Department of Civil Engineering
Building 60-123a
23 College Walk
Clayton, VIC 3168

ENG5001/ENG6001 Advanced Engineering Data Analysis

Semester 1, 2023

Unit Coordinator:
Dr. Shuli Luo
Email: shuli.luo@monash.edu
Office: Room 7307, SEU-Monash JGS Building, Suzhou, China
Office hour: 4:00-6:00 pm, every Friday (with prior notice via email)

Lecturer:
Dr. Qiqun Zheng
Email: Qijun.zheng@monash.edu
Office: Room 8304, SEU-Monash JGS Building, Suzhou, China
Office hour: 4:00-6:00 pm, every Friday (with prior notice via email)

Teaching Assistants:
Ms. Lurong Xu
Email: Lurong.Xu@monash.edu
Mr. Zihan Chen
Email: Zihan.Chen@monash.edu
Ms. Xinyue Qin
Email: Xinyue.Qin@monash.edu

Overview:
Introduces engineering probability and statistics. Case studies are used to illustrate the application of these areas in the design/system analysis process. Topics include.

- Probability
  - Set theory and axioms, Probability of events
  - Discrete and continuous random variables
  - Conditional probability, joint probability distributions
- Statistics
  - Descriptive statistics
  - Inferential statistics
    - Random samples and sample statistics
    - Point/Interval estimation
    - Hypothesis test
- Statistical modelling/estimation
  - Regression analysis
  - Maximum likelihood estimation

This course combines both theory and application with real data sets, summary statistics testing, visualization, and modeling/estimation using available tools, and interpretation.

The example tutorial on engineering data analysis (descriptive analysis and regression modeling) using Excel will be discussed in class. The practice class tutorial session covers basic Python/Matlab programming, big data analysis procedure and case study using selected dataset (file size over GB).

Some assignment/practice class tasks require data analysis, model development and estimation with actual data, using available statistical packages in different software, such as Python (open source), Matlab, and R languages. Excel is also useful for data manipulation and analysis, regression, and other tasks. You may choose whatever software that you are familiar with to finish these tasks.

Software: Python, R, Matlab, Excel or other software that you are comfortable with

Learning outcomes:
On successful completion of this unit, you should be able to:

1. Assess problems from an engineering perspective and deliberate on the relevant contextual factors. Combine and apply sophisticated data analysis methods and decision-making skills to analyse industrial scenarios and make recommendations that support business growth and development.

2. Justify the use of appropriate computer modelling techniques and experimental methods, whilst ensuring model or test applicability, accuracy and limitations of the methods.

3. Collaboratively evaluate an industry scenario to solve a problem or develop an innovation.

4. Demonstrate the effective communication of the outcomes in a written and verbal format and assess the work of others.

Textbook:

- Lecture Notes on Monash Moodle
- Applied Statistics and Probability for Engineers (Douglas C. Montgomery, et.al.)
- Probability & Statistics for Engineers & Scientists (Ronald E. Walpole, et. al.)

Assessments:

- Assignments: 30%
- Quiz:10%
- Mid-semester exam: 20%
- Final exam: 40%

This unit contains a hurdle requirement that you must achieve to be able to pass the unit. You are required to achieve at least 45% in the total continuous assessment component (assignments + quiz + Mid-semester exam) and at least 45% in the final assessment component. The consequence of not achieving a hurdle requirement is a fail grade (NH).

Unit Schedule (Tentative):

Lecture time: 9:00am-11:00am, every Friday, Location: Lecture Hall 204, Software College, Southeast University Suzhou Campus (204报告厅，东南大学苏州校区中大院)

Practical class time: 2:00-4:00pm, every Friday, Location: Lecture Hall 204, Software College, Southeast University Suzhou Campus (204报告厅，东南大学苏州校区中大院)

Date	Lecture	Topic	Assignments		Quiz	Exams	Labs
			OUT	DUE			
Fri, Mar 3	1	Introduction and Descriptive Statistics (Graphical)					
Fri, Mar 10	2	Descriptive Statistics (Numerical)					Lab 1
Fri, Mar 17	3	Basic Probability	AS1		√		Lab 2
Fri, Mar 24	4	Conditional Probability and Bayesian Theorem					Lab 3
Fri, Mar 31	5	Discrete Random Variables and Distributions		AS1	√		Lab 4
Fri, Apr 7	6	Continuous Random Variables and Distributions			√		Lab 5
Semester Break							
Fri, Apr 21	7	Multimodal and Multivariate Distributions				ME	
Fri, Apr 28	8	Independence			√		Lab 6
Fri, May 5	9	Estimation of parameters I	AS2				Lab 7
Fri, May 12	10	Estimation of parameters II			√		Lab 8
Fri, May 19	11	Confidence Intervals and Hypothesis Testing		AS2			Lab 9
Fri, May 26	12	Linear Regression			√		Lab 10
May 29-Jun 5	N/A	Study week					
June 5- Jun 11	N/A	Exam				FE	