UNSW AUSTRALIA

Course Outline

Semester 2 2015

Never Stand Still | Engineering | Mechanical and Manufacturing Engineering

NAVL3120

Ship Design and Propulsion

Contents

1. Staff Contact Details

Contact details and consultation times for course convener

Mr David Lyons CEng FRINA
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Consultation concerning this course is available by email, by phone or in person. For an in-person appointment, please contact me by email first or see me in class.

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

Nil

2. 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.

There is no parallel teaching in this course.

Contact Hours

Lectures/Tutorials	Day	Time	Location
	Tuesday	11am - 2pm	Ainsworth 202 (weeks 1-5, 9-13) Ainsworth 204 (weeks 6-8)
		3pm - 6pm	Ainsworth 202 (all weeks)

Summary of the Course

This course focuses on the design process as it applies to ships and to their principal forms of mechanical propulsion i.e. marine screw propellers and waterjets.

Aims of the Course

This course enables you to explore the ship design process, commencing with the requirements of the owner and progressing to a new design which meets those requirements. You are given practical insight into the role of the various regulatory authorities, and application of the freeboard and tonnage rules and the seakeeping behaviour of ships, and how they all influence the design outcome.

The course also provides you with the terminology unique to ship propulsion. This is then used as a stepping stone into determining the principal particulars of a series-type propeller or waterjet unit to suit a particular application. You are then given the tools to translate these principal particulars into a detailed design which meets the regulatory requirements and a drawing from which a foundry can manufacture the required propeller.

This course uses the ship terminology which you learned in NAVL3610. It lays the groundwork for the procedure which you will use in undertaking your own ship design project in NAVL4120 and NAVL4130, and builds on the report-writing skills which you commenced in ENGG1000.

Student learning outcomes

This course is designed to address the below learning outcomes 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 principal particulars for a new vessel which will meet the owner's requirements and those of the applicable regulations.	PE1.1 – PE1.3, PE1.5, PE2.1 – 2.3
2.	Create a CAD hullform model of the new vessel and analyse the influence of the load line and tonnage regulations.	PE1.1 – PE1.3, PE1.5, PE2.1 – 2.3
3.	Decide on the principal particulars for a new marine screw propeller which will suit a particular application.	PE1.1 – PE1.3, PE1.5, PE2.1 – 2.3
4.	Analyse the propeller by way of hull interaction effects, cavitation and classification society requirements, and provide the details of the new propeller by way of a table of offsets.	PE1.1 – PE1.3, PE1.5, 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 ships and propulsion. 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.

Tutorials are designed to provide you with feedback and discussion on the assignments, and to investigate problem areas in greater depth to ensure that you understand the application and can avoid making the same mistake again.

4. Course schedule

All lectures and tutorials in this course are given by the course convener.

Part A **Design** **Tuesday 1100–1400** **Ainsworth 202 or 204**

Week	**Topic**	
1	Introduction to design and terminology	
2.	Features of specific ship types	
3	Principles and methods of design, first estimates of dimensions	
4	Steps in preliminary design, the mass estimate	
5	Other preliminary estimates	
6	Generation of the lines plan	(in Ainsworth 204)
7	Lines plan tutorial	(in Ainsworth 204)
8	Variation of the lines plan	(in Ainsworth 204)
9	Load lines (1)	
10	Load lines (2)	
11	Tonnage	
12	Seakeeping	
13	Revision and exam details	

Part B **Propulsion** **Tuesday 1500–1800** **Ainsworth 202**

Week	**Topic**
1	Introduction and terminology
2	Blade sections, fluid flow and power transmission
3	Hull–propeller interaction
4.	Laws of similarity and scaling
5	Presentation of thrust and torque data for series propellers
6	Theories of propeller action
7	Cavitation
8	Practical propeller design
9	Propeller details and drawing
10	Strength, mass and polar moment of inertia
11	Waterjet theory
12	Practical waterjet design
13	Revision and exam details

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

5. Assessment

General

You will be assessed by way of short assignments and an examination, both of which involve calculations and descriptive material.

