UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 1 2018

AERO4620

DYNAMICS OF AEROSPACE VEHICLES AND SYSTEMS

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Zoran Vulovic (course convenor)
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Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Consultation times will be announced later. Consultations are possible outside the set times, but a prior appointment is preferred. Email, telephone and Moodle discussions can also be used for solving more general issues.

Contact details and consultation times for laboratory demonstrators

Austin Kong
Email: austin.kong@unsw.edu.au

The consultation time slots will be announced later.

Please see the course Moodle.

2. Important links

- Moodle
- UNSW Mechanical and Manufacturing Engineering
- Course Outlines
- Student intranet
- UNSW Mechanical and Manufacturing Engineering Facebook
- UNSW Handbook

3. Course details

Credit Points

This is a 6 unit-of-credit (UoC) course, and involves 6 hours per week (h/w) of face-to-face contact.

The UNSW website states "The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week."

This means that you should aim to spend about 9 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Contact hours

	Day	Time	Location
Lectures	Monday	10am - 12noon	Tyree Energy Technology G16 (K-H6-G16)
	Tuesday	11am - 1pm	Old Main Building G31 (K-K15-G31)
	Thursday	10am - 12noon	Ainsworth 102 (K-J17-102)
Simulation	By appointment	By appointment	Willis Annexe 117 (K-J18-117)
Lab	TBA	Lecture times	Willis Annexe, lab TBA (K-J18)

Please refer to your class timetable for the learning activities you are enrolled in and attend only those classes.

Summary and Aims of the course

For ease of management, the course is organised into three separate parts: Aerospace Systems, Avionics and Flight Dynamics; they will form Modules A, B and C respectively. Module A will run in Weeks 1 – 4 and Modules B and C in Weeks 5 – 12. In addition, there is an individual flight simulation exercise.

The Aerospace Systems part deals with the so-called airframe systems as well as their effect on aircraft's performance. The Avionics segment studies aircraft electronic systems as well as other systems that directly interface with avionics. The Flight Dynamics covers different aspects of aircraft stability and the parameters that affect it. The wind tunnel experiment demonstrates the longitudinal stability, understanding of which is crucial for flight control systems. It also provides a link between the Flight Dynamics and Avionics modules. Finally, the flight simulation experiment demonstrates the operations of auto-pilots and various navigation and communication systems.

AERO4620 is an important stepping stone in aerospace engineering education. The knowledge acquired during this course is directly applicable to the group design in AERO4110. On the other hand, Module C of this course directly relates to the performance part of AERO3660; at the same time the stability analysis of flying vehicles presented in this module is based on methods learned in MMAN3200 Linear Systems and Control. The large majority of this class is involved in flight experiments that provide a crucial link between the theoretical knowledge gained during the class time and real flight situations. Students were also able to observe the functioning of systems found in General Aviation aircraft. All these components largely contribute to developing necessary engineering skills and knowledge.

Student learning outcomes

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

Learning Outcome		EA Stage 1 Competencies
1.	Learn the analytical aspects of static and dynamic stability	PE1.2, PE2.1
2.	Understand the regulatory aspects of static stability	PE1.3
3.	Establish the connection between the aircraft's mission and the selection of systems and components	PE1.3
4.	Learn how to apply methodologies learnt in MMAN3200 to aerospace applications	PE1.3, PE2.1

4. Teaching strategies

Lectures in the course are designed to provide the basic theory behind the concepts taught. For most classes, PowerPoint slides will be available on-line and beforehand. Students are encouraged to ask questions during classes.

It is very important for fourth year students to be able to use multiple sources. For that reason there is no single textbook to support this course. Instead, only recommended texts are provided, and you will be expected to find other relevant books and make use of them. You are welcome to consult your lecturer on this.

5. Course schedule

Date	Topic	Location	Lecture Content	Demonstration/Lab Content	Suggested Readings
Week 1	Control systems. Hydraulic systems and components.	TETB G16 OMB G31 Ainswth 102	Aerodynamic controls, cockpit controls and transmission media. Hydraulic components.	N/A	Class readings

Date	Topic	Location	Lecture Content	Demonstration/Lab Content	Suggested Readings
Week 2	Pneumatic systems and components. Fuel systems and components.	TETB G16 OMB G31 Ainswth 102	Pneumatic components and comparison with hydraulic counterparts.	N/A	Class readings
Week 3	Cabin environment control	TETB G16 OMB G31 Ainswth 102	Cabin pressurisation and cabin temperature control	N/A	Class readings
Week 4	Electrical systems and components. Test.	TETB G16 OMB G31 Ainswth 102	DC and AC systems and components	N/A	Class readings
Week 5	Avionics requirements. Concept of aircraft stability.	TETB G16 OMB G31 Ainswth 102	What qualifies an electronic component for avionics? Definitions of aircraft stability.	N/A	Class readings
Week 6	Aircraft sensors. Elevator effectiveness. Static margin.	TETB G16 OMB G31 Ainswth 102	Classification of different aircraft sensors. Analysis of static stability parameters.	N/A	Class readings
Week 7	Navigation systems. Stick-free-case. Handling and flying qualities.	TETB G16 OMB G31 Ainswth 102	Dead reckoning and position fixing navigation. Relevance of handling and flying qualities.	N/A	Class readings
Week 8	Automatic flight control. Test.	TETB G16 OMB G31 Ainswth 102	Stability augmentation and fly-by-wire.	N/A	Class readings
Week 9	Autopilots. Mathematical model of longitudinal dynamic.	TETB G16 OMB G31 Ainswth 102	Classification of autopilots and their modes. 3-DOF linear longitudinal model.	N/A	Class readings
Week 10	Laboratory	TETB G16 OMB G31 Ainswth 102	N/A	Determination of longitudinal stability using static wind-tunnel measurements.	Lab handout

