Programme Specification

Department of Naval Architecture
Faculty of Marine Technology
Institut Teknologi Sepuluh Nopember
Surabaya

2014 - 2018

Programme Specification

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided.

Programme Title	Undergraduate Programme of Naval Architecture (Program Sarjana Teknik Perkapalan)
Degree awarded	Bachelor of Engineering (B.Eng.) / *Sarjana Teknik* (S.T.)
Admission Criteria	Graduates from either high school majoring in natural science or vocational school with shipbuilding majors
Length of Study	4 (four) years / 8 (eight) semesters
Minimum credits	144 credits
Core competency	Naval Architecture
Specific competencies	Design, Construction and Maintenance of Ships
Course Language	Indonesian, English
Name of Department	Department of Naval Architecture
Name of Faculty	Faculty of Marine Technology
Name of University	Institut Teknologi Sepuluh Nopember
Address	Jl. Arief Rahman Hakim, Campus ITS Sukolilo Surabaya, East Java, Indonesia, Post Code: 60111
Contact	Phone/Fax.: +6231-5947254 E-mail: kapal@its.ac.id Website: www.its.ac.id www.na.its.ac.id
Year of establishment	1960
Accreditation	"A" grade by National Accreditation Board of Higher Education (BAN-PT), valid until 2018 No. 030/SK/BAN-PT/Ak-XV/S/I/2013

Programme Overview

Brief outline of the programme

The Department of Naval Architecture (DoNA), which was established in 1960 as one of the founding department in Sepuluh Nopember Institute of Technology (ITS), has long contributed to Indonesian maritime industries through development of professional naval architects and research in naval architecture field. DoNA provides a comprehensive higher education in naval architecture based on a solid working knowledge of all the basic engineering skills. The department is one of the oldest naval architecture departments in the ASEAN region and has obtained a "A" grade from the National Accreditation Board of Higher Education (BAN PT).

The field of Naval Architecture is directed towards the design, production, and maintenance of all types of ships including tankers, bulk carriers, cruisers, FPSO, ferries, Liquefied Natural Gas (LNG) Carriers, fishing vessels, traditional boats, etc.

DoNA offers a 4-year Undergraduate and Postgraduate Programmes from which the graduates are expected to be able to design and build as well as maintain the most reliable and cost-effective transport system which can carry out missions successfully in harsh environments.

The curriculum of our department is intended to provide students with a broad knowledge of ship science and technology as well as to develop creativity and analytical skills through study of subjects in the areas of mathematics, fluid and solid mechanics, design theory, and interdisciplinary theories within engineering field. The curriculum is not only includes major engineering disciplines such as fluid mechanics, structural mechanics, design, and information technologies, but also management and production systems as well as regulatory frame work in marine industries.

Educational philosophy

“DoNA strives to help students develop knowledge, appreciation, understanding, ability, and skills which will prepare them for responsible living in a complex world.”

Vision

Becoming a reference institution of higher education in ASEAN in naval architecture and shipbuilding engineering.

Missions

- Conducting quality higher education of naval architecture and shipbuilding engineering in ASEAN;
- Conducting relevant naval architecture and shipbuilding researches in ASEAN level;
- Developing information system and advanced naval architecture and shipbuilding services for society, business and industry;
- Developing the use of naval architecture and shipbuilding engineering in solving problems for society, business and industry;
- Developing quality-oriented and customer-conscious institution management;
- Developing and maintaining values, ethics and morals in all aspects of education in order to grow and develop the civilization, culture and a strong maritime tradition.

Aims

The programme aims to:

- Improve the quality, relevance, academic atmosphere and productivity of graduates in the field of Naval Architecture;
- Improve the quality, quantity and relevance of research activities as well as innovative and creative products and improve scientific publications especially in order to support the vision of ITS to be a world class university;
- Improve the quantity and quality of community service concerning science and engineering in the field of Naval Architecture for national development and economic growth of the Asia Pacific region;
- Enhance the role of the Department of Naval Architecture in maintaining and developing academic, ethical and moral values and character education.

Career Opportunities

Graduates of the department acquire the scientific and technological knowledge and skills in Naval Architecture field during their studies, that enables them to successfully offer their services in the Shipbuilding and Shipping Industries, Oil and Gas Industries, Classification Societies, and at key positions in Government Authorities, Regulatory Bodies, Financial Institution and Banks, Insurance.

Expected Learning Outcomes

Attitude (ELO-1)

1. Devote to God Almighty and able to show religious attitude;
2. Honour the value of humanity in carrying out duties based on religion, morals and ethics;
3. Contribute to the improvement of the quality of life in society, nation, country, and civilization based on Pancasila;
4. Serve as a proud citizen and love of the homeland, have nationalism and a sense of responsibility to the country and nation;
5. Respect the diversity of cultures, views, religions, and beliefs, as well as the original opinions or invention of others;
6. Work together and have social sensitivity and concern for the community and the environment;
7. Obey the law and discipline in the life of society and country;
8. Internalize values, norms, and academic ethics;
9. Demonstrate a responsible attitude towards the work in his own field of expertise independently;
10. Internalize the spirit of independence, struggle, and entrepreneurship;
11. Able to develop and adapt to working conditions individually and in teams;
12. Able to learn the principles of decision making, conduct and organize resources to achieve goals by using the latest information technology and available technology tools;
13. With sufficient experience will be able to provide alternative solutions armed with leadership attitudes, creativity and communication skills to expand the national and international networks and are responsible for the their work and can be given responsibility for the achievement of the work of the organization.

Teaching and Learning Methods

Acquisition of ELO-1.1 – ELO-1.8 are built into all the modules and where appropriate will be discussed in lectures and included in coursework and examinations.

Acquisition of ELO-1.9 – ELO-1.13 are through formal and special lectures, coursework, and projects throughout the programme.

Assessment Methods

ELO-1.1 – ELO-1.13 are assessed through testing of the knowledge base and understanding

is through a combination of written examinations, design exercises, essays, and individual and group projects.

Generic Skills (ELO-2)

1. Able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanity in accordance with the field of Naval Achitecture;
2. Able to demonstrate independent, quality, and measurable performance;
3. Able to examine the implications of the development or implementation of the science technology that concerns and implements the value of humanity in accordance with their expertise based on rules, procedures and scientific ethics in order to generate solutions, ideas, designs or art criticism, compile scientific descriptions of the results of the study in the form of thesis or final project report , and upload them in the college webiste page;
4. Arrange the scientific description of the results of the above study in the form of a thesis or final project report, and upload it in the college website page;
5. Able to make decisions appropriately in the context of problem solving in the area of expertise, based on the results of information and data analysis;
6. Able to maintain and develop networks with counselors, colleagues, and peers both within and outside of their institutions;
7. Able to take responsibility for the achievement of group work and to supervise and evaluate the completion of work assigned to the worker under their responsibility;
8. Able to conduct a self-evaluation process towards working groups under their responsibility, and able to manage learning activity independently;
9. Able to document, store, secure, and rediscover data to ensure validity and prevent plagiarism.

Teaching and Learning Methods

ELO-2.1 – ELO-2.5 are acquired and developed throughout the programme with technical reports (e.g. assignments, laboratory and project reports) and presentations.

ELO-2.6 – ELO-2.8 are developed through coursework assignments, group laboratory experiments, and group project work.

ELO-2.9 is developed through computing modules, individual learning, final year projects, and publications.

Assessment Methods

ELO-2.1 – ELO-2.5 are assessed through coursework and laboratory technical reports and project presentations.

ELO-2.6 – ELO-2.8 are assessed in coursework, individual projects and group projects.

ELO-2.9 is assessed formally in relevant final-year examinations and further assessed throughout publications in partial fulfilment of the degree of Bachelor Engineering.

Specific Skills (ELO-3)

1. Able to apply math, science and principles of naval architecture and shipbuilding to solve complex engineering problems in the design and construction of ships or other floaters;
2. Able to find the source of complex engineering problems in the field of naval architecture or other floaters through the process of investigation, analysis, interpretation of data and information based on the basic principles of naval architecture;
3. Able to formulate alternative solutions for complex engineering problems in the design and construction of ships or other floating structures with regard to economic, health and safety factors of the public, cultural, social and marine environment consideration;
4. Able to design vessels or other floaters and design the development process with an analytical approach and taking into account technical standards, performance aspects, reliability, ease of application, sustainability, and attention to economic, public health and safety, cultural, social and marine environmental factors;
5. Able to select resources and utilize design tools and engineering analysis based on appropriate information and computation technology to carry out engineering activities in naval architecture field;
6. Able to conduct research that includes identification, formulation and analysis of complex engineering problems in the field of design and construction of ships or other floaters.

Teaching and Learning Methods

Throughout the student is encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden their individual knowledge and understanding of the subject.

Where appropriate, ELO-3.1 is reinforced in lectures, but learning is principally in tutorials and assignments.

The abilities characterised by ELO-3.2 – ELO-3.4 are initially encountered in lectures, practical classes and case studies, but are developed principally during the research project.

Acquisition of ELO-3.5 occurs through lectures and case studies and may form a major part of the project. Experimental, research and design skills are further developed through coursework activities, laboratory experiments, and research and design projects. Individual feedback is given to students on all work produced. Creative and design skills are developed through design and project work. These activities develop the abilities listed in ELO-3.6.

Assessment Methods

Analysis and problem solving skills are assessed through unseen written examinations and problem based exercises.

Experimental, research and design skills are assessed through laboratory reports, coursework exercises, project reports and oral presentations.

Knowledge (ELO-4)

1. Master the theoretical concepts of engineering sciences, engineering principles, and engineering design required for the analysis, design, and manufacture of vessels and other floaters;
2. Master the concept of natural science and principles in applying engineering mathematics;
3. Master the principles and techniques in ship design, production, and construction;
4. Master the basic principles of floaters (such as mechanics, hydromechanics);
5. Master the latest principles and issues in economics, social, and ecology in general;
6. Master the knowledge of communication techniques and latest and latest technological developments;
7. Able to formulate problems in naval architecture field to solve practical problems according to the procedure.

Teaching and Learning Methods

Acquisition of ELO-4.1 and ELO-4.2 is through a combination of lectures, tutorials (small group teaching), example classes, laboratory experiments, coursework and project work. Acquisition of ELO-4.3 – ELO-4.5 is through a combination of lectures, tutorials, laboratory experiments, coursework and individual and group projects. Outcome ELO-4.6 is achieved by lectures, tutorials and, where appropriate, hands-on computer exercises. The broader professional outcomes, ELO-4.7 is formally taught in lectures and coursework studies, but is also central to experimental project investigations.

Assessment Methods

Testing of the knowledge base and understanding is through a combination of unseen written examinations and assessed coursework in the form of problem solving exercises, laboratory reports, design exercises, essays and individual and group projects.

Criteria for admission to the programme

Applicants must be graduates from either high school majoring in natural science or vocational school with shipbuilding majors.

Required number of credits

In order to pass the Programme, students should complete successfully relevant courses and will therefore acquire the required number of credits. The undergraduate programme has a study load of 144 credits scheduled in eight semesters, and is divided into preparation phase with study load of 36 credits scheduled in two semesters, and undergraduate phase with a study load of 108 credits scheduled in six semesters. At the preparation phase, students are provided with basic general courses, basic science courses, and basic naval architecture. At the undergraduate phase, students are equipped with basic engineering knowledge, special foundation as well as expertise which become the main character of naval architecture profession, laboratory assignments and ship design projects. Final Year Project is the culmination of an educational program that can be either a design, research, or a theoretical assessment of a problem.