Part A of the course (Design, 3 h/w) counts 50% towards the overall grade in the course, and Part B (Propulsion, 3 h/w) counts 50% towards the overall grade, as follows:

	Part A	**Part B**
Assignments	40%	40%
Examination	60%	60%
Total	100%	100%
Scaled	50%	50%
Overall	100%	

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

Assignments

The set assignments during the semester are shown below. Assignments will be posted on Moodle.

Presentation

All submissions must have a completed standard School cover sheet available on this subject's Moodle page.

All submissions are to be TYPED, neat and clearly set out. All calculations should be shown as, in the event of incorrect answers, marks are awarded for method and understanding.

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

Assignments are due on the scheduled day of the class in the week nominated on the previous page, by 5pm and *are to be submitted via Moodle*.

Late submission of assignments attracts a penalty of five (5) marks for each calendar day the assignment is late. 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 convener 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.

Part A Design

No.	Assignment	Due via Moodle at 5:00pm	Mark	Learning outcome assessed
1	Design of a particular vessel	Tues Week 2	10	1
2	Prelim. design of HS vessel	Tues Week 4	10	1
3	Prelim. design of cargo vessel	Tues Week 6	10	1
4	Lines plan generation	Tues Week 8	20	2
5	Load line calculations	Tues Week 10	10	2
6	Tonnage calculations	Tues Week 12	10	2
	TOTAL		**70**	

Part B Propulsion

No.	Assignment	Due via Moodle at 5:00pm	Mark	Learning outcome assessed
1	Propeller terminology	Tues Week 3	10	3
2	Interaction and cavitation	Tues Week 5	10	4
3	Design charts and polynomials	Tues Week 7	10	4
4	Propeller design	Tues Week 9	10	3
5	Propeller details	Tues Week 11	10	4
	TOTAL		**50**	

Criteria

The following criteria will be used to grade assignments:

The first assignment in Part A is a report, and the following criteria will be used:

- 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—this includes correct grammar, spelling and punctuation.

Correct referencing in accordance with the prescribed citation and style guide.
The fourth assignment in Part A is a CAD drawing of the hullform, and the following criteria will be used:

- Provision of three views.
- Incorporation of waterlines, buttock lines and sections.
- Correct labelling.
- Fairness of hull shape.

All other assignments involve numerical calculations, for which the following criteria will be used:

- Accuracy of numerical answers.
- 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.
- Neatness.

Examinations

The final examination for the course is held during the University examination period in November.

Provisional Examination timetables are generally published on myUNSW in September.

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.

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

6. Expected Resources for students

Textbooks—recommended for reference, not compulsory

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.

Lamb, T.C. (Ed.) (2003 and 2004), *Ship Design and Construction*, v.1 and 2, 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, Jersey City, USA. However, the price to non-members exceeds the member price (of any one book) plus the cost of student membership, so it is advisable to join the Society and order the books at the same time.

Suggested additional readings

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.

Rawson, K.J. and Tupper, E.C. (1969), *Basic Ship Theory*, v.I and v.2, Longman, London.

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

These are all available in the UNSW Library and are useful as additional reading material, giving good descriptions, Rawson and Tupper of the design process and O'Brien and Saunders of lifting-line calculations for propellers; Carlton and Paulling are the modern reference works on propeller design.

Additional materials provided in Moodle

This course has a site on UNSW Moodle which includes:

- copies of assignments
- previous examination papers in this course;
- some answers to the numerical questions; and
- a discussion forum.

The discussion forum is intended for you to use with other enrolled students.

Recommended internet sites

There are many websites giving lectures, papers and data on ship terminology and design. Try searching for "ship design" (including the quote marks.

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

or some of the papers and downloadable software, such as:
www.yildiz.edu.tr/~guner/down.html (lifting-line software)

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:
https://www.library.unsw.edu.au/servicesfor/index.html

7. Course evaluation and development

Feedback on the course is gathered 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 tutorial on generation of a lines plan, where you are now provided with a set of printed notes and you can work through the examples on the computer at your own pace, and extensive revision and clarification of the section in the notes on sheer corrections for load lines. Other recent improvements have included the provision of a recently-published textbook on propeller design, and the distribution of a spreadsheet to you for estimation of propeller off-design performance.

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: 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.

David Lyons
20 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