UNSW AUSTRALIA

Course Outline

Semester 1 2016

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

NAVL4140

Design of Yachts and High Speed Craft

Contents

Course Outline

NAVL4140 Design of Yachts and High Speed Craft

1. Staff Contact Details

Contact details and consultation times for Course Convener

Mr David Lyons FRINA
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.

Contact details and consultation times for additional lecturers

Mr Craig Boulton
Tel (02) 9882 3844 or 0416 075439
Email craig.boulton@asomarine.com.au or craig@boulton.com.au

Dr Rozetta Payne
Tel 0438 602459
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2. Course details

Credit Points:

This is a 6 unit-of-credit (UoC) course, and involves up to 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

	Day	Time	Location
Lectures	Tuesday (even & odd weeks)	9am – 12noon	UNSW Business School (E12) 105
	Day TBA (even weeks)	9am-12noon	TBA
	Tuesday (odd weeks)	1pm-4pm	UNSW Business School (E12) 205

Summary of the course

Australia achieves very highly in sailing yacht and high-speed craft design and construction. This Course focuses on how these vessels are designed, the materials used, the analyses which are required, specifically the hydrodynamics and the rules and regulations which are applicable.

Aims of the course

This Course enables you:

- To explore the design of high-speed craft from the viewpoint of the practising consultant looking at the rules embodied in the High Speed Craft Code 2000 and how they apply in practice. You are given practical insight into the analysis of the structure, and to the application of hydrodynamic principles to the prediction of resistance and performance.

- The Course also provides you with the terminology and tools unique to the design of monohull ballasted sailing yachts, the majority of which is now constructed in composites. You are also given the tools to analyse the sail and rig of the yacht, the fin and ballast requirements, the resistance and, hence, the performance of the yacht using a velocity-prediction program.

This Course uses the ship terminology which you learned in NAVL3610, and builds on the hydrodynamic principles which you learned in NAVL3620. For those choosing a yacht or high-speed ferry for their design project in NAVL4120 and NAVL4130, this provides a good stepping stone for the final design iteration. The assignments also build on the report-writing skills which you commenced in ENGG1000.

Student learning outcomes

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

- Apply the HSC Code 2000 to the design of high-speed vessels and, in particular, the sections on buoyancy, stability and subdivision, operating compartment layout, and accommodation and escape measures, and analyse the vessel's structure in accordance with the rules of a classification society.

- Calculate the resistance and powering requirements of a range of high-speed vessels (including monohulls, catamarans and hydrofoils), and judge whether the craft is performing efficiently in relation to others.
- Decide the principal dimensions for the design of a new monohull sailing yacht to suit an owner's requirements, and be able to advise on the appropriate selection of materials for construction.
- Analyse the influence of sailing yacht rating rules and wind/sea conditions by way of a velocity-prediction program, and analyse the scantlings of the hull structure, the aerodynamics of the sails and rigging, and the hydrodynamics of the hull, keel and rudder.

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 (PE)**
1.	Apply the HSC Code 2000 and Classification Soc. rules	1.1, 1.5, 2.3, 3.4
2.	Calculate resistance and powering of HSC	1.3, 2.2, 3.4
3.	Derive initial design sizing for a monohull sailing yacht	1.1, 1.2, 1.3, 2.2, 3.4
4.	Understand sailing yacht VPPs and derive scantlings	1.1, 1.2, 2.1, 2.3, 3.4

3. Teaching strategies

This Course is included to give you the skills to generate designs of sailing yachts and high-speed craft which will fulfil the owner's requirements and those of the regulatory authorities, and to be able to analyse the principal factors which contribute.

The content reflects the experience of the lecturers in drawing offices, in shipyards, and at sea on various vessels, and practical examples drawn from that experience are used throughout the lectures and tutorials.

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 tutorials.

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 and assignments by way of examples drawn from industry.

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 marine 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 in the week following submission. You will have feedback and discussion while fresh in your mind to improve the learning experience.

Lectures in the Course are designed to cover the terminology and core concepts and theories in the design of yachts and high-speed craft. 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.

The work in the yacht design assignments involves both self-directed work, in being creative in the design of your component, and teamwork, in integrating your component into the overall design.

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

Tutorials in Part C are arranged on both a one-to-one basis with the lecturer, and group sessions with the lecturer, to assist in the analysis at each stage of the design process. Designs of components are discussed as they evolve, with a view to successful integration of the parts into the whole.

4. Course schedule

The lectures and tutorials in this Course are given as follows:

Part A HSC Design Tuesday 0900–1200 E12 105

All lectures in this part are given by Mr Craig Boulton in even weeks.

