WTMiT

Faculty of Maritime Technology and Transport

WEST POMERANIAN UNIVERSITY OF TECHNOLOGY
IN SZCZECIN, POLAND

THE OFFER FOR INTERNATIONAL STUDENTS FOR THE YEAR 2021/2022 SECOND DEGREE

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
1	Automotive Painting Technology	Piotr Nikończuk	winter/summer	6.0	60
2	Auxiliary Machinery in Marine Power Plants	Wojciech Zeńczak	winter/summer	6.0	60
3	Cost-Benefit Analysis and Optimisation	Zbigniew Sekulski	winter/summer	6.0	60
4	Cost-Benefit Analysis and Optimisation in Logistics and Transport	Zbigniew Sekulski	winter/summer	6.0	60
5	Cost-Benefit Analysis and Optimisation of Business Projects in Marine Industry	Zbigniew Sekulski	winter/summer	6	60
6	Data Analysis, Interpretation and Presentation	Zbigniew Sekulski	winter/summer	6	60
7	Design of Ship and Offshore Structures	Zbigniew Sekulski	winter/summer	6.0	60
8	End of Grade project	Zbigniew Sekulski	winter/summer	12	30
9	Equipment of Ship and Offshore Structures	Andrzej Banaszek	winter/summer	3.0	30
10	Ergonomics in the Design and Operation of the Ship	Agata Krystosik-Gromadzińska	winter/summer	6	60
11	Fire Safety Management on the Ships	Agata Krystosik-Gromadzińska	winter/summer	6	60
12	Intermodal Transport	Ludmiła Filina-Dawidowicz	winter/summer	6.0	60
13	Logistics	Ludmiła Filina-Dawidowicz	winter/summer	6	60
14	Marine Power Engineering	Wojciech Zeńczak	winter/summer	3.0	30
15	Maritime Transport	Ludmiła Filina-Dawidowicz	winter/summer	3.0	30
16	Master Thesis	Zbigniew Sekulski	winter/summer	12	30
17	Offshore Wind Power Engineering	Zbigniew Sekulski	winter/summer	6.0	60
18	Oil Tanker Equipment and Service	Andrzej Banaszek	winter/summer	6.0	60
19	Optimization Approach to Statistical Decision-Making	Zbigniew Sekulski	winter/summer	6	60
20	Piping Systems	Andrzej Banaszek	winter/summer	6.0	60
21	Practical Methods of Optimization	Zbigniew Sekulski	winter/summer	6.0	60
22	Practical Methods of Transportation and Logistics Optimisation	Zbigniew Sekulski	winter/summer	6.0	60
23	Production Technology of Ship and Offshore Structures	Tomasz Urbański	winter/summer	6.0	60
24	Refrigeration and air conditioning systems	Tomasz Łokietek	winter/summer	6	60
25	Refrigeration basics	Tomasz Łokietek	winter/summer	6	60
26	Research Methods & Thesis Preparation	Zbigniew Sekulski	winter/summer	15	50
27	Seaports and Logistics Centers Operation	Ludmiła Filina-Dawidowicz	winter/summer	6.0	60
28	Ship and Offshore Structures	Zbigniew Sekulski	winter/summer	6.0	60

	Course title	Person responsible for the course	Semester (winter/summer)	ECTS points	Hours
29	Ship Design	Monika Bortnowska	winter/summer	6.0	60
30	Ship Equipment	Andrzej Banaszek	winter/summer	6.0	60
31	Ship Hydraulics and Pneumatics	Andrzej Banaszek	winter/summer	6.0	60
32	Ship Hydrostatics and Stability	Monika Bortnowska	winter/summer	3	30
33	Ship Structural Mechanics	Maciej Taczała	winter/summer	6.0	60
34	Ship Structural Optimization	Zbigniew Sekulski	winter/summer	6.0	60
35	Strength of Materials	Maciej Taczała	winter/summer	6.0	60
36	Systems Engineering	Zbigniew Sekulski	winter/summer	6.0	60
37	Technology of Ship and Offshore Structures	Tomasz Urbański	winter/summer	6.0	60
38	Thesis Preparation	Zbigniew Sekulski	winter/summer	3	45
39	Transport Infrastructure	Ludmiła Filina-Dawidowicz	winter/summer	6	60
40	Unconventional Energy Sources	Wojciech Zeńczak	winter/summer	6.0	60
41	Watercraft	Zbigniew Sekulski	winter/summer	6.0	60

Course title	Automotive Painting Technology		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Piotr Nikończuk	**E-mail address to the person**	Piotr.Nikonczuk@zut.edu.pl
Course code (if applicable)	WTMiT-1-01-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Students will be familiar with basic of water paintig and powder coating technologies, paint application methods. Student will understand the needs of material coating and paint application restrictions in safety and quality point of view.		
Entry requirements	Basis of physics		
Course contents	Practical exercises: short refinishing works and its quality control. Paint materials. Finisher safety. Manual finishing and refinishing equipment: spray guns, air supply, paint mixing rooms, spray boots. Curing methods. Automatic finishing systems: automatic spray guns, paint supply installations, industrial paint spray booths. Control of coatings quality. Impact to environment.		
Assessment methods	Lectures Exercises Final exam		
Recommended readings	1. Toda, K., Salazar, A.J., Saito, K., Automotive Painting Technology: A Monozukuri-Hitozukuri Perspective, Springer, New York, 2013 2. Streitberger, H-J. and Dossel, K-F, Automotive Paints and Coatings, Wiley-VCH, 2, 2008		
Knowledge	On completion of the course successfully, students will be able to: (1) Understand definitions and terms used in painting technology; (2) Understand painting process; (3) Understand refinishing process, (4) Understand basics of spray coating technology, powder coating technology, and inspection of final surface quality		
Skills	Understand basics of powder and spray coating technology, applications, and inspection of final surface quality; design and solve simple painting technology systems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Auxiliary Machinery in Marine Power Plants		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Wojciech Zeńczak	**E-mail address to the person**	Wojciech.Zenczak@zut.edu.pl
Course code (if applicable)	WTMiT-2-02-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Familiar with the construction and operation of the auxiliary machinery in Marine Power plants		
Entry requirements	Basic thermodynamic, basic mechanics		
Course contents	Exercises on laboratory stands with power plants machinery General characteristic of marine power plants. Fuel oils, lubricating oils and their treatment. Heat exchangers (cooler, condenser and heater). Fresh water generators (evaporators and RO technology). Pumps. Boilers and incinerator. Devices for bilge water treatment. Emissions and abatement technology. Fuel cells. Devices for use of renewable energy sources on ships.		
Assessment methods	Lecture Test		
Recommended readings	1. H.d. McGeorge, Marine Auxiliary Machinery, Elsevier, Amsterdam, Boston, Heidelberg, London, Oxfrod, New York, 2006, 7 2. D.A. Taylor, Introduction to Marine Engineering, Elsevier, Amsterdam, boston, Heidelberg, Londoen, Oxford, New York, 2005, 2		
Knowledge	On successful completion of this course the learner will be able to: demonstrate fundamental knowledge of the auxiliary machinery applied in marine power plants.		
Skills	On successful completion of this course the learner will be able to: analyze and solve simple engineering problems involving auxiliary machinery in marine power plants, using the principles of engineering science.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Cost-Benefit Analysis and Optimisation		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-03-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To give relevant knowledge for calculating and comparing benefits and costs of industrial project or decision (hereafter, "project"). Lecture has two purposes: (1) to determine if it is sound investment/decision (justification/feasibility), (2) to provide basis for comparing projects. It involves comparing total expected cost of each option against total expected benefits, to see whether benefits outweigh costs, and by how much.		
Entry requirements	Cost-Benefit Analysis (CBA), industrial projects, decisions, optimisation		
Course contents	Cost benefit analysis steps of the sample business project – a short summary. STEP 1 – Define the problem/opportunity; Describe the background: (1.1) problem or opportunity statement, (1.2) objective/objectives, (1.3) the voice of the stakeholder (customer) and decision criteria, (1.4) background, (1.5) quick review. STEP 2 – Define scope; Formulate facts and assumptions: (2.1) scope, (2.2) formulate facts and assumptions, (2.3) quick review. STEP 3 – Define alternatives: (3.1) introduction, (3.2) define the status quo, (3.3) the status quo as a baseline, (3.4) documenting the status quo, (3.5) define alternatives / courses of action (COA), (3.6) describe second and third order effects (cause and effect), (3.7) quick review. STEP 4 – Develop cost estimates for each alternative: (4.1) cost concepts, (4.2) other types of costs, (4.3) the cost analysis / estimating process, (4.4) cost analysis process, (4.5) cost estimating strategy, (4.6) trade offs, (4.7) organizing cost data for display, (4.8) inflation and its impact on costing, (4.9) quick review. STEP 5 – Identify quantifiable and non-quantifiable benefits: (5.1) benefits analysis overview, (5.1.1) quantifiable benefits, (5.1.2) non-quantifiable benefits, (5.2) identify, estimate, and evaluate benefits, (5.2.1) identifying benefits, (5.2.2) benefit categories, (5.2.3) estimating quantifiable benefits, (5.2.4) evaluating non-quantifiable benefits, (5.2.5) quantifying benefits, (5.3) quick review. STEP 6 – Define alternative selection criteria: (6.1) introduction, (6.2) alternative selection criteria, (6.3) how to develop selection criteria, (6.4) quick review. STEP 7 – Compare alternatives: (7.1) introduction, (7.2) compare costs and benefits, (7.3) risk assessment, (7.4) risk mitigation, (7.5) decision support tools/methods, (7.5.1) the decision matrix, (7.5.2) other quantitative tools /methods, (7.6) perform sensitivity analysis, (7.7) billpayers, (7.8) quick review. STEP 8 – Report results and recommendations: (8.1) documenting the CBA, (8.2) supplementary content, (8.3) briefing the results of the CBA, (8.4) quick review. Introduction. A short historical background of cost-benefit analysis. Discussing sample costs might be included in cost-benefit analysis: (1) direct costs would be direct labor involved in manufacturing, inventory, raw materials, manufacturing expenses; (2) indirect costs might include electricity, overhead costs from management, rent, utilities; (3) intangible costs such as customer impact of pursuing a new business strategy, project, or construction of a manufacturing plant, delivery delays of product, employee impact; (4) opportunity costs such as alternative investments, or buying a plant versus building one; (5) cost of potential risks such as regulatory risks, competition, and environmental impacts. Discussing sample benefits might be included in cost-benefit analysis: (1) revenue and sales increases from increased production or new product, (2) intangible benefits, such as improved employee safety and morale, as well as customer satisfaction due to enhanced product offerings or faster delivery; (3) competitive advantage or market share gained as a result of the decision. Economic profitability: introduction, Payback Period analysis, time value of money, discount rate, Net Present Value, Internal Rate of Return, a profitability example. Financial feasibility: introduction, feasibility calculation, feasibility example. Final comment. Optimisation problems in financial managements and analysis of projects. Single- and multi-objective optimization problems in cost-benefit analysis. Risk and uncertainty in cost-benefit analysis. Advantages and disadvantages of cost-benefit analysis. Limitations of Cost-Benefit Analysis. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Brent R.J., Applied cost-benefit analysis, Edward Elgar, Cheltenham, 2007		

	2. Boardman A.E., Cost-Benefit Analysis: concept and practice, Pearson Prentice Hall, Upper Saddle River, Upper Saddle River, New Jersey, 2006 3. Pearce D.W., Cost-Benefit Analysis, Macmillan Publishers Limited, London, 1983, ISBN 978-0-333-35281-6, DOI https://doi.org/10.1007/978-1-349-17196-5
Knowledge	To give relevant knowledge for calculating and comparing benefits and costs of industrial project or decision (hereafter, "project"). Lecture has two purposes: (1) to determine if it is sound investment/decision (justification/feasibility), (2) to provide basis for comparing projects. It involves comparing total expected cost of each option against total expected benefits, to see whether benefits outweigh costs, and by how much.
Skills	The ability to use the acquired knowledge to solve practical problems.
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.

