MATH12225 *Applied Computational Modelling*
Term 1 - 2024

Profile information current as at 05/09/2024 01:30 pm

General Information

Overview

Applied Computational Modelling will further your understanding of and ability in mathematical modelling of scientific and engineering problems. You will use built-in MATLAB functions to solve general problems in various disciplines. You will also learn to program in MATLAB to obtain solutions to complex problems through both analytical and numerical approaches. This unit will teach you to approach problems in a way that demonstrates a clear, logical, and systematic procedure of modelling through integrating mathematical and programming knowledge and techniques. You will also learn how to document problems and findings. Course work leads you to approach posed problems in a way that demonstrates a clear, logical, and systematic procedure of modelling through integrating mathematical and programming knowledge and techniques learnt.

Details

Career Level: *Undergraduate*
Unit Level: *Level 2*
Credit Points: *6*
Student Contribution Band: *7*
Fraction of Full-Time Student Load: *0.125*

Pre-requisites or Co-requisites

Pre-requisite: MATH11219
Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the Assessment Policy and Procedure (Higher Education Coursework).

Offerings For Term 1 - 2024

- Bundaberg
- Cairns
- Gladstone
- Mackay
- Online
- Rockhampton

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Website

This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

Regional Campuses
Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

Metropolitan Campuses
Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Written Assessment**
Weighting: 20%
2. **Written Assessment**
Weighting: 30%
3. **Online Test**
Weighting: 50%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the University's Grades and Results Policy for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the CQUniversity Policy site.
You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the CQUniversity Policy site.

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Email, Moodle, Student Feedback

Feedback
Students felt that in certain cases, marking was too arbitrary.

Recommendation
Consider allocating project marking to the unit coordinator, and theory (coding) marking to the other marker/s with a better specification of marking criteria.

Feedback from Email, Moodle, Zoom, Student Feedback

Feedback
Students without previous coding skills experienced a steep / difficult learning curve.

Recommendation
A few weeks of coding is planned to be incorporated into the first year units from 2023. Give further weekly support to students with insufficient coding background.

Feedback from Email, Moodle, Student Feedback

Feedback
Students found the Theory Assignment and Final Online Test long and challenging.

Recommendation
Consider reducing the content/length of the coding-based assessments. Consider scaffolding sessions to help students build confidence for their assessments.

Feedback from Student Feedback

Feedback
Some students felt that more useful knowledge and skills could be learned.

Recommendation
Help students to find interesting projects in their field to model in MATLAB (Project A). Consider linking Project B to more authentic engineering problems.

Unit Learning Outcomes

On successful completion of this unit, you will be able to:

1. Solve general problems in various disciplines using existing functions in MATLAB
2. Program in MATLAB to solve complicated problems
3. Manipulate and interpret input/output data utilising existing tools in MATLAB
4. Formulate and implement procedures of mathematical modelling for authentic situations where analytical solutions exist
5. Design and implement procedures of numeric modelling to develop useful solutions to complex applications
6. Document the solution to posed problems in a way that demonstrates a clear, logical, and systematic procedure of modelling.

The Learning Outcomes for this unit are linked with the Engineers Australia Stage 1 Competency Standards for Professional Engineers in the areas of 1. Knowledge and Skill Base, 2. Engineering Application Ability and 3. Professional and Personal Attributes at the following levels:

Intermediate 1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. (LO: 1I 2I 4N 5I) 1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline. (LO: 1I 2I 3I 4I 5I) 1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. (LO: 1N 2I 4I 5N 6N) 2.3 Application of systematic engineering synthesis and design processes. (LO: 1I 3I 4I) 2.4 Application of systematic approaches to the conduct and management of engineering projects. (LO: 2N 4I 5N 6N) 3.1 Ethical conduct and professional accountability. (LO: 4I 5N) 3.4 Professional use and management of information. (LO: 2I 3N 4I 5I 6I)

