Mathematical Modelling and Computation

15 Points, 0.1250 EFTS
15 July 2019 - 10 November 2019

About EMTH171

This is an introductory course in mathematical modelling and computation using MATLAB. This course introduces the use of computational methods to solve real-world problems. The course includes case studies chosen from a range of engineering and scientific applications.

Learning Outcomes

Students who pass this course will:

- Be familiar with the MATLAB programming environment.
- Be familiar with the basics of structured programming (including for loops, conditional statements, and writing functions).
- Understand the concept of a numerical method and appreciate the need for numerical methods in real-world problem solving.
- Be familiar with numerical integration, Newton's method, and Euler's method for differential equations and systems of coupled differential equations.
- Be able to implement these numerical methods computationally.
- Have an introductory-level understanding of the concepts and techniques involved in formulating a mathematical model of a real-world situation.
- Be able to interpret computational results in the context of a real-world problem.

Course Coordinator and Lecturer

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Course Manager and Lecturer

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Prerequisites and recommended preparation

Prerequisites: 1) MATH101, or 2) NCEA 14 Credits (18 strongly recommended) at level 3 Mathematics (including the standards 'Apply differentiation methods in solving problems (91578)' and 'Apply integration methods in solving problems (91579)'), or 3) Cambridge: D at A level or an A at AS level in Mathematics, or 4) IB: 4 at HL or 6 at SL in Mathematics, or 5) approval of the Head of School based on alternative prior learning.

Recommended preparation: It is strongly recommended that students should have passed EMTH118 or MATH102 before taking EMTH171.

A prior or concurrent enrolment in EMTH119 is also recommended. **If you are taking EMTH171 concurrently with EMTH118 or MATH102, you are likely to experience difficulties and need to put in extra work.**

Lectures

The course will be delivered by lecturers from the School of Mathematics and Statistics. The case studies will be presented by lecturers from other areas within the College of Engineering. There may be guest lectures from other departments.

Assessment

The assessment for this course is:

Labs Quizzes (8 quizzes)	24%
Case Studies (2 @ 8% each)	16%
Test 1	5%
Test 2	15%
Final Examination	40%

To obtain a clear pass for this course you must pass the course as a whole ($\geq$ 50%) <u>and</u> achieve at least 40% in the final examination <u>and</u> achieve the required minimum mark in Part A of Test 2.

The overall lab quiz mark is a weighted average of the marks for the eight individual lab quizzes. The weight for Lab Quiz 1 is 1/15 and the weight for each of remaining seven lab quizzes (Lab Quiz 2 – Lab Quiz 8) is 2/15.

If your final mark on Part A of Test 2 or the final examination does not meet the requirements to pass the course then the highest mark you can receive for the course is a D, regardless of your other marks.

Lab quizzes and labs

Lab quizzes will be on-line and will involve using MATLAB. You will need to work on these Lab Quizzes in your self-study time as well as in your timetabled lab. Most students will need to spend around 5-8 hours in total each week on the Lab Quizzes.

Timetabled labs are held weekly in computer labs, beginning in Week 1 of the semester. You must enrol in a lab group no later than the last Friday preceding the start of the semester. For lab group bookings see [MyTimetable](#) or access your timetable through [MyUC](#). Lab group bookings will opened in early July.

Timetabled labs are two hours long. Tutors will be available in the labs. You are guaranteed a space when you attend your selected lab group. You may also attend other lab groups *if there is space for you*.

Note that all lab quiz submissions will be analysed and compared electronically.

Case Studies

There will be two application-based case studies. Both case studies must be done with a partner who is also enrolled on the course. Case studies will involve modelling the application using MATLAB and writing a report as specified in the case study requirements.

Test 1

Test 1 will be held in Week 4 of Term 1 under exam conditions. Timetable bookings for Test 1 will be opened in Week 2 of the course. Test 1 will test knowledge of MATLAB from the material covered in lectures in the first 3 weeks of the course.

