



UNSW Course Outline

ZEIT8200 Model Based Systems Engineering - 2024

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General Course Information

Course Code : ZEIT8200

Year : 2024

Term : Semester 2

Teaching Period : Z2

Is a multi-term course? : No

Faculty : UNSW Canberra

Academic Unit : School of Systems and Computing

Delivery Mode : Online

Delivery Format : Standard

Delivery Location : UNSW Canberra at ADFA

Campus : UNSW Canberra

Study Level : Postgraduate

Units of Credit : 6

Useful Links

[Handbook Class Timetable](#)

Course Details & Outcomes

Course Description

This course familiarizes systems engineering students with all the related concepts and practices of Model-Based Systems Engineering (MBSE). The course starts with an introduction to System Modeling Language (SysML), covering its diagrams and prototypes. Approximately

half of the course is devoted to SysML, with the remaining focused on methodologies for creating system models, including top-down and bottom-up modelling approaches that illustrate the acausal nature of MBSE as it is built and verified. In particular, Object-Oriented Systems Engineering Methodology (OOSEM), as a top-down methodology, will be discussed in detail, which includes creating the required artifacts for analyzing stakeholder needs, defining system requirements, defining logical architectures, synthesizing candidate allocated architectures, optimizing and evaluating alternatives, and validating and verifying the system. The course includes several tutorials with practical system examples drawn from space systems and involving three main areas of MBSE use: requirements management, cyber-attack surface and kill-chain assessment, and supply chain management.

Course Aims

This course (6 UoC) is your first expedition into MBSE, where you will gain foundational knowledge, discuss the management challenges of MBSE, explore industry best practices, and dive deep into the world of digital engineering.

After completing this course, you will cherish the clarity of finding the Single Source of Truth (SSOT) through MBSE. You will not only grasp the core tenets of MBSE but also distinguish it from traditional approaches. Systems Modelling Language (SysML) will not be a mystery but a canvas for your ingenuity. You will develop a critical eye to assess MBSE implementations, exploring the sensitivity of models to changes and understanding the criticality of different components. Crafting model management plans will become second nature. You will also be exposed to major areas of policy growth and demand driving MBSE, such as requirements management and mission engineering, supply chain management, cyber-attack surface and kill chain assessment. These skills will ensure you remain at the forefront of systems engineering, providing you with the knowledge, expertise, and vision to excel in your role in the industry digital transformation for years to come.

Relationship to Other Courses

ZEIT8200 has a possible follow on ZEIT8247 or ZEIT8296 for the students that would like to do an industry based project researching MBSE applications.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Compare and contrast Model-Based Systems Engineering (MBSE) with traditional systems engineering practices.
CLO2 : Recognise and understand and compare different modelling languages (such as SysML) and MBSE modelling methodologies
CLO3 : Construct MBSE models, demonstrating the practical application of MBSE principles in system design and representation.
CLO4 : Evaluate the efficacy of utilizing MBSE models as digital artefacts and tools for informing decision-making.

Course Learning Outcomes	Assessment Item
CLO1 : Compare and contrast Model-Based Systems Engineering (MBSE) with traditional systems engineering practices.	<ul style="list-style-type: none">• Knowledge Test• Group assignments• Individual Final Assignment• Reflective Analysis
CLO2 : Recognise and understand and compare different modelling languages (such as SysML) and MBSE modelling methodologies	<ul style="list-style-type: none">• Knowledge Test• Group assignments• Reflective Analysis
CLO3 : Construct MBSE models, demonstrating the practical application of MBSE principles in system design and representation.	<ul style="list-style-type: none">• Individual Final Assignment• Group assignments• Reflective Analysis
CLO4 : Evaluate the efficacy of utilizing MBSE models as digital artefacts and tools for informing decision-making.	<ul style="list-style-type: none">• Individual Final Assignment• Reflective Analysis

Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate

Learning and Teaching in this course

The focus of this course is on open-ended independent problem solving, communication skills, and collaboration. Students work in groups on their MBSE modelling and groups usually take diverse approaches and learn by sharing with the whole class. Students are assessed via written reports and oral presentations. The final assessment is a “reflective analysis” where students discuss the rationale for employment MBSE approach in their organizations.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Knowledge Test Assessment Format: Individual	15%	Start Date: Not Applicable Due Date: Week 3: 29 July - 02 August
Group assignments Assessment Format: Group	30%	Start Date: Not Applicable Due Date: Week 8: 16 September - 20 September, Week 9: 23 September - 27 September, Week 10: 30 September - 04 October
Individual Final Assignment Assessment Format: Individual Short Extension: Yes (2 days)	30%	Start Date: Not Applicable Due Date: Week 11: 07 October - 11 October
Reflective Analysis Assessment Format: Individual Short Extension: Yes (2 days)	25%	Start Date: Not Applicable Due Date: Week 13: 21 October - 25 October

Assessment Details

Knowledge Test

Assessment Overview

Online test drawing on material in Modules 1 and 2 to assess foundational understanding of MBSE, identify the core tenets of MBSE and the situations in which it is recommended, and distinguish the differences between MBSE and traditional systems engineering. It will involve a mix of true/false questions, short and longer (comprehension), multiple-choice questions. The duration of the test is approximately one session.

Course Learning Outcomes

- CL01 : Compare and contrast Model-Based Systems Engineering (MBSE) with traditional systems engineering practices.
- CL02 : Recognise and understand and compare different modelling languages (such as SysML) and MBSE modelling methodologies

Group assignments

Assessment Overview

The group assignment is a collaborative effort designed to provide students with hands-on experience in MBSE. In this assignment, students will work together to identify the scope, adapt an MBSE model, and prepare a presentation to communicate findings. This assignment rewards and shapes subsequent assessment that is individual reflection and extension work. Capella

MBSE Tool will be used to build the model.

This group assignment offers students a valuable opportunity to apply MBSE knowledge and skills in a practical context, fostering collaboration and teamwork while addressing real-world system engineering challenges. Embrace this experience and aim for a comprehensive and well-communicated MBSE model and presentation.

Course Learning Outcomes

- CL01 : Compare and contrast Model-Based Systems Engineering (MBSE) with traditional systems engineering practices.
- CL02 : Recognise and understand and compare different modelling languages (such as SysML) and MBSE modelling methodologies
- CL03 : Construct MBSE models, demonstrating the practical application of MBSE principles in system design and representation.

Assessment information

Week 8 submission:

A written report addressing the following:

- 1) Each of the scope requirements (not to exceed 4 pages).
- 2) Each of the modelling requirements (not to exceed 12 pages)

Week 9-10 submission:

A live presentation not to exceed 20 minutes + 10 minutes Q&A synopsis of the Week 8 submission. **Schedule to be confirmed.**

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Individual Final Assignment

Assessment Overview

This assignment offers students a valuable opportunity to appraise the MBSE application they have built in the previous assessment and plan a project's implementation of that MBSE application. Students will build a model management plan and discuss management benefits and challenges of utilizing MBSE models as a tool for informing decision-making. Students will assess the fidelity of the model they have built and document any additional fidelity needed for future use and if that future path should include multiple fidelities for various uses.

Course Learning Outcomes

- CL01 : Compare and contrast Model-Based Systems Engineering (MBSE) with traditional systems engineering practices.
- CL03 : Construct MBSE models, demonstrating the practical application of MBSE principles in system design and representation.
- CL04 : Evaluate the efficacy of utilizing MBSE models as digital artefacts and tools for informing decision-making.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

Reflective Analysis

Assessment Overview

Students will need to write and statement and record a VoiceThread presentation. The reflection will discuss the rationale for the employment of an MBSE approach of their choice in a student's organization. Reflective analysis should address the following criteria: (1) prior assumptions about MBSE; (2) previous experience with MBSE; (3) challenges or breakthroughs a student had while constructing MBSE models; (4) relevance of MBSE to student's workplace; or (5) relevance of MBSE to student's future career, and (6) likely return on investment.

Course Learning Outcomes

- CL01 : Compare and contrast Model-Based Systems Engineering (MBSE) with traditional systems engineering practices.
- CL02 : Recognise and understand and compare different modelling languages (such as SysML) and MBSE modelling methodologies
- CL03 : Construct MBSE models, demonstrating the practical application of MBSE principles in system design and representation.
- CL04 : Evaluate the efficacy of utilizing MBSE models as digital artefacts and tools for informing decision-making.

Assessment information

Complete the following formats for your Reflective Analysis:

1) **Written Statement:** 5-10 pages of written reflection OR summary or 800 words for those students who did the weekly "3-2-1" exercise (must be annexed).

2) **VoiceThread Presentation:** A 8-10-minute VoiceThread presentation with one static slide as a background OR 5-minute VoiceThread presentation for those students who did the weekly "3-2-1" exercise.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

General Assessment Information

Late Submission of Assessment

- The penalty for late submission will be 5% per calendar day, or part thereof, unless prior special consideration has been granted.
- All requests for special consideration must be formally submitted via MyUNSW prior to the assessment due date.
- Late assignments will only be accepted if prior arrangement is made with the lecturer, or a formal application for special consideration is submitted.
- Unless prior arrangement is made with the lecturer or a formal application for special consideration is submitted, a penalty will apply for each day that an assessment item is late.
- Late assignments will be accepted provided they are received prior to the start of the examination period. Students requiring an extension must let me know by email prior to the published due date. Note: Penalties for late submission should apply from the original submission date, unless that date is formally varied by agreement. If a late submission is allowed, the extra time granted should be viewed solely as a period of grace. If this delayed date is not met, the penalty should apply from the original date of submission, not from the end of the period of grace.

Referencing

In this course, students are required to reference following the APA 6 / Chicago NB referencing style. Information about referencing is available at: [Support for Referencing Assignments | UNSW Current Students](#)

Use of Generative AI in Assessments

As this assessment task involves some planning or creative processes, you are permitted to use software to generate initial ideas. However, you must develop or edit those ideas to such a significant extent that what is submitted is your own work, i.e., only occasional AI-generated words or phrases may form part of your final submission. It is a good idea to keep copies of the initial prompts to show your lecturer if there is any uncertainty about the originality of your work.

If the outputs of generative AI, such as ChatGPT form a part of your submission, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension, and exclusion.

* To cite: OpenAI (Year Accessed). ChatGPT. OpenAI. <https://openai.com/models/chatgpt/>

* Please note that the outputs from these tools are not always accurate, appropriate, or properly referenced. Before submission, you should ensure that you have moderated and critically evaluated the outputs from generative AI tools such as ChatGPT.

Grading Basis

Standard

Requirements to pass course

To pass the course, students must achieve at least 50 marks out of a total 100.

All marks obtained for assessment items during the session are provisional.

The final mark as published by the university following the assessment review group meeting is the only official mark.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 15 July - 19 July	Lecture	Introduction to MBSE
Week 2 : 22 July - 26 July	Lecture	Elements of MBSE: Languages, Methods, Tools
	Tutorial	Recorded tutorial: Use of Capella
Week 3 : 29 July - 2 August	Lecture	Traceability: Model-based Requirements and Mission Engineering
	Tutorial	Modelling with Capella: Requirements Analysis
	Assessment	Test
Week 4 : 5 August - 9 August	Lecture	Resilience: Cybersecurity Systems Modelling with MBSE
	Tutorial	Modelling with Capella: Operational Analysis
Week 5 : 12 August - 16 August	Lecture	Supportability: Supply Chain Modelling and Analysis with MBSE
	Tutorial	Modelling with Capella: System Analysis
Week 6 : 19 August - 23 August	Lecture	Quality: MBSE Modelling and Common Modelling Pitfalls
	Tutorial	Modelling with Capella: Logical Architecture
Week 7 : 9 September - 13 September	Lecture	MBSE Models as Digital Artefacts and Tools for Informed Decision Making
	Tutorial	Modelling with Capella: Physical Architecture
Week 8 : 16 September - 20 September	Lecture	MBSE Models as Digital Artefacts and Tools for Informed Decision Making (Part 2)
	Tutorial	Modelling with Capella: Requirements Traceability
	Assessment	Group Assignment (Adapt an MBSE Model): Report
Week 9 : 23 September - 27 September	Lecture	Model Management and Assessment
	Assessment	Group Assignment (Adapt an MBSE Model): Student Presentations
Week 10 : 30 September - 4 October	Lecture	Implementation of MBSE in an Organisation
	Assessment	Group Assignment (Adapt an MBSE Model): Student Presentations
Week 11 : 7 October - 11 October	Lecture	Road to a Digital Enterprise
	Assessment	Individual Assignment (Appraisal and Business Case for the Adapted MBSE Model)
Week 12 : 14 October - 18 October	Lecture	MBSE for System of Systems
Week 13 : 21 October - 25 October	Assessment	Reflective Analysis