Assessment Regulations

Pass mark

The pass mark is C

Common Marking Scheme

The University employs a common marking scheme, which is specified in the Peraturan Akademik (Academic Regulation), namely

Grade Points	Letter Grade	GPA	Description
81 – 100	A	4	Excellent
71 – 80	AB	3,5	Very good
66 – 70	B	3	Good
61 – 65	BC	2,5	Average
51 – 60	C	2	Satisfactory
41 – 50	D	1	Unsatisfactory
0 – 40	E	0	Fail

Study Load Regulations

New students are required to take the entire study load in the first semester and at least the entire study load in the second semester. In the second and the subsequent semesters, the student's study load is determined by the GPA achieved in the previous semester, with the following scheme:

No.	GPA	Maximum Study Load
1	GPA < 2,0	16
2	2,00 ≤ GPA < 2,5	18
3	2,5 ≤ GPA < 3,0	20
4	3,0 ≤ GPA < 3,5	21
5	GPA ≥ 3,5	24

Course Specification

No	Code	Course Title	Credits
Semester I			
1	IG 14110z	Religion	2
2	SF 141201	Physics I	4
3	SM 141203	Calculus I	3
4	MN 141211	Engineering Drawing & Introduction to CAD	3
5	MN 141212	Mechanics and Material Technology	3
6	MT 141201	Introduction to Marine Technology	2
Total Credits			**17**

Semester II			
1	IG 141108	English	3
2	SF 141204	Physics II	3
3	SM 141202	Calculus II	3
4	IG 141106	Nation Knowledge	3
5	MN 141221	Engineering Mechanics I	4
6	MN 141321	Basic Ship Theory I	3
Total Credits			**19**

Semester III			
1	MN 141231	Engineering Mathematics	3
2	MN 141232	Fluid Mechanics	3
3	MN 141233	Engineering Mechanics II	2
4	MN 141234	Introduction to Computer & Programming	3
5	MN 141331	Ship Structure I	3
6	MN 141332	Ship Outfitting	2
7	MN 141333	Basic Ship Theory II	3
Total Credits			**19**

Semester IV			
1	MN 141241	Statistics and Probability	2
2	MN 141341	Ship Design I	3
3	MN 141342	Ship Resistance and Propulsion	4
4	MN 141343	Ship Strength	3
5	MN 141344	Ship Structure II	3
6	MN 141345	Marine System	2
7	MN 141346	Lines Plan	2
Total Credits			**19**

Semester V			
1	MN 141251	Statutory Regulation	2
2	MN 141351	Ship Dynamics	4
3	MN 141352	Ship Design II	3
4	MN 141353	Introduction to Marine Engineering	3
5	MN 141354	Theory and Application of Finite Element	3
6	MN 141355	Ship Design Project I	4
Total Credits			**19**

Semester VI			
1	IG 141107	Scientific Communication and Engineering Knowledge	3
2	MN 141261	Ship Production Technology	3
3	MN 141361	Ship Vibration	3
4	MN 141362	Ship Hydrodynamics	3
5	MN 141363	Welding Technology	3
6	MN 141364	Ship Design Project II	4
Total Credits			**19**

Semester VII			
1	IG 141109	Introduction to Technopreneurship	3
2	MN 141271	Research Methodology	2
3	MN 141272	Optimization Theory and Application	3
4	MN 141371	Computer Aided Ship Design	3
5	MN 141372	Ship Design Project III	4
6	MN 1414xy	Elective I	3
Total Credits			**18**

Semester VIII			
1	MN 141381	Field Work	2
2	MN 141581	Final Project / Thesis	6
3	MN 1414xy	Elective II	3
4	MN 1414xy	Elective III	3
Total Credits			**14**
TOTAL CREDITS			**144**

Elective Course

No	Code	Course Title	Credits
1	MN 141491	Structural Reliability	3
2	MN 141456	Corrosion	3
3	MN 141492	Risk Management	3
4	MN 141493	Strategic Management	3
5	MN 141458	Marine Survey and Inspection	3
6	MN 141494	Small Craft Design (L<30M)	3
7	MN 141495	Introduction to Offshore Engineering	3
8	MN 141496	Fracture Mechanics and Fatique	3
9	MN 141497	Theory of Plates	3
10	MN 141373	Welding Inspection	3
11	MN 141374	Advanced Ship Production Technology	3
12	MN 141365	Advanced Ship Production Management	3
13	MN 141366	Shipping Business	3

Modules

Engineering Drawing & Introduction to CAD
Semester I
Credit: 3 SKS

Aims:
Students are able, conveying their ideas / designs to others in the form of true engineering drawings and able to draw 2 Dimensions as well as 2 Dimensions using computer softwares.

Subject:
Functions and properties drawings as technical language; drawing tools and their use; Lines and letters in the drawing; Column name and section list; Drawing instructions; Projection of three-dimensional objects; American and European Projection; Screw / bolt thread; layer (slices); How to size; Symbol Signs of workmanship; Tolerance ; Reading drawings; Computerized drawing recognition using the Autocad app package.

References:
- College Handout
- G. Takeshi Sato, Menggambar Mesin Menurut Standar ISO
- J.La Hey & L.A de Bruin., Menggambar Bangunan Mesin

Mechanics and Material Technology
Semester I
Credit: 3 SKS

Aims:

- Students are able to know the types and properties of materials in general and specifically used as raw materials for shipbuilding and other floating buildings;
- Students are able to explain the material properties related to the shipbuilding process, the ways of craftsmanship and consider the advantages and disadvantages of its application.

Subject:

Structure of engineering materials; Mechanical properties of materials; Steelmaking process; The iron-carbon balance diagram (Fe-C Diagram); Heat treatment of steel; Steel classification and specifications; Stainless Steel (Stainless Steel); Cast iron; Aluminum and alloy; Hot working; cold working; Fundamentals of tooling machineries; Material selection process.

References:

- Amstead, B.H., Phillip F. Ostwald, Myron L Begeman, dan Sriati Djaprie, "Teknologi Mekanik", Penerbit Erlangga, Jakarta, Edisi Ketujuh, 1992.
- Davies, D.J., dan L. A. Oelmann, "The Structure, Properties, and Heat Treatment of Metals", Pitman Books Limited, London, 1983.
- Flinn, Richard A;, dan Paul K. Trojan, "Engineering Materials and Their Applications", Houghton Mifflin, Boston, 1990.
- Ray, Martyn S., "Elements of Engineering Design", Prentice-Hall, UK, 1985.
- Van Vlack, Lawrence H., dan Sriati Djaprie, "Ilmu dan Teknologi Bahan", Penerbit Erlangga, Jakarta, Edisi Kelima, 1994.

Introduction to Marine Technology
Semester I
Credit: 2 SKS

Aims:

- Students understand the differences of science and technology, engineering ethics, professional responsibilities, maritime technology differences and marine science, and maritime history of Indonesia.

- Students recognize introductory naval architecture, sea transportation, marine engineering and offshore engineering covering the development of Science and Technology in the field of marine such as: characteristics, potential functions and role of sea, type of port, ship and its equipment, motor and equipment and types offshore building.
- Students have the ability to communicate both orally and in writing as well as learning habits

Subject:

General: Science and Technology in Perspective, Ethics Engineering, Engineer as creative person, Technology and Marine Science; Shipping Techniques: Introduction, General Arrangements, Design Procedures, Hull Forms; Forces, Propulsion Devices, Rudder, Materials of Construction, Classification Societies, Shipyards; Water transportation; Marine Engineering; Shipping System Engineering.

References:

- Randall, Robert E. , Element of Ocean Engineering , Society of Naval Architects and Marine Engineers (SNAME), 2010.
- D. A. Taylor (Auth.), Introduction to Marine Engineering 2nd edition, Butterworth-Heinemann, 1996
- E. C. Tupper, Introduction to Naval Architecture, Elsevier, Butterworth Heinemann, 2004

Engineering Mechanics I
Semester 2
Credit: 4 SKS

Aims:

Students are able to determine the reaction forces and moments (magnitude and direction) of statically determined structures, calculate the stress, strain and elongation of axially-loaded structural elements, calculate the shear stress and shear strain due to torsional loading, create and read shear force, normal force and bending moment diagrams, calculate the normal stress due to bending moment and shear stress due to shear force, including shear center.

Subject:

• Basic principles of Statics (static equilibrium); The sum of the forces, the decomposition of forces, the sense of the moment, the sum of moments, the equilibrium; • Support types and reactions; Rolls, joints, tongs, pended rods, reacting reactions of force and moment; • Stress

and strain on axially loaded rods; Tensile and compressive rods, normal stresses, normal strain, stress-strain curves, elasticity, Hooke law, changes in the length of structural elements that are axially loaded; • Voltage and strain on torque-loaded rods; Torsional deformation of circle rod, twist angle, shear strain, linear elastic circular rod, circular tube, torsion formula, uniform torque, power distribution by circular rods; • Internal forces and moments acting on the cross section of the beam; Normal forces, shear forces, bending moments, shear force diagrams, bending moment diagrams, differential equations that connect loads, shear forces and bending moments; • Stress and strain on the cross section of the beam; Pure bending, non-uniform flexural, beam curvature, normal strain, normal stress, shear stress.

References:

- Gere, J.M. and Timoshenko, S.P. "Mekanika Bahan, terjemahan dari Mechanics of Material", Jilid 1, Edisi 4, Erlangga, 2000;
- Hibbeler, RC, "Mechanics of Material", 2000;
- Craig Jr, Roy R, "Mechanics of Material", John Willey, 1996;
- Riley, Sturges and Morris, Popov, "Statics and Mechanics of Material", 1995.

Basic Ship Theory I
Semester 2
Credit: 3 SKS

Aims:

Students are able to:

- Explain the terms of the main sizes, shapes and coefficients of the ship's body shape and parts of ships.
- Describe the lines plan and the relationship of its parts (body plan, water lines, buttock lines).
- Make hydrostatic calculations and Bonjean curves.
- Calculate the floodable length for passenger ships based on SOLAS 1974.
- Calculate ship stability.

Subject:

The main size of the ship, the shape and coefficient of the ship's body shape as well as its parts, the basic principles of lines plan, hydrostatic, Bonjean curves, floodable length, and ship's stability.

References:

- Panunggal, P. E., Manfaat, D., Nasirudin, A., Hasanudin dan Zubaydi, A. (2006). "Teori

Bangunan Kapal I", Handout Kuliah, Jurusan Teknik Perkapalan, Fakultas Teknologi Kelautan, ITS.
- Semyonov-Tyan-Shansky, V. (2004). "Statics and Dynamics of the Ship: Theory of Buoyancy, Stability and Launching", International Law Taxation, United States.
- Scheltema de Heere, R. F. and Bakker, A. R. (1970). "Bouyancy and Stability of Ships", George G. Harrap & Co. Ltd., London.
- Lewis, E.V. (1988). "Principles of Naval Architecture", Volume I: Stability and Strength, The Society of Naval Architects and Marine Engineers, New Jersey, USA.
- Rawson, K.J. and Tupper, E.C. (1976). "Basic Ship Theory", Longman, London.
- International Maritime Organization (IMO) (2008). "Code on Intact Stability 2008", 2008 edition, IMO, London.
- International Maritime Organization (IMO) (1997). "SOLAS", Consolidated Edition, IMO, London.
- International Maritime Organization (IMO) (2008). "International Convention for the Safety of Life at Sea, 1974, and 1988 Protocol relating there to", Consolidated Edition, IMO, London.

Engineering Mathematics
Semester 3
Credit: 3 SKS

Aims:
Students are able to understand the basic mathematical analysis used to solve engineering problems with multiple application instances. With a solid background above the basic calculus, students are able to use it for solutions in the field of shipbuilding techniques such as strength, vibration, dynamics, hydrodynamics, etc.

Subject:
Review the usual differential equations, the first order, second order, the Laplace transform. Linear algebra and vector calculus, vector-determinant, eigen-value problem and its application. Fourier series, Fourier integral, and FFT. The classical partial differential equation uses the separation of variables. Introduction to complex numbers, integral complex and conformal mapping.

