MODULE DESCRIPTION FORM

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CL329/CL331 (semester 1)/CL332 (semester 2) Engineering Mathematics

Module Registrar: Dr John Douglas	**Taught To (Course): Cohorts for whom class is compulsory** Civil Engineering / Civil and Environmental Engineering		
Other Lecturers Involved:	**Credit Weighting:** 20	**Semester:** 1 (CL331) & 2 (CL332)	
Assumed Prerequisites: UG: MM115 Mathematics 1D & MM215 Mathematics 2D (or equivalent) PG: Maths at level 2	**Compulsory class**	**Academic Level:** NQF 5 Year 3	**Suitable for Exchange: Y**

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
22	44							134	200

Educational Aim

This module aims to give an introduction to statistics and probability (semester 1) and computer programming, in general, and Python, specifically (semester 2), and develop applications relevant to Civil and Environmental Engineering in these fields.

Learning Outcomes

On completion of the module the student is expected to be able to

LO1 Treat experimental/observational data statistically

LO2 Understand and use probabilistic models for civil and environmental engineering

LO3 Write and read Python programs to analyse and visualize data

LO4 Write and read Python programs to solve mathematical and engineering problems

Syllabus

The module will teach the following (topics 1 and 2 in semester 1, CL331, and topics 3 and 4 in semester 2, CL332):

Topic 1: Statistics
- Presentation of statistical data
- Measurement of central tendency, dispersion and correlation
- Analyse and describe data using statistical descriptors
- Graphically display data
- Statistics within civil engineering

Topic 2: Probability
- Apply the basic rules of probability
- Identify the properties of discrete and continuous random variables
- Develop simple statistical models and make inferences using discrete probability distributions
- Assess whether data are normally distributed
- Use standard normal and Student's t distribution tables for statistical calculations
- Conduct hypothesis tests

Topic 3: Introduction to Python
- Python IDEs and Anaconda distribution

- Numbers
- Strings
- Variables
- Statements (loops, if tests)
- Data Structures
- Functions
- Input/output

Topic 4: Python as numerical tool
- Arrays and matrices (Numpy library)
- Plots and data visualization (Matplotlib library)
- Integration, curve-fitting (Scipy library)

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 Treat experimental data statistically
C1 Calculate statistical descriptors of data
C2 Perform linear regression of data and analyse and present the results
C3 Perform log-linear regression of data and analyse and present the results

LO2 Understand and use probabilistic models for civil and environmental engineering
C1 Perform statistical hypothesis testing
C2 Calculate confidence intervals
C3 Calculate probabilities using fundamental rules and standard continuous and discrete distributions

LO3 Write and read Python programs to analyse and visualize data
C1 Import, output and plot given data sets
C2 Use functions to accomplish specific tasks
C3 Perform array and matrix operations on given data set

LO5 Create Python scripts to solve mathematical and engineering problems
C1 Create scripts to solve mathematical/engineering problems
C2 Use numerical tools for integration, differentiation and curve-fitting
C3 Use these tools to solve mathematical/engineering problems

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at:
*https://www.strath.ac.uk/staff/policies/academic/*http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/
)

Principle 1. "Assessment and feedback practices promote effective student learning"

Exam-style tutorial questions and regular minitests are used throughout both semesters to illustrate civil and environmental engineering problems and reinforce skills needed to do well in the class test and exam. In both semesters students have multiple (10 in semester 1 and 4 in semester 2) small assessments, a class test, and an examination per semester. Regular feedback allows them to gauge performance and close gaps between current and desired performance. Regular, two-hour tutorial sessions are built into the curriculum to support student learning. Both paper and computer-based assessments are used within semester 1, for some of which collaboration is allowed to encourage social learning. Computer-based assessments are used in semester 2.
Rapid feedback is provided on small assessments ahead of comprehensive class test and examination. In Semester 1, feedback is provided in real-time in an interactive fashion. Students are asked to solve problems of different level of complexities during the lecture and the lecture is tuned to the gaps shown by the students. In tutorials and revision sessions (before class tests and exams), students are asked to become teachers by explaining tasks to classmates.

Principle 2. "Assessment and feedback practices are appropriate, fair, and transparent"

All of the assessments are based on examples from civil and environmental engineering or related disciplines. The tasks aim to test skills required in civil and environmental engineering practice using tools (e.g. software packages) that are used in this context. The mark scheme for each assessment is defined before the students undertake the assessment and this marking scheme is followed rigorously based solely on the students' submissions.

Principle 3. "Assessment and feedback practices are clearly communicated to students and staff"

The grading scheme used for each assessment is made clear to the students at the beginning of each semester as well as before each individual assessment (e.g. via the front page of the exam paper). The timing of each assessment is also stated at the beginning of the semester and the students are reminded on this throughout the semester. The marks available for each part of the assessments are clearly stated. Past papers from previous years are provided to the students for practice and to understand the assessment practices. Worked solutions for the assessments are provided after they have been marked.