Course title	Cost-Benefit Analysis and Optimisation in Logistics and Transport		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-04-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To give relevant knowledge for calculating and comparing benefits and costs of project or decision (hereafter, "project") in transport and logistics. Lecture has two purposes: (1) to determine if it is sound investment/decision (justification/feasibility) in transport and logistics, (2) to provide basis for comparing projects. It involves comparing total expected cost of each option against total expected benefits, to see whether benefits outweigh costs, and by how much.		
Entry requirements	Cost-Benefit Analysis (CBA), transport, logistics, projects, decisions, optimisation.		
Course contents	Cost benefit analysis steps of the sample business project in logistics and transport, the goals and objectives of the action: (1) list alternative actions, (2) list stakeholders, (3) select measurement(s) and measure all cost and benefit elements, (4) predict outcome of costs and benefits over the relevant time period, (5) convert all costs and benefits into a common currency, (6) apply static (non dependant on time) measurements, (7) apply discount rate, (8) calculate the net present value of actions under consideration, (9) perform sensitivity analysis, (10) adopt the recommended course of action. Introduction: the cost-benefit analysis in logistics and transport. Discussion and analysis of two main applications of cost-benefit analysis in logistics and transport: (1) determine if an investment (or decision) is sound, ascertaining if – and by how much – its benefits outweigh its costs, (2) provide a basis for comparing investments (or decisions), comparing the total expected cost of each option with its total expected benefits. Discussion and analysis the benefits most commonly considered in benefit-cost analysis of logistic ans transportation projects: (1) travel time or delay reductions, (2) vehicle cost savings, (3) accident reductions, (4) air emission and greenhouse gas reductions, (5) parking costs savings from projects that reduce vehicle ownership and use. Other effects are: (1) equity and option value impacts that result from projects that increase transport system affordability and diversity; (2) induced travel, including new trips and changes in mode, route, and time of travel; (3) travel time reliability; (4) noise effects; (5) construction disbenefits; (6) habitat and water quality impacts; (7) economic effects; (8) community impacts. Discussion and analysis the costs most commonly considered in benefit-cost analysis of transportation projects: (1) initial costs (site acquisition; planning, design, engineering, and construction); (2) continuing costs; (3) rehabilitation costs; (4) "end of project" costs. Discussion of opportunity costs. Economic profitability in transport and logistics: introduction, Payback Period analysis, time value of money, discount rate, Net Present Value, Internal Rate of Return, a profitability example Optimisation problems in financial managements and analysis of projects in transport and logistics. Single- and multi-objective optimization problems in cost-benefit analysis in logistics and transport. Risk and uncertainty in cost-benefit analysis in logistics and transport. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Brent R.J., Applied cost-benefit analysis, Edward Elgar, Cheltenham, 2007 2. Boardman A.E., Cost-Benefit Analysis: concept and practice, Pearson Prentice Hall, Upper Saddle River, New Jersey, 2006 3. Pearce D.W., Cost-Benefit Analysis, Macmillan Publishers Limited, London, 1983, ISBN 978-0-333-35281-6, DOI https://doi.org/10.1007/978-1-349-17196-5		
Knowledge	On successful completion of this course, students will be able to: (1) formulate a wide range of management problems in transportation and logistics that can be solved to optimality by classical continuous as well as combinatorial optimization techniques and the knowledge of alternative solution approaches such as metaheuristics that can find nearly optimal solutions; (2) awareness how difficult some practical optimization problems in transportation and logistics can be and the complex role performed by managers; (3) understanding the construction and main solution ideas for nonlinear optimization problems in transportation and logistics; (4) assess the quality of available methods and solutions for such problems, as well as to potentially develop such optimization techniques and implementations; (5) formulate optimization problems in transportation and logistics in the presence of uncertainty; (6) knowledge of techniques that can be used to solve such problems; (7) effectively communicate the results of the cost-benefit analysis and optimization to the relevant parties.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Cost-Benefit Analysis and Optimisation of Business Projects in Marine Industry		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-2-04-L	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To give relevant knowledge for calculating and comparing benefits and costs of project or decision (hereafter, "project") in marine industry. Lecture has two purposes: (1) to determine if it is sound investment/decision (justification/feasibility) in marine industry, (2) to provide basis for comparing projects. It involves comparing total expected cost of each option against total expected benefits, to see whether benefits outweigh costs, and by how much.		
Entry requirements	Fundamentals of economics.		
Course contents	Cost-benefit analysis of the sample business project in maritime industry according the following steps – a short summary: (1) set the framework for the analysis, (2) decide whose costs and benefits should be recognized, (3) identify and categorize costs and benefits, (4) project costs and benefits over the life of the program, if applicable, (5) monetize (place a euros value on, for example) costs, (6) quantify benefits in terms of units of effectiveness, or monetize benefits, (7) discount costs and benefits to obtain present values, (8) compute a cost-effectiveness ratio (for CEA) or a net present value, (9) perform sensitivity analysis, (10) formulate conclusions and make a recommendation. Evaluation of project. Introduction: cost benefit-analysis in marine industry. Discussing of the goals that can be set for cost-benefit analysis of business projects in marine industry: (1) evaluate whether a capital investment is worth it, (2) decide whether to hire new employees, (3) determine whether a project or operating change is feasible, (3) develop a benchmark for comparing projects, (4) weigh up one business initiative against another, (5) prioritize investments, so you're focusing on the actions that return the most value first, (6) quantify the effects that a change initiative would have on stakeholders, (7) establish goals for the project itself, for example, to set time, productivity or cost restraints on a project you've analyzed and approved. Discussing sample costs and benefits might be included in cost-benefit analysis in marine industry. Definitions and explanations how to calculate of several measures that are typically used to summarize benefit-cost analyses: (1) Benefit/cost ratio (ratio of discounted benefits to discounted costs); (2) Net present value (discounted benefits minus discounted costs); (3) cost-effectiveness (benefits that can be obtained for a particular cost or cost of achieving a particular benefit); (4) Internal rate of return (discount rate for which the net present value of the project is 0); (5) Payback period (number of years it takes for the cumulative discounted benefits to exceed the cumulative discounted costs). The graphical representation of each measure and how these relate to each other will be also discussed. Profitability examples of business projects in marine industry. Financial feasibility of business projects in marine industry: introduction, feasibility calculation, feasibility example. Optimisation problems buisness projects in marine industry. Single- and multi-objective optimization problems in cost-benefit analysis and decision making. Methods for solving such problems (classic and heuristic methods). Final comment. Evaluation of knowledge		
Assessment methods	Lectures Exercises Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Brent R.J., Applied cost-benefit analysis, Edward Elgar, Cheltenham, 2007 2. Boardman A.E., Cost-Benefit Analysis: concept and practice, Pearson Prentice Hall, Upper Saddle River, New Jersey, 2006 3. Pearce D.W., Cost-Benefit Analysis, Macmillan Publishers Limited, London, 1983, ISBN 978-0-333-35281-6, DOI https://doi.org/10.1007/978-1-349-17196-5		
Knowledge	Upon successful completion of this course, the students should be able to: (1) describe the purpose and objective of cost-benefit analysis and optimization; (2) determine when a cost-benefit analysis and optimization may be performed in a meaningful way; (3) present findings and recommendations related to cost-benefit analysis and optimization of industrial projects; (4) explain and utilize the concepts of cost, present value and discount cost-benefit analysis and optimization industrial projects; (5) identify the elements that may compromise the validity of the cost-benefit analysis and optimization such as limitations in modeling assumptions, limitations in data, and political concerns; (6) effectively use cost-benefit analysis and optimization for practical problems; (7) discuss the strengths and weaknesses of a specific cost-benefit analysis; (8) effectively communicate the results of the cost-benefit analysis and optimization to the relevant parties.		
Skills	The ability to use the acquired knowledge to solve practical problems.		

Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.

Course title	Data Analysis, Interpretation and Presentation		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-ZS	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To give relevant skills to presentation and analysis of collected data for research, commercial, industrial and marketing activities as well as professional practices.		
Entry requirements	Fundamentals of probability theory.		
Course contents	The solution of exercises related to issues discussed during lectures. Skills evaluation. Elements of statistics: cases, variables, types of variables; matrix and frequency table; graphs and shapes of distributions; mode, median and mean; range, interquartile range and box plot, variance and standard deviation; Z-scores; contingency table, scatterplot, Pearson's r; basics of regression; elementary probability; random variables and probability distributions (Normal Distribution, Binomial Distribution & Poisson Distribution). Inferential statistics: observational studies and experiments; sample and population, population distribution, sample distribution and sampling distribution; Central Limit Theorem; point estimates, confidence intervals, introduction to hypothesis testing. Measures of distribution shape: skewness and kurtosis. Skewness and kurtosis application to normality test. How to use statistics to identify outliers in data (what are outliers and how to deal with them?): what are the outliers, types of outliers, most common causes of outliers on a data set (data entry errors(human errors), measurement errors (instrument errors), experimental errors (data extraction or experiment planning/executing errors), intentional (dummy outliers made to test detection methods), data processing errors (data manipulation or data set unintended mutations), sampling errors (extracting or mixing data from wrong or various sources), natural (not an error, novelties in data)). Some of the most popular methods for outlier detection (Z-score or extreme value analysis, probabilistic and statistical modelling, linear regression models, proximity based models, information theory models, high dimensional outlier detection methods). Evaluation of the uncertainty of measurement: measurant, uncertainty of measurement and measurement error, systematic and random errors (uncertainties), uncertainty of measurement and GUM terminology (Evaluation of Measurement Data - Guide to the Expression of uncertainty in measurement; usually referred to as the GUM), type a and type b uncertainties, degrees of freedom and uncertainty in the uncertainty, functional relationships, input and output quantities, propagation of uncertainty, uncertainty components when the inputs are uncorrelated, uncertainty components when the inputs are correlated, summary of procedure for determining the propagation of uncertainty, precision profile and uncertainty of measurement, rules for calculating uncertainty through functional relationships. How people interpret data visualization and presentation. How to interpret uncertainty in common forms of data visualizations. Statistical significance problem. Final comment. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Grima P., Absolute Certainty and Other Fictions: The secrets of statistics, National Geographic, 2017, ISBN 978-84-473-8845-5 2. Rumsey D.J., Statistics for Dummies, For Dummies, 2016, 2nd edition, ISBN 978-1119293521 3. Rumsey D.J., Statistics II for Dummies, For Dummies, 2009, 1st edition, ISBN-13 978-0470466469 4. EA, Expression of the Uncertainty of Measurement in Calibration, European co-operation for acreditation, 1999, EA-4/02 5. NASA, Measurement Uncertainty Analysis Principles and Methods. NASA Measurement Quality Assurance Handbook – ANNEX 3, NASA, 2010, NASA Handbook, NASA-HDBK-8739.19-3 6. Zilli M., A Practical Guide to the Calculation of Uncertainty of Measurement, The Open Toxicology Journal, 2013, 6, (Suppl 1, M3) 20-26, 2013 7. Bell S., Measurement Good Practice Guide No. 11 (Issue 2). A Beginner's Guide to Uncertainty of Measurement, National Physical Laboratory, Teddington, Middlesex, United Kingdom, 1999, ISSN 1368-6550 8. Claus O. Wilke, Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, O'Reilly Media, 2019, 1st Edition, ISBN 978-1492031086 9. Lydia Denworth, A Significant Problem, Scientific American, 2019, 10		
Knowledge	To give relevant skills to presentation and analysis of collected data for research, commercial, industrial and marketing activities as well as professional practices. It helps in obtaining information from it as the raw data is non-comprehensive in nature.		