References:
- Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, John Wiley & Sons, 2011
- Michael D. Greenberg, Advanced Engineering Mathematics, Second Edition, Prentice-Hall International, 1998.

Fluid Mechanics
Semester 3
Credit: 3 SKS

Aims:

- Students understand the properties of the fluid, the difference between fluid with a solid, a sense of viscosity, a fluid flow classification;
- Students understand the concept of hydrostatics and are able to apply to compute the variations of pressure and forces acting on the inclined field;
- Students understand the basic equations of fluid dynamics in both integral and differential form and are able to apply to solve practical problems;
- Students understand and are able to perform calculations related to flow in pipes and ducts and external flow;
- Students are able to perform dimensional and similitude analysis.

Subject:

• Preliminary; fluids vs. solids, pressure, viscosity, surface tension, frictional flow and ideal flow, laminar and turbulent flow, compressible and incompressible flow; dimensions and units; • Fluid Statics; the basic equations of fluid statics, absolute pressure and 'gauge' pressure, manometer, hydrostatic force on the immersed material; • Basic equations of fluid flow; integral equations: conservation of mass, impulse conservation (Newton II law), conservation of energy, Law II Thermodynamics; application; Differential equations: continuity equations, momentum equations; • Incompressible potential flow; Bernoulli theorem, Kelvin vortex theorem, velocity potential, stream function, uniform flow, sources and sinks, superposition; • Internal viscous flow (flow in pipes and ducts); entrance flows, fully developed flows, turbulent flow velocity profile, coefficient of friction and head loss; • External viscous flow; flow in flat plate surface, boundary layer, drag, elevator; • Dimensional and similitude analysis; dimensions and units, dimensional homogeneity, Buckingham's pi theorem, similarity, models.

References:

- Introduction to fluid mechanics, Fox, R.W. and McDonald, A.T., Wiley, 1985. (FD85)
- Fluid Mechanics, Douglas, J.F., Gasiorek, J.M. and Swaffield, J.A., Longman.
- Fluid Dynamics, Hughes, W.F. and Brighton, J.A., Schaum's Outline Series, McGraw Hill, 1967. (HB67)
- Incompressible flow, Panton, R.L., Wiley, 1996.

Engineering Mechanics II
Semester 3
Credit: 2 SKS

Aims:
Students are able to calculate the main voltage and maximum shear stress of a 2D element voltage condition, calculate the deflection of the beam due to lateral load, calculate the support reactions of the static beam structure indefinitely, calculate the critical load of the column structure.

Subject:
Stress on field, Beam deflection, Static beam indefinite, Column.

References:
- Gere dan Timoshenko, Mekanika Bahan edisi ke 4, Erlangga, Jakarta.
- E.P. Popov, Mekanika Teknik, Erlangga, Jakarta.

Introduction to Computer & Programming
Semester 3
Credit: 3 SKS

Aims:
Students are able to:
- Describe the principles of design, process design, case-based design, and computer-aided design.
- Describe the mathematical concepts underlying graphs, interpolation and fairing curves in fields and spaces.
- Perform calculations to represent curves in fields and spaces.
- Describe the techniques of artificial intelligence and its use in the design process.
- Describe the pattern matching techniques and their use in the design process.

Subject:
Principles of design, process design, case-based design, computer-aided ship design (CAD), mathematical concepts underlying graphs, interpolation and fairing curves in fields and spaces, Artificial Intelligence (AI), and pattern matching.

References:
- Manfaat, D. (2013). "*Case-Based Design* (Desain Berbasis Kasus)", Gramedia Pustaka Utama, Jakarta, Indonesia.

- Manfaat, D. (2008). "Penerapan Teknik Kecerdasan Buatan dalam Mendukung Proses Perancangan Kapal", Pidato Pengukuhan Guru Besar ITS, ITS Press, Surabaya, 4 Juni.
- Rooney, J. and Steadman, M. (Eds.) (1987). "*Principles of Computer Aided Design*", Pitman, London, Great Britain.
- Evans, J. Harvey (1959). "*Basic Design Concepts*", Naval Engineers Journal, November.
- Taggart, R. (1980). "*Ship Design and Construction*", SNAME, USA.
- Rogers, D. F. and Adams, J. A. (1990). "*Mathematical Elements for Computer Graphics (2nd edition)*", McGraw-Hill, Inc., USA.
- Lee, B. S. (1989). "*Computer Aided Ship Production*", *Lecture Notes*, Department of Ship and Marine Technology, University of Strathclyde, Glasgow, Scotland.
- Hawkes, B. (1990). "*The CADCAM Process*", Pitman, London, Great Britain.

Ship Structure I
Semester 3
Credit: 3 SKS

Aims:

- Students are able to understand the names of the ship's construction section, understand the ship's construction drawings and are able to draw from different projections.
- Students are able to calculate the size of ship's profile by using classification rules.
- Students are able to apply the construction requirements in accordance with the classification rules.

Subject:

The names of construction parts. Construction System. Bureau of classifications. Loads that applied on ships. Basic calculation of construction. Basic construction. Hull's construction. Deck's construction. Construction in the engine room.

References:

- Barabanov N, Structural Design of Sea Going Ships, 1960
- Taggart R, Ship Desigm and Construction, SNAME, 1980
- Yasuhisa Okumoto, Design of Ship Hull Structures, 2008
- Biro Klasifikasi Indonesia, 2009

Ship Outfitting
Semester 3
Credit: 2 SKS

Aims:
Students are able to demonstrate the relationship between ship's outfitting equipment with related rules of both Classification rules and statutory regulations.

Subject:
Mooring & anchoring, opening & closures, hold sparring & deck covering, deck fittings, hatch covering, cargo handling, pollution prevention & environment protection, safety, navigation, dan communication.

References:

- Kurniawati, H.A, *Ship Outfitting*, Teaching Grant Report, Surabaya, Indonesia, 2009.
- Lloyd's Register, Interactive software "*RuleFinder*", latest version.
- Biro Klasifikasi Indonesia, *Rules and Regulations for the Classification of Ships*.
- Lamb, Thomas (ed.), *Ship Design and Construction*, vol. **I**, SNAME, New Jersey, 2004.
- Lloyd's Register, *Rules and Regulations for the Classification of Ships*, 2007
- Van Dokkum, Klass, *Ship Knowledge*, Dokmar, Enkhuizen, Netherlands, 2005.

Basic Ship Theory II
Semester 3
Credit: 3 SKS

Aims:
Students are able to:
- Describe the basic principles of freeboard and rules defined under International Convention on Load Lines 1966 (ICLL 1966) and Protocol of 1988.
- Calculate to determine the ship's hull.
- Explain the basic principles of capacity and tonnage and regulations determined by the International Conference on Tonnage Measurement of Ships 1969.
- Calculate to determine the ship's tonnage.
- Explain the basic principles ship's launching.
- Calculate to determine the magnitude of parameters calculated in the launching stages of the vessel.
- Explain the basic principles of ship stability in a damage condition.
- Calculate to determine the magnitude of stability parameters for vessels in a damage condition.

Subject:

The basic principles and regulations of the IMO are applicable to freeboard, capacity and tonnage and ship launching and damaged stability.

References:

- Panunggal, P. E. (2006). "Teori Bangunan Kapal II", Handout Kuliah, Jurusan Teknik Perkapalan, Fakultas Teknologi Kelautan, ITS.
- International Maritime Organization (IMO) (2005). "International Convention on Load Lines, 1966 and Protocol of 1988", Consolidated Edition, IMO, London.
- International Maritime Organization (IMO) (1983). "International Conference on Tonnage Measurement of Ships 1969", IMO, London.
- Leavitt, C. M. (1980). "Launching", in Robert O. Taggart, Ed., "Ship Design and Construction", Chapter XVII, pp. 657–695, SNAME, Jersey City, NJ.
- Semyonov-Tyan-Shansky, V. (2004). "Statics and Dynamics of the Ship: Theory of Buoyancy, Stability and Launching", International Law Taxation, United States.
- International Maritime Organization (IMO) (2008). "International Convention for the Safety of Life at Sea, 1974, and 1988 Protocol relating there to", Consolidated Edition, IMO, London.

Statistics and Probability
Semester 4
Credit: 2 SKS

Aims:

Students understand and apply the concepts of the set, of all possibilities that can occur or are known by the concept of probability, about the theoretical probability distribution, about sampling appropriately accompanied by sampling distribution, estimation, hypothesis testing for a study, multiple regressions. In addition, students are expected to be able to evaluate the use of analytical tools selected for decision making.

Subject:

- Probability: (uncertain world, knowledge of the uncertainty)
    - Counting
    - Random variables, distributions, quantiles, mean variance
    - Conditional probability, Bayes' theorem, base rate fallacy
    - Joint distributions, covariance, correlation, independence
    - Central limit theorem
- Statistics I: pure applied probability (data in an uncertain world, knowledge of the

uncertainty)
    - Bayesian inference with known priors, probability intervals
    - Conjugate priors
- Statistics II: applied probability (data in an uncertain world, imperfect knowledge of the uncertainty)
    - Bayesian inference with unknown priors
    - Frequentist significance tests and confidence intervals
    - Resampling methods: bootstrapping
    - Linear regression

References:

- Dajan, Anto, : "Pengantar Metode Statistik", jilid II, LP 3 ES, Jakarta,2003.
- Harinaldi, Dr. Ir. M.Eng., "Prinsip-prinsip Statistik untuk Teknik dan Sains", Erlangga, 2005
- Stroud, K.A., "Matematika untuk Teknik", Erlangga, 2005
- Santoso, Singgih :" Buku Latihan SPSS Statistik Parametrik", Elex Media Komputindo, Jakarta, 2000.

Ship Design I
Semester 4
Credit: 3 SKS

Aims:

- Student must be able to understand the role of marine industries
- Student must be able to understand ship acquisition process
- Student must be able to understand ship design process and methods
- Student must be able know how to create lines plan
- Student must be able to know how to design general arrangement including the regulations involve on it
- Student must be able to know how to choose main engine from the market
- Student must be able to understand the ship technical specification and tender package
- Student must be able to know how to calculate ship cost and price
- Student must be able to understand basic engineering economics and ship operating costs

Subject:

- **Introduction to Marine Industry**; World fleet, Cargo transport business;
- **Ship Acquisition Process**; Planning stage, Design stage, Commercial activities,

Production activities;

- **Ship Design Process**; Design spiral, Characteristics of ship design, Design requirements, Design Constrain (physical limit, Class Rule, International & National Regulation), Concept design, Preliminary design, Contract design, Detail design;
- **Ship Design Methods**; Parent design approach, Trend curves approach (Statistics), Iterative design approach, Parametric studies approach, Optimisation approach;
- **System Based Design**; Payload and ship function, Cargo capacity and cargo spaces, Ship systems, DWT and LWT estimations;
- **Design of Lines Plan**; Bow and stern design, Designing lines using a basis ship, Designing lines to minimise power, Twin-screw lines and appendages, High stability lines, Designing lines for seakeeping & manoeuvrability, The lines above the water lines;
- **Powering & Machinery Selection**; Propulsion system, Engine propeller matching, Machinery consideration and selection, Fuel Economy;
- **General Arrangement Design**; Overview regulatory and classification requirement (IMO's and ILO's products and Classification Rules), General arrangement, Accommodation arrangement, Hull outfitting arrangement, Safety appliances arrangement, Cargo spaces, Mooring arrangement, Cargo handling arrangement, Hazardous and fire zones;
- **Specification and Tender Package**; Technical specification format, Contract, Tender Package;
- **Cost Estimating**; Cost and price, Cost breakdown, Engineer's estimate, Approximate cost data;
- **Economics in Ship Design**; Engineering Economic, Evaluation criteria (ARR, IRR, NPV, RFR), Practical application of techno-economic calculation, Operational Economic, Ship owners and operations, Operating Costs, Daily running costs, Voyage costs, Cargo handling costs, Some cost figures.

