UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2017

NAVL3710

SHIP PROPULSION AND MACHINERY

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1. Staff contact details

Contact details and consultation times for course convenor

Mr David Lyons FRINA (teaching Part B: Resistance, Powering and Propulsion component)
Naval Architecture Stream Co-Ordinator
Room 208D, Ainsworth Building J17
Email david.lyons@unsw.edu.au
Tel (02) 9385 6120 or 0418 208370 (send SMS or leave voicemail if unattended)

Consultation concerning this Course is available by email, by phone or in person. For an in-person appointment, please contact David by email first or see him in class on Wednesdays.

Contact details and consultation times for additional lecturers/demonstrators/lab staff

Mr Mel Atack (teaching Part A : Machinery component)
Tel 0417 177967
Email melvinatack@hotmail.com

2. Course details

Credit Points

This is a 6 unit-of-credit (UoC) course, and involves up to 5 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
Lecture: Part B - Mr Lyons	Monday	2pm – 5pm	Business School 205
Lecture: Part A Mr Atack	Thursday	10am – 12noon	Business School 205

Summary of the course

This course focuses on the ship propulsion train and auxiliary machinery required, ship resistance and the prediction of the power required for propulsion and shipbuilding contracts and equipment. It is divided into:

Part A – Machinery
Part B – Resistance, Powering & Propulsion

Aims of the course

This course enables you to explore the principal means of ship power (diesel engines, gas turbines, steam turbines, diesel electric, etc.), the transmission system, and the requirements of the auxiliary machinery for hotel loads.

You are also given the tools of current numerical methods of resistance prediction so that you can predict the power required to provide a contracted speed or, for a tug, a contracted bollard pull. Propeller design and waterjet installations are studied and design procedures are learned.

This course uses the ship terminology which you learned in NAVL3610. It uses thermodynamic principles from MMAN2700 and electrical principles from ELEC1111, and builds on the report-writing skills which you commenced in ENGG1000.

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.	Decide on the most-appropriate form of mechanical propulsion for a new vessel and specify the transmission system and auxiliary machinery.	PE1.3, PE1.5, PE2.1, PE2.2, PE2.3
2.	Understanding SOLAS systems and automation.	PE2.1-2.3
3.	Be conversant with a range of ship resistance prediction methods.	PE1.1, PE1.2, PE2.2
4.	Analyse the propulsion power required by way of the resistance or bollard-pull characteristics.	PE1.1, PE1.2, PE2.2
5.	Be competent in the fundamentals of propulsion design: propellers and water jet installations.	PE2.1-2.4
6.	Deciding propeller particulars	PE2.1-2.3
7.	Propeller analysis	PE2.1-2.3

3. Teaching strategies

Lectures in the course are designed to cover the terminology and core concepts and theories in the design of propulsion trains, auxiliary machinery, shipbuilding contracts and equipment. They do not simply reiterate the texts, but build on the lecture topics using examples taken directly from industry to show how the theory is applied in practice and the details of when, where and how it should be applied.

4. Course schedule

Date	Week	Mon	Thu	Topic
24/7/17	1	x		Part B - Resistance & Powering: Components of resistance and methods of calculation Propulsion: Introduction and terminology
27/7/17			x	Part A - Selection criteria for main propulsion and other systems
31/7/17	2	x		Part B - Resistance & Powering: USNA patrol vessel series and Radojcic et al. methods Propulsion: Blade sections, fluid flow and power transmission
3/8/17			x	Part A - Steam plant
7/8/17	3	x		Part B - Resistance & Powering: Mercier and Savitsky, and Lahtiharju et al. methods Propulsion: Hull–propeller interaction
10/8/17			x	Part A - Diesel plant
14/8/17	4	x		Part B - Resistance & Powering: Van Oortmerssen's and Holtrop's methods Propulsion: Laws of similarity and scaling
17/8/17			x	Part A - Gas turbine plant, turbo and diesel-electric combinations
21/8/17	5	x		Part B - Resistance & Powering: Robinson's and Ridgeley-Nevitt's methods Propulsion: Presentation of thrust and torque data for series propellers
24/8/17			x	Part A - Shafting
28/8/17	6	x		Part B - Resistance & Powering: Using commercial resistance-prediction software packages Propulsion: Theories of propeller action
31/8/17			x	Part A - Gearing and power take-offs
4/9/17	7	x		Part B - Resistance & Powering: Air and wind resistance Propulsion: Cavitation
7/9/17			x	Part A - Electricity generation and distribution
11/9/17	8	x		Part B - Resistance & Powering: Appendage resistance Propulsion: Practical propeller design
14/9/17			x	Part A - Pumps, piping and compressors
18/9/17	9	x		Part B - Resistance & Powering: Resistance in shallow water Propulsion: Propeller details and drawing
21/9/17			x	Part A - Fuel-handling and treatment systems
23/9/17-2/10/17				Mid-semester break
3/10/17	10	x		Part B - Resistance & Powering: Ship squat Propulsion: Strength, mass and polar moment of inertia