Principle 4. "Assessment and feedback practices are continuously reviewed"

Lecturers engage regularly with students and class reps about how the semester is going, including, but not limited to, assessment. We make use of mid-term questionnaires and discussion with class reps to obtain feedback from students and possibly adjust teaching approach. In addition, feedback provided by the students in end-of-semester questionnaires are carefully studied with a view to modifying the assessment and feedback practices of the coming year, in addition to the experience gained by the lecturer when teaching the course.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams

	Examinations				**Courseworks**		**Projects**	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	4	Nov., Dec., Mar. May	1.5h, 2h, 1.5h, 2h	15%, 25%, 15%, 25%	14	10 x 1% + 4 x 2.5%		
L/Outcomes	LO1, LO2, LO3, LO4				LO1, LO2, LO3, LO4			

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Coursework / Submissions deadlines (*academic weeks*):
Semester 1: Weeks 1 to 6 and weeks 8 to 11, Semester 2: Weeks 3, 5, 8 and 11

Resit Assessment Procedures:
3hr examination in August diet

PLEASE NOTE:
Students must gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference**

- Applied statistics for civil and environmental engineers, N. T. Kottegoda, R. Rosso, Dawsonera, 2nd ed. Oxford : Blackwell 2008. **
- Facts from Figures, M. J. Moroney, 3rd rev.ed., Penguin books 1956. **
- Introduction to probability and statistics for engineers and scientists, S. R. Ross, 5th ed., Elsevier, 2014. **
- Introduction to probability and statistics, W. Mendenhall, Edition 15, metric version, Cengage, 2020. **
- Advanced Guide to Python 3 Programming. Hunt, John. Cham: Springer International Publishing AG 2019. *
- Python Programming Fundamentals. Lee, Kent D Mackie, Ian (Editor). 2nd ed. 2014 London: Springer London 2014. Undergraduate Topics in Computer Science. **
- A Beginners Guide to Python 3 Programming. Hunt, John Mackie, Ian (Editor) ; Abramsky, Samson (Editor) ; Hankin, Chris (Editor) ; Hinchey, Mike (Editor) ; Kozen, Dexter C (Editor) ; Pitts, Andrew (Editor) ; Riis Nielson, Hanne (Editor) ; Skiena, Steven S (Editor) ; Stewart, Iain (Editor). Cham: Springer International Publishing 2019. Undergraduate Topics in Computer Science. **
- Elementary Mechanics Using Python: A Modern Course Combining Analytical and Numerical Techniques. Malthe-Sørenssen, Anders Ashby, Neil (Editor); Brantley, William (Editor) ; Fowler, Michael (Editor) ; Hjorth-Jensen, Morten (Editor) ; Inglis, Michael (Editor) ; Klose, Heinz (Editor) ; Sherif, Helmy (Editor). 2015 Cham: Springer International Publishing 2015. Undergraduate Lecture Notes in Physics. *
- The Python Workbook: A Brief Introduction with Exercises and Solutions. Stephenson, Ben 2014 Cham: Springer International Publishing 2014. **

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
Lecture after class test results released	During the weekly lecture	Unknown at present

Session:

Approved:

Course Director Signature:
Date of Last Modifications:

(Updated May 2018)

MODULE TIMETABLE

Module Code:	**CL329**	**Module Title:**	**Engineering Mathematics**

Brief Description of Assessment:
Individual exams, class tests (T) and mini tests (MT)/assignments in both semesters. In semester 1 the MTs are online and require a mark of 80% or more to obtain the 1% credit towards the final grade (repeat attempts may be made within the time-limit). In semester 2 the assessments are online assignments with roughly a two or three-week deadline, where a Jupyter Notebook containing the solution needs to be uploaded. All assessments require use of a PC (Excel and Minitab in semester 1 and Anaconda in semester 2) and access to Myplace. In semester 1, real-time automatic feedback is provided on these MTs during the assessment. In addition, at the following lecture some general feedback is given. General feedback on the class test is also provided during a subsequent lecture. Worked solutions are provided for both the class test and exam following release of the marks.

Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
CL331	Choose an item. Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Class Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Online Test Choose an item.	Exam

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
CL332	Choose an item. Choose an item.	Course work Set Choose an item.	Choose an item. Choose an item.	Course work Submit Project Set	Choose an item. Choose an item.	Course work Submit Course work Set	Choose an item. Choose an item.	Class Test Choose an item.	Course work Submit Course work Set	Choose an item. Choose an item.	Choose an item. Choose an item.	Course work Submit Choose an item.	Exam