UNSW Course Outline

ZEIT8031 Reliability Engineering Fundamentals - 2024

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General Course Information

Course Code : ZEIT8031
Year : 2024
Term : Semester 1
Teaching Period : Z1
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : School of Systems and Computing
Delivery Mode : Online
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

The course will cover the principal methods of reliability analysis, including fault trees, reliability block diagrams, failure mode and effects analysis, event tree construction, reliability data collection and analysis, modelling systems for reliability analysis. The course will focus on

capability system acquisition problems related to defence industry.

Course Aims

This course aims to:

1) Introduce students to the major aspects of reliability engineering as they relate to systems acquisition project management, systems engineering, requirements engineering, systems integration, enterprise architecture, and conceptual design.

2) Introduce fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis and methods of modelling systems for reliability analysis

3) Provide practical experience for reliability analysis.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Understand the major aspects of reliability engineering as they relate to systems acquisition project management, systems engineering, requirements engineering, systems integration, enterprise architecture, and conceptual design.
CLO2 : Understand fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis and methods of modelling systems for reliability analysis
CLO3 : Practice the development of key reliability analysis strategies.

Course Learning Outcomes	Assessment Item
CLO1 : Understand the major aspects of reliability engineering as they relate to systems acquisition project management, systems engineering, requirements engineering, systems integration, enterprise architecture, and conceptual design.	• Online Test • Assignment 1 • Assignment 2 • Assignment 3
CLO2 : Understand fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis and methods of modelling systems for reliability analysis	• Assignment 1 • Assignment 2 • Assignment 3
CLO3 : Practice the development of key reliability analysis strategies.	• Assignment 2 • Assignment 3

Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate | Microsoft Teams

Learning and Teaching in this course

Successful completion of this course significantly contributes to the acquisition of UNSW graduate capabilities. UNSW is committed to fostering globally focused graduates who embody scholarly rigor, leadership skills, and professional competence within an international community.

Throughout the course, students will be actively encouraged to cultivate specific graduate attributes (GAs) by engaging in course activities and mastering the knowledge content. These attributes will be rigorously assessed within the various assessment tasks:

(GA1) Proficiency in basic probability and statistics, enabling a comprehensive understanding and application of common probability distributions for typical reliability scenarios.

(GA2) Competence in data analysis, encompassing both frequentist and Bayesian inference methods for analyzing typical failure data.

(GA3) Expertise in reliability modeling, addressing both failure mechanisms and systems, thereby supporting informed inference in the field of reliability.

Other Professional Outcomes

Course Details:

Reliability Engineering Fundamentals offers a comprehensive exploration of the reliability engineering domain, providing a semi-intensive survey of key concepts. The course is crafted to establish a strong philosophical foundation for reliability engineering, complemented by practical examples of application. It is also dedicated to exploring the application of analytical methods in fostering the design of reliable and efficient equipment, coupled with strategic planning for effective equipment servicing. Upon completion, students will acquire a profound understanding of the strategies and objectives integral to a contemporary reliability program. They will also gain familiarity with current techniques essential for developing robust products. The course incorporates diverse examples spanning various applications, aiming to cultivate an appreciation for the challenges inherent in the multifaceted components of developing and producing complex products and systems.

Reliability Engineering Fundamentals emphasizes the pivotal role of probability models as a robust tool for illustrating and assessing the inherent variability in equipment performance and longevity. Beyond its focus on introductory study, the text serves as a valuable resource for practising engineers. Those engaged in the design process will discover a clear explanation of reliability and maintenance issues crucial to the success of their creations. Likewise, engineers tasked with product reliability analysis, verification, or planning maintenance support for fielded equipment will find the material both pertinent and easily accessible for practical application.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Online Test Assessment Format: Individual	15%	Start Date: 25/02/2024 10:00 AM Due Date: 10/03/2024 11:55 PM Post Date: 25/02/2024 10:00 AM
Assignment 1 Assessment Format: Individual	25%	Start Date: 20/03/2024 10:00 AM Due Date: 07/04/2024 10:55 PM Post Date: 20/03/2024 10:00 AM
Assignment 2 Assessment Format: Individual	25%	Start Date: 20/04/2024 10:00 AM Due Date: 12/05/2024 11:55 PM Post Date: 20/04/2024 10:00 AM
Assignment 3 Assessment Format: Individual	35%	Start Date: 20/05/2024 10:00 AM Due Date: 07/06/2024 11:55 PM Post Date: 20/05/2024 10:00 AM