Date	Topic	Location	Lecture Content	Demonstration/Lab Content	Suggested Readings
Week 11	Cockpit electronics. Mathematical model of lateral dynamics.	TETB G16 OMB G31 Ainswth 102	Displays and communication systems. 3-DOF linear lateral model.	N/A	Class readings
Week 12	Avionics standardisation. <u>Lab report due.</u> State variable technique.	TETB G16 OMB G31 Ainswth 102	ARINC standards. Longitudinal and lateral state-space models.	N/A	Class readings
Week 13	Revision. Contingency time.	TETB G16 OMB G31 Ainswth 102	TBA	N/A	TBA

Some minor adjustments to the lecturing schedule are possible without notice. Major changes will be announced on Moodle.

6. Assessment

Assessment overview

Assessment	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	*Deadline for absolute fail*	Marks returned
Tests (2)	50 minutes each	42% (30% + 12%)	1, 2 and 3	Module A (aircraft systems); Module C (static stability, handling and flying qualities)	Week 4 class time; Week 8 class time	N/A	Two weeks after the test
Lab report	6 pages	10%	1, 2 and 4	Correct calculation, understanding of theory behind the experiment	Tuesday 23rd May 23:50 (Week 12) via Moodle	Thursday 25th May 23:50	Two weeks after the submission
Simulation	45 minutes	2%	3	Punctuality, discipline, co-operation (Module B)	Week 7 - 13	N/A	One week from the exercise
Final exam	2 hours	46%	1, 2 and 3	Entire Module B and the Dynamic Stability part of Module C.	Exam period, date TBC	N/A	Upon release of final results

To pass the course you need to obtain a minimum of 50% in total as well as a minimum of **40% for Module C.**

Assignments

Presentation

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

Late submissions will be penalised 5 marks per calendar day (including weekends). An extension may only be granted in exceptional circumstances. Special consideration for assessment tasks must be processed through student.unsw.edu.au/special-consideration.

It is always worth submitting late assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

Where there is no special consideration granted, the 'deadline for absolute fail' in the table above indicates the time after which a submitted assignment will not be marked, and will achieve a score of zero for the purpose of determining overall grade in the course.

Marking

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Examinations

You must be available for all tests and examinations. Final examinations for each course are held during the University examination periods, which are June for Semester 1 and November for Semester 2.

Provisional Examination timetables are generally published on myUNSW in May for Semester 1 and September for Semester 2

For further information on exams, please see the Exams section on the intranet.

Calculators

You will need to provide your own calculator, of a make and model approved by UNSW, for the examinations. The list of approved calculators is shown at student.unsw.edu.au/exam-approved-calculators-and-computers

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an "Approved" sticker for it from the School Office or the Engineering Student

Centre prior to the examination. Calculators not bearing an “Approved” sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

For details of applying for special consideration and conditions for the award of supplementary assessment, see the School intranet, and the information on UNSW’s Special Consideration page.

7. Attendance

You are required to attend a minimum of 80% of all classes, including lectures, labs and seminars. It is possible to fail the course if your total absences equal to more than 20% of the required attendance. Please see the School intranet and the UNSW attendance page for more information.

8. Expected resources for students

There is no textbook for the course. PowerPoint slides will be available on Moodle for Modules A and B lectures but students are expected to use various sources.

Recommended texts

Aviation Theory Centre (Melbourne, Vic.) 2012a, “Aircraft general knowledge and aerodynamics for the CASA PPL and CPL day VFR syllabus”, Huntingdale, Vic.: Aviation Theory Centre

Collinson, R. – “Introduction to Avionics”, 1st ed., London; New York: Chapman & Hall, c1996

Cook, M.V., “Flight Dynamics Principles”, Arnold Publishers, UK, 1997.

UNSW Library website: https://www.library.unsw.edu.au/
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

9. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School’s Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

Last year the response rate was too low for any significant conclusion. However, those few that did respond indicated that three-hour lecture blocks were too long. As a result, the only change from the last year is the introduction of two-hour lectures.

10. Academic honesty and plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism: student.unsw.edu.au/plagiarism The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here:
www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Further information on School policy and procedures in the event of plagiarism is available on the intranet.

11. Administrative matters and links

All students are expected to read and be familiar with School guidelines and polices, available on the intranet. In particular, students should be familiar with the following:

- Attendance, Participation and Class Etiquette
- UNSW Email Address
- Computing Facilities
- Assessment Matters (including guidelines for assignments, exams and special consideration)
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Student Support Services

Zoran Vulovic
05 February 2018

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	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