6/10/17			x	Part A - Filters and purifiers
9/10/17	11	x		Part B - Resistance & Powering: Yacht resistance prediction: the Delft Systematic Yacht Hull Series Propulsion: Waterjet theory
12/10/17			x	Part A - Heat exchangers, distillation plant and hotel services
16/10/17	12	x		Part B - Resistance & Powering: Catamaran resistance prediction: Zips, Muller-Graf, Scott, Wong, and slender-body methods Propulsion: Practical waterjet design
19/10/17			x	Part A - SOLAS systems and automation
23/10/17	13	x		Revision and exam details: Parts A & B by David Lyons

5. Assessment

Assessment overview: Parts A and B are equally weighted

Part A: Machinery						
No.	**Assignment**	**Weight**	**Learning outcomes assessed**	**Assessment criteria**	**Due date and submission requirements**	**Marks return-ed:**
1	Terminology	15%	1	Correct identification and usage	Week 5: 24/8/17	2 weeks after submis sion
2	Gas turbine fuel and air	15%	1	Lecture material from weeks 1 and 4.	Week 7: 7/9/17	2 weeks after submis sion
3	Main machinery recommenda tion	15%	1	All course content from weeks 1-8.	Week 9: 21/9/17	2 weeks after submis sion
4	SOLAS requirements	15%	2	Correct reference to SOLAS requirement.	Week 11: 12/10/17	2 weeks after submis sion
Exam		40%	1,2	All Part A content.	Examination period: 4-19/11/17	
Part B: Resistance, Powering & Propulsion						
No.	**Assignment**	**Weight**	**Learning outcomes assessed**	**Assessment criteria**	**Due date and submission requirements**	**Marks return-ed:**
1	USNA & Lahtiharju resistance	15%	3	Application of methods	Week 5: 26/8/17	2 weeks after submis sion
2	Robinson's resistance prediction	15%	3	Application of method	Week 7: 9/9/17	2 weeks after

						submis sion
3	Design charts and polynomials	15%	4,5,6	Correct design procedure requirement	Week 11: 14/10/17	2 weeks after submis sion
4	Propeller design	15%	5,6,7	Correct design procedure		
Exam		40%	3-7	All Part B content.	Examination period: 4-19/11/17	

Assignments

Presentation

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

All submissions are to be neatly typed and clearly set out. Presenting them clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

Part A: By hard copy in-class.
Part B: By email to *david.lyons@unsw.edu.au*

Late submissions will be penalised 5% of the available 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 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.

Examinations

You must be available for all tests and examinations. The final School examination for this Course will be held during the University examination period 4-19 November 2017.

Provisional examination timetables are generally published on myUNSW in September for Semester 2.

For further information on exams, please see the Exams section on the intranet and contact the Course convenor.

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.

6. Expected resources for students

Part A – Machinery
Students are given extensive lecture notes and Powerpoint presentations by the lecturer which are uploaded to Moodle.

Part B – Resistance, Powering and Propulsion
The Bentley Systems *Maxsurf Resistance* software is available for use in Ainsworth 204.

NMSC, National Standard for Commercial Vessels, Part C Design and Construction, Section 5, Engineering (downloadable from the AMSA website www.amsa.gov.au).

Classification society rules are available on the MECH computer system as follows:

Det Norske Veritas	*Rules for High Speed Light Craft*
	Rules for Ships
Lloyd's Register	*Rules for Special Service Craft*
	Rules for Ships

All American Bureau of Shipping and DNV GL rules are available for download from the Internet.

General Textbooks

Ghose, J.P. and Gokarn, R.P. (2004), *Basic Ship Propulsion*, Allied Publishers, New Delhi.

