UNSW AUSTRALIA

Course Outline

Semester 1, 2015

Never Stand Still | Faculty of Engineering | School of Mechanical and Manufacturing Engineering

AVEN2230

AVIATION TECHNOLOGIES

Contents

AVEN2230: AVIATION TECHNIQUES
COURSE OUTLINE

1. STAFF CONTACT DETAILS

Contact details for course convener

A/Prof N. A. Ahmed
(also responsible for Aerodynamics Component)
Room G17/464K
Tel (02) 9385 4080
Fax (02) 9663 1222
Email n.ahmed@unsw.edu.au

Contact details for additional lecturers and demonstration/laboratory teaching staff

Dr J. Olsen (Propulsion Component)
Room F21/107J
Tel (02) 9385 5217
Fax (02) 9663 1222
Email j.olsen@unsw.edu.au

Dr N. Tsafnat (Flight Dynamics/Simulation Component)
Room G17/464D
Tel (02) 9385 6158
Fax (02) 9663 1222
Email n.tsafnat@unsw.edu.au

Dr Z. Vulovic (Systems Component and Simulation demonstrations)
Room F21/107D
Tel (02) 9385 6261
Fax (02) 9663 1222
Email z.vulovic@unsw.edu.au

Casual Staff:
Yong Ying Zheng, Yendrew Yauwenas , Tzi Chieh (Monica) Chi ,William Crowe

Laboratory Officer:
Terry J. Flynn, Bruce Oliver

Consultation Please check with each Lecturer/demonstrator of this course for consultation

2. COURSE DETAILS

Units of credit

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.”

For a standard 24 UoC in the semester, this means 600 hours, spread over an effective 15 weeks of the semester (thirteen weeks plus stuvac plus one effective exam week), or 40 hours per week, for an average student aiming for a credit grade Various factors, such as your own ability, your target grade, etc., will influence the time needed in your case. Some students spend much more than 40 h/w, but you should aim for not less than 40 h/w on coursework for 24 UoC.

This means that you should aim to spend not less than about 10 h/w on this course, i.e. an additional 4 h/w of your own time. This should be spent in making sure that you understand the lecture material, completing the set assignments, further reading about the course material, and revising and learning for the examination.

There is no parallel teaching in this course.

Summary of the course

This course will cover aspects of aviation systems and avionics, aerodynamics, aircraft control and performance.

Aims of the course

The aim is to introduce students to these technologies listed above and describe how they relate to aircraft flight. The course consists of both qualitative and quantitative studies as well as laboratory components.

This course can be taken by all interested students in the degree program but is a necessary perquisite for students in Program 3920 wishing to enrol in AVEN3430 or AVEN3940 in Year 3.

Student learning outcomes

At the conclusion of this course, it is expected that you will be able to:

- Be familiar with the basic principles associated with incompressible flow in wing design
- Demonstration of the significance of some of the concepts used in wing design through physical experimentation
- Become familiar with numerical experimentation using computational fluid dynamics
- Decide on the appropriate class of wing in the design of a new aircraft.
- Understand the effect of pressure loss in hydraulic, pneumatic, and fuel system.

Graduate attributes

UNSW's graduate attributes are shown at
https://my.unsw.edu.au/student/atoz/GraduateAttributes.html

UNSW graduates will be:

Scholars who are:

1. understanding of their discipline in its interdisciplinary context (*)
2. capable of independent and collaborative enquiry (*)
3. rigorous in their analysis, critique, and reflection (*)
4. able to apply their knowledge and skills to solving problems (*)
5. ethical practitioners (*)
6. capable of effective communication (*)
7. information literate (*)
8. digitally literate

Leaders who are:

9. enterprising, innovative and creative (*)
10. capable of initiating as well as embracing change (*)
11. collaborative team workers (*)

Professionals who are:

12. capable of independent, self-directed practice (*)
13. capable of lifelong learning (*)
14. capable of operating within an agreed Code of Practice (*)

Global Citizens who are:

15. capable of applying their discipline in local, national and international contexts (*)
16. culturally aware and capable of respecting diversity and acting in socially just/responsible ways
17. capable of environmental responsibility

Graduate attributes targeted and developed in this course are marked with an asterisk (*). Furthermore, these professional attributes are also identified in the Assessment.

A statement of broad graduate attributes has meaning when expressed in the context of the discipline. Thus, the Faculties are responsible for expressing these University Graduate Attributes in the context of the professional area, discipline and program level, and for their explicit development and assessment within the curricula. The graduate attributes contextualised for engineering are shown at http://learningandteaching.unsw.edu.au/content/userDocs/GradAttrEng.pdf

Students will be supported in developing the above attributes through:

(i) the design of academic programs
(ii) course planning and documentation
(iii) assessment strategies
(iv) learning and teaching strategies.

In this course, you will be encouraged to develop Graduate Attributes 1, 2, 3, 5, 6, 9, 10 and 12 by undertaking the selected activities and knowledge content. These attributes will be assessed within the prescribed assessment tasks, as shown in section 5 under Assessment.