References:

- Lamb, Thomas (ed.), (2004), Ship Design and Construction, Vol. I, SNAME, New Jersey.
- Watson, D.G.M., (1997), Practical Ship Design, Elsevier Ocean Engineering Series, London.
- IMO, SOLAS (*International Convention for the Safety of Life at Sea, 1974, as amended*).
- IMO, MARPOL (*International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978 relating thereto, as amended*).
- Aryawan, W.D., (2013), Handout Kuliah Desain Kapal
- Schneekluth, H., and Bertram, V., *Ship Design for Efficiency and Economy*, Second edition, Butterworth-Heinemann, 1998.

Ship Resistance and Propulsion
Semester 4
Credit: 4 SKS

Aims:

Students can describe the understanding of basic fluid mechanics, resistance, resistance components and basic theory of ship resistance, estimate the resistance magnitude of monohull, multihull and special vessels using various available methods and can predict the size of main engine, explain various kinds of mover system, basic theory of propeller, able to design propeller using various methods, and understand the term of hull-engine-propeller matching.

Subject:

- **Introduction to Fluid Flow;** Fluids and their properties, Concepts of Fluid flow, Ideal and viscous fluid flow (two dimensional flow), Similarity and dimensional analysis;
- **Resistance**; Components of resistance: frictional, residuary and total resistance, air, appendage, wave making, eddy and form resistances, Resistance Test, Resistance Calculation Method, Relation of Hull Form to Resistance, Advanced Marine Vehicles;
- **Propeller Design**; Marine Propulsor Types & Screw Propeller, Screw Propeller (geometry & other definitions), Propeller Design & Analysis, Basic Propeller Design and drawing, Model Propeller Test and Important Parameter, Open water model test, Standard series model propeller test, Propeller design diagram, Propeller-hull interaction phenomenon, Self-propulsion test, overload test, Cavitation phenomenon, Speed trials, Overview of unconventional propellers.

References:

- Rawson, K J and Tupper, E C (2001), Basic Ship Theory, Vols 1 and 2, Butterworth Heinemann, Oxford, UK;
- Harvald, S A (1983), Resistance and Propulsion of Ships, John Wiley and Sons, Toronto, Canada;
- Lewis, E V (editor, 1988), Principles of Naval Architecture, Vol. 2, the Society of Naval Architects and Marine Engineers, New Jersey, USA;
- Molland, A F (editor, 2008), the Maritime Engineering Reference Book, Butterworth-Heinemann, Oxford, UK;
- Zubaly, R B (1996), Applied Naval Architecture, Cornell Maritime Press, Maryland, USA;
- Gerr, D (2001), Propeller Handbook, International Marine, Maine, USA;
- RINA Publications;

- SNAME Publications;
- Transactions NECIES; International Shipbuilding Progress.

Ship Strength
Semester 4
Credit: 3 SKS

Aims:
Students are able to calculate the strength based on the ship's length and verify the size of ship's construction profile.

Subject:
Ship loads, General Properties of Ship's Construction Response to Load, Vessel loading, Distributed lengthwise gravity and upward force, Vertical and horizontal combinations of bending moments, Calculation of numerical and curvature moments numerically and distributed, Effective width, Moment of ship sectional inertia, Normal stress, shear stress, and torsion, Power extends.

References:

- Biro Klasifikasi Indonesia, ***" Peraturan Klasifikasi dan Konstruksi Baja ",*** Volume II, Jakarta, 2006.
- Evans, J.H. , ***" Ship Structural Design Concepts " ,*** Cornell Maritime Press, 1975.
- Hugehes, O.F. , ***" Rational Methods in Ship Design "*** , John Willley & Sons, New York, 1983.
- N. Barabanov, ***" Structural Design of Sea Going Ship "*** , Peace Publishers, Moscow.
- Taggart, R , ***" Ship Design and Construction "*** , SNAME, 1980
- Timoshenko, S.P, Cs, ***"Theory of Plates and Shells "*** , 2nd ed., McGraw Hill Book Company, New York, 1959.
- Timoshenko, S.P***, " Mechanics of Materials "*** , McGraw Hill Book Company, New York, 1961.
- Szilard, R., "Theory and Analysis of Plates, Classical and Numerical Methods", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1974;

Ship Structure II
Semester 4
Credit: 3 SKS

Aims:

- Students are able to understand the names of the ship's construction section understand the ship's construction drawings and be able to illustrate from various projections.
- Students are able to calculate the size of ship construction by using the classification rules.
- Students are able to apply the terms of construction in accordance with the Classification rules.

Subject:

Shipboard. Construction of the bow. Construction of a stern. Steering construction. Construction of propeller shaft tube. Construction of caps. Super structure and Deck House. Construction and reinforcement on watertight doors and windows. Cantilever.

References:

- Barabanov N, Structural Design of Sea Going Ships, 1960.
- Taggart R, Ship Desigm and Construction, SNAME, 1980.
- Yasuhisa Okumoto, Design of Ship Hull Structures, 2008.
- Biro Klasifikasi Indonesia, 2009.

Marine System
Semester 4
Credit: 2 SKS

Aims:

Students are able to understand the basic concepts of piping systems can be supporting components, and able to understand the existing piping system in the ship.

Subject:

Basic of fluid mechanics, pumps, compressors and blowers, piping system planning, ship service system and HVAC.

References:

- Ir. Murdjianto M.Eng, Ahmad N M.Eng **"Sistem Perkapalan"**
- D.A.Taylor, MSc, 2nd edition**" Introduction to Marine Enginering "** Elsevier

- H.D.McGeorge.CEng, 7th rev.edition **" Marine Auxiliary Machinery "** Butterworth Heineman
- D.J Eyres. M.Sc Fifth edition **" Ship Construction"** Butterworth Heineman
- Roy L Harrington **" Marine Enginering "** The Society of Naval Architect & Marine Engineering
- Nayyar, Mohinder L, 7th edition **" Piping Handbook "** McGraw Hill
- Wang,Shan K, 2nd edition **" Handbook of Air Conditioning & Refigeration "** McGraw Hill
- SOLAS
- Jurnal (SNAME, RINA, ISP, SNAOE, etc)

Lines Plan
Semester 4
Credit: 2 SKS

Aims:
In this course, students are able to draw a good lines plan, calculate and draw the Hydrostatic and Bonjean Curves, calculate and draw a static stability curve for intact condition.

Subject:
Lines Plan; the type and size of the main vessel is given, half-width and height tables are given, drawing body plan, sheer plan and half-breadth plan, mall usage for each plan, the relationship between the 3 plans; Hydrostatic curve as a laden function, minimum 5 points; the area of the AWP water and the weight of the LCF water field, the area of the AST station (Bonjean curve) and the large ivory area of AM, the WSA wet surface area, the molded volume and the location of the KB and LCB density, the skin volume, TPC, MTC and DDT, TBM, LBM, TKM and TBM; Static Stability Curve; for intact condition, according to the Krilov / Barness method until the angle is inclied (60º), KG is given, compared to IMO intact stability criteria.

References:
- Khetagurov, "Marine Auxilliary Machinery and Systems", Peace Publishers, Moscow;
- Classification rules.
- Taggart, R,"Ship Design and Construction", SNAME, 1980;
- Munro Smith,"Element of Ship Design".

Statutory Regulation
Semester 5
Credit: 2 SKS

Aims:
Students will be taught about statutory regulations related to maritime safety, maritime security, and marine environmental protection & pollution prevention.

Subject:
Introduction of statutory regulations, UNCLOS 1982, Tonnage Convention, SOLAS 1974, Other statutory regulations concerning maritime safety, Maritime security, MARPOL 73/78, Other statutory regulations concerning environment protection and pollution prevention, Regulation concerning liability and compensation.

References:

- Kurniawati, H.A., *Statutory Regulations*, Lecture Notes, Surabaya, Indonesia, 2013.
- Lloyd's Register, Interactive software "*RuleFinder*", latest version.
- FAO/ILO/IMO, *Voluntary Guidelines for the Design, Construction, and Equipment of Small Fishing Vessels, 2005*.
- ILO Conventions, *International Labour Organization Conventions*.
- IMO, AFS Convention 2001 (*International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001, as amended*).
- IMO, BLU Code (*Code of Practice for the Safe Loading and Unloading of Bulk Carriers*).
- IMO, BWM Convention 2004 (*International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004, as amended*).
- IMO, COLREGS 1972 (*Convention on the International Regulations for Preventing Collisions at Sea, 1972, as amended*).
- IMO, CSS Code (*Code of Safe Practice for Cargo Stowage and Securing*).
- IMO, FAL Convention 1965 (*Convention on Facilitation of International Maritime Traffic, 1965*).
- IMO, Hong Kong Convention 2009 (*Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009, as amended*).
- IMO, Grain Code (*International Code for the Safe Carriage of Ships Carrying Grain in Bulk*).
- IMO, IBC Code (*International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk*).
- IMO, ICLL 1966/1988 (*International Convention on Load Lines, 1966, as amended by the Protocol of 1988*).
- IMO, IGC Code (*International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk*).

- IMO, IMDG Code (*International Maritime Dangerous Goods Code*).
- IMO, IMSBC Code (*International Maritime Solid Bulk Cargoes Code*).
- IMO, Inmarsat Convention 1976 (*Convention on the International Maritime Satellite Organization, 1976, as amended*).
- IMO, 2008 IS Code (*International Code on Intact Stability, 2008*).
- IMO, ISM Code (*International Management Code for the Safe Operation of Ships and for Pollution Prevention*).
- IMO, ISPS Code (*International Code for the Security of Ships and of Port Facilities*).
- IMO, 1996 London Protocol (*1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter*).
- IMO, LSA Code (*International Life-Saving Appliance Code*).
- IMO, MARPOL 73/78 (*International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978 relating thereto, as amended*).
- IMO, 2009 MODU Code (*Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009*).
- IMO, Nairobi Convention 2007 (*Nairobi International Convention on the Removal of Wrecks, 2007*).
- IMO, Salvage Convention 1989 (*International Convention on Salvage, 1989*).
- IMO, SAR Convention 1979 (*International Convention on Maritime Search and Rescue, 1979*).
- IMO, 1995 STCW Convention (*International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers, 1995, as amended*).
- IMO, STCW Code (*Standards of Training, Certification, and Watchkeeping for Seafarers Code).*
- IMO, STCW-F (*International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, 1995, as amended*).
- IMO, SOLAS 1974 (*International Convention for the Safety of Life at Sea, 1974, as amended*).
- IMO, SUA Convention (*Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation, 1988, and the 2005 Protocol*).
- IMO, SUA Protocol (*Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf, 1988, and the 2005 Protocol*).
- IMO, Tonnage Convention 1969 (*International Convention on Tonnage Measurement of Ships, 1969*).
- IMO, Torremolinos Convention and Protocol (*International Convention for the Safety of Fishing Vessels, 1977, as modified by the Torremolinos Protocol of 1993 relating thereto*).
- UN, UNCLOS 1982 (*United Nations Convention on the Law of the Sea, 1982*).

Ship Dynamics
Semester 5
Credit: 4 SKS

Aims:
Students are taught to calculate the estimation of ship motion in regular and irregular waves with uncoupled linear method, considering the movement of the ship in the process of designing the ship. Students are also invited to do practicum in hydrodynamic laboratory.

