

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur (GIET University)



B. Tech (Fourth Semester – Regular/Supplementary) Examinations, April 2026

23BMEPC24004 – Quality Control and Reliability (Mechanical)

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. Define quality and Statistical Quality Control (SQC) with suitable examples. | CO1 | K1 |
| b. Write the mathematical formulas to calculate the UCL and LCL of a p-chart. | CO3 | K2 |
| c. A lot of 500 items is inspected using a sampling plan with $n = 50$ and $c = 2$. Determine whether the lot is accepted if 3 defectives are found. | CO2 | K4 |
| d. Briefly explain the Total Quality Management (TQM) and state its key objectives. | CO4 | K2 |
| e. Differentiate between Mean Time to Failure (MTTF) and Mean Time Between Failures (MTBF). | CO5 | K2 |

PART – B**(10 x 5 = 50 Marks)**Answer **ALL** the questions

- | | Marks | CO # | Blooms Level |
|--|-------|------|--------------|
| 2. a. Explain the fundamental differences between Quality Assurance (QA) and Quality Control (QC) with real-world examples. | 5 | CO1 | K4 |
| b. A process is monitored with subgroup size $n = 5$. $A_2 = 0.577$, $D_3 = 0$, $D_4 = 2.114$, find control limits. Find overall mean ($\bar{X}$) and average range ($\bar{R}$). The data are: | | | |

Sample No.	Observations
1	15, 18, 16, 17, 19
2	14, 16, 15, 17, 18
3	19, 20, 18, 21, 22
4	13, 15, 14, 16, 17
5	20, 21, 19, 22, 23

5 CO3 K4

(OR)

- | | | | |
|--|---|-----|----|
| c. Why quality control is required and note down its significant in service sectors. | 5 | CO1 | K4 |
| d. During inspection of car door panels, the number of surface defects (scratches, dents) is recorded and given in the following table. Construct a c-chart for the above data and interpret the condition of the process. | | | |

Sample No.	Number of Defects (c)
1	3
2	5
3	4
4	6
5	2
6	4

5 CO3 K4

- | | | |
|--|-----|----|
| 3.a. Explain the effect of sample size and acceptance number on producer's and | CO2 | K2 |
|--|-----|----|

consumer's risks.

- b. A double sampling plan has: $n_1 = 60$, $c_1 = 2$, $r_1 = 5$ and $n_2 = 60$, $c_2 = 4$.

For $p = 0.03$, (a) Determine the probability that the lot is accepted after the first sample, (b) Determine the probability that the decision goes to the second sample, (c) Compute the overall probability of acceptance.

5 CO2 K5

(OR)

- c. Define lot-by-lot sampling and explain its purpose in quality control. 5 CO2 K2
- d. Given a double sampling plan: First sample: $n_1=80, c_1=1, r_1=4$ and Second sample: $n_2=80, c_2=3$. If the lot has **5% defectives**, calculate: (a) Probability of rejection after first sample, (b) Probability of acceptance after second sample, (c) Overall probability of acceptance 5 CO2 K5
- 4.a. Analyze the role of ISO 9000 in enhancing organizational performance. 5 CO4 K4
- b. Examine the interrelationship between TQM tools and organizational performance. 5 CO4 K5

(OR)

- c. Analyze the effectiveness of Quality Circles in employee involvement and quality improvement. 5 CO4 K4
- d. Compare KAIZEN and continuous improvement strategies in modern industries. 5 CO4 K5
- 5.a. A machine operates for 5000 hours and experiences 25 failures. Compute: (i) Failure rate (ii) Mean Time Between Failures (MTBF). 5 CO5 K4
- b. Three components ($R_1 = 0.8$, $R_2 = 0.85$, $R_3 = 0.9$) are connected in parallel, and the combination is connected in series with a component $R_4 = 0.95$. Find system reliability. 5 CO5 K4

(OR)

- c. The failure times (in hours) of 10 components are: 100, 120, 140, 160, 180, 200, 220, 240, 260, 280. Find: (i) MTTF (ii) Failure rate. 5 CO5 K4
- d. A system has three components in parallel (0.7, 0.75, 0.8) and this combination is connected in series with two components (0.9, 0.85). Find overall reliability. 5 CO5 K4
- 6.a. Explain the Product Life Cycle (PLC) concept. Discuss reliability considerations at each stage of the life cycle. 5 CO6 K4
- b. Discuss the importance of Pareto principle (80/20 rule) in reliability improvement and quality management. 5 CO6 K4

(OR)

- c. Explain the product development process for a new model of home grinder incorporating reliability considerations at each stage. 5 CO6 K6
- d. Discuss the advantages and limitations of using redundancy techniques in product design. 5 CO6 K4

--- End of Paper ---