

University of Toronto, Department of Mechanical and Industrial Engineering

Winter session 2025

Graduate course MIE 1721S – Reliability

Instructors: D. Banjevic (office BA8139)

Timing: Three hours/week, for 13 weeks, Thursdays, 6-9, in-person, classroom BA B024

Starts: January TBA, ends: April TBA

Office hours: by appointment, questions by Quercus, some OH will be scheduled before test and exam (TBA)

Course work: Two assignments (10%, first on February TBA, due on February TBA, second on March TBA, due on April TBA, mid-term test (35%, February TBA), final exam (55%, April TBA). Chance for a project (only for students from industry that can provide real data; in that case, final exam 45%, project 10%).

Web-site: On Portal.

Learning Outcomes

After completing this course, students should be able to:

- understand importance of reliability and asset management in design and production
- review and improve overall reliability of assets and maintenance practices
- design, organize, collect, and analyse maintenance and reliability data
- use statistical models to predict remaining useful life of assets on long term, and upcoming failures on short term
- evaluate reliability of complex systems through creation and analysis of reliability block diagrams
- optimize maintenance and economic life of capital assets in accordance with time value of money
- understand influence of environmental/external factors on life of assets and apply measures to minimize them
- analyze failure modes, failure causes, and consequences, using fault-tree analysis and other appropriate methods to be able to minimize fail-danger situations
- optimize inspection intervals for protective devices for dormant failures

COURSE OUTLINE

Textbook: John P. Bentley: Reliability and Quality Engineering, second ed., Addison-Wesley, 1999. (may not be easy to find), and Jardine, A.K.S., and Tsang, A.H.S. (2012). *Maintenance, Replacement and Reliability*, second ed.

Recommended: An Introduction to Reliability and Maintainability Engineering, C.E. Ebeling, Waveland Press, Inc, 2005; lot of exercises (second edition).

Tentative list of topics that will be covered is given below. Additional topics and extensions will be considered. A moderate knowledge of probability and statistics is assumed as a requirement.

1. Principles of quality
2. Principles of reliability

3. Reliability of systems
4. Failure rate data and models
5. Quality and reliability in design and manufacture
6. Reliability and availability in maintenance
7. Asset management: capital equipment replacement policies
8. Protective systems
9. Asset management: preventive replacement policies

Class slides will be posted in advance. Some additional material will be available on the website (textbook problems solutions, practice problems, old tests and exams, some research papers and case studies).

List of some useful books:

Ross, S.M. (1988). *A First Course in Probability*.

Crowder, M.J., Kimber, A.C., Smith, R.L., and Sweeting, T.J. (1994). *Statistical Analysis of Reliability Data*.

Blischke, W.R., and Murthy, D.N.P. (2000). *Reliability: Modeling, Prediction, and Optimization*.

Cox, D.R., and Oakes, D. (1984). *Analysis of Survival Data*.

Meeker, W.Q., and Escobar, L.A. (1998). *Statistical Methods for Reliability Data*.