3. RATIONALE FOR INCLUSION OF CONTENT AND TEACHING APPROACH

This course is included to give you the skills to identify and prescribe the characteristics associated with the selection and usage of designs of engines for aircraft propulsion.

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 demonstrations.

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 demonstrations.

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. TEACHING STRATEGIES

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. They 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 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.

5. ASSESSMENT

General

You will be assessed through a combination of class tests, laboratory works and final examination. The distribution of marks and other details are given below. There will be three class tests ((on Aerodynamics, Propulsion and Flight) Dynamics), The students should carry out all their data and calculations and record them in his/her log book that will be used to assess the System and Flight simulation components.

5.1 Distribution of Marks

Flight Mechanics Component (worth 10% in total)	**Weighting**
Class Test	10%

Aerodynamics Component (worth 10% in total)	**Weighting**
Class Test	10%

Propulsion Component (worth 10% in total)	**Weighting**
Class Test	10%

Simulation Component (worth 10% in total)	**Weighting**
Logbook (Data Acquisition and solving Equations)/ZV to advise)	10%

System Component (worth 10% in total)	**Weighting**
Logbook (Based on Laboratory)/ZV to advise)	10%

Final Examination (worth 50% in total)	**Weighting**
Aerodynamics	12.5%
Propulsion	12.5%
Systems	12.5%
Flight Mechanics	12.5%

5.2 Details

5.2.a Class Tests:

NA will advise about the nature of the class test on Aerodynamics. Aerodynamics class test will be of 30 minutes duration in total.

JO will advise about the nature of the class test on Propulsion. Propulsion class test will be of 30 minutes duration in total.

NT will advise about the nature of the class test Flight Dynamics. Flight dynamics class test will be of 30 minutes duration in total.

5.2.b Assessment of Systems and Flight Simulation

(Laboratory Performance and Log book based)

The log book must be a bound exercise book containing the date of experiment, observations, notes, calculations, figures and comments by the student while conducting the experiment. **No loose sheets are acceptable**. All handouts related to a particular experiment should be appropriately stapled or pasted in the log book.

The log book will be used to check the attendance in laboratory experiments and assess student performance in Simulation and System components of this course.

The preferred set-out of any numerical calculation is similar to the following:

$\Delta = \rho\nabla$ (Equation in symbols)
$= 1.025 \times 200$ (Numbers substituted)
$= 205$ t (Answer with units)

Submission

Logbooks are due in Week 12 at 4pm in Blockhouse 205.

The logbook must be handed in during lecture time, NOT through the school office. LATE Logbooks will NOT be accepted and will incur zero mark. NO EXCEPTION!

Criteria

The following criteria will be used to grade logbook:

For main body of text:

- Identification of experiment heading, date, time, venue etc
- Identification of key facts and the integration of those facts in a logical development.
- Clarity of communication—this includes development of a clear and orderly structure and the highlighting of core arguments.
- Sentences in clear and plain English
- Correct referencing, if any, in accordance with the prescribed citation and style guide.

For numerical calculations:

- Accuracy of numerical answers.
- All working shown (see *Presentation* above).
- Use of diagrams, where appropriate, to support or illustrate the calculations.
- Use of graphs, were appropriate, to support or illustrate the calculations.
- Use of tables, where appropriate, to support or shorten the calculations.

5.2.c Final Examination

There will be a formal examination of two hour duration. There will be four questions in total, one on aerodynamics, one on propulsion, one on systems and one on flight mechanics

In order to pass the course, you must achieve an overall mark of at least 50%.

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.

Special Consideration and Supplementary Assessment

For details of applying for special consideration and conditions for the award of supplementary assessment, see *Administrative Matters*, available from the School website.

6. ACADEMIC HONESTY AND PLAGIARISM

Plagiarism is using the words or ideas of others and presenting them 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 booklet which provides essential information for avoiding plagiarism: https://my.unsw.edu.au/student/academiclife/Plagiarism.pdf

There is a range of resources to support students to avoid 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. Information is available on the dedicated website Plagiarism and Academic Integrity website: http://www.lc.unsw.edu.au/plagiarism/index.html

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 a 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.

