UNSW AUSTRALIA

Course Outline

Semester 2 2015

Never Stand Still | Engineering | Mechanical and Manufacturing Engineering

AERO3630

AERODYNAMICS

Contents

1. STAFF CONTACT DETAILS

Contact details for course convener

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Contact details for laboratory staff

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Consultation

Please check with each Lecturer/Laboratory Officer/Casual Staff of this course for their consultation times.

Administration

All issues regarding administration should be directed to A/Prof N. A. Ahmed or any of the demonstrators via email.

2. COURSE DETAILS

Units of credit

This is a 6 unit-of-credit (UoC) course, and involves 3 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.

There is no parallel teaching in this course.

Contact Hours

	Day	**Time**	**Location**
Lectures	Wednesday Weeks 1-8, 11-12	14:- 17	Ainsworth 202
Demonstrations/Lab	Wednesday Weeks 9,10	14-17	Willis Annexe Lab 116A

Summary of the course

This course focusses on fundamental principles associated with aircraft aerodynamics and physical experimentation using facilities such as wind tunnels.

Aims of the course

The overall objective is to introduce the students to the qualitative and quantitative examination of fluids in motions and the physical forces exerted by fluids, particularly those considered incompressible and inviscid, on their boundaries with a view to calculating aerodynamic forces on streamlined bodies such as wings of aircraft. Thus the emphasis is on lift and drag force components in incompressible flow. The students will also be introduced to the basic techniques associated with physical and numerical experimentations.

This course extends the basic thermodynamic and fluid mechanical principles which you learned in MMAN2600 and MMAN2700 to aerospace engineering and builds on the report-writing skills which you commenced in ENGG1000 and self-investigative investigations, analysis and critical appraisals.

Student learning outcomes

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

Learning Outcome		EA Stage 1 Competencies
1.	Be familiar with the basic principles associated with incompressible and compressible flows in wing design	PE 1.1, 1.2, 1.3, 1.5
2.	Demonstration of the significance of some of the concepts used in wing design through physical experimentation	PE 2: (PE 2.1-2.3)
3.	Decide on the appropriate class of wing in the design of a new aircraft.	PE 3: (PE 2.1-2.3)
4.	Be able to communicate, be creative, understand and apply knowledge in a responsible and ethical and professional manner	PE 2.3, 3.2)

Note: EA = Engineers Australia (EA); PE = Professional Engineers (PE):

3. TEACHING STRATEGIES

Lectures

Lectures in the course are designed to cover the terminology and core concepts and theories in the design, selection of airfoil sections wing configurations in aircraft design.

Laboratory Experiments

Laboratory experiments do not simply reiterate the texts, but build on the lecture topics using physical experimentation that are generally used in research and aerospace industries.

Demonstrations and Practice problems

They are designed to provide you with feedback and discussion on the various topics covered both in lectures and laboratory works, and to investigate problem areas in greater depth to ensure that you understand the application.
The content reflects the experience of the lecturers in aircraft research and design and typical examples drawn from that experience are presented throughout the lectures and Practice Problems.

Remember, effective learning is supported when you are actively engaged in the learning process and by a climate of enquiry, and these are both an integral part of the lectures and Practice Problems.

You become more engaged in the learning process if you can see the relevance of your studies to professional, disciplinary and/or personal contexts, and the relevance is shown in the lectures, laboratory experiments and assignments by way of examples drawn from practical world.

Dialogue is encouraged between you, others in the class and the lecturers. Diversity of experiences is acknowledged, as some students in each class have prior industry or practical experience. Your experiences are drawn on to illustrate various aspects, and this helps to increase motivation and engagement.

It is expected that assignments will be marked and handed back within two weeks following submission. You will have feedback and discussion while fresh in your mind to improve the learning experience.

4. COURSE SCHEDULE

All schedules and descriptions provided below may be changed at short notice to suit exigencies.