Skills	The ability to use the acquired knowledge to solve practical problems.
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.

Course title	Design of Ship and Offshore Structures		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-2-05-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To give relevant knowledge on the structural design of specific ship types (bulk-carriers, containerships, chemical tankers, ro-ro, ropax, etc.). The idea is now to go in the details of some specific ship types to take into account their design specificities (IMO conventions and class requirements, specific loads).		
Entry requirements	CAD – Modeling and Drawings. Material Science. Mechanics. Strength of Materials. Calculus methods.		
Course contents	Structural design of a midship block section (typically one hold) for selected type of ship or design of structural block of offshore installation according to corresponding classification rules. Evaluation of project. Design loads, short- and long-term prediction. Hull structure design system: design flow, general arrangement, basic design of hull structures, optimization technique in basic design process, structural drawings, approval drawings, detail drawings, production data, standardization. Design of stiffeners, girders, pillars, plates, design of stiffened panel, optimization of grillage structure, structural methods for mitigation of vibrations. Structural regions: shell structure, bulkheads, swash bulkheads, corrugated bulkheads, deck structure, double hull structure, ship hatch corners, fore construction, engine room construction, stern construction and stern frame, superstructures. Design of specific types of ships: bulk-carriers, general cargo, containerships, oil tankers, chemical and gas tankers, passenger ships, high speed craft. Hull structure arrangement, hold arrangement, wing tanks of tankers, bulkhead arrangement. Oil platforms: fixed platforms, compliant towers, semi-submersible platforms, jack-up platforms, drilling ships, floating production systems, tension-leg platforms, spar platforms, normally unmanned installations, and conductor support systems. Elements of the oil/gas production process: wellheads, production manifold systems, production separators, glycol process to dry gas, gas compressors, water injection pumps, oil/gas export metering and main oil line pumps. Emergency support vessels. Application of composites in marine structures. Evaluation of knowledge.		
Assessment methods	Lectures Project Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Bai Y. (Ed.), Marine Structural Design, Elsevier, 2003 2. Chalmers D.W., Design of ships structures, Elsevier, London, 1993		
Knowledge	On successful completion of this course, students should be able to: (1) perform structural design of various types of marine structures, (2) apply knowledge to various types of marine structures, (3) select relevant structural materials as well as structural components application to marine structures.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	End of Grade project		
Level of course	second cycle		
Teaching method	project course		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-2-	**ECTS points**	12
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Within the framework of the End of Grade project course, students will explore different ways of finding information, defining the scope of a project and doing research, as well as different ways of communicating the results. The End of Grade project course includes the stages of defining a topic and formulating a problem statement, selecting and reviewing relevant literature, designing an empirical study as well as performing it, including data collection and analysis, analysing the empirical data, make theoretical conclusions and finally writing and rewriting a written report.		
Entry requirements	Not specified.		
Course contents	Activity specific to the end of Grade project subject. Project evaluation.		
Assessment methods	Project Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Russel L. Ackoff, Scientific method: Optimizing Applied Research Decisions, John Wiley & Sons, New York, 1962		
Skills	Student will be able to critically and systematically integrate knowledge and to analyse, assess and deal with complex phenomena, issues and situations even with limited information; identify and formulate issues critically, independently and creatively as well as to plan and use appropriate methods, undertake advanced tasks within predetermined time frames, and to contribute to the formation of knowledge as well as the ability to evaluate this work; speech and writing, to report clearly and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, both in a national and international context; participate in research and development work or independent work in other advanced contexts.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others.		

Course title	Equipment of Ship and Offshore Structures		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Andrzej Banaszek	**E-mail address to the person**	Andrzej.Banaszek@zut.edu.pl
Course code (if applicable)	WTMiT-2-06-L	**ECTS points**	3.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	The Learner after of learning process should be able to demonstrate of knowledgement refer to types of ship equipment systems mounted on board of ships and Offshore platforms, basic elements os structure of a/m systems, material, technical characteristics, procedures. Should be able to calculations of main ship and offshore equipment systems, elements and to design of basic ship and offshore systems comply with international regulations and rules		
Entry requirements	Basic mechanics, basic structural strength		
Course contents	Project of choosen deck equipment on example ship or petroleum platform. Basic information, types of tankers, size categories, current structural design, Cargo systems mounted on board of tankers, basic elements of structure of main piping systems, pumps, valves, flow characteristics, procedures of main piping systems calculations, materials, technical documentation, oil spills, tank cleanings, procedures at fuel terminal, Pre-transfer preparation, safety, Ship measurements, international regulations and rules. Efficiency of ship equipment main systems Overview of ship equipment and technical solutions mounted on board product and chemical tankers build in Szczecin Shipyard Szczecinska		
Assessment methods	Lecture/Workshop Lecture-grade Workshop - continuous assessment		
Recommended readings	1. D.A. Taylor, Introduction to Marine Engineering, Elsevier, 2005, 1 2. Shaw, Brien R., Petroleum engineering, The McGrwa-Hill Inc, New York, 2007, 10th 3. Brian Silowash, Piping System Manual, The Mc Grew-Hill Inc, New York, 2010, 1, ISBN 978-0-07-159276-5		
Knowledge	On successful completion of this lecture, students will be able to: know types of equipment mounted on board of ships and offshore platforms.		
Skills	On successful completion of this lecture, students will be able to: apply knowledge to various types of ships, explain the advantages and disadvantages of various solutions, apply appropriate types of equipment in design.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Ergonomics in the Design and Operation of the Ship		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Agata Krystosik-Gromadzińska	**E-mail address to the person**	agata.krystosik@zut.edu.pl
Course code (if applicable)	xxxxx	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	polish
Hours per week	4	**Hours per semester**	60
Objectives of the course	To get basic knowledge for understanding and application of ergonomic design and diagnosis		
Entry requirements	Basics of naval architecture and occupational health and safety		
Course contents	Ergonomic design guideline study Computer modelling- examples Legislation study Analysis of the material working environment onboard Ergonomic design of engine room Ergonomic design of navigation bridge Didactic discussion- summary Ergonomic design guideline Computer modelling support Ergonomic diagnosis methods Legislation Didactic discussion- summary- part 1 Factors of the material working environment Workload and mental strain on board Occupational diseases prevention Ergonomic design of different ship regions Ergonomic work organization onboard Didactic discussion- summary- part 2		
Assessment methods	lecture, class disscussion, auditorium exercises coursework, final exam		
Recommended readings	1. Salvendy G., Handbook of Human Factors and Ergonomics, John Wiley & Sons, Inc., 2012, 4th ed. 2. Soares M.M., Rebelo F., Ergonomics in Design: Methods and Techniques, CRC Press, 2016, 2016 3. EU directives, guidelines and standards on safety and health at work		
Knowledge	After this course, the student will have knowledge about: (1) design of ergonomic workstations at ship (2) assessment of the degree of compliance with ergonomic requirements of different workstations at ship (3) accessment of the hazards, workload and mental strains on board (4) formulating proposals for improving working conditions; work organization and management procedures.		
Skills	After this course, the student will be able to: (1) design ergonomic workstations at ship (2) assess the degree of compliance with ergonomic requirements of different workstations at ship (3) access the hazards, workload and mental strains on board (4) formulate proposals for improving working conditions; work organization and management procedures.		
Other social competences	After this course, the student will be competent to: (1) design ergonomic workstations at ship (2) assess the degree of compliance with ergonomic requirements of different workstations at ship (3) access the hazards, workload and mental strains on board (4) formulate proposals for improving working conditions; work organization and management procedures.		

Course title	Fire Safety Management on the Ships		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Agata Krystosik-Gromadzińska	**E-mail address to the person**	agata.krystosik@zut.edu.pl
Course code (if applicable)	xxxxx	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	polish
Hours per week	4	**Hours per semester**	60
Objectives of the course	To get basic knowledge for understanding the fire risk and fire safety management onboard		
Entry requirements	Basics of naval architecture and fire phenomenon		
Course contents	Legislation study and understanding Analysis of the different fires onboard Identification of flammable materials and ignition sources Passive fire safety methods onboard Active fire safety methods onboard Fire safety management onboard Fire modelling Didactic discussion- summary Fire phenomenon International legislation Fire risk on different ship types Didactic discussion- summary- part 1 Fire danger in different regions of ship (engine room, accomodation spaces etc.) Fire prevention and protection Fire safety management on the ship Didactic discussion- summary- part 2		
Assessment methods	lecture, class disscussion, auditorium exercises coursework, final exam		
Recommended readings	1. International Maritime Organization, International Convention for the Safety Life at Sea (SOLAS), 1974 2. Drysdale D., An Introduction to Fire Dynamics, Wiley, 2011, 3rd ed. 3. EU directives, guidelines and standards 4. National Transportation Safety Board, Marine Accident Reports, 2011 5. Muckett M., Furness A., Fire Safety Management, Elsevier, 2007 6. Tupper E., C., Introduction to Naval Architecture, Elsevier, 2013		
Knowledge	After this course, the student will have knowledge how to: (1) describe the fire as the compex phenomena; (2) estimate the fire risk on different ship types; (3) identify the main ignition sources and flammable materials; (4) design and apply fire safety methods sutable for expected fire danger; (5) will undersand the philosophy of the international legislation; (6) be able to build the adequate fire safety management procedures.		
Skills	After this course, the student will be able to: (1) describe the fire as the compex phenomena with the use of mathematical and numerical models; (2) estimate the fire risk on different ship types with the use of different methods; (3) identify the main ignition sources and flammable materials; (4) to design and apply fire safety methods sutable for expected fire danger; (5) undersand the philosophy of the international legislation; (6) be able to build the adequate fire safety management procedures and implement them.		
Other social competences	After this course, the student will have competences: (1) to describe the fire as the compex phenomena withe the use of different methods and models; (2) to estimate the fire risk on different ship types; (3) to identify the main ignition sources and flammable materials; (4) to design and apply fire safety methods sutable for expected fire danger; (5) to build the adequate fire safety management procedures.		

Course title	Intermodal Transport		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Ludmiła Filina-Dawidowicz	**E-mail address to the person**	Ludmila.Filina@zut.edu.pl
Course code (if applicable)	WTMiT-2-06-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn basic concepts of intermodal transport operation. To foster critical thinking when choosing intermodal transport technology.		
Entry requirements	None.		
Course contents	Intermodal transport concept. Idea of transport modes integration. Intermodal transport units. Maritime and land transport infrastructure. Vehicles used in intermodal transport. Organizational aspects of intermodal transport. Transportation technologies. Directions of intermodal transport development. Intermodal transport concept. Idea of transport modes integration. Intermodal transport units. Maritime and land transport infrastructure. Vehicles used in intermodal transport. Organizational aspects of intermodal transport. Transportation technologies. Directions of intermodal transport development. Knowlege evaluation		
Assessment methods	Lectures. Exercises. Lectures: final exam. Exercises: continuous assessment of student’s work during the classes.		
Recommended readings	1. Monios J., Bergqvist R. (eds.), Intermodal Freight Transport and Logistics, CRC Press, 2017 2. Rodrigue J.-P. (ed.), The Geography of Transport Systems, Fourth Edition, Routledge, London, 2017 3. Lowe D., Intermodal Freight Transport, Routledge, 2005		
Knowledge	The student will be able to get konwlege on intermodal transport operation, units, vehicles and infrastructure involved.		
Skills	The student will be able to apply knowledge to different transport modes, explain advantages and disadvantages of selected transportation technologies.		
Other social competences	The student will be able to improve social and personal competences including self-awareness, self-management, social awareness, relationship skills and responsability on decision-making.		

