UNSW AUSTRALIA

Course Outline

Semester 2 2015

Never Stand Still | Engineering | Mechanical and Manufacturing Engineering

NAVL3710

Ship Standards and Marine Engineering

Contents

1. Staff Contact Details

Contact details and consultation times for course convenor

Mr David Lyons CEng FRINA
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Tel: (02) 9385 6120 – voicemail

Consultation concerning this course is available by email, by phone or in person. For an in-person appointment, please contact me by email to arrange.

Contact details and consultation times for additional lecturers

Dr Mac Chowdhury
Tel (02) 9385 4119
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Mr Richard Sproge
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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
	Monday	2pm - 5pm (Mr Lyons 2-3pm, Mr Sproge 3-5pm)	OMB 150 (weeks 1-13)
	Thursday	9am – 12noon (Mr Lyons 9-10am, Dr Chowdhury 10-12noon)	UNSW Business School (E12) 232 (weeks 1-13)

Summary of the Course

This course focusses on the ship propulsion train and auxiliary machinery required, the steering and manoeuvrability, the specification and tendering process, and the prediction of the power required for 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 given practical insight into the manoeuvring characteristics of the ship, and the shipboard equipment needed to translate these characteristics into outcomes.

The course also provides you with the terminology unique to the procurement process, by way of the specification, drawings and documentation required for the tendering and construction process. 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.

This course uses the ship terminology which you learned in NAVL3610, and builds on the overall view of the propulsion train given in NAVL3120. 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 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 most-appropriate form of mechanical propulsion for a new vessel which will meet the contractual requirements, and specify the transmission system and auxiliary machinery.	PE1.1 – PE1.3, PE1.5, PE2.1 – 2.3
2.	Analyse the manoeuvring characteristics of the vessel's hullform, compare that to achievable standards, and specify the steering gear required.	PE1.1 – PE1.3, PE1.5, PE2.1 – 2.3
3.	Decide on an appropriate type of specification for the construction of the vessel, draft the specification, and specify the drawings and other documentation required for procurement of the vessel.	PE1.1 – PE1.3, PE1.5, PE2.1 – 2.3
4.	Analyse the propulsion power required by way of the resistance or bollard-pull characteristics.	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 propulsion trains, auxiliary machinery and procurement. 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

The lectures in this course are given as follows:

Part A **Machinery** **Monday 1500–1700** **OMB150**

All lectures in this part are given by Mr Richard Sproge.

Week	Topic
1	Selection criteria for main propulsion and other systems
2.	Steam plant
3	Diesel plant
4	Gas turbine plant, turbo and diesel-electric combinations
5	Shafting
6	Gearing and power take-offs
7	Electricity generation and distribution
8	Pumps, piping and compressors
9	Fuel-handling and treatment systems
10	Filters and purifiers
11	Heat exchangers, distillation plant and hotel services
12	SOLAS systems and automation
13	Revision and exam details tutorial

Part B **Manoeuvrability** **Monday 1400–1500** **OMB150**

All lectures in this part are given by Mr David Lyons.

Week	Topic
1	Introduction, ship controllability
2	Equations of motion
3	Linearisation of equations
4	Meaning of terms and non-dimensionalisation
5	Determination of coefficients and use of equations
6	Rudder terminology and selection criteria
7	Rudder size, number, forces and torques
8	Rudder stock and tiller size
9	Rudder action in turning
10	Acceleration of ships
11	Deceleration of ships and backing
12	Manoeuvrability standards and high-performance rudders
13	Revision and exam details tutorial

Part C Contracts and Equipment Thursday 1000–1200 E12-232

All lectures in this part are given by Dr Mac Chowdhury.

Week	Topic
1	Design documentation
2	Tendering procedures and contract administration
3	USL Code steel structure
4	Classification society rules for steel structure
5	USL Code/SA design loads and aluminium structure
6	USL Code/SA design loads and FRP structure
7	NSCV steering gear and shafting
8	Materials of construction (1)
9	Materials of construction (2)
10	Trials
11	Engine-room arrangement
12	Ship piping systems
13	Revision and exam details tutorial

Part D Powering Thursday 0900–1000 E12-232

All lectures in this part are given by Mr David Lyons.

Week	Topic
1	Components of resistance and methods of calculation
2	USNA patrol vessel series and Radojcic et al. methods
3	Mercier and Savitsky, and Lahtiharju et al. methods
4	Van Oortmerssen's and Holtrop's methods
5	Robinson's and Ridgeley-Nevitt's methods
6	Using commercial resistance-prediction software packages
7	Air and wind resistance
8	Appendage resistance
9	Resistance in shallow water
10	Ship squat
11	Yacht resistance prediction: the Delft Systematic Yacht Hull Series
12	Catamaran resistance prediction: Zips, Muller-Graf, Scott, Wong, and slender-body methods
13	Revision and exam details tutorial

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.

The various parts of the course contribute towards the overall grade as follows:

	Part A Machinery	**Part B Manoeuvrability**	**Part C Contracts&Equip't**	**Part D Powering**
	R.M. Sproge	D. Lyons	M. Chowdhury	D. Lyons
h/w	2	1	2	1
Assignments	40%	40%	40%	40%
Examination	60%	60%	60%	60%
Total	100%	100%	100%	100%
Scaled	33.3%	16.7%	33.3%	16.7%
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 either be handed out in hard copy in class, or available on Moodle.

Presentation

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

All submissions are expected 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:

$P_E = R_T v$ (Equation in symbols)
$= 203.7 \times 20.58$ (Numbers substituted)
$= 4192$ kW (Answer with units)

Submission

Assignments are due on the scheduled day of the class in the week nominated on the following page, by 5pm. Those assignments for Mr Lyons *are to be submitted via Moodle*, while the remainder are to be submitted in hard copy to Mr Sproge or Dr Chowdhury.

