

MEC701 Advanced Computational Analysis

School: School of Science, Technology and Engineering

2026 | Trimester 2

UniSC Moreton Bay

**BLENDED
LEARNING**

Most of your course is on campus but you may be able to do some components of this course online.

Online

ONLINE

You can do this course without coming onto campus, unless your program has specified a mandatory onsite requirement.

Please go to usc.edu.au for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1. Description

In this course you will develop advanced skills in computational methods, enabling you to analyse complex engineering problems using cutting-edge computational techniques. You will gain expertise in numerical modelling, simulation, and optimization, empowering you to make informed engineering decisions and contribute to innovative solutions.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Asynchronous weekly learning material	1hr	Week 1	12 times
Seminar – On campus	1hr	Week 1	3 times
Tutorial/Workshop 1 – On campus	2hrs	Week 1	10 times
ONLINE			
Learning materials – Asynchronous weekly learning material	1hr	Week 1	12 times
Seminar – Online	1hr	Week 1	3 times
Tutorial/Workshop 1 – Online	2hrs	Week 1	10 times

1.3. Course Topics

Topics may include:

- High-Performance Computing Techniques
- Finite Element Analysis and Applications
- Computational Fluid Dynamics and Heat Transfer
- Optimization Methods in Engineering
- Multi-scale Modeling and Simulation
- Data Analysis and Machine Learning for Engineering Applications
- Uncertainty Quantification and Sensitivity Analysis

2. What level is this course?

700 Level (Specialised)

Demonstrating a specialised body of knowledge and set of skills for professional practice or further learning. Advanced application of knowledge and skills in unfamiliar contexts.

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES	GRADUATE QUALITIES MAPPING	PROFESSIONAL STANDARD MAPPING *
On successful completion of this course, you should be able to...	Completing these tasks successfully will contribute to you becoming...	Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Assess, quantify and manage uncertainty in advanced computational simulations and sensitivity analysis.	Creative and critical thinker	2, 2.1.b, 2.1, 3.4.a, 3.4.b, 3.4.c, 3.4
2 Analyse alternative optimization methods to specific engineering problems and justify optimal solutions.	Creative and critical thinker	2, 2.1.f, 2.1
3 Apply data analysis and machine learning techniques using high-performance computing to synthesise engineering solutions.	Empowered	2, 2.2.d, 2.2
4 Construct computational models to simulate engineering phenomena.	Empowered	2, 2.2.b, 2.2
5 Interpret and communicate the results of advanced computational analysis to both technical and non-technical stakeholders.	Engaged	3, 3.1.a, 3.2.a, 3.2.b, 3.1, 3.2
6 Demonstrate a comprehensive understanding of the theoretical foundations and principles governing advanced computational analysis techniques in engineering.	Knowledgeable	1, 1.3.a, 1.3

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.3.a	Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the engineering discipline: Proficiently applies advanced technical knowledge and skills in at least one specialist practice domain of the engineering discipline.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2	Elements of competency: Engineering Application Ability
2.1.b	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Ensures that all aspects of an engineering activity are soundly based on fundamental principles - by diagnosing, and taking appropriate action with data, calculations, results, proposals, processes, practices, and documented information that may be ill-founded, illogical, erroneous, unreliable or unrealistic.

CODE	COMPETENCY
2.1.f	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Conceptualises alternative engineering approaches and evaluates potential outcomes against appropriate criteria to justify an optimal solution choice.
2.2.d	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Applies a wide range of engineering tools for analysis, simulation, visualisation, synthesis and design, including assessing the accuracy and limitations of such tools, and validation of their results.
2.2.b	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Constructs or selects and applies from a qualitative description of a phenomenon, process, system, component or device a mathematical, physical or computational model based on fundamental scientific principles and justifiable simplifying assumptions.
2.1	Engineering Application Ability: Application of established engineering methods to complex engineering problem solving.
2.2	Engineering Application Ability: Fluent application of engineering techniques, tools and resources.
3.4.a	Professional and Personal Attributes - Professional use and management of information: Is proficient in locating and utilising information - including accessing, systematically searching, analysing, evaluating and referencing relevant published works and data; is proficient in the use of indexes, bibliographic databases and other search facilities.
3.4.b	Professional and Personal Attributes - Professional use and management of information: Critically assesses the accuracy, reliability and authenticity of information.
3.4.c	Professional and Personal Attributes - Professional use and management of information: Is aware of common document identification, tracking and control procedures.
3	Elements of competency: Professional and Personal Attributes
3.1.a	Professional and Personal Attributes - Ethical conduct and professional accountability: Demonstrates commitment to uphold the Engineers Australia - Code of Ethics, and established norms of professional conduct pertinent to the engineering discipline.
3.2.a	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Is proficient in listening, speaking, reading and writing English.
3.2.b	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations pertinent to the engineering discipline.
3.1	Professional and Personal Attributes: Ethical conduct and professional accountability.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
3.4	Professional and Personal Attributes: Professional use and management of information.

5. Am I eligible to enrol in this course?

Refer to the [UniSC Glossary of terms](#) for definitions of "pre-requisites, co-requisites and anti-requisites".

5.1. Pre-requisites

Enrolled in GC002, GD002, MC002, GC003, GD003 or MC003

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

Not applicable

5.4. Specific assumed prior knowledge and skills (where applicable)

Not applicable

6. How am I going to be assessed?

6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

6.2. Details of early feedback on progress

Early feedback will be provided through completion of weekly activities in workshops. Furthermore, feedback on each assessment will be provided which will be used to help with the following assessment.