Course title	Logistics		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Ludmiła Filina-Dawidowicz	**E-mail address to the person**	Ludmila.Filina@zut.edu.pl
Course code (if applicable)	AAAAA	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn basic concepts of logistics. To foster critical thinking when choosing logistic services.		
Entry requirements	None.		
Course contents	The essence of logistics. System and process approaches in logistics. Logistics systems structure. Supply, production and distribution of goods. Logistics chains creation. Infrastructure of logistic processes. Inventory management. Types of logistic services. Logistic centers. Logistic service of customer. The essence of logistics. System and process approaches in logistics. Logistics systems structure. Supply, production and distribution of goods. Logistics chains creation. Infrastructure of logistic processes. Inventory management. Types of logistic services. Logistic centers. Logistic service of customer. Knowlege evaluation.		
Assessment methods	Lectures. Exercises. Lectures: final exam. Exercises: continuous assessment of student’s work during the classes.		
Recommended readings	1. Christopher M., Logistics & Supply Chain Management, FT Publishing International, 2016 2. Mangan J., Lalwani Ch. L., Global Logistics and Supply Chain Management, John Wiley & Sons Inc., 2016 3. Grant D. B., Wong Ch. Y., Trautrims A., Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management, Kogan Page Ltd., 2017		
Knowledge	The student will be able to get konwlege on basic concepts of logistics.		
Skills	The student will be able to apply knowledge to different phases of logistic service, design a simple logistic chain, make critical analysis of logistic services selection.		
Other social competences	The student will be able to improve social and personal competences including self-awareness, self-management, social awareness, relationship skills and responsability on decision-making.		

Course title	Marine Power Engineering		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Wojciech Zeńczak	**E-mail address to the person**	Wojciech.Zenczak@zut.edu.pl
Course code (if applicable)	WTMiT-2-09-L	**ECTS points**	3.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Acquaintance with construction and exploitation of marine power plants. Familiar with the construction and operation of the Marine Power Plants		
Entry requirements	None. Basic mechanics, physics		
Course contents	Preliminary design of selected ship machinery service system. Classification of energy sources (fossil and nuclear fuels, renewable energy sources, word reserves). Ecological aspects of energy use. Energy conservation, conversion and efficiency (First and Second Law of Thermodynamics). General description of marine power plants. Diesel engines (mode of operation; fundamentals of thermodynamics). Machinery service systems and equipment (starting air system; fuel oils, lubricating oils and their treatment; cooling systems, heat transfer and heat exchangers). Ship service systems and equipment (boilers and thermodynamic principles; fresh water generators; devices for bilge water treatment; refrigeration, air conditioning and ventilation; fire protection). Emissions and abatement technology. Devices for use of renewable and unconventional energy sources on ships (wind, solar, biomass, fuel cells). Devices for use of ocean energy (tidal, streams, wave, thermal, wind).		
Assessment methods	Lectures. Exercises. Lecture Written exam. Test		
Recommended readings	1. H.d. McGeorge, Marine Auxiliary Machinery, Elsevier, Amsterdam, Boston, Heidelberg, London, Oxfrod, New York, 2006, 7 2. D.A. Taylor, Introduction to Marine Engineering, Elsevier, Amsterdam, boston, Heidelberg, Londoen, Oxford, New York, 2005, 2		
Knowledge	On successful completion of this lecture, students should be able to know types of marine power plants, auxiliary machinery, how different energy sources can use.		
Skills	On successful completion of this lecture, students should be able to apply knowledge to various solution of marine power systems, explain the advantages and disadvantages of various solutions, apply appropriate types of equipment in design.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Maritime Transport		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Ludmiła Filina-Dawidowicz	**E-mail address to the person**	Ludmila.Filina@zut.edu.pl
Course code (if applicable)	WTMiT-2-10-L	**ECTS points**	3.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To offer deep insight to maritime transport of different cargo types. To show ports and ships operations, as well as terminals facilities in detail and from a practical perspective.		
Entry requirements	Ship Design		
Course contents	Analysis of characteristics of cargo transported by ships. Advantages and disadvantages of selected transportation strategies. Analysis of port infrastructure, equipment and services range on chosen seaport example. Final assessment of students' achievements. Technical and operational parameters of ships. Liner and tramp shipping. Types of transportation strategies. Cargo types in maritime transport. Safety problems in maritime cargo transport. Documents in maritime transport, standard trade terms Incoterms. Seaports classification, port infrastructure and equipment. Characteristics of services provided in seaports (ship services, cargo services etc.). Phases of ship service in seaport area. Seaport operating parameters.		
Assessment methods	Lectures. Exercises. Lectures: final exam. Exercises: continuous and final assessment of student's work during the classes.		
Recommended readings	1. Bichou K., Szyliowicz J. S., Zamparini L. (Editors), Maritime Transport Security. Issues, Challenges and National Policies, EE Elgar., 2014 2. Weintrit A., Neumann T., Marine Navigation and Safety of Sea Transportation: Maritime Transport & Shipping, CRC Press, 2013 3. Burns M. G., Port Management and Operations, CRC Press, 2014 4. Christopher K., Port Security Management (second edition), CRC Press, 2014		
Knowledge	The student will be able to get konwlege on basic phases of ship service at the seaport territory.		
Skills	The student will be able to apply knowledge to various cargo types transportation, ship service at the seaport territory, explain advantages and disadvantages of selected transportation strategies.		
Other social competences	The student will be able to improve social and personal competences including self-awareness, self-management, social awareness, relationship skills and responsability on decision-making.		

Course title	Master Thesis		
Level of course	second cycle		
Teaching method	project course		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-2-	**ECTS points**	12
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	Within the framework of the Master's Thesis course, students will explore different ways of finding information, defining the scope of a project and doing research, as well as different ways of communicating the results. The Master's thesis course includes the stages of defining a topic and formulating a problem statement, selecting and reviewing relevant literature, designing an empirical study as well as performing it, including data collection and analysis, analysing the empirical data, make theoretical conclusions and finally writing and rewriting a written report called a Master's thesis.		
Entry requirements	Not specified.		
Course contents	Activity specific to the Master Thesis subject.		
Assessment methods	Project Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Russel L. Ackoff, Scientific method: Optimizing Applied Research Decisions, John Wiley & Sons, New York, 1962		
Knowledge	Knowledge spectific to a Master thesis subject.		
Skills	Upon completion of this course, the student has achieved the following learning outcomes: (1) the student has access to and insight in (the diversity and boundaries of) the discipline of communication professionals; (2) the student is able to find and select the relevant professional literature by making use of (online) databases; (3) the student is able to evaluate, interpret and compare different academic sources and to use these sources in a project paper; (4) the student is able to write a clear project paper; (5) the student is able to evaluate the findings, strengths and limitations of a certain project line and is able to reflect on this. The learning outcomes of this course will be communicated to the students during the first lectures.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others.		