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The class involves distance study, some in group work. There will be an online lecture every week and online workshops (tutorials) on the listed weeks only. Some weeks are set aside for student groups to present. A detailed schedule and Week-by-Week content will be available for students on Moodle.

Course Resources

Prescribed Resources

- Course slides and readings (available on Moodle)
- Course recorded lectures (available on Moodle).
- **Capella** Software. Throughout the course, students will be utilizing **Capella**, a powerful and intuitive modelling tool specifically designed for MBSE applications.

Textbooks:

- Madni A.M., Augustine N., Sievers, M. (2023). *Handbook of Model-Based Systems Engineering*. Springer Cham.
- Verma, D. (2023). *Systems Engineering for the Digital Age: Practitioner Perspectives*. John Wiley & Sons, Inc.

Recommended Resources

A range of supporting material is available on Moodle as well as a suggested list of references for further reading.

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of each course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups (where applicable). Student opinions really do make a difference.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct: <https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf>

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Emiliya Suprun				Available for consultation (online) during normal working hours. Please email me to make an appointment.	No	Yes
Lecturer	Keith Joiner				Available for consultation (online) during normal working hours. Please email me to make an appointment.	No	No
	Ebrahim Aliy				Available for consultation (online) during normal working hours. Please email me to make an appointment.	No	No

Other Useful Information

School-specific Information

The Learning Management System

Moodle is the Learning Management System used at UNSW Canberra. All courses have a Moodle site which will become available to students at least one week before the start of semester. Please find all help and documentation (including Blackboard Collaborate) at the Moodle Support page.

UNSW Moodle supports the following web browsers:

- Google Chrome 50+
- Safari 10+

Internet Explorer is not recommended. Addons and Toolbars can affect any browser's performance.

Operating systems recommended are:

- Windows 10,
- Mac OSX Sierra,
- iPad IOS10

Further details:

[Moodle System Requirements](#)

[Moodle Log In](#)

If you need further assistance with Moodle:

For enrolment and login issues please contact:

IT Service Centre

Email: itservicecentre@unsw.edu.au

Phone: (02) 9385-1333

International: +61 2 9385 1333

For all other Moodle issues please contact:

External TELT Support

Email: externalteltsupport@unsw.edu.au

Phone: (02) 9385-3331

International: +61 2 938 53331

Opening hours:

Monday – Friday 7:30am – 9:30 pm

Saturday & Sunday 8:30 am – 4:30pm

[Study at UNSW Canberra](#)

Study at UNSW Canberra has lots of useful information regarding:

- Where to get help
- Administrative matters
- Getting your passwords set up
- How to log on to Moodle
- Accessing the Library and other areas.

[UNSW Canberra Student Hub](#)

For News and Notices, Student Services and Support, Campus Community, Quick Links, Important Dates and Upcoming Events

School Contact Information

Deputy Head of School (Education): Dr Erandi Hene Kankanamge

E: e.henekankanamge@adfa.edu.au

T: 02 5114 5157

Syscom Admin Support: syscom@unsw.edu.au

T: 02 5114 5284

Syscom Admin Office: Building 15, Level 1, Room 101 (open 10am to 4pm, Mon to Fri)