Subject:
Simple harmonic wave and regular wave, Uncoupled Movement, Irregular Waves Boat motion on irregular waves, Dynamic effects of ship movement, Coupled Movement, Added power, wave load, Stability of ship movement, Movement considerations in design, Ship motion, Equations of movement and stability direction, Performance of motion

References:

- Bhattacharya, R, "Dynamic of Marine Vehicles", john willey and sons, new York, 1978
- Lewis, E.V (editor),"The Motion of Ship in Waves in Principles of Naval Architect" Volume II, SNAME, new York, 1988
- Rawson,K.J and Tupper,E>C,"Basic Ship Theory", volume II, Butterworth Heinemann, oxford, 2001
- Lloyd, ARJM,"Seakeeping; ship Behavior in Rough Weather", Ellis Horword Limited, 1989

Ship Design II
Semester 5
Credit: 3 SKS

Aims:
- Student must be able to understand the current design method and technology available in shipping industries.
- Student must be able to understand how to create inovative design.
- Student must be able to understand how to apply the optimisation approach in the design stage.
- Student must be able to understand the design principal and consideration for various ship types.

Subject:

- **Innovation in Ship Design;** Need for innovation, History of innovation in ship design, Invention & innovation: definition, process, sources. Combination of innovation: putting innovation in practice and techniques: analogy from nature, brainstorming,
- **Optimal Design;** Problem formulation (objective function, design variables, constraints, parameters), Optimisation concept and applications in ship design including principal dimensions and ship scantling, Model Development: Multiple liniear regression analysis, Neural networks, Nonlinear programming, Multicreterionoptimisation and decision making, Genetic algorithms.
- **Special Ships (mission, design considerations, regulations)**; Car & passenger liners, Fishing vessels, Dredgers, Tug boats, FPSO vessels, Tankers, LPG/LNG carriers, Chemical tankers, Bulk Carriers, Timber Carriers, Patrol vessels, Crane vessels, Survey and Research vessels, Rescue and salvage ships, Floating Dock.

References:

- Lamb, Thomas (ed.), (2004), Ship Design and Construction, Vol. I, SNAME, New Jersey, 2004.
- Watson, D.G.M., (1997), Practical Ship Design, Elsevier Ocean Engineering Series, London
- IMO, SOLAS (*International Convention for the Safety of Life at Sea, 1974, as amended*).
- IMO, MARPOL (*International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978 relating thereto, as amended*).
- Aryawan, W.D., (2013), Handout Kuliah Desain Kapal.

Introduction to Marine Engineering
Semester 5
Credit: 3 SKS

Aims:

Students are taught about basic concepts, thermodynamics & Heat transfer, diesel engines, boilers & steam turbines, gas turbines, electric motor drives, propagation systems and propellers, ship electrical systems, heat exchangers

Subject:

Basic concepts, thermodynamics & Heat transfers, diesel engines, boilers & steam turbines, gas turbines, electric motor drives, propagation systems and propellers, ship electrical systems, heat exchangers.

References:

- Ir. Murdjianto M.Eng, Ahmad N M.Eng "Motor Penggerak Kapal"
- D.A.Taylor, MSc, 2nd edition" Introduction to Marine Enginering " Elsevier
- H.D.McGeorge.CEng, 7th rev.edition " Marine Auxiliary Machinery "Butterworth Heineman
- D.J Eyres. M.Sc Fifth edition " Ship Construction" Butterworth Heineman
- Roy L Harrington " Marine Enginering " The Society of Naval Architect & Marine Engineering
- Doug Woodyard, Eighth edition " Pounders Marine Diesel Engine & Gas Turbines" Elsevier
- Dr.CB Barras " Ship Design & Performance for Masters & Mates " Elsevier
- Anthoni Molland "The Maritime Engineering Reference Book" Butterworth Heineman
- SOLAS
- Jurnal (SNAME, RINA, ISP, SNAOE, etc)

Theory and Application of Finite Element
Semester 5
Credit: 3 SKS

Aims:

- Students are able to understand the basic concepts of finite element method,
- Students are able to use it to solve simple structural problems,
- Students are able to develop it to solve complex problems on ships and other marine structures with the help of available finite element finite software.

Subject:

One-dimensional Elements Two-dimensional Elements Skeletal Structures, Homogeneous and Nonhomogeneous Boundary Conditions, Bandwidth, Substructure, Inclined or Skew Support, Vector Transformation, Stress Severity Decrease Method, Direct Stiffness Method, Introduction Dynamics, Considerations in Model Modeling.

References:

- Cooks, R. D., Malkus, D.S., Plesha, M.E. And Witt, R.J., "Concepts and Applications of Finite Element Analysis", Fourth Edition, John Wiley & Sons Inc., 2002.
- W. Weaver and P.R. Johnston, "Finite Elements for Structural Analysis", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1984

Ship Design Project I
Semester 5
Credit: 4 SKS

Aims:

- Students able to determine the main dimensions of a ship with simple optimization techniques, namely set-based design method;
- Students able to design lines plan;
- Students able to design a General Arrangement.

Subject:

• Owner requirements; including the type of cargo/vessel, carrying capacity (ton or other unit), gross tonnage (optional), official and experimental speed, maximum leverage (if any), classifications used, comparative vessels and other appropriate requirements; • Designed and calculated are; for comparison vessels (estimated payload, approximate shipping radius, regression of key size to payload), change main dimensions comparison, main dimensions, resistance and propulsion, lightweight and deadweight, KG and LCB, tonnage vessel selection, main engineand gearbox (if required) and estimated length of engine room, deck machine selection, ship price estimate and operating cost; • Inspections include; weight and weight estimates, volume and/or number of container/passenger vehicles, intact stability according to SOLAS 1974, MARPOL 73/78 requirements, hull arising according to International Load Line Convention 1960, tonnage of vessels according to International Convention on Tonnage Measurement of Ships 1966; • Choosing an optimum vessel; Lines plan; examination of lines plan shape in the bow and stern, inspection of displacement, LCB, all coefficient, bulb cross section area; • General arrangement; inspection of loading space capacity, extensive inspection of various rooms (accommodation etc.) according to Maritime Labor Conventions and Recommendations 1994 no. 92, 133, 140 and 141 and others from the ILO, ladder up and down, especially to the Engine Room.

References:

- Lamb, Thomas (ed.), (2004), Ship Design and Construction, Vol. I, SNAME, New Jersey, 2004.
- Watson, D.G.M., (1997), Practical Ship Design, Elsevier Ocean Engineering Series, London
- IMO, SOLAS (*International Convention for the Safety of Life at Sea, 1974, as amended*).
- IMO, MARPOL (*International Convention for the Prevention of Pollution from Ships 1973 as modified by the Protocol of 1978 relating thereto, as amended*).
- Aryawan, W.D., (2013), Handout Kuliah Desain Kapal.

Ship Production Technology
Semester 6
Credit: 3 SKS

Aims:

- Students are able to know, execute, and cooperate in the process of building new vessels.
- Students know the method methods used in the ship building process.
- Students know the activities undertaken in the ship building process.

Subject:

Definition and basic concept of ship product, PWBS Concept, Group Technology, Ship Production Technology, Material Treatment Method, Fabrication Method, Sub Assembly Method, Assembly Method, Material Handling, Erection and Launching

References:

- Shipbuilding Technology - H.W. Schloot;
- Plant Layout - H.W. Schloot;
- Journal of Ship Production, SNAME.;
- RINA Publication;
- SNAME Publication.

Ship Vibration
Semester 6
Credit: 3 SKS

Aims:

- Students are able to understand the solid basic concept of vibration system
- Students are able to develop analytical skills to solve simple vibration problems on ships
- Students are able to develop analytical skills to recognize and solve more complex problems

Subject:

Free vibration without damping, Free vibration with dumping, Vibration Force, Long Propulsion System Vibration, Torsional Vibration Case Study, Periodic Excitation, Periodic Case Vibration Study, Vibration with Multiple Degree of Freedom.

References:

- Asjhar Imron, Mechanical Vibration.
- Asjhar Imron, Web site: http:/ftk.its.ac.id, (modules, animation, hands-on exercise, etc)
- Vorus, W.S, Vibration, the Principles of Naval Architecture Series, SNAME, New Jersey, 2010.
- Guidance Notes on Ship Vibration, American Bureau of Shipping, 2006
- Thomson, W.T, Theory of Vibrations with Applications, 5th edition, 1997.
- Tse, F, Ivan Morse dan Rolland Hinkle, Mechanical Vibrations (classic textbook regarding mechanical vibration).

Ship Hydrodynamics
Semester 6
Credit: 3 SKS

Aims:

- Students are able to understand and explain fluid flow characteristics with their viscosity and ideal fluid and their correlation with the dynamics of floating or ship motions
- Students are able to understand the characteristics of the foil form and its application in the shipping field and understand the dynamics fluid dynamics concept and its application in the naval architecture field.

Subject:

Fluid flow with viscosity, Boundary Theory, Ideal Fluid Flow, Foil and Wings Theory, Numerical Fluid Dynamics.

References:

- Prandtl, L and Tietjens, O G (1934), Applied Hydro- and Aeromechanics, Dover Publication, New York, USA.
- Duncan, W J, Thom, A S, and Young, A D (1970), Mechanics of Fluid, Edward Arnold, London, UK.
- Newman, J N (1979), Marine Hydrodynamics, MIT Press, USA.
- Round, G F and Garg, V K (1986), Applications of Fluid Dynamics, Edward Arnold, London, UK.
- Versteeg, H K and Malalasekera, W (1995),
- Bertram, V (2002), Practical Ship Hydrodynamics, Butterworth-Heinemann, Oxford, UK.

Welding Technology
Semester 6
Credit: 3 SKS

Aims:

- Students are able to know the types and applications of welding processes commonly used for the construction of ships and other floating buildings;
- Students are able to explain the metallurgical changes that occurred during the welding process took place and the types of defects welding and prevention.
  Students are able to simply calculate the strength of welding and welding costs.

Subject:

Welding method; Safety of welding work; SMAW welding process; GMAW welding process; FCAW welding process; GTAW welding process; SAW welding process; Terminology and parts of welded joints; Metallurgy welding; Weld discontinuity; Welded connection holder; Welding costs.

References:

- Wiryosumarto, Harsono, dan Toshie Okumura, *Teknologi Pengelasan Logam*, Pradnya Paramita, Jakarta, Cetakan Kedelapan, 2000.
- AWS, Welding Inspection Handbook, American Welding Society, Miami, 3rd Edition, 2000.
- Jeffus, Larry, *Welding - Principles and Applications*, Delmar Publishers Inc., Albany, 3,d Edition, 1993.
- Jenney, Cynthia L., and Annette O'Brien, *Welding Handbook, Volume 1 - Welding Science and Technology*, American Welding Society, Miami, 9th Edition, 2001
- O'Brien, R.L., *Welding Handbook, Volume 2 - Welding Processes*, American Welding Society, Miami, 8th Edition, 1991.
- Oates, William R., *Welding Handbook, Volume 3 - Materials & Applications Part l*, American Welding Society, Miami, 8th Edition, 1996.
- Oates, William R., and Alexander M. Saitta, *Welding Handbook, Volume 3 – Materials & Applications Part 2*, American Welding Society, Miami, 8th Edition, 1998.

Ship Design Project II
Semester 6
Credit: 4 SKS

Aims:

- Students are able to calculate the size of ship construction; designing and drawing cross-section and shipbuilding construction plan equipped with detail on stern holes, engine room at foundation and chimney section including upper, middle, curved and

one part

- Students are able to calculate longitudinal strength distribution of the ship's mass and the location of its center point towards the height and length; calculate the load distribution, latitude, torque and torque, normal and shear stresses in calm water and waves, according to the Indonesian Bureau of Classification or other Classification societies.

Subject:

Construction system; load and bottom construction, hull and deck of the vessel at the stern, the engine room, the middle, the bow and one partition; cross sectional construction and construction plans, center gravity of ship and vessel point; load distribution, latitude, bending moment, torque moment, normal stress and shear stress.