Course title	Offshore Wind Power Engineering		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-10-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To give relevant knowledge on technical as well as economical aspects of offshore wind farm design and exploitation.		
Entry requirements	Wind energy, offshore wind power installations, design, exploitation, cost-benefit analysis, optimisation.		
Course contents	The solution of design problems related to issues discussed during lectures. Skills evaluation. Introduction to offshore wind power installations - OWPI (presentation of OWPI market, types of wind turbines, onshore and offshore, OWPI challenges (in design, in operation, maintenance, etc.)). OWPI components (turbines, rotors, support). Connection to electric grid. Economics/energetic aspects: how much energy can we produce?, how to assess potential production? Theoretical background of offshore wind warms: sea states, wind states (non linear behaviour and stochastic behaviour), dynamic behaviour, fatigue behaviour. Design and analysis foundations of OWPI: loads and load cases (wind action, wave action, other actions (seismic, shock)), standard load cases (from Class Societies - rules), pressure (how to move from wave/wind spectrum to pressure fields acting on structure), structural responses (how to move from pressure fields acting on structure to response (stress, displacement, vibration)), rules based & industrial practice. Construction methods (planning and logistic chains, assembling technology). Inspection and maintenance (special vessels to construction and service of OWPI, monitoring, inspection/maintenance – “Risk Based Inspection”. Evaluation of knowledge.		
Assessment methods	Lectures Project Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Det Norske Veritas & Risø National Laboratory, Guidelines for Design of Wind Turbines, 2002 2. Manwell, J.F., McGowan, J.G, Rogers, A.L., Wind Energy Explained: Theory, Design and Application, John Wiley & Sons, Ltd, 2009		
Knowledge	Upon successful completion of this course, the students should be able to: (1) demonstrate a broad knowledge of the offshore wind power engineering and of the technological and financial evolution of the relevant industry; (2) demonstrate familiarity with the content and philosophy of the European legislative framework on offshore wind power industry and to relate to the processes and factors that lead to its development; (3) explain the contemporary global, regional and local offshore wind power engineering issues and develop systemic, critical and creative thinking about their impact on economic activities; (4) demonstrate skills and experiences necessary for engineers to lead the field of offshore wind power engineering, in efficient and clean power generation technologies and of rational use of energy; (5) demonstrate awareness on safety and environmental concerns surrounding the offshore wind power industry.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Oil Tanker Equipment and Service		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Andrzej Banaszek	**E-mail address to the person**	Andrzej.Banaszek@zut.edu.pl
Course code (if applicable)	WTMiT-2-11-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Calculations of cargo and main piping systems and elements on ships, design of cargo and basic piping systems, Calculation of tanker loading/unloading time, Pre-transfer preparations, Loading/unloading plan.		
Entry requirements	None.		
Course contents	Basic information, types of tankers, size categories, current structural design, Cargo systems mounted on board of tankers, basic elements of structure of main piping systems, pumps, valves, flow characteristics, procedures of main piping systems calculations, materials, technical documentation, oil spills, tank cleanings, procedures at fuel terminal, Pre-transfer preparation, safety, Ship measurements, international regulations and rules. Basic information, types of tankers, size categories, current structural design, Cargo systems mounted on board of tankers, basic elements of structure of main piping systems, pumps, valves, flow characteristics, procedures of main piping systems calculations, materials, technical documentation, oil spills, tank cleanings, procedures at fuel terminal, Pre-transfer preparation, safety, Ship measurements, international regulations and rules.		
Assessment methods	Lectures. Projects. Writing exam.		
Recommended readings	1. Paul Armitage, Crude Oil Tanker Basics: The Theory and Practice of Crude Oil Cargo Operations, 2009		
Knowledge	The Learner after a completion of learning process should be able to demonstrate of knowledgement refer to cargo systems mounted on board of tankers, basic elements of structure of main piping systems, pumps, valves, flow characteristics, materials, safety oil spills, tank cleanings, pre-transfer preparations and loading/unloading procedures.		
Skills	After the course the students will be able to calculations of cargo and main piping systems, loading/unloading plandeck equipment load during normal exploitation tanker and loading/unloading time comply with international regulations and rules.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Optimization Approach to Statistical Decision-Making		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-2-01-L	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	A objective of the course is give to students of modern methods for the best possible use of the observations for purposes of statistical test and estimation procedures as well as optimal decision-making in the final.		
Entry requirements	Fundamentals of optimization, fundamentals of probability, fundamentals of statistics.		
Course contents	Discussion of some practical problems related to: definition of the statistical decision problem; distribution function of random variable; decision rule concept; a randomized decision rule; loss, cost, and risk functions; Bayes and minimax solutions of the decision problem; complete classes of decision rules; relation to von Neumann's theory of games; formulation and testing of statistical hypothesis; regression and correlation analysis. Discussion of some practical problems related to: ordering and ranking of performance between decision functions; admissibility; admissible decision functions, inadmissible decision functions; feasible and admissible risk functions; Pareto domination; Pareto frontier; Bayes optimality; minimaxity; some relationships between the concepts of admissibility, Bayes optimality, and minimaxity; solution methods of optimization problems of statistical decisions. Evaluation of practical competence. Definition of the statistical decision problem; distribution function of random variable; decision rule concept; a randomized decision rule; loss, cost, and risk functions; Bayes and minimax solutions of the decision problem; complete classes of decision rules; relation to von Neumann's theory of games; formulation and testing of statistical hypothesis; regression and correlation analysis; discussion of some special cases. Ordering and ranking of performance between decision functions; admissibility; admissible decision functions, inadmissible decision functions; feasible and admissible risk functions; Pareto domination; Pareto frontier; Bayes optimality; minimaxity; some relationships between the concepts of admissibility, Bayes optimality, and minimaxity; solution methods of optimization problems of statistical decisions; discussion of some special cases. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Bross I.D.J., Design for Decision, The Macmillan Company, New York, 1959 2. Grima P., Absolute Certainty and Other Fiction: The Secrets of Statistics, RBA Coleccionables, 2012		
Knowledge	Upon successful completion of this course, the students will be prepared to apply optimization methods as well as modern statistical decision theory and statistical methods to design, development and operational evaluation of engineering objects and systems.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Piping Systems		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Andrzej Banaszek	**E-mail address to the person**	Andrzej.Banaszek@zut.edu.pl
Course code (if applicable)	WTMiT-2-13-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The Learner after of learning process should be able to demonstrate of knowledgement refer to types of piping systems mounted on board of ships, basic elements os structure of a/m systems, material, pumps, valves, flow characteristics, procedures. Should be able to calculations of main piping systems, elements and to design of basic ship piping systems comply with international regulations and rules		
Entry requirements	Basic mechanics, basic structural strength		
Course contents	Basic information, types of piping systems mounted on board of ships, basic elements of structure of main piping systems, pumps, valves, flow characteristics, procedures of main piping systems calculations, materials, technical documentation, international regulations and rules. Basic information, types of piping systems mounted on board of ships, basic elements of structure of main piping systems, pumps, valves, flow characteristics, procedures of main piping systems calculations, materials, technical documentation, international regulations and rules. Efficiency of piping systems Overview of piping system mounted on board ships build in Szczecin Shipyard Szczecinska		
Assessment methods	Lecture/Workshop Lecture-grade Workshop - continuous assessment		
Recommended readings	1. Brian Silowash, Piping System Manual, The Mc Grew-Hill Companies Inc, New York, 2010, ISBN 978-0-07-159276-5		
Knowledge	On successful completion of this lecture, students will be not able to: know types of piping systems mounted on board of ships and offshore platforms, technical data band basic calulations of main characteristics.		
Skills	After the course the students will be able to calculations of main piping systems, elements and to design of basic ship piping systems comply with international regulations and rules.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Practical Methods of Optimization		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-14-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn basic concepts of continuous optimization.		
Entry requirements	Linear algebra, differential calculations.		
Course contents	Solving some practical examples of unconstrained and constrained optimisation problems. Skills evaluation. Introduction: what is optimization problem? Definition of mathematical formulation of continuous optimization (necessary and sufficient conditions of local optimality, concept of matrix positive definition, convex and concave functions). General formulation of optimization problem. Review and discussion of optimization problems. General formulation of optimization algorithm. Review and discussion of classical optimization algorithms. Detailed formulation of selected representative optimization algorithms classified by the extent of information they require (nonderivative methods, gradient methods, Newton-Raphson methods). Constraints in optimization problems. Optimization methods of constrained problems (Kuhn-Tucker conditions, Lagrange multipliers method, penalty function methods). Evaluation of knowledge.		
Assessment methods	Lectures Exercises Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Dennis, J.E., Schnabel, R.B., Numerical Methods for Unconstrained Optimization and Nonlinear Equations, Society for Industrial and Applied Mathematics, Philadelphia, 1996 2. Gill, P.E., Murray, W., Wright, M.H., Practical Optimization, Academic Press, London, 1986		
Knowledge	After this course, the student will be able to: (1) estimate the actual complexity of nonlinear optimization problems; (2) apply lower complexity bounds, which establish the limits of performance of optimization method; (3) explain the main principles for constructing the optimal methods for solving different types of optimization problems, (4) use the main problem classes (general nonlinear problems, smooth convex problems, nonsmooth convex problems, structural optimization); (5) understand the rate of convergence of the main optimization methods; (6) two testing computer projects give a possibility to compare the theoretical conclusions and predictions with real performance of minimization / maximization methods.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Practical Methods of Transportation and Logistics Optimisation		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-15-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn basic concepts of continuous and discrete optimisation methods in transport and logistics.		
Entry requirements	Linear algebra, differential calculations.		
Course contents	Solving some practical examples of unconstrained and constrained optimisation problems in transport and logistics. Skills evaluation. Introduction: what is optimisation problem in transportation and logistics? General formulation of optimisation problem in transportation and logistics. Review and discussion of optimisation problems in transportation and logistics. Single- and multi-objective optimization problems in transportation and logistics. Introduction to graph theory application to modelling of transportation and logistic problems. Graphs, trees, spanning trees, and minimal spanning trees (definition, characterization, and simple properties). The minimum connector problem (Prim's algorithm), shortest-path problems. Transportation problems: transportation model, approach to solution to a transportation problem by using transportation algorithm (initial basic feasible solution: north - west corner method, least cost cell method, Vogel's approximation method), optimality test (stepping stone method of optimality test, modified distribution method of optimality test), alternate solutions. Green vehicle transportation problem based on carbon (CO_2) emission for minimize environmental impact. The effects of route decision on energy consumption and emission. Discussing the following 10 rules to be essential requirements for success intransportation and logistic optimization: (1) Objectives - must be quantified and measurable, (2) Models - must faithfully represent required logistics processes, (3) Variability - must be explicitly considered, (4) Data - must be accurate, timely, and comprehensive, (5) Integration - must support fully automated data transfer, (6) Delivery - must provide results in a form that facilitates execution, management and control, (7) Algorithms - must intelligently exploit individual problem structure, (8) People - must have the domain and technology expertise required to support the models, data, and optimization engines, (9) Process - must support optimization and have the ability to continuously improve, (10) Return on Investment (ROI) - must be provable considering the total cost of technology, people and operations. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Dennis, J.E., Schnabel, R.B., Numerical Methods for Unconstrained Optimization and Nonlinear Equations, Society for Industrial and Applied Mathematics, Philadelphia, 1996 2. Gill, P.E., Murray, W., Wright, M.H., Practical Optimization, Academic Press, London, 1986		
Knowledge	On successful completion of this course, students will be able to: (1) formulate a wide range of management problems in transportation and logistics that can be solved to optimality by classical continuous as well as combinatorial optimization techniques and the knowledge of alternative solution approaches such as metaheuristics that can find nearly optimal solutions; (2) awareness how difficult some practical optimization problems in transportation and logistics can be and the complex role performed by managers; (3) understanding the construction and main solution ideas for nonlinear optimization problems in transportation and logistics; (4) assess the quality of available methods and solutions for such problems, as well as to potentially develop such optimization techniques and implementations; (5) formulate optimization problems in transportation and logistics in the presence of uncertainty; (6) knowledge of techniques that can be used to solve such problems; (7) effectively communicate the results of the cost-benefit analysis and optimization to the relevant parties.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Production Technology of Ship and Offshore Structures		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Tomasz Urbański	**E-mail address to the person**	Tomasz.Urbanski@zut.edu.pl
Course code (if applicable)	WTMiT-2-13-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To be acquainted with production technology of various types of ships and offshore structures.		
Entry requirements	Material Science. Mechanics. Ship and Offshore Structures.		
Course contents	Technology instructions of welding in ship and offshore structure fabrication. Conventional welding in shipbuilding technology: Gas Metal Arc, Gas Tungsten Arc, Manual Metal Arc, Submerged Arc Welding. Defining and measuring some forms of welding distortions. The quality control of welded joints. AVEVA system in shipbuilding – exercises in Hull Detailed Design module. Introductory information on ship productions technology: types of shipyards, pre-treatment, prefabrication and production methods. Outline of the welding metal alloys applied in offshore and large-scale structures. Manufacturability of welds, manufacturability of large-scale and offshore structures. Welding-induced stresses and deformations, their impact on production, operation and safety of ships and offshore structures. Storage of materials, methods, equipment, transportation. Pre-treatment workshop and processing centre. Cutting and bending metal sheets and profiles, equipment and technological operations. Prefabrication processes. Fabrication of flat and curved sections, spatial sections and blocks. Suitable instrumentation, mechanization, automation, robotics, trends. Processes of hull fitting. Transport in shipyard . Launching ships Technology of building specific ship types (bulk-carriers, containerships, chemical tankers, ro-ro, ropax, ships supporting offshore industry, etc.). Technology of production and repair of composites and all-steel sandwich panels in marine structures. Technology of building offshore steel and concrete structures (rigs, caissons, pontoons, wind mill towers) and pipe systems on sea bed. Underwater technology supporting offshore structures – fabrication and application of manned and unmanned vehicles.		
Assessment methods	Lectures. Exercises Final test (lectures) Grade on the basis of value of the reports (exercises)		
Recommended readings	1. Eyres D.J., Ship Construction, University of Plymouth, 2001 2. Gerwick B.C., Construction of Marine and Offshore Structures, CRC Press London, New York, 2000		
Knowledge	On successful completion of this course, students will be able to explain what is the best production process for selected ship and offshore structures.		
Skills	On successful completion of this course, students will be able to prepare of technological procedures for ship and offshore structure production, construct the technological process for ship and offshore structure production, apply the knowledge to the different kind of ships and offshore structures.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Refrigeration and air conditioning systems		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Tomasz Łokietek	**E-mail address to the person**	Tomasz.Lokietek@zut.edu.pl
Course code (if applicable)	ŁO2	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn about refrigeration and air conditioning systems		
Entry requirements	None		
Course contents	Design of refrigeration or air conditioning system Estimation of cooling load. Air distribution. Piping design. Air handling equipment. Refrigeration equipment. Systems and applications.		
Assessment methods	Lectures Projects Written tests Completed project assignment		
Recommended readings	1. Trott A.R., Welch T., Refrigeration and air conditioning, Butterworth-Heinemann, Great Britain, 2000, 3 2. ASHRAE, ASHRAE Handbook HVAC Applications, ASHRAE, USA, 2007, 2007 3. ASHRAE, ASHRAE Handbook HVAC Systems and Equipment, ASHRAE, USA, 2008, 2008 4. ASHRAE, ASHRAE Handbook Refrigeration, ASHRAE, USA, 2010, 2010		
Knowledge	Student will aquire knowledge about refrigeration and air conditioning systems		
Skills	The ability to use aquired knowledge to solve practical problems		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others.		