Lewis, E.V. (Ed.) (1988), *Principles of Naval Architecture*, v.2, Resistance, Propulsion and Vibration, Society of Naval Architects and Marine Engineers, Jersey City.

Kerwin, J.E. and Hadler, J.B. (2010), *The Principles of Naval Architecture Series: Propulsion,* Society of Naval Architects and Marine Engineers, Jersey City.

All of these are available in the UNSW Library.

The first is available via the Internet from the Bookshop of India at www.bookshopofindia.com for about $30 posted (depending on exchange rate).

The others are available for purchase from the Society of Naval Architects and Marine Engineers (SNAME) www.sname.org. However, the price to non-members usually exceeds the member price plus the cost of student membership, so it is advisable to join the Society and order the books at the same time. Please see the Course Convenor regarding joining procedures.

Suggested additional readings

Part A – Machinery
Hall, D. (1999), *Practical Marine Electrical Practice*, Second Edition, Witherby, London.

Rowen, A.L., Gardener, R.F., Femenia, J., Chapman, D.S. and Wiggins, E.G. (2005), *Marine Engineering*, vols. 1 and 2, Society of Naval Architects and Marine Engineers, Jersey City.

Taylor, D.A. (1996), *Introduction to Marine Engineering*, Butterworth Heinemann, London.

Except for Hall (1999), these are all available in the UNSW Library and are useful as additional reading material.

Rowen et al. (2005) is also available for purchase from the Society of Naval Architects and Marine Engineers, Jersey City, USA. However, the price to non-members (of any one book) exceeds the member price plus the cost of student membership, so it is advisable to join the Society and order the books at the same time. Please see the course convenor for an application form if you wish to do this.

Part B – Resistance, Powering and Propulsion
Lewis, E.V. (Ed.) (1988), *Principles of Naval Architecture*, v.2, Resistance, Propulsion and Vibration, Society of Naval Architects and Marine Engineers, Jersey City.

MacPherson, D. (1993), Reliable Performance Prediction: Techniques Using a Personal Computer, *Marine Technology*, v.30, n.4, October (also available online from www.hydrocompinc.com/knowledge/library.htm).

Paulling, J.R. (2010), *Principles of Naval Architecture: Ship Resistance and Flow*, Society of Naval Architects and Marine Engineers, Jersey City.

Carlton, J.S. (2008), *Marine Propellers and Propulsion*, 2nd Ed., Butterworth-Heinemann, London.

O'Brien, T.P. (1962), *The Design of Marine Screw Propellers*, Hutchison, London.

Paulling, J.R. (Ed.) (2010), *Principles of Naval Architecture: Propulsion*, Society of Naval Architects and Marine Engineers, Jersey City.

Saunders, H.E. (1957), Hydrodynamics in Ship Design, v.1 and v.2, Society of Naval Architects and Marine Engineers, Jersey City.

Additional materials provided in Moodle

This course has a website on UNSW Moodle which includes:

- copies of assignments (as they are issued), otherwise issue in-class;
- previous examination papers in this course from 2010 onwards;
- answers to the numerical questions in examinations from 2010 onwards; and
- a discussion forum.

The discussion forum is intended for you to use with other enrolled students. The course convenor will occasionally look at the forum and take note of any frequently-asked questions, but will not respond to questions on the forum. If you want help from the convenor then direct contact is preferred.

Recommended internet sites

There are many websites giving lectures, papers and data on ship terminology and design..

Principal particulars of many different types of vessels are available on the Internet. You might like to try the following for a start:

Austal Ships	www.austal.com
Incat Crowther	www.incatcrowther.com.au
Incat Australia	www.incat.com.au
One2Three Naval Architects	www.one2three.com.au

There are also many websites giving lectures, papers and data on propellers and propeller design. Try searching for propellers, or propeller design.

You can check some of the propeller manufacturers:
www.veem.com.au
www.australpropeller.com.au
www.stonemanganese.co.uk
www.arneson-industries.com/page.php?type=products&id=drives

(for surface-piercing propellers)
www.sistemar.com (for CLT propellers)
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.

UNSW Library website: https://www.library.unsw.edu.au/

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 the alignment of component parts within the course that complement each other. To that end, the ship's entire powering and propulsion train from the engines to the propeller are treated as a whole in order to mee the powering requirements that are assessed in order to overcome the vessel's resistance.

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: 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.

9. 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

David Lyons FRINA
20 June 2017

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