Advanced 1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. (LO: 1I 2A 4N 5I) 1.4 Discernment of knowledge development and research directions within the engineering discipline. (LO: 1I 2N 4I 5A) 1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline. (LO: 1I 2N 3I 4A 5I) 2.1 Application of established engineering methods to complex engineering problem-solving. (LO: 1I 2A 4N) 2.2 Fluent application of engineering techniques, tools and resources. (LO: 1A 2A 3I 4A 5I 6I) 3.2 Effective oral and written communication in professional and lay domains. (LO: 4A 5I 6I) 3.3 Creative, innovative and pro-active demeanour. (LO: 2A 3I 4I) 3.5 Orderly management of self, and professional conduct. (LO: 4A) 3.6 Effective team membership and team leadership. (LO: 2I 4A 5I 6I)

Note: LO refers to the Learning Outcome number(s) which link to the competency and the levels: N – Introductory, I – Intermediate and A - Advanced.

Refer to the Engineering Undergraduate Course Moodle site for further information on the Engineers Australia's Stage 1 Competency Standard for Professional Engineers and course level mapping informationhttps://moodle.cqu.edu.au/course/view.php?id=1511

Alignment of Learning Outcomes, Assessment and Graduate Attributes

— N/A Level | ◦ Introductory Level | • Intermediate Level | • Graduate Level | ◦ Professional Level | ◦ Advanced Level

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
1 - Written Assessment - 20%		•	•	•	•	•
2 - Written Assessment - 30%	•	•			•	•
3 - Online Test - 50%	•		•	•		

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Communication						•
2 - Problem Solving	•	•	•	•	•	•
3 - Critical Thinking		•	•	•	•	•
4 - Information Literacy	•	•	•	•	•	•
5 - Team Work						
6 - Information Technology Competence	•	•	•	•	•	•
7 - Cross Cultural Competence						
8 - Ethical practice						
9 - Social Innovation						
10 - Aboriginal and Torres Strait Islander Cultures						

Textbooks and Resources

Textbooks

MATH12225

Prescribed

Applied Computational Modelling with MATLAB
1st edition (2018)
Authors: Yucang Wang, William W Guo
Pearson
Melbourne , VIC , Australia
ISBN: 9781488624780
Binding: Paperback

View textbooks at the CQUniversity Bookshop

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Microsoft Word AND Excel or equivalent Mac or Open Source packages
- MATLAB Software (MathWorks do allow registered students to access their online software platform. Information will be provided by your Unit Coordinator.)

Referencing Style

All submissions for this unit must use the referencing style: Harvard (author-date)
For further information, see the Assessment Tasks.

Teaching Contacts

Piet Janse Van Rensburg Unit Coordinator
p.jansevanrensburg@cqu.edu.au

Schedule

Week 1 - Introduction to MATLAB - 04 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
MATLAB: getting started; Basic types and operations in MATLAB; Built-in functions.	Chapter 1 - Introduction to MATLAB.	

Week 2 - Arrays, vectors and matrices - 11 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Arrays, vectors and matrices and their basic operation.	Chapter 2 - Arrays, vectors and matrices.	

Week 3 - Plotting and input/output in MATLAB - 18 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
Plotting and visualization; Input/output in MATLAB.	Chapter 3 - Plotting and input/output in MATLAB.	

Week 4 - M-files, scripts, user-defined functions and flow controls - 25 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic

M-files and user-defined functions; Flow controls.	Chapter 4 - M-files, scripts, user-defined functions and flow controls.	

Week 5 - Curve fitting by the least squares method - 01 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
MATLAB implementations of linear and quadratic curve fitting.	Chapter 5 - Curve fitting by the least squares method.	

Vacation Week - 08 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic

Week 6 - Interpolation with MATLAB - 15 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
MATLAB implementations of Lagrange interpolation; Newton interpolation and cubic splines.	Chapter 6 - Interpolation with MATLAB.	**Project Assignment A** - Due Wednesday Week 6 - 11:00 PM AEST

Week 7 - Numerical methods for solving ODEs - 22 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
MATLAB implementations of Euler method, improved Euler method and Runge-Kutta method.	Chapter 7 - Numerical methods for solving ODEs.	