Course title	Refrigeration basics		
Level of course	second cycle		
Teaching method	lecturing course / laboratory course / lecture		
Person responsible for the course	Tomasz Łokietek	**E-mail address to the person**	Tomasz.Lokietek@zut.edu.pl
Course code (if applicable)	ŁO1	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn the basics of refrigeration		
Entry requirements	None		
Course contents	Refrigeration cycles calculation Construction and operation of a refrigerating unit and heat pump. Pressure tests. Detection of refrigerant leaks. Using the system diagram. Settings of control devices. Energy testing of a refrigeration device. Fundamentals. Refrigeration cycles. Refrigerants. Compressors. Condensers. Evaporators. Expansion valves. Controls. Other circuit components. Selection and balancing of components. Materials. Construction. Site erection.		
Assessment methods	Lecture Exercices Laboratories Written tests Reports		
Recommended readings	1. Trott A.R., Welch T., Refrigeration and air conditioning, Butterworth-Heinemann, Great Britain, 2000, 3 2. ASHRAE, ASHRAE Handbook Fundamentals, ASHRAE, USA, 2009, 2009		
Knowledge	Student will aquire knowledge about the basics of refrigeration		
Skills	Student will be able to calculate basic refrigeration cycles and analyse the results; to operate a refrigeration unit, measure and interpret operating parameters		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others.		

Course title	Research Methods & Thesis Preparation		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-2-01-Z	**ECTS points**	15
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	50
Objectives of the course	The students will be trained to: (1) collect, read and understand scientific international literature of a specific topic; (2) formulate a research question extracted from data in the literature; (3) formulate a research proposal including problem definition, aim of the Master Thesis, methodology and time frame for the Master Thesis research project; (4) write a report containing a literature overview, the research proposal including problem definition, aim of the project, methodology and time frame for the Master Thesis research project.		
Entry requirements	Not specified.		
Course contents	The solution of practical problems related to issues discussed during lectures. Quantitative Research. Proposals that are written in chapters are the most common but will differ in their content by disciplines and also by the type of proposal (i.e. quantitative or qualitative research). Students should work closely with the research adviser to determine the specific content required for the type of research to be conducted and for the discipline. The proposal is often the first three to four chapters of the student's thesis or dissertation. The proposal is discussed in terms of what "will be" done in conducting the research. Qualitative Research. Qualitative research proposals may vary considerably, yet they do contain some common features. The specific theoretical framework selected for qualitative studies significantly influences the content of the proposal. Organization of the Thesis: (1) front page, (2) student's declaration on originality of the thesis; (3) dedication page (optional); (4) acknowledgement (optional); (5) vita (optional); (6) abstract; (7) table of contents; (8) list of tables (optional); (9) list of figures (optional); (10) list of symbols / abbreviations / notations / terminology (optional); (11) list of appendices; (12) introduction (relevance of the topic and the necessity for solution; practical and theoretical value of the topic; motives for choosing a particular topic; work aims and tasks; research object; research methods; an explanation of the work structure (brief overview of all parts, page, table and figure count); key literature used; work limitations and difficulties; plan of work and methodology; (13) assumptions and initial data; (14) theoretical section(s) (basic premises for the theoretical section; material sorting and the structure of the theoretical section; the requirements of the content for the theoretical section; preparation of theoretical model; the use and citation of the sources; highlighting the most important parts); (15) empirical (analytical) section (research methods, hypothesis, and data); (16) analysis, design, implementation and interpretation of results; (17) critical assessment of own work; (18) references / bibliography; (19) further Work; (20) summary & conclusion; (21) appendices (optional). Technical pointers for the final Master Thesis paper: text; citation in the text; quotations in the text; tables in the text; figures in the text. Copyright and plagiarism policy. Evaluation of knowedge.		
Assessment methods	Lectures Project Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Russel L. Ackoff, Scientific method: Optimizing Applied Research Decisions, John Wiley & Sons, New York, 1962		
Knowledge	Upon completion of this course, the student has achieved the following learning outcomes: (1) the student has access to and insight in (the diversity and boundaries of) the discipline of communication sciences; (2) the student is able to find and select the relevant scientific literature by making use of (online) databases; (3) the student is able to evaluate, interpret and compare different academic sources and to use these sources in a scientific paper; (4) the student is able to write a clear academic paper; (5) the student is able to evaluate the findings, strengths and limitations of a certain research line and is able to reflect on this. The learning outcomes of this course will be communicated to the students during the first lectures.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Seaports and Logistics Centers Operation		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Ludmiła Filina-Dawidowicz	**E-mail address to the person**	Ludmila.Filina@zut.edu.pl
Course code (if applicable)	WTMiT-2-17-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn basic concepts of seaports and logistics centres operation.		
Entry requirements	None.		
Course contents	Seaports classification, seaport’s main infrastructure and equipment. Characteristics of services provided in seaports. Phases of ship service in seaport. Seaports operating parameters. Logistics centres classification, its main infrastructure and equipment. Characteristics of services provided in logistics centres, comprehensive logistics service. Operating parameters of logistics centres. Seaports classification, seaport’s main infrastructure and equipment. Characteristics of services provided in seaports. Phases of ship service in seaport. Seaports operating parameters. Logistics centres classification, its main infrastructure and equipment. Characteristics of services provided in logistics centres, comprehensive logistics service. Operating parameters of logistics centres. Knowlege evaluation		
Assessment methods	Lectures. Exercises. Lectures: final exam. Exercises: continuous assessment of student’s work during the classes.		
Recommended readings	1. Namboothiri R., Drayage Operations at Seaports., VDM Verlag Dr. Mueller e.K., 2007 2. Song D.-W., Panavides P., Maritime Logistics: A Complete Guide to Effective Shipping and Port Management, Kogan Page Publishers, 2012		
Knowledge	The student has knowledge concerning the basis of seaports and logistics centers operation.		
Skills	The student will be able to make the assessment of seaports and logistics centers operational business activity.		
Other social competences	The student will be able to improve social and personal competences including self-awareness, self-management, social awareness, relationship skills and responsability on decision-making.		