Assessment Details

Online Test

Assessment Overview

The test covers material from Chapters 1 – 3 of the course text and is designed to scaffold students' preparation for Assignment 1

Course Learning Outcomes

- CLO1 : Understand the major aspects of reliability engineering as they relate to systems acquisition project management, systems engineering, requirements engineering, systems integration, enterprise architecture, and conceptual design.

Detailed Assessment Description

This test will scaffold Assignment 1. This test aims at helping you see that you are on the right track. The test contains 10 Multiple Choice Questions (MCQs) and covers the first three chapters.

Assessment Length

10 MCQs

Submission notes

The test contains 10 questions and has a time limit of 30 minutes. Please make sure you will not be interrupted, and have a reliable (wired) internet connection before commencing. Answer each question as best you can/answer as many questions as you can in the time allowed. All questions appear on one page.

Assignment submission Turnitin type

Not Applicable

Assignment 1

Assessment Overview

To provide students with an opportunity to demonstrate their ability to apply the knowledge and understanding they have gained throughout the course.

Course Learning Outcomes

- CLO1 : Understand the major aspects of reliability engineering as they relate to systems acquisition project management, systems engineering, requirements engineering, systems integration, enterprise architecture, and conceptual design.
- CLO2 : Understand fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis and methods of modelling systems for reliability analysis

Detailed Assessment Description

Assignment #1 focuses primarily on System Reliability Modelling. It also assesses the understanding of some of the techniques used in applications that involve different distributions such as Weibull, Normal, Gamma, etc.

Assignment submission Turnitin type

Not Applicable

Assignment 2

Assessment Overview

To provide students with an opportunity to demonstrate their ability to apply the knowledge and understanding they have gained throughout the course.

Course Learning Outcomes

- CLO1 : Understand the major aspects of reliability engineering as they relate to systems acquisition project management, systems engineering, requirements engineering, systems integration, enterprise architecture, and conceptual design.
- CLO2 : Understand fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis and methods of modelling systems for reliability analysis
- CLO3 : Practice the development of key reliability analysis strategies.

Detailed Assessment Description

Assignment #2 focuses on System Reliability Modelling, which is extended to include Failure processes, Age acceleration and nonparametric statistical methods

Assignment submission Turnitin type

Not Applicable

Assignment 3

Assessment Overview

To provide students with an opportunity to demonstrate their ability to apply the knowledge and understanding they have gained throughout the course.

Course Learning Outcomes

- CLO1 : Understand the major aspects of reliability engineering as they relate to systems acquisition project management, systems engineering, requirements engineering, systems integration, enterprise architecture, and conceptual design.
- CLO2 : Understand fault tree and reliability block diagrams; Failure Mode and Effects Analysis (FMEA); event tree construction and evaluation; reliability data collection and analysis and methods of modelling systems for reliability analysis
- CLO3 : Practice the development of key reliability analysis strategies.

Detailed Assessment Description

This final assignment is to provide students with an opportunity to demonstrate their ability to apply the knowledge and understanding they have gained throughout the course.

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Test and Quizzes The test covers material from Chapters 1 – 3 of the course text and is designed to scaffold your preparation for Assignment 1. Test questions are developed from the in-between lines of these chapters. So, careful reading is required. Note that the test is open for

ONE week and must be completed by the nominated closing date. You can attempt the test only once—your mark will be based on that attempt. Please note that the test is timed, and you must complete as many questions as you can within the given duration.

Quizzes are provided for the remaining text chapters. These quizzes are not assessed, they are designed to scaffold the remainder of your study. You may repeat the quizzes as many times as you wish.