Week	Topic
2	Introduction, the HSC Code, g_{coll}, accommodation and escape measures, operating compartment layout
4	Accommodation design, intact and damaged stability, extent of damage, criteria
6	Stability, lifesaving, fire safety, structure and global loads
8	Structure, DNV HSLC rules, LR SSC rules, and NSCV Category F rules
10	Structural design of a web frame, seakeeping
12	Wake wash, propulsion

Part B HSC Hydrodynamics Day TBA 0900–1200 venue TBA

All lectures in this part are given by Dr Rozetta Payne in even weeks.

Week	Topic
2	Introduction and dimensional analysis
4	Transport efficiency and sustention
6	Planing vessel resistance prediction (1)
8	Planing vessel resistance prediction (2)
10	Analysis of hydrofoil lift, drag and cavitation
12	High-performance craft (hydrofoils, ACVs SES, etc.)

Part C Yachts Tuesday 0900-1200 E12 105 and 1300-1600 E12 205

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

Week	Topic
1	(a) Introduction, course outline, resistance (b) Yacht hydrodynamics (1): resistance upright and heeled, unappended and appended
3	(a) Yacht hydrodynamics (2): appendage design, seakeeping/added resistance, resistance "budget" (b) Yacht aerodynamics (1): sail plan design
5	(a) Yacht aerodynamics (2): rig design (b) Construction materials (1): composites
7	(a) Construction materials (2): timber, aluminium, steel (b) Construction materials (3): costs, gyradius, design of fittings
9	(a) Stability: intact static and dynamic (b) Rules and regulations (1): Structural rules — ABS Yacht Guide, ISO standards
11	(a) Rules and regulations (2): Rating and handicap rules — ORCi, IRC, Volvo ocean rule (b)Velocity prediction programs, tank testing, CFD codes
13	Revision and exam details tutorial for Parts A, B and C; submission of Part C design assignments

5. Assessment

Assessment overview

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

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

	Part A **HSC Design** C.J. Boulton	**Part B** **HSC Hydrodynamics** R.M. Payne	**Part C** **Yachts** D.Lyons
h/w	1.5	1.5	3
Assignments	40%	40%	50%
Examination	60%	60%	50%
Total	100%	100%	100%
Scaled	50%	50%	
Part	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 on the following page. Assignments will be provided in class (Parts A and B) or full briefs posted on the Course's Moodle site (Part C).

Part A **High Speed Craft Design**

No.	Assignment	Mark	Learning outcomes assessed (see p.4)	Due Tue
1	(a) Field-of-vision requirements	5	1-Use of HSC Code	Week 3
	(b) General arrangement layout	10	1-Use of HSC Code	Week 5
	(c) Stability of multihull craft	10	1-Use of HSC Code	Week 5
2	Frame structure of a catamaran	50	1-Use of classification society rules	Week 12
	Total	75		

Part B **High Speed Craft Hydrodynamics**

No.	Assignment	Mark	Learning outcomes assessed (see p.4)	Due Tue
1	Dimensional analysis	10	2-Resistance, powering and efficiency	Week 4
2	Transport efficiency	10	2-Resistance, powering and efficiency	Week 6
3	Resistance of planing craft	10	2-Resistance, powering and efficiency	Week 9
4	Hydrofoil lift, drag and cavitation	10	2-Resistance, powering and efficiency	Week 11
	Total	40		

Part C **Yachts**

No.	Assignment (choose one*)	Mark	Learning outcomes assessed (see p.4)	Due Tue
1	Design of rudder and stock	50	3&4-Analyze hydrodynamics	Week 13
2	Design of ballast lead and fin keel	50	3&4-Analyze hydrodynamics	Week 13
3	Lines plan of canoe body	50	3-Decide principal dimensions	Week 13
4	Drawing of deck arrangement	50	3-Decide principal dimensions	Week 13
5	Design of keel floors	50	4-Analyze structure	Week 13
6	Design of rudder bearings (&1)	50	4-Analyze structure	Week 13
7	Design of hull shell laminate (&3)	50	4-Analyze structure	Week 13
8	Design of deck laminate (&4)	50	4-Analyze structure	Week 13
9	Design of mast section	50	4-Analyze mast and rigging	Week 13
10	Drawing of interior arrang't (&3, 4)	50	3-Decide principal dimensions	Week 13
11	Drawing of sail plan and rig	50	3-Decide principal dimensions	Week 13
12	Marketing brochure for the design	50	3-Analyze results	Week 13

(& = Liaise with Assignment No.)

* each student must choose a different assignment topic; 'first-in, best-dressed' by advising Course Convenor.

Part C

Assignments in Part C are each a part of a typical team project to design a 20 m yacht. You will be expected to undertake one part of the project (i.e. one assignment). You should coordinate your work in this assignment with your yacht in NAVL4120 if you have chosen the yacht in that Course.

It is expected that each assignment will take at least 16 h to complete, including background reading, calculations, drawing (sketch or CAD), and a written overview of about 200 words. These assignments give a practical application of the design methodology, and further practice in written communication skills.