Course title	Ship and Offshore Structures		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-18-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To supply the basic knowledge about design and building processes of conventional ship structures together with the knowledge of typical hull body configurations and structural details. The practical engineering aspects of this knowledge are presented in connection with modern software for design and construction.		
Entry requirements	CAD – Modelling and Drawings, Material Science, Mechanics, Material Strength.		
Course contents	Construction of selected ship types – general cargo ships, containerships, tankers – crude oil, chemical and gas tankers, passenger ships, high speed craft. Project evaluation. Ship types and size. General arrangement of ship. Main ship hull particulars. Body lines and coefficients, reference planes. International and national maritime organizations and institutions, classification societies. Rules and regulations, international conventions. Ship structural materials – steel, wood, aluminium alloys, reinforced plastics, concrete. Joining methods. Environment conditions and loads. Local and overall strength of a ship hull. Ship hull framing systems. Hull structure - structural components and selected outfitting elements: double bottom, sides, decks, bulkheads, fore and aft ends, main engine room including engine foundations, superstructures. Ship drawings and modelling – CAD/CAM systems and software. Ship construction - fabrication steps – lofting, ordering materials, cutting and forming, fabrication and erection, control of dimensions, launching, trials and preparation for delivery. Oil platforms: fixed platforms, compliant towers, semi-submersible platforms, jack-up platforms, drillships, floating production systems, tension-leg platforms, spar platforms, normally unmanned installations, conductor support systems. Elements of the oil/gas production process: wellheads, production manifold systems, production separators, glycol process to dry gas, gas compressors, water injection pumps, oil/gas export metering and main oil line pumps. Emergency support vessels. Evaluation of knowledge.		
Assessment methods	Lectures Project Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Baker R., Primer of Offshore Operations, PETEX, 1998 2. Lamb T., Ship Design and Construction. The Principles of Naval Architecture Series, The Society of Naval Architects and Marine Engineers, New York, N.Y., 2004		
Knowledge	On completion of the course successfully, students will be able to: (1) perform a preliminary structural design of a ship hull and oil platform; this includes demonstrating a basic understanding of the sources of structural loads, types and control of material stresses, primary and secondary structural failure modes, classification society rules, factors of safety, and materials selection; (2) apply basic hull girder analysis for the design of a ship structure, including calculations of vertical global hull girder bending loads, section modulus, and bending stresses; (3) apply basic concepts of shear stresses in ship and oil platform primary and tertiary structures, including shear flow and shear lag effects; (4) apply basic concepts for the bending of beams, plates, and stiffened panels as applied to a ship and oil platform structure; (5) apply basic concepts for the buckling of columns, plates, and stiffened panels as applied to a ship and oil platform structure.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Ship Design		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Monika Bortnowska	**E-mail address to the person**	Monika.Bortnowska@zut.edu.pl
Course code (if applicable)	WTMiT-2-19-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Be familiar with the concepts of ship design. Perform a preliminary ship design calculation, weight calculations. Perform preliminary design analysis of the ship (estimate the main dimensions, perform the hull form, check the buoyancy equation). Be familiar with relevant maritime regulations. Create the shape of the hull - Maxsurf Modeler program. Hull resistance calculation - Maxsurf Resistance program. Stability calculation - Maxsurf Stability program. Calculation of operating costs.		
Entry requirements	None.		
Course contents	Be familiar with the concepts of ship design. Perform a preliminary ship design calculation, weight calculations. Perform preliminary design analysis of the ship (estimate the main dimensions, perform the hull form, check the buoyancy equation). Be familiar with relevant maritime regulations. Create the shape of the hull - Maxsurf Modeler program Hull resistance calculation - Maxsurf Resistance program Stability calculation - Maxsurf Stability program Calculation of operating costs. Definition of various characteristics of ships, economics and design. Introduction to the process design, the spiral design, the design assumptions. Design methods, statistical and systematic design using similar ships and types ships. Estimate displacement, design the main dimensions. Modeling of the hull form, General arrangement design. Powering, Freeboard and tonnage calculations. National and international rules, stability, seakeeping in design.		
Assessment methods	Lectures. Project. Written exam.		
Recommended readings	1. H. Schneekluth, V. Bertram, Ship design for efficiency and economy, Second edition, Butterworth-Heinemann, Oxford, 1998, ISBN 0 7506 4133 9 2. International Conventions and Regulations of Classification Societies 3. E. C. Tupper, BSc, CEng, RCNC, FRINA, WhSch, Introduction to Naval Architecture, Fourth Edition, Elsevier Butterworth-Heinemann, Oxford, 2004, ISBN 0 7506 6554 8		
Knowledge	The student has knowledge of the types, construction features, safety and security of ships and related design and operational problems.		
Skills	The student is able to design a vessel along with its entire process, in accordance with the set specifications, taking into account the requirements of classification societies, standards and regulations and rules of good engineering practice. The student is able to make a preliminary economic analysis, ie.: assess the costs of construction and operation of floating objects; knows how to take into account the economic criterion in the design.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Ship Equipment		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Andrzej Banaszek	**E-mail address to the person**	Andrzej.Banaszek@zut.edu.pl
Course code (if applicable)	WTMiT-2-20-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The Learner after of learning process should be able to demonstrate of knowledgement refer to types of ship equipment mounted on board of ships, basic elements os structure of a/m systems, material, functions, maintenance, technical characteristics, procedures. Should be able to calculations of typical equipment, elements and to design of basic ship piping equipment comply with international regulations and rules		
Entry requirements	Basic mechanics, basic structural strength		
Course contents	Basic information, types of equipment, mounted on board of ships, basic procedures number and size of deck equipment mounted on ships, basic information about types of cargoes, pulley block systems, ropes, deck cranes, deck gantries, deck mooring and anchor winches, lashing system of containers, hatch covers, hydraulics and pneumatics on ships, cargo systems on tankers, horizontal loading systems, equipment of ro-ro and passenger ships, special equipment, rescue boats etc. Basic information, types of equipment, mounted on board of ships, basic procedures number and size of deck equipment mounted on ships, basic information about types of cargoes, pulley block systems, ropes, deck cranes, deck gantries, deck mooring and anchor winches, lashing system of containers, hatch covers, hydraulics and pneumatics on ships, cargo systems on tankers, horizontal loading systems, equipment of ro-ro and passenger ships, special equipment, rescue boats etc. Overview of ship equipment mounted on board ships build in Szczecin Shipyard Szczecinska		
Assessment methods	Lecture/Workshop Lectures. Exercises. Lecture-grade Workshop - continuous assessment Writing examination.		
Recommended readings	1. D.J. House, Seaman techniques, Heineman Newnes, Oxford, 1990, 1, OX2 8EJ 1990 ISBN 043491091 0 2. D.J. House, Seaman techniques, Heineman Newnes,, Oxford, 1990, 1, OX2 8EJ 1990 ISBN 0 434 90774		
Knowledge	The Learner after a completion of learning process should be able to demonstrate of knowledgement refer to basic informations to types of equipment, mounted on board of ships.		
Skills	The Learner should be able to calculations of deck equipment load during normal exploitation, design and calculation of basic elements of deck equipment with drive systems comply with requirements of Classification Societies.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Ship Hydraulics and Pneumatics		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Andrzej Banaszek	**E-mail address to the person**	Andrzej.Banaszek@zut.edu.pl
Course code (if applicable)	WTMiT-2-21-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	The Learner after of learning process should be able to demonstrate of knowledgement refer to types of systems systems mounted on board of ships, basic elements os structure of a/m systems, material, pumps, valves, flow characteristics, procedures. Should be able to calculations of main hydraulic systems, elements and to design of basic ship hydraulic systems comply with international regulations and rules		
Entry requirements	Basic mechanics, basic structural strength,		
Course contents	Basic information, types of hydraulic and pneumatic systems mounted on board of ships, basic elements of structure of hydraulic and pneumatic systems, procedures of hydraulic and pneumatic system calculations, hydraulic central loading system on product and chemical tankers. Basic information, types of hydraulic and pneumatic systems mounted on board of ships, basic elements of structure of hydraulic and pneumatic systems, procedures of hydraulic and pneumatic system calculations, hydraulic central loading system on product and chemical tankers. Overview of ship equipment mounted on board ships build in Szczecin Shipyard Szczecinska		
Assessment methods	Lectures. Projects. Writing examination.		
Recommended readings	1. J. Watton, Fundamentals of Fluid Power Control, Uni Press, Cambridge, 2009, 1, ISBN 10052176252		
Knowledge	The Learner after a completion of learning process should be able to demonstrate of knowledgement refer to basic informations to basic elements of structure of hydraulic and pneumatic systems, especially mounted on board of ships.		
Skills	The Learner after a completion of learning process should be able to recognize of procedures, and to calculations of a/m systems comply with requirements of Classification Societies.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Ship Hydrostatics and Stability		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Monika Bortnowska	**E-mail address to the person**	Monika.Bortnowska@zut.edu.pl
Course code (if applicable)	AAA	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	2	**Hours per semester**	30
Objectives of the course	To acquaint students with the basic theoretical issues of floating objects and its importance in their design. Ability to pose problems and solve them based on the laws of hydromechanics of floating objects.		
Entry requirements	Mathematics, Basic mechanics, Basic ocean engineering, Basic geometry		
Course contents	Preparation of a simplified drawing of the theoretical lines of hull. Based on a series of 60 ships calculating geometrical and hydrostatic parameters of the hull, development of hydrostatic curves. Calculation of metacentric height, righting lever GZ, GZ graph as a function of heeling angle. Tasks with buoyancy and stability. Based on ships of the 60 series, area, volume and moment computations using approximate formula (Simpson method), computation of ship hydrostatic particulars, hydrostatic curves, applications. Equilibrium of floating objects, metacentric height, computation of transversal metacentric height. Initial stability, stability at small and large angles, statical and cross curves of stability. Effect of grain cargo on stability, inclining experiment, dynamic stability, stability criteria. Knowledge evaluation		
Assessment methods	Lectures. Practical methods: practical exercises using typical audiovisual means Writting		
Recommended readings	1. Adrian Biran, Ship Hydrostatics and Stability, Butterworth-Heinemann, Great Britain, 2006 2. Bryan Barrass, D.R.Derrett, Ship Stability for Masters and Mates, Elsevier, sixt edition, Great Britain, 2006		
Knowledge	Student has basic knowledge of the theory of vessels, their hydrodynamic and operational properties.		
Skills	Student is able to critically assess the usefulness of the available methods and design tools used in ship construction and choose and apply the appropriate method.		
Other social competences	Ship Design WM-WTMiT_1-_??_K01 Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Ship Structural Mechanics		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Maciej Taczała	**E-mail address to the person**	Maciej.Taczala@zut.edu.pl
Course code (if applicable)	WTMiT-2-22-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Student will be able to understand and apply the finite element method for analysis of ship structural strength.		
Entry requirements	Fundamentals of mathematics Fundamentals of mechanics		
Course contents	Practical exercises. Thin plate theory, analytical solutions. Stiffened plates, structural orthotrophy, effective width of plating. Plate finite elements. Theory of torsion of thin-walled beams – open and closed cross-sections. Overall strength of ship hull – bending, shear, torsion, ultimate capacity. Local strength: framework, grid, shell models – assumptions and computational methods. Stability of structural elements; plates and stiffeners, buckling modes, methods of analysis. Modelling of structural elements in the finite element method. Hierarchic models of hull structures. Fatigue analysis of structural elements of ship hull.		
Assessment methods	Lecture. Exercises. Written or oral exam Observation of students		
Recommended readings	1. Hughes O.F., Ship Structural Design, The Society of Naval Architects and Marine Engineers, Jersey City, New Jersey, 1988 2. Bathe K.J., Finite element procedures, Prentice Hall, 1996		
Knowledge	Student will have the extended knowledge on the finite element method and structural response of ship hull members.		
Skills	Student will be able to perform analysis of strength of ship structures using the finite element computer code.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Ship Structural Optimization		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-23-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To learn basic concepts of optimization, capability of setting a task of optimising ship structural design, gain a capability of recommending an optimization method for the specific problem, using computer codes for solution of optimization problem as well as interpreting and discussing results.		
Entry requirements	Ship structure, linear algebra.		
Course contents	Practical exercises on ship structural optimization. Optimization of plates, beams, girders, stiffened panels, and ship hull structures. Evaluation of skills. Introduction: why optimization in ship structural design? Problems and methods of general optimization: basic ideas, general formulation of optimization problem, classification of optimization problems, general formulation of optimization algorithm, classification of optimization algorithms. Ship structural optimization: general formulation of ship structural optimization problem, features of ship structural optimization problems, approaches in ship structural optimization, methods of ship structural optimization. Optimization of plates. Optimization of beams. Optimization of girders. Optimization of stiffened panels. Optimization of ship hull structures. Single- and multi-objective optimization in ship structural design. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Project Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Birk, L., Harries, S. (Editors), Birk, OPTMISTIC – Optimization in Marine Design, In Proceedings of the 39th WEGEMT Summer School, Berlin, May 19th – 23nd., 2003 2. Hughes, O.F, Paik, J.K., Ship Structural Analysis and Design, The Society of Naval Architects and Marine Engineers, 2010, ISBN 978-0939773824		
Knowledge	On completion of the course successfully, students will be able to: (1) demonstrate knowledge and understanding of the basic ideas underlying optimization techniques for ship structural optimization; (2) demonstrate knowledge and understanding of some of the most common standard optimization models of ship structures and how they can be solved; (3) appreciate some of the power of using the mathematical approach to optimization problems relevant to ship structural design; (4) show logical thinking in ship structural optimization problem solving.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Strength of Materials		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Maciej Taczała	**E-mail address to the person**	Maciej.Taczala@zut.edu.pl
Course code (if applicable)	WTMiT-2-24-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Student will be able to understand and apply the analytical methods for evaluation of structural strength using simple models.		
Entry requirements	Mathematics, mechanics.		
Course contents	Practical exercises. Basic concepts of strength of materials. Experimental determination of mechanical properties of materials. Axial tension and compression, Hooke law, principle of superposition. Statically indeterminate trusses. Analysis of strain and stress. Generalized Hooke law. Axially-symmetrical thin-walled vessels. Shear calculation, bolt connections, welded connections. Moments of inertia of planar figures. Torsion of bars with circular cross-sections. Free torsion of bars with rectangular cross-sections. Bending: shear forces and bending moments diagrams, differential equation of deflection. 3D strain and stress, tensors of strain and stress Combined stress; strength hypotheses. Statically indeterminate beams. Elastic and elastic-plastic buckling of bars.		
Assessment methods	Lecture. Exercises. Written or oral exam. Observation of students.		
Recommended readings	1. Beer, F.P., E.R. Johnston, et al., Mechanics of Materials, McGraw-Hill, 2001 2. Den Hartog, Jacob P., Strength of Materials, Dover Publications, Inc.,, 1961		
Knowledge	Student will have the basic knowledge on strength of structural elements.		
Skills	Student will be able to understand and apply the analytical methods for evaluation of structural strength analysis for simple models.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Systems Engineering		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-27-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	Systems Engineering is a scientific way to understand the underlying structure and characteristics of systems and their complexities. This course will acquaint you with concept of systems and the role systems engineering plays in their development. It will also provide a basic framework for planning and assessing system development and how systems analysis methods and techniques are integrated within the systems engineering process.		
Entry requirements	Calculus methods.		
Course contents	The solution of practical problems related to issues discussed during lectures. Skills evaluation. Introduction: Systems thinking is a framework for solving problems based on the premise that a component part of an entity can best be understood in the context of its relationships with other components of the entity, rather than in isolation. The way to fully understand why a problem occurs and persists is to understand the “part” in relation to the “whole.” A focus of systems thinking is on understanding the linkages and interactions among the elements that compose the entirety. Describing the origins and characteristics of modern complex systems and systems engineering as a profession. Definition the “systems engineering viewpoint” and how it differs from the viewpoints of technical specialists and project managers. Describing the domain, fields, and approaches of the systems engineering discipline. Developing the hierarchical model of a complex system and the key building blocks from which it is constituted. Definition the breadth and depth of the knowledge domain of systems engineers in terms of the system hierarchy. Discussioan and analysis the the following concepts important in applying systems thinking: analysis, synthesis. Describing the concept of the systems engineering life cycle, which sets the framework for the evolution of a complex system from a perceived need to operation and disposal. Developing the key responsibilities of systems engineering in the corresponding phase of the life cycle. Describing the key parts that systems engineering plays in the management of system development projects. Definition the basic organization and the planning documents of a system development project, with a major emphasis on the management of project risks. System design keys discussion and analysis: (1) successfully understanding and defining the project objectives and operational concepts; (2) complete and thorough requirements traceability; (3) formulation clear and unambiguous requirements; (4) documentation all decisions made during the development of the original design concept in the technical data package; (5) the design solution verification. The systems engineer’s dilemma discussion and analysis. At each cost-effective solution: (1) to reduce cost at constant risk, performance must be reduced; (2) to reduce risk at constant cost, performance must be reduced; (3) to reduce cost at constant performance, higher risks must be accepted; (4) to reduce risk at constant performance, higher costs must be accepted. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Goldberg B.E., Everhart K., Stevens R., Babbitt III N., Clemens P., and Stout L, System Engineering “Toolbox” for Design-Oriented Engineers, National Aeronautics and Space Administration, Marshall Space Flight Center, Alabama, 1994 2. INCOSE, Systems Engineering Handbook, INCOSE-TP-2003-002-03, 2006		
Knowledge	Upon completion of this course, students will have the knowledge and skills to: (1) specify what constitutes a system; (2) undertake a systems engineering design process for a relatively complex system; (3) use a systems approach to complex problems, and to design and operational performance; (4) proficiently design engineering systems and/or processes in accordance with specified and agreed performance criteria; (5) understand the importance and relevance of sustainable practices and where they are most effectively applied in an engineered system; (6) understand the importance of the testing, validation and verification process from the very beginning of a systems engineering design process.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		