References:

- Barabanov N, Structural Design of Sea Going Ships, 1960
- Taggart R, Ship Desigm and Construction, SNAME, 1980
- Yasuhisa Okumoto, Design of Ship Hull Structures, 2008

Research Methodology
Semester 7
Credit: 2 SKS

Aims:

- Students are able to determine and develop research ideas from various sources;
- Students are able to extract a paper or scientific paper in Indonesian or English in accordance with the style or nuances of the academic language;
- Students are able to understand the procedures of writing a scientific report and able to make a research report (i.e Final Year Project);
- Students are able to understand the procedures of experimental research, observation by data collection/conducting field survey/interview and numerical research;
- Students are able to understand the making of a research proposal, preparing the final report of research and how to present the report of the research results.

Subject:

Basic Research, Research Topic, Research Report, Research Process, Experimental Design, measurement variable, measurement: validity, data collection method, sampling method, statistic test, data analysis and interpretation

References:

- Suryabrata, Sumadi, Metodologi Penelitian, Rajawali Press, 2008
- Soetriono, Rita, Filsafat Ilmu dan Metodologi Penelitian, Andi Offset, 2007

Optimization Theory and Application
Semester 7
Credit: 3 SKS

Aims:

- Students are able to properly state an optimization problem;
- Students are able to apply one and many variable optimization techniques with various constraints;
- Students are able to apply appropriate optimization methods.

Subject:

- General Definition: Explain the understanding, position and function of the optimization process. Definitions of variables, parameters, constants, objective functions and constraints;
- Search Method: Explain the simplest optimization methods of Exhaustive, Bisection, Two Point Equal Interval, Three Point Equal Interval and Golden Section Search Methods;
- Linear Program: Explains how to formulate Linear Problems and their examples;
- Scheduling Issues: Explains how to solve Problems, Scheduling and examples;
- Task-Division Problems: Explains how to Solve Task-Sharing Issues and their examples;
- Transportation Issues: Describes how to solve Transport Problems and their examples;
- Dynamic Programs: Describes how to solve Dynamic Problems and their examples in the field of business development, Examples in determining the type of cargo that is eligible to be transported;
- Nonlinear Program: Explains how to formulate and steps to get the optimum price with Hooke and Jeeves Method, Advanced with Nelder and Mead Method and use of External Penalty Function Method;
- Goal Programming: Explains how to formulate and solve Goal Programming Problems and their examples;
- Separable Program: Describes the role and function of the Separable Issue and how to solve it;
- Ship Design Issues: Explains how to formulate Optimization Issues in a Ship Design;
- Hydrodynamic Issues: Explains how to formulate Optimization Issues in the field of Hydrodynamics;

- Structure and Production Issues: Explains how to formulate Optimization Issues in Structures and ship Production

References:

- Singiresu S Rao, ”Optimization, Theory and Applications”, 3rd edition, Wiley, Eastern Limited, New Delhi, 1996;
- Katta G. Murthy, "Linear and Combinatorial Programming", John Wiley & Sons, New York, 1996.

Computer Aided Ship Design
Semester 7
Credit: 3 SKS

Aims:

Students are able to:

- Describe the principles of design, process design, case-based design, and computer-aided design.
- Describe the mathematical concepts underlying graphs, interpolation and fairing curves in fields and spaces.
- Perform calculations to represent curves in fields and spaces.
- Describe the techniques of artificial intelligence and its use in the design process.
- Describe the pattern matching techniques and their use in the design process.

Subject:

Principles of design, process design, case-based design, computer-aided ship design (CAD), mathematical concepts underlying graphs, interpolation and fairing curves in fields and spaces, Artificial Intelligence (AI), and pattern matching.

References:

- Manfaat, D. (2013). “*Case-Based Design* (Desain Berbasis Kasus)”, Gramedia Pustaka Utama, Jakarta, Indonesia.
- Manfaat, D. (2008). “Penerapan Teknik Kecerdasan Buatan dalam Mendukung Proses Perancangan Kapal”, Pidato Pengukuhan Guru Besar ITS, ITS Press, Surabaya, 4 Juni.
- Rooney, J. and Steadman, M. (Eds.) (1987). “*Principles of Computer Aided Design*”, Pitman, London, Great Britain.
- Evans, J. Harvey (1959). “*Basic Design Concepts*”, Naval Engineers Journal, November.
- Taggart, R. (1980). “*Ship Design and Construction*”, SNAME, USA.
- Rogers, D. F. and Adams, J. A. (1990). “*Mathematical Elements for Computer Graphics (2nd edition)*”, McGraw-Hill, Inc., USA.

- Lee, B. S. (1989). "*Computer Aided Ship Production*", *Lecture Notes*, Department of Ship and Marine Technology, University of Strathclyde, Glasgow, Scotland.
- Hawkes, B. (1990). "*The CADCAM Process*", Pitman, London, Great Britain.

Ship Design Project III
Semester 7
Credit: 4 SKS

Aims:
Students are able to calculate and design propeller, sterntube, steering, ship launching, and ship safety.

Subject:
Designing propellers, sterntube, rudders, ship launching, and ship safety.

References:

- Biro klasifikasi Indonesia
- S A Harvald (1983), Resistance and Propulsion of Ships, John Wiley and Sons, Toronto, Canada.
- E V Lewis (editor, 1988), Principles of Naval Architecture, Vol. 2 & 3, SNAME, New Jersey, USA
- D Gerr (2001), Propeller Handbook, International Marine, Maine, USA.
- K J Rawson and E C Tupper (2001), Basic Ship Theory, Vols. 1 and 2, Oxford, UK.
- A F Molland, S R Turnock and D Hudson (2011), Ship Resistance and Propulsion, Cambridge University Press, UK.
- Proceeding seminar and jpurnal (RINA, SNAME, etc).

Field Work
Semester 8
Credit: 2 SKS

Aims:
- Students are able to complete well in shipping or engineering duties given by their advisor and the company where the field work take place within the specified time period;
- Students are able to understand appropriate shipping industry processes in reality and can prove what is gained in theory.

Subject:

- Make a field work proposal to the proposed companies;
- Perform internship programme in the naval architecture related companies;
- Preparation of technical reports on the implementation/completion of tasks provided and advisors corporate supervisors;
- Preparation of a final report on what is done on field work and able to answer questions from the lecturer in the oral examination.

References:

- -

Final Year Project
Semester 8
Credit: 6 SKS

Aims:

- Students are able to solve or analyze a case or problem in slightly modified atandard method or create a program for a particular case;
- Students are able to compare two or more cases / methods and derive conclusion based on it.
- Students are able to apply the theoretical concepts in the field of naval architecture that can be applied to floating structure.

Subject:

• Research Background • Literature study • problem definition • objectives and rationale • Data collection (if relevant) • Research methodology • Schedule • Significance • Results • Conclusions and Recommendation.

References:

- -

Structural Reliability
Credit: 3 SKS
Elective Courses

Aims:

- Students are able to explain the concept of safety and structure;
- Students are able to model structure and structure.

Subject:

• Introduction to Reliability Techniques; • The concept of reliability; • The basis of reliability and mathematical risk; • Mix populations with different risks; • Physical aspects of structural failure; • Structure load and behavior; • Mathematics - statistical models that represent the real conditions of the structure; • Reliability without safe condition inspection; • Risks of Static Failure of boundary load, Risk of failure with deteriorating strength, Risk sharing; • Instant risk alignment, Cut from the power time curve; • Structures with initial, structural cracks with multiple modes of failure and location.

References:

- Lewis EE, ”Introduction to Reliability Engineering”, John Wiley and Sons, 1989;
- O’ Connor PDT, ”Practical Reliability Engineering”, John Wiley and Sons, 1991;
- Thoft-Christensen,P, ”Structural Reliability Theory and applications”, Springer Verlag, 1986.

Corrosion
Credit: 3 SKS
Elective Courses

Aims:

- Students are able to explain corrosion principles,
- Students are able to explain the type of corrosion that occurs on the ship, Students are able to explain the method of prevention of corrosion,
- Students are able to explain the design and management of corrosion, corrosion economy,
- Students are able to analyze all types of corrosion that occur in the field and its prevention.

Subject:

Corrosion definition, corrosion factor, corrosion impact; Principle of corrosion process, basic principle of corrosion, Major Corrosion factor; Corrosion Type; Definition of Corrosion Prevention; Material Selection; Design in relation to Corrosion; Manufacturing Process in relation to corrosion; Corrosion Prevention, Economic Corrosion; Cathodic Protection Design.

References:

- Supomo, Heri. Diktat Kuliah Korosi. Surabaya 1999.

Risk Management
Credit: 3 SKS
Elective Courses

Aims:
Students are able to know, implement and cooperate in identifying and implementing risk management in the shipping industry.

Subject:
Basic risk management theory, risk identification, risk identification method, risk type, risk measurement, risk financing, risk control, risk transfer, case study.

References:

- Managing Risk krom Process System (2005),Ian t Cameroon, Raman Ragu elsevier Limited, teobald road UK
- Fundamental of Risk Management, (2010), Paul Hopkins Replika Press Pvt Ltd India

Strategic Management
Credit: 3 SKS
Elective Courses

Aims:
- Students are able to know, implement and cooperate in developing strategic management in the shipping industry business.
- Students are able to improve their knowledge of conceptual framework/strategic management theory so that they are able to understand, formulate and analyze business issues either functional level, business and corporation.

Subject:
Basic strategic management concepts through internal and external environmental analysis steps, vision, mission and objectives, generic strategic election, corporate strategy, functional strategy, staffing and organizational design, and business performance measurement.

References:

- Colley, John L, Ir., Jacqueline L., Doyle, Robert D., Hardie., 2002, Corporate Strategy, McGraw Hill, USA.
- Dess, Gregory G and G.T. Lumpkin, Alan Eisner, 2009, Strategic Magement, Text and Cases 3rd ed., International Edition, McGraw Hill Company, Inc, USA.

- David, Fred R., 2007, Strategic Managemenet Concept and Cases 11th ed.
- Hill, Charles W.L. & Jones, Gareth R., 2009. Stra8tegic Management, th Edition, Houghton Mifflin
- Hitt, Michael A; R. Duane Ireland and Robert E. Hoskisson, 2005, Strategic Management : Competitiveness and Globalization : Cases, 6th Edition South Western College Publishing, USA
- Pearce II, John A & Richard B. Robinson. 2009 Jr. Strategic Management : Formulation, Implementation, And Control 11th ed
- Porth, Stephen J., 2003, Strategic Management : A-Cross Function Approach, Pearson Education, Inc. New Jersey
- Wheelen, Thomas L and I David Hunger, 2008, Concept in Strategic Management and Business Policy, 11th Edition, Prentice Hall, USA

Marine Survey and Inspection
Credit: 3 SKS
Elective Courses

Aims:
Students are able to know, implement and cooperate in conducting surveys and inspections on the shipping industry.

Subject:
Basic theory of ship survey and inspection, Basic Design Inspection; Examination of construction drawings; Examination of construction materials; Inspection of machining components; Examination of hull construction; Examination of deck equipment; Inspection of ship's machinery equipment, inspection of navigation and communication equipment; Checking on dock trial, Sea trial examination, Inspection of administrative completeness for ship certification.

References:

- Barabanov N, Structural Design of Sea Going Ships, 1960
- Taggart R, Ship Desigm and Construction, SNAME, 1980
- Yasuhisa Okumoto, Design of Ship Hull Structures, 2008
- Biro Klasifikasi Indonesia, 2009
- R. Lee Storch, C.P. Hammon, Howard M. Bunc, & Richard C. Moore, "Ship Production 2nd Edition", Cornell Maritime Press, 1995.

Small Vessel Design (L<30M)
Credit: 3 SKS
Elective Courses

Aims:

- Students are able to understand and explain the understanding of small vessels according to the terms of classification and expert views,
- Students are able to understand the hydrodynamic basics of small vessels, the calculation of vessel resistance and the determination and selection of shipbuilding systems, understand the construction / structure of small vessels and materials used to build small vessels,
- Students are able to understand the stability and safety issues associated with small vessels.