Assignments

The three assignments (which will be posted on the online site) provide you with an opportunity to demonstrate your ability to apply the knowledge and understanding you have gained throughout the course. The assignments require higher-order independent thinking beyond the ability to read, comprehend, and remember the information provided in the course text. They will help you draw together all of the discrete areas studied in each chapter. You are expected to make significant effort to complete your assignments (worth 70% of the course marks and approximately 90 hours of effort). Marks for the assignments will be allocated based on the effort you apply, and the depth of understanding demonstrated. For the students who submit the first and second assignments on time, feedback will usually be available on Moodle within two weeks of the due date. As the third assignment is considered the capstone assessment of the course, no feedback on this will be provided on Moodle before the end of the semester.

Late Submission of Assessment:

UNSW adheres to standardized penalties for late submissions, requiring prior arrangements with the lecturer or a formal application for special consideration to avoid penalties. A penalty of 5% of the total available mark applies for each working day an assessment item is late, up to a maximum of 5 days (120 hours). After this period, no further submissions are accepted, resulting in a grade of zero (0).

It's important to note that work commitments are generally not considered a justification for late submissions. Any allowed extensions should be seen as a grace period, and if the delayed date is not met, penalties apply from the original due date, not the end of the grace period.

Grading Basis

Standard

Requirements to pass course

You are not required to pass any one particular piece of assessment; you simply need to achieve at least 50 marks out of a total 100 marks to pass this course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Reading	Reading Chapter 1: Introduction Watching Chapter 1's Summary
Week 2 : 4 March - 8 March	Reading	Reading Chapter 2: System Structures Watching Chapter 2's Summary
	Homework	Complete Homework #1
Week 3 : 11 March - 15 March	Reading	Reading Chapter 3: Reliability of System Structures Watching Chapter 3's Summary
	Homework	Complete Homework #2
	Assessment	The online test opened on 11 March 2024 and is due on 18 March 2024
Week 4 : 18 March - 22 March	Reading	Reading Chapter 4: Reliability over Time Watching Chapter 4's Summary
	Assessment	Online Test: Due 18 March 2024 The census date is Sun 24 Mar 2024
Week 5 : 25 March - 29 March	Reading	Reading Chapter 5: Failure Processes Watching Chapter 5's Summary
	Homework	Complete Homework #3
Week 6 : 1 April - 5 April	Reading	Reading Chapter 6: Age Acceleration Watching Chapter 6's Summary
	Assessment	Assignment 1 is due on 7 April 2024
Week 7 : 22 April - 26 April	Reading	Reading Chapter 7: Nonparametric Statistical Methods Watching Chapter 7's Summary
	Homework	Complete Homework #4
Week 8 : 29 April - 3 May	Reading	Reading Chapter 8: Parametric Statistical Methods Watching Chapter 8's Summary
	Homework	Complete Homework #5
Week 9 : 6 May - 10 May	Reading	Reading Chapter 9: Repairable Systems I: Renewal and Instantaneous Repair Watching Chapter 9's Summary
	Assessment	Assignment 2 is due on 12 May 2024
Week 10 : 13 May - 17 May	Reading	Reading Chapter 10: Repairable Systems II: Nonrenewal and Instantaneous Repair Watching Chapter 10's Summary
	Homework	Complete Homework #6
Week 11 : 20 May - 24 May	Reading	Reading Chapter 11: Availability Analysis Watching Chapter 11's Summary
	Homework	Complete Homework #7
Week 12 : 27 May - 31 May	Other	Preparation for Assignment 3 - due on 7 June 2024
Week 13 : 3 June - 7 June	Assessment	Assignment 3 is due on 7 June 2024

Attendance Requirements

Not Applicable - as no class attendance is required

General Schedule Information

The following schedule is recommended and will form the basis of activities for the semester:

Course Resources

Prescribed Resources

RELIABILITY ENGINEERING Probabilistic Models and Maintenance Methods Second Edition, JOEL A. NACHLAS, CRC Press

Recommended Resources

O'Connor, P. and Kleyner, A., 2012. *Practical reliability engineering*. John Wiley & Sons.

Xu, Z. and Saleh, J.H., 2021. Machine learning for reliability engineering and safety applications: Review of current status and future opportunities. *Reliability Engineering & System Safety*, *211*, p.107530.