7. COURSE SCHEDULE

AVEN 2230							
	MONDAY : Central Lecture Block 5 (Webs 250) (For Lectures/Demonstrations) (9am-11am)					THURSDAY: (Blockhouse 205) (Lecture/Demonstrations) (14pm-16pm)	
WK	ACTIVITY	PARALLEL ACTIVITY Details		PARALLEL ACTIVITY Details		ACTIVITY	TOPIC/Details
1	Lecture (Flight)	Introduction to AVEN2230 (NA)		none		Lecture (Flight)	Introduction/ Atmosphere (NT)
2	Lecture (Flight)	Un-accelerated Flight/ S & L Flight/ Power for Flight (NT)				Lecture (Flight)	Range/endurance/ Pull-ups, turns/ Flight envelope (NT)
3	Lecture (Flight)	Excess Power, ROC and Climb gradients and Descent **CLASS TEST** **(NT)**		none		Lecture (Aerodynamics)	Introduction to Aerodynamics (NA)

4	Lecture (Aerodynamics)	Introduction to Experimental Methods in Aerodynamics (NA)		none			Lecture (Aerodynamics)	Introduction to Experimental Methods in Aerodynamics (NA)
5	Experiment (Aerodynamics) Willis Annex Building L110	Smoke flow visualization: 9.00-9.40am: Groups 1,2 NA/YY/TF/BO 9.40-10.20am: Groups 3,4 NA/YY/TF 10.20-11.00am : Groups 5,6 NA/ YY/TF/BO		Experiment (Simulation) (F21)	9.00am-9.40am: Group 1 (Lab: F21) ZV/WC 9.40am-10.20 am: Group 2 (Lab: F21) ZV/WC 10.20 am-11.00am : Group 3(Lab: F21ZV/WC/MC		Experiment (Aerodynamics) Tyree Building LG 9 and 10	Aerodynamic Lift on Airfoil: 4.00-4.40pm : Groups 5,6 NA/YY/TF/BO 4.40-5.20pm : Groups 1,2 NA/YY/TF/BO 5.20-6.00am : Groups 3,4 NA//YY/TF/BO

6	Experiment (Aerodynamics) Tyree Building LG 9 and 10	Aerodynamic Drag on Airfoil: 9-00am-9.40am : Groups 3,4 NA//YY/TF/BO 9.40-10.20am : Groups 5,6 NA/ YY/TF/BO 10.20-11.00am : Groups 1,2 NA/ YY/TF/BO		Experiment (Simulation) (F21)	9.00am-9.40am: Group 6 (Lab: F21) ZV/WC/MC 9.40am-10.20 am: Group 4 (Lab: F21) ZV/WC/MC 10.20 am-11.00am : Group5 (Lab: F21) ZV/WC/MC		WRAP-UP: (Aerodynamics)	ALL Groups 1-12 4pm-5pm NA/YY **CLASS TEST (AERODYNAMICS)**
7	WRAPUP	WRAP-UP (Simulation) ZV/WC/MC					Lecture (Propulsion)	History/Introduction to Engines
8	Lecture (Propulsion)	Propellers and reciprocating engines (JO)					Lecture (Propulsion)	Turbojets and Turbofans/ (JO)

9	Lecture (Propulsion)	Thrust and efficiency-the trade off (JO)				Lecture (Propulsion)	Materials, Noise and Pollution (JO) **Class Test on Propulsion**
10	Lecture (Systems)	Hydraulic Systems and Components (ZV)		none		Lecture (Systems)	Pneumatic Systems and Components (ZV)
11	Lecture (Systems)	Electrical Systems and Components (ZV)		none		Lecture (Systems)	Fuel Systems and Components (ZV)
12	Experiment (Systems) Tyree Building LG 9 and 10	9am-9.40am : Groups 5,6 ZV/YE/TF 9.40am-10.20am : Groups 1,2 ZV/YE/TF 10.20am-11am: Groups 3,4 ZV/YE/TF				WRAP-UP	WRAP-UP Systems) ALL Groups 1-12 **LOGBOOK DUE (Systems/Simulation)**

13	Revision (Any Topic, If needed) NA/JO/NT/ZV	ALL Groups 1-12 ZV/YE		none		Revision (Any Topic, If needed) NA/JO/NT/ZV	ALL Groups 1-12

Lecturers: JO John Olsen NA N.A.Ahmed
NT Naomi Tsafnat ZV Zoran Vulovic

Demonstrators/Demonstrators: MC Monica Chee YE Yendrew Yauwenas
YY Yong Ying Zheng WC William Crowe

Laboratory Officer: TF Terry Flynn BO Bruce Oliver

The schedules shown may be subject to change at short notice to suit exigencies.

The Simulation Experiments will be held building F21
(Engineering Simulation Laboratory).

The Aerodynamic laboratory Inspections/demonstrations and system experiments will be held in G19/Tyree building (Please check before you go)

The Systems Experiments will be held in Tyree Building

8. RESOURCES FOR STUDENTS

Lecture notes

Lecture notes and Laboratory notes are either available on Blackboard or will be handed out in class.

Suggested readings

- Anderson, J D, *Introduction to Flight,* 5th Ed, McGraw Hill, 2005
- 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
- Nicholas Cumpsty, *Jet Propulson, a simple guide to the thermodynamic design and performance of jet engines*, 2nd edition, 2003, Cambridge University Press
- 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

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:
www.library.unsw.edu.au/servicesfor/students.html.

9. 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 demonstration 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 work and report writing.

10. ADMINISTRATIVE MATTERS

You are expected to have read and be familiar with *Administrative Matters*, available on the School website. 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
February 2015