Test 2

Test 2 covers MATLAB programming and will be held during Term 4 (see the lecture and lab schedule for the date) under exam conditions. Timetable bookings for this test will be opened in the week commencing 19 August (Week 6 of the course). Test 2 will be in two parts: Part A and Part B. Part A and Part B are equally weighted.

If you get less than 50% in Part A of the test there will be an opportunity to resit this part. However, the highest mark you can get for Part A in the resit is 50%. **Note that you need to achieve at least 50% in Part A of the Test (either in your first attempt, or in the resit) to pass the course, regardless of your other course marks.**

Final Examination

The final exam will be 2 hours long and will be held in the end-of-year examinations period. It is your responsibility to check the date, time, and venue of the exam on the UC examinations system (http://www.canterbury.ac.nz/exams/).

The final exam will cover material from the whole course, including the two case studies. All material covered in lectures is examinable, including any guest lecture material, unless the lecturer has explicitly stated otherwise.

Note that you need to achieve at least 40% in the final exam to pass the course, regardless of your other course marks.

If you are unable to sit the final examination due to exceptional circumstances such as illness you should contact the Course Manager or Course Coordinator immediately as well as submitting a Special Consideration application. Our School policy in these circumstances is to require students to sit an alternative assessment at the Christchurch UC campus as soon as possible. You should be prepared to make yourself available for such an alternative assessment. This may mean delaying or reorganising your travel plans.

Recommended Reading

The texts below are only recommended. They are not required. The books mentioned below and many other similar texts are available in the Library. Any book on introductory numerical analysis would be useful. Good ones include:

- Chapra, S C and Canale, R P. Numerical Methods for Engineers. McGraw Hill*****
- Atkinson, K E and Han, W. Elementary Numerical Analysis. Wiley

A MATLAB reference book may be useful. Good ones include:

- Chapman, Stephen. Matlab Programming for Engineers. Brooks/Cole*****
- Attaway, Stormy. MATLAB: a practical introduction to programming and problem solving

* Also recommended (but not required) for EMTH271/MATH270.

Workload

You should spend about 10 hours a week during term times working on this course. Typically this would be 4 contact hours (lectures and lab) and at least 6 hours self-study. Some students will find that they need to spend more time than this. **You will need to work on Lab Quizzes during this self-study time as well as during your 2-hour timetabled lab time**.

You may need to spend additional time on case studies and preparing for the Tests. The lecture break is an opportunity to consolidate the material covered in the first term. All students will need to spend extra time preparing for the final examination.

Learn and uclive email

This course uses Learn for all course material and for course news and discussion forums. Check the Learn site frequently for all course information and resources. All email communications including copies of News Forum postings from Learn will be sent to your uclive email address only. Use your uclive email address when contacting course staff to avoid your email being blocked by spam filters.

Lecture, lab and test allocations on your timetable

Access your timetable using this MyTimetable link or go to your timetable via MyUC. You will be notified using the Learn News Forum when bookings are open for Labs and for Tests. The notification will include a final date for self-allocation. After that date you will be automatically allocated a time by the system. This automatic allocation will only take into account your UC timetabled study commitments and it may not be possible to reallocate you if you have a clashes with non-study activities. Make sure you choose a time for yourself before the self-allocations close to avoid having to miss or reorganise other activities.

General information

If you require the mark that you have been credited with for either of the two case studies to be reconsidered you will need to show the Course Manager or Course Coordinator the original marked copy of your case study report. This applies to both students in the pair jointly submitting the case study.

For general information that applies to all students studying courses offered by the School of Mathematics & Statistics see School of Mathematics and Statistics, General Information for Students.

This includes information about the Special Considerations process. Note that any Special Consideration is not available for individual assessment items worth less than 10% of the course assessment. For this course this means that Special Consideration is not available for the following assessment items: individual lab quizzes, individual case studies, Test 1. Please contact the Course Manager immediately if you miss one of these assessments.

Please note the information above about Special Considerations and the final examination.