

MEPE3002 METROLOGY, QUALITY CONTROL AND RELIABILITY (3-0-0)

Course Objectives:

This course covers metrology principles, quality control techniques, and reliability engineering. Students will learn about measurement systems, tolerances, control charts, sampling plans, and Taguchi methods. Emphasis is placed on statistical quality control, ISO standards, and reliability analysis (MTTF, MTBF) to ensure product quality and performance in manufacturing.

Module-I: (08 Hours)

Metrology: Need of Inspection, Precision and accuracy, Sources of error, Types of error. Line standard, end standard, limits, fits, tolerances, Hole & shaft basis system, Interchangeability, selective assembly, ISO system for limits & fits, Limit gauges-Snap, plug, ring, taper, position gauges-Gauge design, Taylor's principle.

Module-II: (06 Hours)

Comparators- Characteristics, Relative Advantages of various types of comparators, Mechanical, optical, Pneumatic, Fluid displacement type, Measurement by light wave Interference.

Module-III: (06 Hours)

Control charts for variable (X,R,S, CUSUM, EWMA), Control charts for fraction, non-conforming control charts for non-conformation.

Module-IV: (05 Hours)

Design of single sampling plan. Double, multiple and sequential sampling plans, O.C. curve, AOQ, AOQL, Taguchi's Loss function, Orthogonal Arrays, Linear Graphs, parametric design, signal-to noise Ratio, ANOVA, TQM, Taguchi, ISO 9000, ZIT, Quality circle.

MODULE-V: (05 Hours)

Bath-tub-curve, system reliability, reliability improvement, maintainability and availability, Availability of single repairable system using Markov model, Life tests, acceptance sampling plan based on life tests, Sequential acceptance sampling plan based on MTTF & MTBF.

Course Outcomes:

- CO1: Remembering (Knowledge): Define metrology terms (precision, accuracy, tolerances) and recall ISO standards for limits and fits.
- CO2: Understanding (Comprehension): Explain the working principles of comparators (mechanical, optical, pneumatic) and Taguchi's loss function.
- CO3: Applying (Application): Construct control charts (X, R, CUSUM) and design sampling plans (single/double) for quality assessment.
- CO4: Analyzing (Analysis): Evaluate system reliability using bath-tub curves and Markov models for repairable systems.
- CO5: Creating (Synthesis): Develop quality improvement strategies using ANOVA, orthogonal arrays, and TQM principles.

Reference Books:

1. Engineering Metrology- R.K. Jain
2. Engineering Metrology and Measurement- K. Duraivelu and S. Karthikeyan
3. Introduction to Statistical Quality control- D.C. Montgomery
4. Statistical Quality Control- M. Mahajan & Dhanpat Rai
5. Production Technology- P.C. Sharma