Subject:

Hydrodynamic of Small Boats, Resistance, Powering, Small Vessel Construction, Stability and Safety problems.

References:

- Dictate Courses Designing small vessels, Mahardjo, 1996, Surabaya ITS
- Basic Ship Theory (Rawson and Tupper)
- WEGEMT School on Small Craft Technology (1998 at Southampton)

Introduction to Offshore Engineering
Credit: 3 SKS
Elective Courses

Aims:

- Students can explain: Types of offshore structures, Aspects of marine operation, and Basic principles in designing offshore structures;
- Students are able to perform calculations related to: linear wave theory, current and wave loading, dynamic response: single degree of freedom system (SDOF), fatigue structure.

Subject:

Introduction of 'Offshore Structure Design' Type of offshore structure; operational in the Sea; Design Considerations; Theory of Waves; Wave theory (Continued); Hydrodynamic Load; Distribution of ocean waves; Wave Statistics; Dynamic analysis; Fatigue Approach; Floating Platform Performance.

References:

- Barltrop, N. D. P. and Adams, A. J., Dynamics of fixed marine structures, 3rd edition, Butterworth-Heinemann Ltd, Oxford, 1991;
- Chakrabarti, S. K., Hydrodynamics of offshore structures, Computational Mechanics Publications, ISBN 0-905451-66-X, 1987;
- Claum, G. I, et al, Offshore structures: Vol 1: Conceptual design and hydromechanics;Vol 2: Strength and safety for structural design, Springer Verlag, London 1992;
- Graff, W. J., Introduction to offshore structures, Gulf Publishing Company, 1981;
- Journee, J.M.J. and Massie, W.W., Offshore Hydromechanics, Delft University of Technology, The Netherlands, 2001;
- McClelland, B. and Reifel, M.D., Planning and Design of Fixed Offshore Platforms, Van Nostrand Reinhold Co, New York, 1986;
- Sarpkaya, T. and Isaacson, M., Mechanics of wave forces on offshore structures, Van Nostrand Reinhold, New York, 1981;
- Wardenier, J., Berkelder, A.G.J. and Smelt, G., Offshore and Hydraulic steel structures, Vol.1, Lecture note, Faculteit Civiele Techniek en Geowetenschappen, TU Delft, The Netherlands, 1998.

Fracture Mechanics and Fatique
Credit: 3 SKS
Elective Courses

Aims:

- Students are able to explain the concept of safety and structural reliability;
- Students are able to model the load and structural capability and calculate the reliability index of a structure.

Subject:

• Introduction to Reliability Techniques; • The concept of reliability; • The basis of reliability and mathematical risk; • Mix populations with different risks; • Physical aspects of structural failure; • Structure load and behavior; • Mathematics - statistical models that represent the real conditions of the structure; • Reliability without safe condition inspection; • Risks of Static Failure of boundary load, Risk of failure with deteriorating strength, Risk sharing; • Instant risk alignment, Cut from the power time curve; • Structures with initial, structural cracks with multiple modes of failure and location.

References:

- Lewis EE, ”Introduction to Reliability Engineering”, John Wiley and Sons, 1989;
- O’ Connor PDT, ”Practical Reliability Engineering”, John Wiley and Sons, 1991;
- Thoft-Christensen,P, ”Structural Reliability Theory and applications”, Springer Verlag, 1986.

Theory of Plates
Credit: 3 SKS
Elective Courses

Aims:

- Students are able to calculate the deflection and the main stresses on the plates with lateral loads and loads in the field and check whether the plates will fail or not by using one of the failure theory
- Students are able to calculate the burden of load or buckling stress on plain plates, performing buckling calculations according to the Bureau of Classification
- Students are able to design plates with one way or two-way stirrers against buckling loads in a rational way as well as the Bureau of Classification.

Subject:

Definition and type of plate, elasticity theory for 2D elements, equations of plate element balance with lateral load, plate differential equation, boundary conditions, double Fourier series, Navier settlement, Levy settlement, failure theory for static load plates, balance plate equations with lateral loads and in the field, plain buckling plates with various loads, buckling plates with profiles, buckling examination plate according to Class.

References:

- Szilard, R, Teori dan Analisis Pelat,
- Owen Hughes, Ship Structural Design,

Welding Inspection
Credit: 3 SKS
Elective Courses

Aims:

- Students know the types of destructive and non-destructive testing of the weld joints, as well as the code / standard underlying the tests, especially those applied to shipbuilding.

- Students know the welding and testing symbols without damaging and understand how to apply them to construction drawings.
- Students understand the definition and function of WPS, PQR in the weld fabrication process, and are able to conduct a simple review of WPS and PQR; students understand the procedure of testing welders according to code / standard.
- Students understand the procedure of writing a weld inspection report properly and correctly.
- Students understand the organizational systems, functions, and tasks of each department in the shipyard.

Subject:

Destructive testing of weld joints; Non-destructive testing of weld joints; Welding and testing symbols without damage; Specification of welding procedure (WPS) and qualification welder (WQT); Report writing; Weld organization system.

References:

- Widharto, Sri, *Welding Inspection*, Mitra Wacana Media, Jakarta, 2013.
- AWS, Welding Inspection Handbook, American Welding Society, Miami, 3rd Edition, 2000.
- AWS A2.4, *Standard Symbols for Welding, Brazing and Non Destructive Examination*, American Welding Society, Miami, 1998.
- AWS, *Economics of Welding and Cutting*, American Welding Society, Miami, 2001.

Advanced Ship Production Technology
Credit: 3 SKS
Elective Courses

Aims:

Students are able to know, implement, and cooperate in using technology in the process of new shipbuilding.

Subject:

Understanding of production technology, breakdown process, process after launching, shipyard, dock planning, survey, location survey, design of shipyard capacity, workshop capacity design, layout planning and machine layout in workshop.

References:

- Bruce & Garrard.., "Business of Shipbuilding", Witherbys Publishing, 1999;
- R. Lee Storch, C.P. Hammon, Howard M. Bunc, & Richard C. Moore, "Ship Production

2nd Edition", Cornell Maritime Press, 1995.

Advanced Ship Production Management
Credit: 3 SKS
Elective Courses

Aims:
Students are able to know, execute and cooperate in using advanced management tools in the process of building new vessels.

Subject:
Material Planning and Control on Shipbuilding, Human Resources Planning and Control, Planning and Controlling of Planners, Facility Planning and Control, Time Planning and Control, Project Management, Dockyard Productivity, Quality Planning and Control.

References:
- Shipbuilding Technology - H.W. Schloot;
- Plant Layout - H.W. Schloot;
- Ship Production - Storch, R.L., Butterworth, 1982;
- Journal of Ship Production, SNAME;
- RINA Publication;
- SNAME Publication.

Shipping Business
Credit: 3 SKS
Elective Courses

Aims:
- Students are able to know, implement, and cooperate in developing the shipping business.
- Students are able to plan the development of shipyards economically and plan their investments

Subject:
Shipbuilding, Material Supply, use of financial instruments, Business Process, Business risk management, Costing scheme, Shipbuilding business Investation, Models of Business Shipbuilding, Influence of external factors to shipping business, Strategy of location selection and regional economic growth, Supply Chain restructuring of the shipbuilding

industry.

References:

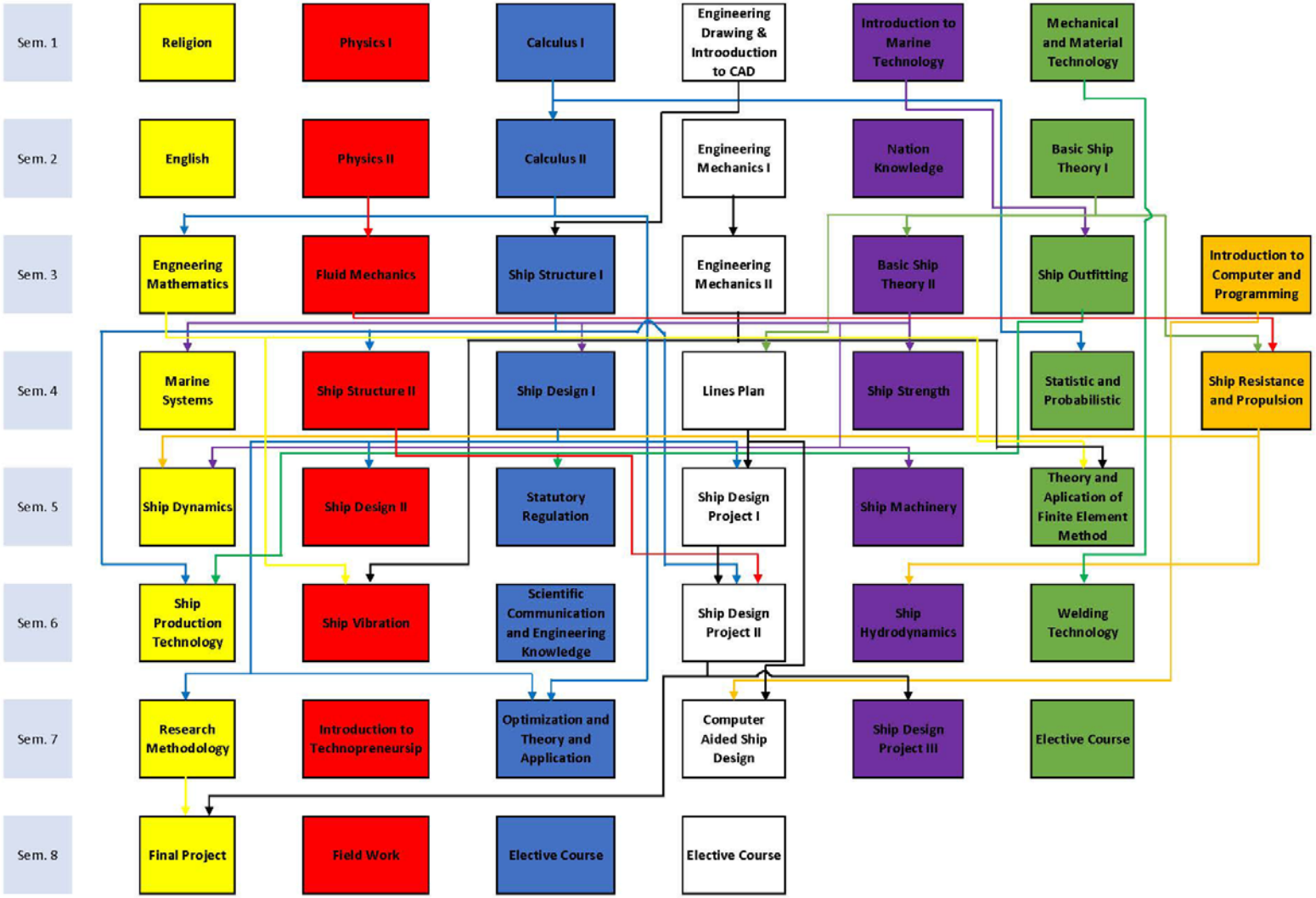
- Bruce & Garrard.., "Business of Shipbuilding", Witherbys Publishing, 1999;
- Manajemen Resiko;
- R. Lee Storch, C.P. Hammon, Howard M. Bunc, & Richard C. Moore, "Ship Production 2nd Edition", Cornell Maritime Press, 1995;
- Journal of Ship Production, SNAME