Lecture/Problem solving/Lab Schedule
FOR AERO3630/NAVL3620 Day: WEDNESDAY TIME: 14-17

WK	Topic	Who should attend?	Location	Lecturer/ Demonstrators
1	Intro to Aerodynamics/ Potential Flow Concepts	AERO3630	ME202	NA
2	Thin Airfoil Theory	AERO3630	ME202	NA/JY/YY/YYZ/GM
3	Lifting Line Theory/ Finite Wing Theory	AERO3630	ME202	NA/JY/YY/YYZ/GM
4	**CLASS TEST 1**/ Compressible flow	AERO3630	ME202	NA/JY/YY/YYZ/GM
5	Introduction to Experimentation/ Dimensional Analysis	AERO3630/ NAVL3620	ME202	NA/JY/YY/YYZ/GM
6	Introduction to Experimentation/ Dimensional Analysis/	AERO3630/ NAVL3620	ME202	NA/JY/YY/YYZ/GM
7	Compressible Flow/ Shock Waves/ Prandtl Meyer Expansion Method	AERO3630	ME202	NA/JY/YY/YYZ/GM
8	Method of characteristics/ Small perturbation theory/ **CLASS TEST 2**	AERO3630	ME202	NA/JY/YY/YYZ/GM
9	**Experiment 1:** Smoke flow visualisation **Experiment 2:** Pressure Distribution around a cylinder	AERO3630/ NAVL3620	UG LAB116A	DL/JY/YY/YYZ/GM
STUDY BREAK				

10	**Experiment 3:** Lift of an airfoil **Experiment 4:** Drag of an airfoil	AERO3630/ NAVL3620	UG LAB116A	DL/JY/YY/YYZ/GM
11	**WRAP UP**** for Aero students	AERO3630	ME202	JY/YY/YYZ/DM
12	REVISION/ **CLASS TEST 3**	AERO3630/ NAVL3620	ME202	JY/YY/YYZ/DM

****Wrap up for Naval Students will be held on Monday during 10am-1pm in** UNSW Business School 232 **(**JY/YY/YYZ/DM)

5. ASSESSMENT

General

You will be assessed through a combination of assignments, class tests, laboratory work and a final examination. In order to pass the course, you must achieve an overall mark of at least 50%.

Details

A. Class Test No.1 (based on Lectures/Practice Problems)

Class Test no. 1 will be on Lecture materials covered up to week 3 and will be held in Week 4. The test will be of 30 minutes duration and multiple-choice type.

The learning outcome assessed in Class Test 1 are: PE1.1, 1.2, 1.3, 1.5, 2.1, 2.2, 2.3

B. Class Test no.2 (based on Lectures/Practice Problems)

Class Test No. 2 will be on Lecture materials covered up to week 7 and will be held in Week 8. The test will be of 30 minutes duration and multiple-choice type.

The learning outcome assessed in Class Test 2 are: PE1.1, 1.2, 1.3, 1.5, 2.1, 2.2, 2.3

C. Class Test No.3 (on Flow Experimentation)

Class Test No. 3 will be on Flow Experimentation will be held in Week 12. The test will be of one hour duration and will be based on the Flow Experimentation material covered up to the end of Week 10. The test will be of the multiple-choice type.

The learning outcome assessed in Class Test 3 are: PE1.1, 1.2, 1.3, 1.5, 2.1, 2.2, 2.3

D. Flow Experimentation Logbook

For the Flow Experimentation you must keep a logbook. The log book will be a bound A4 exercise book containing the date of experiment, observations, notes, calculations, figures and your comments while conducting the experiment. No loose sheets are acceptable. All

handouts related to a particular experiment should be appropriately stapled or pasted into the log book. The log book is to be submitted to the Lecturer-in-Charge /Demonstrators in Week 12 with the Flow Experimentation report.

The learning outcome assessed in logbook are: PE 2.3, 2.4

E. Flow Experimentation Report

Following the class test, you will be required to write a report on one of the four experiments which have been conducted in the wind tunnel, using the details from your logbook and lecture notes. The specific experiment will be at random, and will be decided by the lecturer, but will be the same experiment for the whole class. Your report is to be submitted to the Lecturer-in-charge in Week 12 with the Flow Experimentation logbook.