Week 8 - Numerical methods using MATLAB built-in functions - 29 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
Interpolating data using MATLAB built-in functions; Curve fitting using MATLAB built-in functions; Solving differential equations using MATLAB built-in functions.	Chapter 8 - Numerical methods using MATLAB built-in functions.	**Theory Assignment** - Due Wednesday Week 8 - 11:00 PM AEST

Week 9 - Modelling of mechanical vibrations using MATLAB - 06 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Mechanical Project: Modelling of vibrations of a system with single degree of freedom using MATLAB.	Chapter 9 - Modelling of mechanical vibrations using MATLAB.	

Week 10 - Modelling of RLC electrical circuits using MATLAB - 13 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Electrical Project: Modelling of RLC circuits using MATLAB.	Chapter 10 - Modelling of RLC electrical circuits using MATLAB.	

Week 11 - MATLAB modelling of mechanical vibrations with multiple degrees of freedom (MDOF) - 20 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Civil Project: Modelling of vibrations of a system with multiple degrees of freedom using MATLAB.	Chapter 11 - MATLAB modelling of mechanical vibrations with multiple degrees of freedom (MDOF).	**Project Assignment B** - Due Wednesday Week 11 - 11:00 PM AEST

Week 12 - 27 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
Other applications of MATLAB in engineering mathematics.		

Review/Exam Week - 03 Jun 2024

Module/Topic	Chapter	Events and Submissions/Topic

		Final Online Test: timetable to be released towards the end of the semester.

Exam Week - 10 Jun 2024

Module/Topic	Chapter	Events and Submissions/Topic

Assessment Tasks

1 Theory Assignment

Assessment Type
Written Assessment

Task Description
This assessment covers MATLAB fundamentals and numeric methods, done in Weeks 1-8.
Coding solutions will be required for practical applications as described in the assignment instructions.
Individual work is mandatory - this is a take-home test. None of your steps or solutions may be discussed or divulged to a fellow student.
Please refer to the CQU plagiarism policy - a signed cover page declaring individual work is required.
The assignment questions will be released on the unit website at least 2 weeks before the assignment is due to be submitted.
Legible and tidy screenshots of all your work (code, text results and plots) should be pasted into a MS Word file, then converted to PDF for marking (from the PDF).
All MATLAB files are to be zipped and submitted as a .zip file.

Assessment Due Date

Please refer to the 'Schedule' section of this unit profile.

Return Date to Students

We strive to return assessments to students within 2 weeks.

Weighting
20%

Minimum mark or grade
A minimum of 40% must be attained for this Theory Assignment in order to pass the unit.

Assessment Criteria
A marking rubric will be issued with the assignment.
Sub-sections of the marking rubric are awarded full marks if they are error-free, partial marks if there are some problems, and no marks if not attempted or contain so many errors as to render the attempt to be without value.
Legible and tidy screenshots of all your work (code, text results and plots) should be pasted into a MS Word file, then converted to PDF for marking (from the PDF).
All MATLAB files are to be zipped and submitted as a .zip file.
For detailed information on what to submit, refer to the Assessment Instructions that will be issued through Moodle.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
1) Legible and tidy screenshots of all your work (code, text results and plots) should be pasted into a MS Word file, then converted to PDF for marking (from the PDF). 2) All MATLAB files are to be zipped and submitted as a .zip file. 3) Official CQU signed plagiarism statement.

Learning Outcomes Assessed

- Program in MATLAB to solve complicated problems
- Manipulate and interpret input/output data utilising existing tools in MATLAB
- Formulate and implement procedures of mathematical modelling for authentic situations where analytical solutions exist

- Design and implement procedures of numeric modelling to develop useful solutions to complex applications
- Document the solution to posed problems in a way that demonstrates a clear, logical, and systematic procedure of modelling.

