School of Engineering

ENGG2100: Engineering Risk and Uncertainty

Singapore PSB
Trimester 1 - 2024 (Singapore)

COURSE OUTLINE

OVERVIEW

Course Description

This course introduces students to the development and application of probability and risk concepts to provide solutions to common problems formulated in engineering practice. Its purpose is to provide the foundation material for later year courses so students are able to understand the risk and uncertainty that is part of engineering design.

Academic Progress Requirements

Nil

Requisites

If you have successfully completed CIVL2040 Engineering Probabilities, you cannot enrol in ENGG2100.

You cannot enrol in this course if you are active in one of the Engineering programs of
Bachelor of Engineering (Mining Transfer Program) [10478],
Bachelor Engineering (Hons)(Civil)/Bachelor Engineering(Hons)(Surveying) [12282],
Bachelor of Engineering (Honours) (Civil)[12288],
Bachelor of Engineering (Honours) (Civil) / Bachelor of Business [12289],
Bachelor of Eng (Hons) (Civil) / Bachelor of Eng (Hons) (Environmental) [12290],
Bachelor of Engineering (Honours) (Environmental) [12298],
Bachelor of Engineering (Environmental) (Honours) / Bachelor of Science [12299] or
Bachelor of Engineering (Honours) (Civil) / Bachelor of Mathematics [40005].

Assumed Knowledge

Course content covered in ENGG1003 Introduction to Procedural Programming (previously ENGG1002), and content covered in MATH1120 Mathematics for Engineering, Science and Technology 2.

Contact Hours

Singapore PSB
Computer Lab
Face to Face On Campus
2 hour(s) per week(s) for 5 week(s) (starting week see timetable)

Lecture
Face to Face On Campus
4 hour(s) per week(s) for 13 week(s) starting Week 1

Tutorial
Face to Face On Campus
2 hour(s) per week(s) for 2 week(s) starting Week 11

Tutorial
Face to Face On Campus
2 hour(s) per week(s) for 4 week(s) starting Week 2

www.newcastle.edu.au
CRICOS Provider 00109J

Unit Weighting	10
Workload	Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator

Singapore PSB
Prof Jinsong Huang
Jinsong.Huang@newcastle.edu.au
+61 2 4921 5118
Consultation: via email.

Teaching Staff

Dr Kam Choong Lee
KamChoong.Lee@newcastle.edu.au
Consultation: to be advised on Canvas.

School Office

School of Engineering (Callaghan)
SENG-ADMIN@newcastle.edu.au
+61 2 4921 5798

SYLLABUS

Course Content

- An introduction to probability concepts, probability distributions, theorem of total probability, and Bayes theorem targeted to engineering applications
- Monte Carlo simulation: theory and practice
- Bayesian inference with applications to the binomial, normal and Poisson distributions
- Linear and nonlinear regression models
- Introduction to risk assessment including sources of risk and risk acceptance criteria
- Decision making under uncertainty including system representation, decision trees and optimisation

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Formulate and solve problems dealing with probability and statistics in engineering applications.

2. Employ the key concepts of probability, Bayesian inference and regression models to estimate uncertainty in engineering systems.

3. Develop practical skills in Monte Carlo simulation.

4. Apply principles of making decisions under uncertainty.

5. Apply risk management principles.

Course Materials

Lecture Materials:

- All lecture slides, tutorials and computer lab materials are provided on Canvas.

Other Resources:
The following textbook is NOT required but can be helpful for the course:

- Alfredo H-S. Ang and Wilson H. Tang, Probability concepts in engineering: emphasis on applications to civil and environmental engineering, 2nd edition, John Wiley & Sons Inc., 2007, 406 pp.

ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Written Assignment 1	5pm Friday Week 5	Individual	20%	1, 2
2	Written Assignment 2	5pm Friday Week 9	Individual	20%	1, 2, 3
3	Written Assignment 3	5pm Friday Week 12	Individual	15%	1, 2
4	Written Assignment 4	5pm Friday Week 14	Individual	15%	1, 2, 4, 5
5	Formal Examination	During the formal examination period.	Individual	30%	1, 2, 3, 4, 5

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Written Assignment 1

Assessment Type Written Assignment
Purpose Students will have to apply their knowledge on mathematics of probability, theorem of total probability, Bayes theorem, descriptors of random variables, and normal probability distribution.
Description This assignment requires answering a series of questions to test the understanding and correct application of probability concepts and the normal probability distribution.
Weighting 20%
Due Date 5pm Friday Week 5
Submission Method Online
Assessment Criteria To be advised on Canvas.
Return Method Online
Feedback Provided Online. Correct answers are provided after marking.
Group feedback is also provided during lectures and Canvas.

Assessment 2 - Written Assignment 2

Assessment Type Written Assignment
Purpose Students will have to apply their knowledge probability distributions and apply the concepts of Monte Carlo algorithms in order to solve engineering related problems.
Description This assignment requires answering a series of questions on probability distribution as well as programming of Monte Carlo routines in Python to solve specific problems.
Weighting 20%
Due Date 5pm Friday Week 9
Submission Method Online
Assessment Criteria To be advised on Canvas.
Return Method Online
Feedback Provided Online. Correct answers are provided after marking.
Group feedback is also provided during lectures and Canvas.

Assessment 3 - Written Assignment 3

Assessment Type Written Assignment
Purpose Students will have to apply their knowledge on statistical inference to select adequate probability distributions, Bayesian inference concepts and linear regression.
Description This assignment requires answering a series of questions to test the understanding and correct application of statistical inference to estimate uncertainty in engineering problems.
Weighting 15%
Due Date 5pm Friday Week 12
Submission Method Online
Assessment Criteria To be advised on Canvas.
Return Method Online

Feedback Provided	Online. Correct answers are provided after marking. Group feedback is also provided during lectures and Canvas.

Assessment 4 - Written Assignment 4

Assessment Type	Written Assignment
Purpose	Students will have to apply their knowledge on linear and non-linear regression models as well as implementing tools for decision making under uncertainty and risk management.
Description	This assignment requires answering a series of questions to test the understanding and correct application risk and uncertainty for making decisions and management.
Weighting	15%
Due Date	5pm Friday Week 14
Submission Method	Online
Assessment Criteria	To be advised on Canvas.
Return Method	Online
Feedback Provided	Online. Correct answers are provided after marking. Group feedback is also provided during lectures and Canvas.

Assessment 5 - Formal Examination

Assessment Type	Formal Examination
Description	The final exam will examine all material presented in lectures, tutorials and laboratories.
Weighting	30%
Due Date	During the formal examination period.
Submission Method	Formal Exam
Assessment Criteria	The final exam will be marked on the correctness of the solution and the approach (working out) used to obtain the solutions.
Return Method	Not Returned
Feedback Provided	No Feedback.

ADDITIONAL INFORMATION

Grading Scheme This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Attendance

Attendance/participation will be recorded in the following components:

- Computer Lab (Method of recording: Recorded during class.)
- Tutorial (Method of recording: Recorded during class.)

Attendance is NOT compulsory, but highly recommended.

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.

Please make sure you check Canvas and you student email regularly for any announcements concerning the course.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures that support a safe and respectful environment at the University.

This course outline was approved by the Head of School on 22nd November 2023. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

Graduate Profile Statements – ENGG2100

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability				
12	3.2. Effective oral and written communication in professional and lay domains.				
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.				
15	3.5. Orderly management of self, and professional conduct.				
16	3.6. Effective team membership and team leadership.				
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	X	X	X	2
8	2.2. Fluent application of engineering techniques, tools and resources.				
9	2.3. Application of systematic engineering synthesis and design processes.				
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.	X	X	X	2
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.				
2	1.2. Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.	X	X	X	3
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.				
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.				
5	1.5. Knowledge of contextual factors impacting the engineering discipline.				
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.				