Competency Matrix

Smt	No.	Course	Credits	ELO-1													ELO-2									ELO-3						ELO-4						
				1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	1	2	3	4	5	6	7
I	1	Religion	2	X				X		X	X							X				X	X	X	X													
	2	Physics 1	4								X	X		X	X	X	X	X			X	X	X	X		X							X					
	3	Calculus I	3								X	X		X	X	X	X	X			X	X	X	X		X							X					
	4	Engineering Drawing & Introduction to CAD	3								X	X		X	X	X	X	X	X		X	X	X	X		X		X						X				X
	5	Introduction to Marine Technology	2								X	X		X	X	X			X		X	X	X	X		X	X	X							X	X			
	6	Mechanics and Material Technology	3								X	X		X	X	X			X		X	X	X	X		X	X	X						X				X	
II	7	English	3		X		X		X		X	X		X		X						X	X	X												X	X		
	8	Physics II	3								X	X		X	X	X	X	X			X	X	X	X		X							X					
	9	Calculus II	3								X	X		X	X	X	X	X			X	X	X	X		X							X					
	10	Engineering Mechanics I	4								X	X		X	X	X	X	X	X		X	X	X	X		X						X	X	X	X			
	11	Nation Knowledge	3	X	X	X	X	X	X	X	X	X		X								X	X	X												X			
	12	Basic Ship Theory I	3								X	X		X	X	X	X	X	X		X	X	X	X		X						X	X		X			
III	13	Engineering Mathematics	3								X	X		X	X	X	X	X			X	X	X	X		X						X	X		X			
	14	Fluid Mechanics	3								X	X		X	X	X	X	X	X		X	X	X	X		X	X					X	X		X			
	15	Ship Structure I	3								X	X		X	X	X	X	X	X		X	X	X	X		X	X	X				X	X	X				X
	16	Engineering Mechanics II	3								X	X		X	X	X	X	X	X		X	X	X	X		X						X	X	X	X			
	17	Basic Ship Theory II	3								X	X		X	X	X	X	X	X		X	X	X	X		X	X					X	X	X	X			
	18	Ship outfitting	2					X	X	X	X	X	X	X	X	X			X			X	X	X													X		
	19	Introduction to Computer and Programming	2					X	X	X	X	X	X	X	X	X			X			X	X	X							X						X		
IV	20	Marine Systems	2					X	X	X	X	X	X	X	X	X			X			X	X	X			X	X								X	X		
	21	Ship Structure II	3						X	X	X	X		X	X	X	X	X	X		X	X	X	X		X	X	X				X	X	X				
	22	Ship Design I	3						X	X	X	X	X	X	X	X			X		X	X	X	X			X	X						X				
	23	Lines Plan	2								X	X		X	X	X					X	X				X		X	X					X				X	
	24	Ship Strength	3								X	X		X	X	X	X	X	X		X	X	X	X		X	X	X				X	X	X				X
	25	Statistic and Probability	2								X	X		X	X	X	X	X	X		X	X	X	X		X												
	26	Ship Resistance and Propulsion	4								X	X		X	X	X			X		X	X	X	X		X	X	X				X	X	X				X
V	27	Ship Dynamics	4								X	X		X	X	X			X	X	X	X	X	X		X	X	X		X	X	X	X		X			
	28	Ship Design II	3						X	X	X	X	X	X	X	X			X			X	X	X			X	X						X					
	29	Statutory Regulation	2						X	X	X	X		X	X	X			X		X	X	X	X			X	X								X			
	30	Ship Design Project I	4								X	X		X	X	X			X	X	X	X			X	X	X	X	X	X		X	X	X			X	X
	31	Ship Machinery	3						X		X		X	X	X				X			X	X	X			X	X								X	X	
	32	Theory and Application of Finite Element Method	3								X	X		X	X	X			X	X	X					X	X	X		X	X	X	X				X	X

Smt	No.	Course	Credits	ELO-1													ELO-2									ELO-3						ELO-4						
				1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	1	2	3	4	5	6	7
VI	33	Ship Production Technology	3						X		X	X	X	X	X	X			X			X	X	X			X	X						X			X	X
	34	Ship Vibration	3								X	X		X	X	X			X	X	X	X	X	X		X	X	X		X		X	X		X			X
	35	Scientific Communication and Engineering Knowledge	3			X		X	X	X	X	X	X	X	X	X			X			X	X	X	X												X	
	36	Ship Design Project II	4								X	X		X	X	X			X	X	X	X			X	X	X	X	X	X		X	X	X			X	X
	37	Ship Hydrodynamics	3								X	X		X	X	X			X	X	X	X	X	X		X	X	X		X	X	X	X		X			X
	38	Welding Technology	3			X		X	X	X	X	X	X	X	X	X			X	X		X	X	X				X	X						X		X	X
VII	39	Research Methodology	2			X		X	X	X	X	X	X	X	X	X			X	X		X	X	X		X	X	X				X				X	X	X
	40	Introduction to Technopreneurship	3			X		X	X	X	X	X	X	X	X	X					X	X	X	X												X	X	
	41	Optimization Theory and Application	3						X	X	X	X	X	X	X	X			X	X	X	X	X	X		X	X	X		X	X	X	X	X			X	X
	42	Computer Aided Ship Design	3			X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X		X				X		X	X	X			X	
	43	Ship Design Project III	4								X	X		X	X	X			X	X	X	X			X	X	X	X	X	X		X	X	X			X	X
	44	Elective Course	3																																				
VIII	45	Final Project	6			X	X	X	X	X	X	X	X		X		X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
	46	Field Work	2			X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X								X	X	X
	47	Elective Course	3																																				
	48	Elective Course	3																																				

Curriculum Tree



Support for student learning

Induction

Prior to the first week of the first semester students attend an induction programme. New students will be given a general introduction to University life and the University's principle support services and general information about the departments and their programme, as described in the IPITS (Information and introduction of ITS) Handbook. New and continuing students will be given detailed programme information and the timetable of lectures/practicals/labs/tutorials/etc. The International Office offers an additional induction programme for overseas students (see http://io.its.ac.id/)

Education and Research Support

There are facilities and services to support students' learning some of which are accessible to students across the University and some of which will be geared more particularly to students in the Faculty or discipline area.

The Department provides:

- Classrooms – There are seven classrooms that can accommodate 20-30 students per room. The classrooms are intentionally designed to accommodate such number of students in order to create an effective learning atmosphere. Each classroom is equipped with air-conditioner, a whiteboard, and LCD projector.
- Laboratories – There are four laboratories within the department according to each group discipline, namely: Ship Design Laboratory, Ship Construction and Ship Strength Laboratory, Ship Hydrodynamics Laboratory, and Ship Production Technology and Shipping Management Laboratory. In addition, there is a Drawing Studio on the 4th floor of the building that is utilized by students to complete their Lines Plan Projects.
  - ✓ The Ship Design Laboratory plays an important role as a ship design and engineering center and is equipped with computers and software tools to develop efficient and eco-friendly ship designs.
  - ✓ The Ship Construction and Ship Strength Laboratory plays an important role in construction and ship strength research, especially testing of materials to be used in ship building. In detail, the research and testing cover the problems of welding technique and welding (DT and NDT) inspection, ship vibration, material fatigue and advanced / special materials. To support such activities, the laboratory is equipped with tensile test equipment, and software for structural analysis (NASTRAN).
  - ✓ The Ship Hydrodynamics Laboratory is one of the backbone of ITS and Indonesia in testing and developing various ship designs. It was built in 1986 as a grant from the German Government and recognized by ITTC in 1993. The main facility

of this hydrodynamic laboratory is a towing tank that can be used for measuring ship resistance, seakeeping and maneuvering testing on a limited scale. The laboratory is also equipped with CFD (Computational Fluid Dynamics) tools to support the research and development of more accurate ship design.

  - ✓ The Ship Production Technology and Shipping Management Laboratory focuses on welding activities which is the main work in the process of building a steel vessel. In order to meet these needs, the laboratory is equipped with welding machines (manual and semi-automatic) and gas cutting tools. The laboratory also develops research on non-metallic material materials such as; FRP, composite, wood and bamboo. In addition, the laboratory is also used as a more efficient ship building management center.

- Meeting rooms – There are four meeting rooms within the department, 1 large meeting room that can accommodate up to 50 people and 3 meeting rooms can accommodate up to 50 people.
- Administration room – A devoted room to supervisory or managerial functions related to institutional administration, student affairs and services for students. Activities related to administrative and performing other services supportive of department administration, including:
  - ✓ Preparation, maintenance, and storage of departmental records;
  - ✓ Departmental policy and procedural matters;
  - ✓ Personnel recruitment, personnel administration, and affirmative action compliance at the department or school level; and
  - ✓ Work related to membership in professional societies that relate to one's administrative responsibilities.

The Faculty provides:

- Seminar room – The seminar room within the Faculty is named after B.G Munaf, the first Dean of the Faculty as a appreciation of his dedication and can accommodate up to 100 people.
- Reading Room - The reading room is equipped with more than 9000 printed books, 70 journals both national and international, as well as several hundred of proceedings related to naval architecture and marine technology. In addition, there are more than 6500 a combined of total of final year projects, theses, and dissertations by both undergraduate and postgraduate stundents of the Faculty. The reading room is completed with air conditioners, chairs, and tables for reading, racks for storing bags, and computers that have full internet access to library resources. The reading room is open from 08.00 to 16:00 daily only on Monday to Friday.

The University provides:

- A Main Library located in the center of the institute and provide study facilities to strengthen the learning and research activities of its students and staffs. ITS main library offers various facilities to ensure a pleasant study environment, namely: discussion room, wi-fi access facility, lockers, cafetaria, rental, equipment for printing and copying, seminar meeting room, prayer room, and hot spot cafe. ITS main library provide access to around 95.848 printed textbooks, more than 70.000 local content information (scientific work produced by ITS academic community), 62.892 copies of magazines and scientific journals (available in Indonesian and English), 2.267 copies of references such as handbooks, encyclopedias, proceedings, dictionaries, rules, manuals, standards, secondary and tertiary information, and more than 35.000 audio visual collection. The collections are updated and can be accessed online through http://library.its.ac.id. Students also can access to online international journals through www.sciencedirect.com account registered on behalf of ITS.

Pastoral support

Each incoming student has an academic advisor assigned to track student progress toward their degrees until their graduation. Consultation with advisors is usually conducted at the beginning of every semester to discuss class options, their educational and personal goals, possible majors and careers, co-curricular opportunities that may interest them, and to use all resources of the department and university to his or her best advantage. However, students can seek further academic and personal advice from the advisor during the semester when necessary.

Furthermore, at the beginning of each semester, students are required to meet advisors for planning their credit load and guiding course selections to make sure they meet the degree requirements. At the end of semester, student academic performances will be announced and recorded in the academic monitoring system, which can be accessed online through https://integra.its.ac.id by both the students and their academic advisors. The information includes students' GPA as well as number of courses that students have passed. Based on this information, therefore, the students' advisors are able to evaluate the students' progress and give feedback on the students' performances adequately.

In addition the University offers a range of support services, including the Student Advice Centre, see https://sac.its.ac.id/.

Methods for evaluating and improving the quality of teaching and learning

Student evaluations

Students will have the opportunity to have their say on the quality of the programme in the following ways:

- Completing student evaluation questionnaires for each course of the programme
- Acting as a student representative on various committees, e.g. Students Association or Student Executive Board.

Programme reviews

Academic Institution Quality Assurance conducts an annual monitoring and review of the department based on the appraisal forms filled by the department's management.

National accreditation

Every five years the department goes through a process of national accreditation held by BAN – PT (Badan Akreditasi Nasional – Perguruan Tinggi / National Accreditation Board for Higher Education).

In addition, information relating to the programme is provided in:

The University Prospectus (see http://its.ac.id/)
The University Academic Regulations (see http://baak.its.ac.id/newsite/upload/1_Peraturan_Akademik_ITS_2014_Final_9_Jan_2015.pdf)
The Degree Programme Prospectus (see http://www.na.its.ac.id/)