2 Project Assignment A & B

Assessment Type
Written Assessment

Task Description
Two Project tasks will be issued, the first one being an introductory project task and the second being a more technical discipline-specific task.
To capture the work done, a report will be required for the first task, while a video may be required for the second task.
Team work is encouraged (only 2 persons per team), and only ONE combined report or video needs to be submitted by BOTH students for a complete Moodle record.
A CQU plagiarism statement and declaration of how the team work was shared, has to be signed by both team members.
It is expected that the 2 team members alternate tasks so that each student gets exposure to all types of tasks, including background research, code development and report writing. Include details on your report or video cover page.
Team reports must be professional and typed, including references. In cases where an individual student cannot conveniently join up to form a team, a slightly reduced report specification will be issued.
Photographic or video evidence is required to prove that both team members were involved in the coding / modeling. For this reason it is required that photo's of each team member's fingers are shown in front of the active MATLAB result windows.
(For national and international accreditation, we get audited by Engineers Australia, and this photographic proof makes it easy to satisfy the auditors that each student has fully participated in all projects.)
Project work is compulsory and all students must pass the Project assessment in order to pass the unit.
Details of the project tasks will be posted on the unit website at least 2 weeks before submission is due.

Assessment Due Date

Please refer to the 'Schedule' section of this unit profile.

Return Date to Students

We strive to return assessments to students within 2 weeks.

Weighting
30%

Minimum mark or grade
A minimum of 50% must be attained for this Project Assignment A & B in order to pass the unit.

Assessment Criteria
A marking rubric will be issued with the Project Instructions. Rubric grading will include the following criteria:

Report style, language, uniformity, tidiness;
Background research done and proven with mini literature review and proper referencing;
Graphics content quality and usefulness;
Technical / theoretical content and correctness including calculations, analysis / design and justification;
Code content: efficiency, correctness, tidiness / spacing, and commenting;
Photographic, video and/or other evidence that project was sufficiently modelled by the team;
Discussion and understanding of modelling results.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
1) A complete typed report, combined as one .pdf file. 2) Any video files. 3) All Matlab file/s. 4) Signed CQU plagiarism statement.

Learning Outcomes Assessed

- Solve general problems in various disciplines using existing functions in MATLAB
- Program in MATLAB to solve complicated problems
- Design and implement procedures of numeric modelling to develop useful solutions to complex applications

- Document the solution to posed problems in a way that demonstrates a clear, logical, and systematic procedure of modelling.

3 FINAL ONLINE TEST

Assessment Type
Online Test

Task Description
This assessment item covers the weekly Topics 1 - 8.
This will be an 'open resource' online test but you will be required to sign a declaration of individual work done and include this with your submission.
No contact is allowed with fellow students or any person proficient in the field, i.e. no virtual contact via the Moodle forums, neither using any communications technology to exchange information etc.
The final online test questions will be released on the unit website on the day of the assessment.
5 Hours will be allowed, but this includes scanning and uploading. Late penalties will be deducted at 20% per hour (or proportional part).

Assessment Due Date

Will take place in the exam period, final date to be announced on unit website.

Return Date to Students

CQU does not require that marked End of Term Online Test papers be made available to students. Grades will only be available after the confirmation of grades.

Weighting
50%

Minimum mark or grade
A minimum of 50% must be attained for this Final Online Test in order to pass the unit.

Assessment Criteria
Sub-sections of the Final Online Test are awarded full marks if they are error-free, partial marks if there are some problems, and no marks if not attempted or contain so many errors as to render the attempt to be without value.
Legible and tidy screenshots of all your work (code, text results and plots) should be pasted into a MS Word file, then converted to PDF for marking (from the PDF).
All MATLAB files are to be zipped and submitted as a .zip file.
For detailed information on what to submit, refer to the Assessment Instructions that will be issued through Moodle.

Referencing Style

- Harvard (author-date)

Submission
Online

Submission Instructions
1) Legible and tidy screenshots of all your work (code, text results and plots) should be pasted into a MS Word file, then converted to PDF for marking (from the PDF). 2) All MATLAB files are to be zipped and submitted as a .zip file. 3) Official CQU signed plagiarism statement.

Learning Outcomes Assessed

- Solve general problems in various disciplines using existing functions in MATLAB
- Manipulate and interpret input/output data utilising existing tools in MATLAB
- Formulate and implement procedures of mathematical modelling for authentic situations where analytical solutions exist

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the **Student Academic Integrity Policy and Procedure**. This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?
A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?
A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?
For academic advice and guidance, the Academic Learning Centre (ALC) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?

Be Honest
If your assessment task is done by someone else, it would be dishonest of you to claim it as your own

Seek Help
If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)

Produce Original Work
Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem