

COURSE STAFF

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Space Mission Development is offered as an online course. This course outline will detail the mode of delivery and the learning process.

Consultations: The primary avenues for asking questions and seeking clarifications in this course are the Moodle Discussion Forums. You are strongly encouraged to ask questions via these channels rather than via email. When necessary, you are welcome to email the Lecturer to ask questions, and all effort will be made to answer you. ALL email enquiries should be made from your student email address with ELEC9762 in the subject line, otherwise they will not be answered.

Keeping Informed: Announcements will be primarily made on Moodle and only if necessary via email (to your student email address). In this course, we will use Moodle <https://moodle.telt.unsw.edu.au/login/index.php>. Please note that you will be deemed to have received this information once it is posted on Moodle, so you should take careful note of all announcements. The onus is on you to keep checking the Moodle webpage for information and announcements.

Contact Hours

This course is offered online and consequently there are no face-to-face contact hours. The material for this course primarily consists of recorded lectures, slides, lecture notes and additional resources. Students should expect to spend 3 hours weekly on recorded lectures and an additional 2 hours on reviewing course notes and recommended reading. Support will be given on the Moodle webpage and through the discussion forum. An average of 3-4 hours per week is expected to be spent on the assignment.

Context and Aims

This course looks at the process involved in getting a mission from the proposal stage to the launch stage, including the test and evaluation processes. It will cover mission related aspects ranging from definition of the mission, through the mission specification and development to the launch and commissioning. The course aims to give students an in-depth look at the process involved in defining and undertaking a space mission. Specific aims include:

1. Describe to students the process involved in defining a space mission.
2. Give students an understanding in deriving the mission specification
3. Explain to students how to go from the mission specifications to the system functions
4. Explain to students how to go from the functions to the elementary units: (specification, production)
5. Explain to students how to formulate a system development plan
6. Explain to students how to move from the elementary units to the system: assembly, integration and test on ground

7. Give students an understanding of the issues involved in the launch campaign and in-orbit testing (IOT

Indicative Lecture Schedule

The recorded lectures are all posted on Moodle and are accessible to you. The schedule below is indicative to you so you can pace yourselves. The topics are given on a weekly basis:

Period	Summary of Lecture Program
Week 1	Introduction to the Module
Week 2	Space Mission Definition
Week 3	Mission Development Tools
Week 4	Specifying the Mission
Week 5	Specification to Functions
Week 6	Functions to Elementary Units 1 and 2
Week 7	Transitioning to Implementation 1 and 2
Week 8	Case Studies (1)
Week 9	Case Studies (2)
Week 10	Wrap up

Assessment

Weekly Assessments	20%
Assignment	30%
Final Exam (2 hours)	50 %

COURSE DETAILS

Credits

This is a 6 UoC course and the expected workload is 15 hours per week throughout the 10 week term. The University defines a UoC as requiring 25 hours of total learning effort per semester, spread over lectures, tutorials, labs, and the student's own study time (see <https://my.unsw.edu.au/student/atoz/UnitsOfCredit.html>). Therefore, it is expected that 150 hours will be allocated to this course. This equates to about 15 hours per week over the 10 weeks of the course. As this is primarily a self-study course, most of this effort should be spent by students watching the lectures, reading the recommended supporting material, and doing the assessments.

Relationship to Other Courses

The Space Mission Development course is a core specialisation course within the Master of Engineering Science (Satellite Systems Engineering) program (ELECOS8338). This course can be taken in either the first or second year of the program, although it is intended (though not required) that this be taken early in the Satellite Systems Engineering Masters program. This course is also available as a Technical Elective in Electrical Engineering Undergraduate and Masters programs.

Pre-requisites and Assumed Knowledge

There are no prerequisite courses leading into this course, however it is expected that enrolling students will have completed a 4 year Bachelor's in Engineering and have prior undergraduate learning in Mechanics, Mathematics and Physics.

Following Courses

Although this course is not a pre-requisite for any other course, it is a core course of the ELECOS8338 program, and as such should ideally be undertaken in the first year of the program.

Learning outcomes

After successful completion of this course, you should be able to:

1. List the steps involved in undertaking a space mission
2. Explain the process involved in obtaining the mission specifications
3. Discuss the issues involved in fleshing out the system design
4. Describe the issues involved in the launch campaign
5. Describe the in-orbit testing (IOT) of the satellite.

This course is designed to provide the above learning outcomes which arise from targeted graduate capabilities listed in **Appendix A**. The targeted graduate capabilities broadly support the UNSW and Faculty of Engineering graduate capabilities (listed in **Appendix B**). This course also addresses the Engineers Australia (National Accreditation Body) Stage I competency standard as outlined in **Appendix C**.

Syllabus

This course examines the steps and issues involved in the development of satellite missions. Topics covered include the mission definition and specification, moving from the mission to the functions, from the functions to the elementary units, system development plan, integration and testing (from the units to the system), launch and in-orbit testing (IOT).

Specifically the topics are detailed below:

- **Defining the mission (mission specification):** Roles; Client (Need); Design/Construction (Provider); Operator (Operational provider); Dissemination (Data network); End-User; and Mission types (Telecomms, GNSS, RO, Science). From the mission to the functions, covering: Mission requirements (Functional, Performance, Design, Operational).
- **From the functions to the elementary units:** Specification, production; Mission planning, Using brown's approach to scoping a mission and to estimate the costs; and Development stages and

time/budget per phase.

- **Program management:** Mission phases (Prephase A – Phase E); Budgeting and cost modelling; and Time management.
- **From the elementary units to the system:** assembly, integration and test on ground platform integration; coupling; thermal vacuum test; antenna integration and alignment; solar array integration; mechanical and Radio-frequency (RF) testing; readying for flight configuration; and Launch campaign & IOT.

TEACHING STRATEGIES

Delivery Mode

The course will be delivered online. The course material for each week has three components:

- The learning guide: A brief learning guide that introduces the topic for that week and provides a breakdown of the concepts to be learned.
- The study material: this comprises lecture recordings, course notes, slides, and other recommended reference material.
- The weekly assessment: The lesson for that week is concluded by an assessment task that is take on Moodle.

Learning in this Course

You are expected to be diligent in your self-study and to complete all weekly tasks in order to maximise learning. In addition to the lecture notes/video, you should read relevant sections of the recommended text. Reading additional texts will further enhance your learning experience. Group learning is also encouraged. As this is an online course, group interaction will be facilitated using the Moodle discussion forum. You are highly encouraged to post questions and comments and to respond to questions and comments that others post. This interaction will be very beneficial to your learning experience.

ASSESSMENT

The assessment scheme in this course reflects the intention to assess your learning progress through the trimester. Ongoing assessment occurs through the weekly tasks and assignments.

Weekly Assessment Tasks

The weekly assessment tasks are small progress checks that permit you to gauge what you got out of the lesson and how well you understood it. These are compulsory and must be taken by the deadline for each.

Assignment

The assignment allows self-directed study leading to the solution of partly structured problems. Marks will be assigned according to how completely and correctly the problems have been addressed, the quality of the code written for the assignment (must be attached to the report), and the understanding of the course material demonstrated by the report.

The assignment will be released in week 4 and will be due by the end of week 10. Assignment submission will be through Moodle. Late reports will attract a penalty of 10% per day (including weekends).

Final Exam

The exam in this course is a standard closed-book 2 hour written examination, comprising five compulsory questions. University approved calculators are allowed. The examination tests analytical and critical thinking and general understanding of the course material in a controlled fashion. Questions may be drawn from any aspect of the course (including laboratory), unless specifically indicated otherwise by the lecturer. Marks will be assigned according to the correctness of the responses. Please note that you must pass the final exam in order to pass the course.

Relationship of Assessment Methods to Learning Outcomes

Assessment	Learning Outcomes						
	1	2	3	4	5	6	7
Laboratory practical assessments	✓		✓				
Lab exam				✓			
Mid-semester exam		✓					✓
Assignment						✓	
Final exam					✓		

COURSE RESOURCES

Course Notes

Lecture notes have been prepared and will be available to students that cover the core content of the course. Additionally a detailed case study of the mission development of the Cassini/Huygens mission is also provided that will be referred to during the course. You will be told which sections of the text and/or handouts to read before each class so that you are prepared for the subject material and can ask questions about any topics that you are unsure about. You are recommended to take your own notes or annotate your own copy of the lecture notes or handouts.

Textbooks

On-line resources

Moodle

As a part of the teaching component, Moodle will be used to disseminate teaching materials, host forums and occasionally quizzes. Assessment marks will also be made available via Moodle: <https://moodle.telt.unsw.edu.au/login/index.php>.

Mailing list

Announcements concerning course information will be given in the lectures and/or on Moodle and/or via email (which will be sent to your student email address).

