.1, 49.9, 50.0
2	50.3, 49.7, 50.2, 50.1, 49.8
3	49.9, 50.0, 50.3, 50.2, 49.7
4	50.1, 50.2, 49.9, 50.0, 50.3
5	50.2, 49.8, 50.1, 50.3, 49.9

5   CO3   K5

(OR)

c. The PQR Electronics company produces resistors with a specified resistance of 1000 ohms. The quality control team collects 5 subgroup samples of 5 resistors each. Calculate the control limits for X bar chart and R chart to interpret the result.

Subgroup	Measurements
1	980, 1020, 1000, 990, 1010
2	1010, 980, 1000, 1020, 990
3	990, 1010, 980, 1000, 1020
4	1000, 990, 1010, 980, 1020
5	1020, 1000, 990, 1010, 980

5   CO3   K5

		Marks	CO #	Blooms Level
d.	What are the various uses of control charts in a manufacturing environment? Explain how control charts help in process monitoring.	5	CO3	K4
3.a.	Differentiate between single, double, and multiple sampling techniques with suitable examples.	5	CO2	K2

b.	A process engineer records the following number of surface defects per square meter of material processed: Construct the U-chart for result interpretation.		5	CO3	K5

Sample	Area (m²)	Defects
1	5	1
2	4	3
3	6	2
4	5	1
5	5	6

(OR)

c. Draw and explain the Operating Characteristic (OC) curve for a single sampling plan. — 5 CO5 K5

d. A quality control team monitors the number of defects in a sample of 10 units of a product. The data collected over 10 samples is: 8, 6, 7, 9, 5, 8, 6, 7, 10, 9 . Construct a C chart and determine whether the process is in control or not. — 5 CO3 K5

4.a. Compare the Kaizen approach with traditional improvement models. How do Quality Circles support the Kaizen philosophy? — 5 CO4 K5

b. Describe the role of training and education in Total Quality Management, including the necessary skills and competencies for quality professionals. — 5 CO4 K5

(OR)

c. Explain the philosophy and principles of JIT. How does JIT contribute to quality improvement and waste reduction? — 5 CO4 K5

d. What are the key challenges and obstacles to implementing Total Quality Management, and how can organizations overcome them? — 5 CO4 K5

5.a. A system consists of 2 components in series, with the first component having a reliability of 0.95 and the second component being a parallel combination of 2 sub-components with reliabilities of 0.8 and 0.7. Calculate the overall system reliability. — 5 CO5 K4

b. Explain the concept of hazard rate and its significance in reliability engineering. — 5 CO5 K4

(OR)

c. A mechanical component has a Weibull shape parameter $\beta = 1.5$ and scale parameter $\eta = 1000$ hours. Determine the reliability at 500 hours and the mean time to failure. — 5 CO5 K4

d. A system consists of 2 parallel branches, each containing 2 components in series. Branch 1 has components with reliabilities of 0.9 and 0.8, while Branch 2 has components with reliabilities of 0.85 and 0.95. Calculate the system reliability. — 5 CO5 K4

6.a. Describe the role of preventive maintenance and predictive maintenance techniques in reliability enhancement. — 5 CO6 K4

b. Differentiate between unit redundancy and standby redundancy. Illustrate with practical examples where each type is effectively applied. — 5 CO6 K2

(OR)

c. Explain the stages of product development with suitable diagram and example. — 5 CO5 K4

d. Describe the various stages of the product design process. How do considerations of reliability and maintainability influence each stage? — 5 CO5 K4

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