6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1a	Oral	Individual	30%	10 minutes	Week 7	Online Assignment Submission with plagiarism check
All	1b	Activity Participation	Individual	20%	2000 words	Week 7	Online Assignment Submission with plagiarism check
All	2	Report	Individual	50%	5000 words	Week 12	Online Assignment Submission with plagiarism check

All - Assessment Task 1a: Presentation

GOAL:	Application of developed knowledge to the advanced computational analysis		
PRODUCT:	Oral		
FORMAT:	Application of developed knowledge to the advanced computational analysis		
CRITERIA:	No.		Learning Outcome assessed
	1	Investigation and analysis of advanced computational problems and concepts using creativity and initiative to synthesise innovative solutions to new and emerging problems.	1 5 6
	2	Construction of models using computational models to simulate engineering phenomena.	3 4
	3	Interpretation and communication of the results of advanced computational analysis to both technical and non-technical stakeholders.	2 5 6
GENERIC SKILLS:	Communication, Organisation, Applying technologies, Information literacy		

All - Assessment Task 1b: Artefact - Technical and Scientific

GOAL:	Presentation of initial model development.		
PRODUCT:	Activity Participation		
FORMAT:	Presentation of initial model development.		
CRITERIA:	No.		Learning Outcome assessed
	1	Analysis of alternative optimisation methods to specific engineering problems and justification of optimal solutions.	1 2 6
	2	Construction of models using computational models to simulate engineering phenomena.	3 4 6
	3	Demonstration of a comprehensive understanding of the theoretical foundations and principles governing advanced computational analysis techniques in engineering.	6
GENERIC SKILLS:	Communication, Problem solving, Applying technologies, Information literacy		

All - Assessment Task 2: Final report

GOAL:	Report detailing the final model development that discusses the assumptions and limitations of the results obtained.		
PRODUCT:	Report		
FORMAT:	Report detailing the final model development that discusses the assumptions and limitations of the results obtained.		
CRITERIA:	No.		Learning Outcome assessed
	1	Assessment, quantification and management of uncertainty in computational simulations and sensitivity analysis.	1 6
	2	Analysis of alternative optimisation methods to specific engineering problems and justification of optimal solutions.	2 3 6
	3	Construction of models using computational models to simulate engineering phenomena.	3 4
	4	Interpretation and communication of the results of advanced computational analysis to both technical and non-technical stakeholders.	2 5 6
GENERIC SKILLS:	Communication, Problem solving, Applying technologies, Information literacy		

7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Student workload is calculated at 12.5 learning hours per one unit.

8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Canvas site– Please log in as soon as possible.

8.1. Prescribed text(s) or course reader

There are no required/recommended resources for this course.

8.2. Specific requirements

N/A

9. How are risks managed in this course?

Health and safety risks for this course have been assessed as low. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the health and safety risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the [online induction training for students](#), and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Canvas, are electronically checked through Turnitin. This software allows for text comparisons to be made between your submitted assessment item and all other work to which Turnitin has access.

10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

- (a) The final mark is in the percentage range 47% to 49.4%; and
- (b) The course is graded using the Standard Grading scale

10.3. Assessment: Submission penalties

Late submissions may be penalised up to and including the following maximum percentage of the assessment task's identified value, with weekdays and weekends included in the calculation of days late:

- (a) One day: deduct 5%;
- (b) Two days: deduct 10%;
- (c) Three days: deduct 20%;
- (d) Four days: deduct 40%;
- (e) Five days: deduct 60%;
- (f) Six days: deduct 80%;
- (g) Seven days: A result of zero is awarded for the assessment task.

The following penalties will apply for a late submission for an online examination:

Less than 15 minutes: No penalty
From 15 minutes to 30 minutes: 20% penalty
More than 30 minutes: 100% penalty

10.4. SafeUniSC

UniSC is committed to a culture of respect and providing a safe and supportive environment for all members of our community. For immediate assistance on campus contact SafeUniSC by phone: [07 5430 1168](tel:0754301168) or using the [SafeZone](#) app. For general enquires contact the SafeUniSC team by phone [07 5456 3864](tel:0754563864) or email safe@usc.edu.au.

The SafeUniSC Specialist Service is a Student Wellbeing service that provides free and confidential support to students who may have experienced or observed behaviour that could cause fear, offence or trauma. To contact the service call [07 5430 1226](tel:0754301226) or email studentwellbeing@usc.edu.au.

10.5. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the [Learning Advisers](#) web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au.

10.6. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to [Student Hub](#), email studentwellbeing@usc.edu.au or call 07 5430 1226.

10.7. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, [AccessAbility Services](#) can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to [Student Hub](#), email AccessAbility@usc.edu.au or call 07 5430 2890.

10.8. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Central Examinations
- Deferred Examinations
- Student Conduct
- Students with a Disability

For more information, visit <https://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching>

10.9. Student Charter

UniSC is committed to excellence in teaching, research and engagement in an environment that is inclusive, inspiring, safe and respectful. The [Student Charter](#) sets out what students can expect from the University, and what in turn is expected of students, to achieve these outcomes.

10.10. General Enquiries

In person:

- **UniSC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **UniSC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **UniSC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **UniSC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **UniSC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **UniSC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au