OTHER MATTERS

Dates to note

Important dates are available at: <https://student.unsw.edu.au/dates>

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see: <https://student.unsw.edu.au/plagiarism>. To find out if you understand plagiarism correctly, try this short quiz: <https://student.unsw.edu.au/plagiarism-quiz>.

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies (see <https://student.unsw.edu.au/guide>), and particular attention is drawn to the following:

Workload

It is expected that you will spend at least **15 hours per week** studying a 6 UoC course, from Week 1 until the final assessment, including both face-to-face classes and independent, self-directed study. In periods where you need to need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Regular and punctual attendance at all classes is expected. UNSW regulations state that if students attend less than 80% of scheduled classes they may be refused final assessment.

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must submit all assignments and attend all examinations scheduled for your course. As of Term 1 2019, assessment of applications for Special Consideration will be managed centrally and the University has introduced a “fit to sit/submit” rule. You will no longer be required to take your original documentation to the Nucleus for verification. Instead, UNSW will conduct source checks on documentation for verification purposes. You can apply for special consideration when illness or other circumstances beyond your control interfere with an assessment performance. If you need to submit an application for special consideration for an exam or assessment, you must submit the application prior to the start of the exam or before the assessment is submitted, except where illness or misadventure prevent you from doing so. If you sit an exam or submit an assignment, you are declaring yourself well enough to do so.

Continual Course Improvement

This course is under constant revision in order to improve the learning outcomes for all students. Please forward any feedback (positive or negative) on the course to the course convener or via the online student survey myExperience. You can also provide feedback to ELSOC who will raise your concerns at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to the School and UNSW policies: <https://www.engineering.unsw.edu.au/electrical-engineering/resources>
<https://student.unsw.edu.au/guide>

APPENDICES

Appendix A: Targeted Graduate Capabilities

Electrical Engineering and Telecommunications programs are designed to address the following targeted capabilities which were developed by the school in conjunction with the requirements of professional and industry bodies:

- The ability to apply knowledge of basic science and fundamental technologies;
- The skills to communicate effectively, not only with engineers but also with the wider community;
- The capability to undertake challenging analysis and design problems and find optimal solutions;
- Expertise in decomposing a problem into its constituent parts, and in defining the scope of each part;
- A working knowledge of how to locate required information and use information resources to their maximum advantage;
- Proficiency in developing and implementing project plans, investigating alternative solutions, and critically evaluating differing strategies;
- An understanding of the social, cultural and global responsibilities of the professional engineer;
- The ability to work effectively as an individual or in a team;
- An understanding of professional and ethical responsibilities;
- The ability to engage in lifelong independent and reflective learning.

Appendix B: UNSW Graduate Capabilities

The course delivery methods and course content directly or indirectly addresses a number of core UNSW graduate capabilities, as follows:

- Developing scholars who have a deep understanding of their discipline, through lectures and solution of analytical problems in tutorials and assessed by assignments and written examinations.
- Developing rigorous analysis, critique, and reflection, and ability to apply knowledge and skills to solving problems. These will be achieved by the laboratory experiments and interactive checkpoint assessments and lab exams during the labs.
- Developing capable independent and collaborative enquiry, through a series of tutorials spanning the duration of the course.
- Developing digital and information literacy and lifelong learning skills through assignment work.
- Developing ethical practitioners who are collaborative and effective team workers, through group activities, seminars and tutorials.
- Developing independent, self-directed professionals who are enterprising, innovative, creative and responsive to change, through challenging design and project tasks.
- Developing citizens who can apply their discipline in other contexts, are culturally aware and environmentally responsible, through interdisciplinary tasks, seminars and group activities.

Appendix C: Engineers Australia (EA) Professional Engineer Competency Standard

	Program Intended Learning Outcomes	
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals	✓
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing	✓
	PE1.3 In-depth understanding of specialist bodies of knowledge	✓
	PE1.4 Discernment of knowledge development and research directions	
	PE1.5 Knowledge of engineering design practice	✓
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice	
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving	✓
	PE2.2 Fluent application of engineering techniques, tools and resources	✓
	PE2.3 Application of systematic engineering synthesis and design processes	
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability	
	PE3.2 Effective oral and written communication (professional and lay domains)	✓
	PE3.3 Creative, innovative and pro-active demeanour	✓
	PE3.4 Professional use and management of information	✓
	PE3.5 Orderly management of self, and professional conduct	
	PE3.6 Effective team membership and team leadership	✓