

ME3344E RELIABILITY, SAFETY AND ASSET MANAGEMENT FOR ENGINEERS

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Pre-requisite required: No

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✓	✓			✓

Total Lecture Sessions: 39

Course Outcomes:

- CO1:** Identify terminology, and standards in reliability, safety, and asset management for mechanical systems.
- CO2:** Apply reliability analysis tools and maintenance strategies to solve asset performance problems with measurable improvements.
- CO3:** Examine and interpret asset condition data to detect failure patterns and determine optimization approaches.
- CO4:** Construct detailed asset reliability or safety improvement proposals using quantitative methods and emerging technologies.

Fundamentals of Reliability, Safety, and Asset Management: Key Definitions, Concepts, and Terminologies: Reliability, Availability, Maintainability, Safety; Relevant Standards and Frameworks: ISO 55000, ISO 31000, ISO 14224 — Understanding Applicability in Mechanical Engineering; Types of Failures and Failure Mechanisms in Mechanical Components; Industrial Case Studies Highlighting Asset Management Importance

Core Principles and Assessment Methods: Reliability Metrics: MTBF, MTTR, Availability, Failure Rate; Failure Modes and Effects Analysis (FMEA) – Procedure and Applications; Fault Tree Analysis (FTA) – Quantitative and Qualitative Techniques; Reliability Centered Maintenance (RCM); Case Studies with Real Industrial Asset Data for Identifying Reliability and Safety Risks

Safety Management Systems and Risk Assessment: Introduction to Safety Management Systems (SMS); Risk Identification and Hazard Analysis: HAZOP, LOPA; Quantitative Safety Assessment Tools and Techniques; Root Cause Analysis for Safety Incidents; Safety Culture and Behavior-Based Safety Programs in Industry

Maintenance and Asset Management Practices: Maintenance Types and Strategies: Preventive, Predictive, Condition-Based; Asset Lifecycle Management and Performance Metrics

Quantitative Data Analysis in Reliability and Safety: Statistical Methods for Reliability Data Analysis; Reliability Prediction and Life Estimation Models; Data Interpretation: Identifying Failure Patterns, Trends, and Anomalies

Decision Making and Optimization in Asset Management: Cost-Benefit Analysis of Maintenance and Safety Interventions; Risk-Based Decision-Making Frameworks; Sustainability Considerations in Asset Management; Multi-Criteria Decision Analysis Techniques for Asset Optimization, Artificial Intelligence and Machine Learning for Predictive Maintenance; Case Studies on Technology Implementation in Mechanical Industries

References:

- [1] Souza, G. F. M., Netto, A. C., Melani, A. H. A., Michalski, M. A. C. and Silva, R. F. 2022. *Reliability Analysis and Asset Management of Engineering Systems*, 1st ed., Elsevier, Amsterdam, The Netherlands.
- [2] Modarres, M., and Groth, K.. 2023. *Reliability and Risk Analysis*, 2nd ed., CRC Press.
- [3] Corte, A. 2025. *Reliability Engineering and Asset Maintenance: Concepts and Metrics Productivity and Costs*, 1st ed., Amazon Digital Services LLC
- [4] Smith, D. J. 2017. *Reliability, Maintainability and Risk*. 9th ed., Elsevier
- [5] Dhillon, B. S. 2019. *Maintainability, Maintenance, and Reliability for Engineers*. 1st ed., CRC Press.
- [6] Dhillon, B. S. 2005. *Reliability, Quality, and Safety for Engineers*. 1st ed. CRC Press.
- [7] Ebeling, C. E. 2019. *An Introduction to Reliability and Maintainability Engineering*. 12th ed., TataMacGraw-Hill Publishing Company Limited.