Coit, D.W. and Zio, E., 2019. The evolution of system reliability optimization. *Reliability Engineering & System Safety*, *192*, p.106259.

Course Evaluation and Development

A key priority outlined in UNSW's 2025 Strategy is the pursuit of academic excellence in education. A crucial aspect of assessing UNSW's progress toward this objective involves actively seeking input from our students. At the conclusion of this course, students will be invited to participate in the myExperience survey to gather valuable insights.

Throughout the semester, students are encouraged to provide feedback through various channels, including direct communication with lecturers, utilizing the "On-going Student Feedback" link in Moodle, participating in Student-Staff Liaison Committee meetings within schools, engaging in informal feedback sessions led by staff, and contributing to focus groups.

We welcome and value any recommendations, observations, or sentiments you may wish to share directly with the lecturers. Your feedback plays a pivotal role in our commitment to enhancing and refining this course promptly.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Ismail Ali		Capability Systems Centre, School of Systems and Computing, UNSW Canberra		Dr Ali is available for consultation during normal working hours. Please email first to make a time. We are usually available for consultation during the week from Monday to Friday during 10am to midday via email contact initially. You may also arrange a	No	Yes

Other Useful Information

Academic Information

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of each course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups (where applicable). Student opinions really do make a difference. Refer to the Moodle site for your course to see how the feedback from previous students has contributed to the course development.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct.

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Equitable Learning Services (ELS)

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitible Learning Services team. Equitable Learning Services is a free and confidential service that provides

practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators** (ELFs) are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: https://www.student.unsw.edu.au/equitable-learning

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct. Find relevant information at: Student Code of Conduct (unsw.edu.au)

Plagiarism undermines academic integrity and is not tolerated at UNSW. It is defined as using the words or ideas of others and passing them off as your own, and can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

https://student.unsw.edu.au/plagiarism

Submission of Assessment Tasks

Special Consideration

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:

(i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or

(ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: https://www.student.unsw.edu.au/special/consideration/guide

Or apply for special consideration through your MyUNSW portal.

Late Submission of assessment tasks (other than examinations)

UNSW has a standard late submission penalty of:

- 5% per day,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Electronic submission of assessment

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

Release of final mark

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is the only official mark.

School-specific Information

The Leaning Management System

Moodle is the Learning Management System used at UNSW Canberra. All courses have a Moodle site which will become available to students at least one week before the start of semester. Please find all help and documentation (including Blackboard Collaborate) at the Moodle Support page.

UNSW Moodle supports the following web browsers:
• Google Chrome 50+
• Safari 10+
Internet Explorer is not recommended. Addons and Toolbars can affect any browser's performance.

Operating systems recommended are:
• Windows 10,
• Mac OSX Sierra,
• iPad IOS10

Further details:
Moodle System Requirements
Moodle Log In

If you need further assistance with Moodle:

For enrolment and login issues please contact:
IT Service Centre
Email: itservicecentre@unsw.edu.au
Phone: (02) 9385-1333
International: +61 2 9385 1333

For all other Moodle issues please contact:
External TELT Support

Email: externalteltsupport@unsw.edu.au

Phone: (02) 9385-3331

International: +61 2 938 53331

Opening hours:

Monday – Friday 7:30am – 9:30 pm

Saturday & Sunday 8:30 am – 4:30pm

Study at UNSW Canberra

Study at UNSW Canberra has lots of useful information regarding:

• Where to get help

• Administrative matters

• Getting your passwords set up

• How to log on to Moodle

• Accessing the Library and other areas.

UNSW Canberra Student Hub

For News and Notices, Student Services and Support, Campus Comminity, Quick Links, Important Dates and Upcoming Events

School Contact Information

Deputy Head of School (Education): Dr Erandi Hene Kankanamge

E: e.henekankanamge@adfa.edu.au

T: 02 5114 5157

Syscom Admin Support: syscom@unsw.edu.au

T: 02 5114 5284

Syscom Admin Office: Building 15, Level 1, Room 101 (open 10am to 3pm, Mon to Fri)