Presentation

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

All submissions are expected to be neatly typed 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.

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

$A_{bow} = 0.0035AmfV$	(Equation in symbols)
$= 0.0035 \times 480 \times 0.95 \times 1.0 \times 18.00$	(Numbers substituted)
$= 28.7\ m^2$	(Answer with units)

Submission

Assignments in Parts A and B are due on the scheduled day of the class in the week nominated above. Assignments should be submitted direct to the lecturer in class.

Assignments in Part C are due for submission to the lecturer at the start of the class in Week 13.

Late submissions will be penalised 5% 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.

Criteria

The following criteria will be used to grade assignments:

For reports:

- 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.

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.
- Neatness.

Return of marks

a. Generally, assessments will be marked and returned within 2 weeks of the due date except those worth less than 5% of the final grade, which will be marked and returned within 1 week of the due date.
b. The larger, more complicated assessments in Part C may take up to but no more than 3 weeks to mark.

Examinations

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.

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 Part C for the whole semester.

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 the Exams section on the intranet.

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

Textbooks

Part A

International Maritime Organisation (2001), International Code of Safety for High-speed Craft 2000, IMO, London.

This is available in the UNSW Library, and for download from the Moodle website.

Part B

Doctors, L.J. (1985), Hydrodynamics of High-speed Small Craft, University of Michigan, Department of Naval Architecture and Marine Engineering, Report 292, Ann Arbor.

The above is available in the UNSW Library, and for download from the Moodle website.

Doctors, L.J. (2015), Hydrodynamics of High-Performance Marine Vessels, Vols. 1 and 2, Amazon Books http://www.amazon.com/Hydrodynamics-High-Performance-Marine-Vessels-Volume/dp/1512244716

Part C

Larsson, L. and Eliasson, R.E. (2007), *Principles of Yacht Design*, 5th Ed., Adlard Coles Nautical, London is highly recommended.

The 3rd Edition is available in the UNSW Library.

Suggested additional readings

Parts A and B

Journal *Fast Ferry International*.

Papers from Fast Sea Transportation (FAST) conferences.

Papers from Fast Ferry International (FFI) conferences.

These are available in the UNSW Library. All are useful as additional reading material.

Part C

Claughton, R.E., Wellicome, J.F. and Shenoi, A. (Eds), *Sailing Yacht Design: Theory* (v.1) *and Practice* (v.2), Longman, London.

Marchaj, C.A. (1985), *Sailing Theory and Practic*e, Dodd Mead and Co., New York.

Marchaj, C.A. (1988), *Aero-hydrodynamics of Sailing*, Adlard Coles, London.

Skene, N.L. and Kinney, F.S. (1981), *Skene's Elements of Yacht Design*, 8th Ed, Dodd Mead & Co., New York.

All of these are available in the UNSW Library and are useful as additional reading material.

Papers from SNAME's annual Chesapeake Sailing Yacht Symposia (not available in the UNSW Library) are also useful reading material:
http://www.sname.org/chesapeakesailingyachtsymposiumcsys/home .

Additional materials provided in Moodle

This Course has a website on Moodle which may include:
- copies of assignments (as they are issued);
- previous examination papers in this Course from 2011 onwards;
- answers to the numerical questions in examination papers from 2010 onwards; and
- a discussion forum.

The discussion forum is intended for you to use with other students enrolled in this Course. The Course Convenor may occasionally look at the forum and take note of any frequently-asked questions and may respond to questions on the forum. If you want help from the Course Convenor then direct contact is suggested.

Recommended Internet sites

Parts A and B

Principal particulars and design details of many different types of vessels are available on the internet. You might like to try the following:

Austal Ships	www.austal.com
Incat Crowther Design	www.incatcrowther.com
One2three Naval Architects	www.one2three.com.au

or a general site (containing links to many other sites) such as

AIMEX	www.aimex.asn.au

Part C

There are many websites giving lectures, papers and data on yachts and yacht design.

You might like to try the following:
http://www.sailyachtresearch.org/tech-resources/library-syrf
http://www.orc.org/index.asp?id=8
http://www.sailing.org/documents/index.php

Beneteau	www.beneteau.com
McConaghy	www.mcconaghyboats.com
Gurit Composites	www.gurit.com
Reichel-Pugh Yacht Design	www.reichel-pugh.com
Farr Yacht Design	www.farrdesign.com

or, for news of what's happening in the yacht-racing world:

Sail World	http://www.news.sail-world.com/

Other useful websites (for all parts) may 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.

One starting point for assistance is:
http://info.library.unsw.edu.au/web/services/services.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 further documentation of the assignments and provision of PowerPoint notes for Part A, the addition of more assignments to suit the increasing number of students in Part C, and the provision of notes and assignments on Moodle.

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

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

D. Lyons *FRINA*
Naval Architecture Stream Coordinator
17 February 2016

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