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 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.

Part A Machinery

No.	Assignment	Due	Mark	Learning outcomes assessed
1	Terminology	Mon 24th Aug	10	1
2	Gas turbine fuel and air	Mon 7th Sept	10	1
3	Main machinery recommendation	Mon 21st Sept	10	1
4	SOLAS requirements	Mon 12th Oct	10	1
	TOTAL		**40**	

Part B Maneuverability

No.	Assignment	Due	Mark	Learning outcomes assessed
1	The equations of motion	Thurs 3rd Sept	10	2
2	Rudder design	Thurs 17th Sept	10	2
3	Angle of heel in a turn	Thurs 8th Oct	10	2
4	Acceleration and deceleration	Thurs 22nd Oct	10	2
	TOTAL		**40**	

Part C Contracts and Equipment

No.	Assignment	Due	Mark	Learning outcomes assessed
1	Tendering and contract mgment	Thurs 20th Aug	10	3
2	Steel structure to rule reqmts	Thurs 3rd Sept	10	3
3	Shafting and rudder calculations	Thurs 8th Oct	12	3
4	Sea trials	Thurs 22nd Oct	8	3
	TOTAL		**40**	

Part D Powering

No.	Assignment	Due	Mark	Learning outcomes assessed
1	USNA and Lahtiharju resistance	Mon 24th Aug	10	4
2	Robinson's resistance prediction	Mon 7th Sept	10	4
3	Other components of resistance	Mon 21st Sept	10	4
4	Ship squat	Mon 12th Oct	10	4
	TOTAL		**40**	

Criteria

The following criteria will be used to grade assignments:

For report-style assignments 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.

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

- 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.
- Neatness.

Examinations

There will be two two-hour examinations at the end of the semester. Paper 1 will cover all material in both Parts A and B for the whole semester, and Paper 2 will cover all material in both Parts C and D for the whole semester.

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

Notes are posted on Moodle for Parts A, B, C and D.

Part C

In addition to the notes on Moodle, the contracts section of Part C requires the following:

AGPS, Uniform Shipping Laws Code, Subsection 5L Steel Structure (available in the UNSW Library or downloadable from the AMSA website www.amsa.gov.au)

Standards Australia, AS4132.1 Design Loads, AS 4132.2 Aluminium Structure, and AS4132.3 FRP Structure are available online via the UNSW Library website, http://info.library.unsw.edu.au/welcome.html, under Databases and SearchFirst, for which you will need to have your Unipass number.

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:

DNVGL	Rules for High Speed Light Craft
	Rules for Ships
Lloyd's Register	Rules for Special Service Craft
	Rules for Ships

American Bureau of Shipping rules and guides are available for download from www.eagle.org

Suggested additional readings

Part A

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.

Part B

Lewis, E.V. (Ed.) (1988), *Principles of Naval Architecture*, v.3, Motions in Waves and Controllability, Society of Naval Architects and Marine Engineers, Jersey City.

Taggart, R. (Ed.) (1980), *Ship Design and Construction*, Chapter XII, Society of Naval Architects and Marine Engineers, Jersey City.

These are both text books for other naval architecture courses at UNSW and are available in the UNSW Library. They are 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 C

Fisher, K.W. (2004) Shipbuilding Specifications: Best Practice Guidelines, *International Journal of Maritime Engineering*, Royal Institution of Naval Architects, London, March

Lamb, T. (Ed.) (2003), *Ship Design and Construction*, Vol. 1, Chapter 4, Society of Naval Architects and Marine Engineers, Jersey City.

Part D

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.

These are all available in the UNSW Library and are useful as additional reading material. The descriptions in Robb are particularly insightful and helpful, although the numbers and the unit system have changed.

The first and last are also available for purchase from the Society of Naval Architects and Marine Engineers, Jersey City, USA.

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 in Parts B, C and D; and
- a discussion forum.

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

Recommended internet sites

Part A

There are many websites giving lectures, papers and data on engines and marine engineering. Try searching for “marine engines” or “marine engineering”.

Part B

There are also many websites giving lectures, papers and data on manoeuvring and control. Try searching for “manoeuvring”.

For high-performance rudders etc: http://voith.com/en/products-services/marine-technology-374.html

Part C

All classification societies maintain websites with varying levels of information available. Some, e.g. American Bureau of Shipping and DNVGL, offer their complete rules and regulations online.

The National Marine Safety Committee website also offers the USL Code and the NSCV. Try the following:

ABS	www.eagle.org
DNV GL	www.dnvgl.com
LR	www.lr.org
NMSC	www.amsa.gov.au

The NSW Maritime Authority’s website www.maritime.nsw.gov.au/cv/vessel_compliance.html has a number of spreadsheet applications which are useful for calculating the requirements for

- shafting diameters
- shafting systems (bearing spacing, couplings, etc.)
- rudder and steering gear
- bilge systems
- fuel tanks.

Part D

There are also many websites giving lectures, papers and data on resistance prediction, some including software for use online or for download. Try searching for “resistance prediction” or “catamaran resistance prediction” (including the quote marks), for example, with your favourite search engine (or, better, a meta-search engine such as Dogpile at www.dogpile.com).

Other useful websites (for all parts) will be advised in class

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 periodically using various means, including the Course and Teaching Evaluation and Improvement (CATEI) process, informal discussion in the final tutorial 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 assignments and the introduction of material on the influence of shallow water and squat on ship performance in lieu of further prediction methods. Other recent improvements include a re-arrangement of lecture material on gas turbines, and a re-wording of the assignment on gas turbines.

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