The learning outcome assessed in report are: PE 2.3, 2.4, 3.1-3.5

F. Mini Research Project

Proposal Draft: Select your research topic in the field of Aerodynamics and provide a brief description of your proposal (less than 100 words). Submit your proposal draft along with the topic name in pdf or word format online in Moodle.

Detailed Proposal: Construct your research proposal in details using background research. You must describe the findings from at least five journal articles and explain how these findings relate to the studies undertaken in your research topics. You must critically assess the problem statement, hypothesis, methodology, result, and contribution to knowledge regarding your research topic. You will need to submit your work in pdf or word format online in Moodle.

The Mini Research Project must be uploaded in Moodle by week 11

The learning outcome assessed in research project are: PE 1.1-6, 2.3, 2.4, 3.1-3.5

G. Final Examination:

There will be a formal examination of two hour duration. There will two questions in total of equal marks

The learning outcome assessed in final examination are: PE 1.1-5, 2.3, 2.4, 3.1-3.3

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 Administrative Matters.

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 https://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

Presentation

All submissions should have a standard School cover sheet which is available from this subject's Moodle page.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work. Presenting them 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. Where an assessment task is worth less than 20% of the total course mark and you have a compelling reason for being unable to submit your work on time, you must seek approval for an extension from the course convenor ***before the due date***. Special consideration for assessment tasks of 20% or greater must be processed through https://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.

Special Consideration and Supplementary Assessment

For details of applying for special consideration and conditions for the award of supplementary assessment, see Administrative Matters, available on the School website and on Moodle, and the information on UNSW's Special Consideration page.

The distribution of marks are given below:

	Marks	**Weight**
Class Test No.1 (based on Lectures/Problem solving)	10	10%
Class Test No.2 (based on Lecture/Problem solving)	10	10%
Class Test No.3 (based on Flow Experimentation)	20	20%
Flow Experimentation Log Book	5	5%
Flow Experimentation Report	15	15%
Mini Research Project (Max 5,000 words)	20	20%
Main body of text:		
Aims, Significance and Novelties/Innovation	(10)	
Methodologies	(5)	
Conclusions	(3)	
Up-to-date information	(2)	
Final examination	20	20%
Total	**100**	**100%**

6. EXPECTED RESOURCES FOR STUDENTS

Lecture notes and other relevant materials for Lectures, Demonstrations, Problem Solving and Experimentation will be available on-line in Moodle and updated as necessary.

Suggested readings

Anderson, J D, *Fundamentals of Aerodynamics*, 2nd Ed, McGraw Hill, 1995

McCormick, B W, *Aerodynamics, Aeronautics and Flight Mechanics*, 2nd edition, Wiley, 1997

Abbott, I H & von Doenhoff, A E, *Theory of Wing Sections*, Dover, 1956

Clancy, *Aerodynamics*, Pitman, 1979

Rae & Pope, *Low Speed Wind Tunnel Testing*, 2nd Ed. Wiley, 1984

Other Resources

If you wish to explore any of the lecture topics in more depth, then other resources are available and assistance may be obtained from the UNSW Library.

One starting point for assistance is: https://www.library.unsw.edu.au/servicesfor/index.html

7. COURSE EVALUATION AND DEVELOPMENT

Feedback on the course is gathered periodically using various means, including the Course and Teaching Evaluation and Improvement (CATEI) 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.

In this course, recent improvements resulting from student feedback include a reduction in the number of laboratory experiments and report writing

8. 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: https://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: http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Further information on School policy and procedures in the event of plagiarism is presented in a School handout, Administrative Matters, available on the School website.

9. ADMINISTRATIVE MATTERS

You are expected to have read and be familiar with *Administrative Matters*, available on the School website: https://www.engineering.unsw.edu.au/mechanical-engineering/sites/mech/files/u41/S2-2015-Administrative-Matters_20150721.pdf

This document contains important information on student responsibilities and support, including special consideration, assessment, health and safety, and student equity and diversity.

N.A. Ahmed
July 2015

APPENDIX A: ENGINEERS AUSTRALIA (EA) PROFESSIONAL ENGINEER COMPETENCY STANDARDS

	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