Course title	Technology of Ship and Offshore Structures		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Tomasz Urbański	**E-mail address to the person**	Tomasz.Urbanski@zut.edu.pl
Course code (if applicable)	WTMiT-2-28-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To be acquainted with fabrication technology of various types of ships and offshore structures.		
Entry requirements	Material Science. Mechanics. Ship and Offshore Structures.		
Course contents	Technological design of fabrication process of a chosen floating object. Classification of ships and offshore objects. Technology of fabrication of ships supporting offshore industry. Technology of fabrication of steel and concrete offshore installations (rigs, caissons, pontoons, wind mill towers). Innovative materials in shipbuilding, including sandwich type. Unconventional methods of launching. Principles of welding technology. Manufacturability of welds, manufacturability of large-scale and offshore structures. Welding-induced stresses and deformations, their impact on production, operation and safety of ships and offshore structures. Technology and exploitation criteria in design and building. Forming, fitting, outfitting. Tolerances in the building process. Measurements of imperfections, data mining. Technological design of fabrication process of a chosen floating object.		
Assessment methods	Lectures. Exercises Final test (lectures) Grade on the basis of value of the reports (exercises)		
Recommended readings	1. Gourd L. M., Principles of Welding Technology, The Welding Institute, London, 1995 2. Jenney C. L., O'Brien A., ed, Welding Science and Technology of Welding Handbook, American Welding Society, Miami, 2001		
Knowledge	Students should be able to prepare the technological procedures for ship and offshore structure production.		
Skills	Students should be able to construct the technological process for ship and offshore structure production, apply the knowledge to the different kind of ships and offshore structures, explain what is the best production process for selected ship and offshore structures.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Thesis Preparation		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-2-01-Z	**ECTS points**	3
Semester	winter/summer	**Language of instruction**	english
Hours per week	3	**Hours per semester**	45
Objectives of the course	Within the framework of the Thesis Preparation course, students will explore different ways of finding information, defining the scope of a project and doing research, as well as different ways of communicating the results. The course includes the stages of defining a topic and formulating a problem statement, selecting and reviewing relevant literature, designing an empirical study as well as performing it, including data collection and analysis, analysing the empirical data, make theoretical conclusions and finally writing and rewriting a written report.		
Entry requirements	Not specified.		
Course contents	The solution of practical problems related to issues discussed during lectures. Organization of the Thesis: (1) front page, (2) student's declaration on originality of the thesis; (3) dedication page (optional); (4) acknowledgement (optional); (5) vita (optional); (6) abstract; (7) table of contents; (8) list of tables (optional); (9) list of figures (optional); (10) list of symbols / abbreviations / notations / terminology (optional); (11) list of appendices; (12) introduction (relevance of the topic and the necessity for solution; practical and theoretical value of the topic; motives for choosing a particular topic; work aims and tasks; research object; research methods; an explanation of the work structure (brief overview of all parts, page, table and figure count); key literature used; work limitations and difficulties; plan of work and methodology; (13) assumptions and initial data; (14) theoretical section(s) (basic premises for the theoretical section; material sorting and the structure of the theoretical section; the requirements of the content for the theoretical section; preparation of theoretical model; the use and citation of the sources; highlighting the most important parts); (15) empirical (analytical) section (research methods, hypothesis, and data); (16) analysis, design, implementation and interpretation of results; (17) critical assessment of own work; (18) references / bibliography; (19) further Work; (20) summary & conclusion; (21) appendices (optional). Technical pointers for the final Master Thesis paper: text; citation in the text; quotations in the text; tables in the text; figures in the text. Copyright and plagiarism policy. Evaluation of knowedge.		
Assessment methods	Project Students will be expected to complete written tests, projects and homework assignments as specified by the teacher. Student attendance and participation in class sessions play a vital role in successful course completion.		
Recommended readings	1. Russel L. Ackoff, Scientific method: Optimizing Applied Research Decisions, John Wiley & Sons, New York, 1962		
Knowledge	To be abble to thesis preparation.		
Skills	Upon completion of this course, the student has achieved the following learning outcomes: (1) the student has access to and insight in (the diversity and boundaries of) the discipline of communication professionals; (2) the student is able to find and select the relevant professional literature by making use of (online) databases; (3) the student is able to evaluate, interpret and compare different academic sources and to use these sources in a project paper; (4) the student is able to write a clear project paper; (5) the student is able to evaluate the findings, strengths and limitations of a certain project line and is able to reflect on this. The learning outcomes of this course will be communicated to the students during the first lectures.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others.		

Course title	Transport Infrastructure		
Level of course	second cycle		
Teaching method	lecturing course / lecture		
Person responsible for the course	Ludmiła Filina-Dawidowicz	**E-mail address to the person**	Ludmila.Filina@zut.edu.pl
Course code (if applicable)	aaaaaa	**ECTS points**	6
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To offer deep insight to infrastructure of different transport modes. To learn basic element of point and linear infrastructure. To foster critical thinking regarding infrastructure development.		
Entry requirements	None.		
Course contents	Technical and operational characteristics of the linear and point infrastructure. Road transport infrastructure: roads, parkings. Railway transport infrastructure: railway tracks, stations, electric traction. Maritime transport and inland navigation infrastructure: ports, waterways. Air transport infrastructure: air corridors, airports. Trans-European transport network. Selected infrastructure development trends and strategies. Technical and operational characteristics of the linear and point infrastructure. Road transport infrastructure: roads, parkings. Railway transport infrastructure: railway tracks, stations, electric traction. Maritime transport and inland navigation infrastructure: ports, waterways. Air transport infrastructure: air corridors, airports. Trans-European transport network. Selected infrastructure development trends and strategies. Knowlege evaluation		
Assessment methods	Lectures. Exercises. Lectures: final exam. Exercises: continuous assessment of student’s work during the classes.		
Recommended readings	1. Fabbro, S. (Ed.), Mega Transport Infrastructure Planning. European Corridors in Local-Regional Perspective, Springer, 2015 2. Drewello H., Scholl B. (Eds.), Integrated Spatial and Transport Infrastructure Development. The Case of the European North-South Corridor Rotterdam-Genoa, Springer, 2016 3. Muddle D., Rail Transport Infrastructure, Dolans Publishing, 2016		
Knowledge	The student will be able to get konwlege on basic elements forming transport infrastructure.		
Skills	The student will be able to apply knowledge to different transport modes, make critial analysis of infrastructure functioning.		
Other social competences	The student will be able to improve social and personal competences including self-awareness, self-management, social awareness, relationship skills and responsability on decision-making.		

Course title	Unconventional Energy Sources		
Level of course	second cycle		
Teaching method	laboratory course / lecture		
Person responsible for the course	Wojciech Zeńczak	**E-mail address to the person**	Wojciech.Zenczak@zut.edu.pl
Course code (if applicable)	WTMiT-2-30-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To be acquainted with application of unconventional energy sources in engineering practice. Familiar with the use of unconventional energy sources		
Entry requirements	None. Basic thermodynamic, basic mechanics		
Course contents	Classification of energy sources. World’s fossil fuel reserves. Ecological aspects of energy use. Hydroelectricity. Tidal Energy. Tidal and oceans streams energy. Wave energy. Ocean thermal energy. Geothermal energy. Wind energy. Solar thermal energy. Solar photovoltaic. Energy from biomass. Biofuel. Hydrogen technology. Fuelcell. Application of unconventional energy sources on ships. Practical exercises on the topics of the lecture Classification of energy sources. World’s fossil fuel reserves. Ecological aspects of energy use. Hydroelectricity. Tidal Energy. Tidal and oceans streams energy. Wave energy. Ocean thermal energy. Geothermal energy. Wind energy. Solar thermal energy. Solar photovoltaic. Energy from biomass. Biofuel. Hydrogen technology. Fuelcell. Application of unconventional energy sources on ships.		
Assessment methods	Lectures. Exercises. Lecture Written exam. Test		
Recommended readings	1. Larmine J., Dicks.A, Fuel cell Systems Explained, John Wiley&Sons Ltd., chichester, London, New York, Toronto, 2000, 1 2. F. Barbir, PEM Fuel Cells. Theory and Practice, Elsevier, MAsterdam, Bostom, Heodelberg, London, Oxford, New York, 2005, 1 3. Boyle Godfrey, Renewable Energy, Oxford University Press, Oxford, 2004, 1 4. Gasch R., Twele, Wind Power Plants, Solarpraxis AG, Berlin, 2002, 1		
Knowledge	On successful completion of this course the learner will be able to demonstrate fundamental knowledge of the unconventional energy sources.		
Skills	On successful completion of this course the learner will be able to Analyze and solve simple engineering problems involving unconventional energy sources; Use technology effectively in the delivery of instruction, assessment, and professional development.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making.		

Course title	Watercraft		
Level of course	second cycle		
Teaching method	project course / lecture		
Person responsible for the course	Zbigniew Sekulski	**E-mail address to the person**	Zbigniew.Sekulski@zut.edu.pl
Course code (if applicable)	WTMiT-1-33-L	**ECTS points**	6.0
Semester	winter/summer	**Language of instruction**	english
Hours per week	4	**Hours per semester**	60
Objectives of the course	To give basic knowledge related to inland water as well as seagoing transport vessels.		
Entry requirements	Structural materials, mechanics.		
Course contents	The solution of design problems related to issues discussed during lectures. Skills evaluation. Nomenclature and definitions related to the waterborne transport and ships. Rules and conventions. Types of ships. Inland and coastal boats. Seagoing commercial vessels. Special purpose vessels. Elements of naval architecture: components of the waterborne vessels in general, propulsion systems, steering systems, holds, compartments, superstructure, superstructure, equipment. Design considerations of ships: hydrostatics, buoyancy, hydrodynamics, manoeuvrability. Form coefficients of the ship hull (block coefficient, midship coefficient, and waterplane coefficient) and ratios of the principal dimensions (length to beam, L/B, beam to draft B/T, and draft to depth, T/D) and their impact on the operational features of the ship (payload, power, speed, fuel consumption, exhaust, income, costs). Ship hull framing systems: longitudinal, transversal, mixed; advances, disadvantages. Main structural components. Lifecycle: design construction, repair and conversion, end of service. Ship pollution: oil spills, ballast water, exhaust emissions. Evaluation of knowledge.		
Assessment methods	Lectures Exercises Student attendance and participation in class sessions play a vital role in successful course completion. Students will be expected to complete written tests, projects and homework assignments as specified by the teacher.		
Recommended readings	1. Babicz J., Encyclopedia of Ship Knowledge, Baobab Naval Consultancy, Gdańsk, 2007 2. Bertram V., Schneekluth H., Ship Design for Efficiency and Economy, Butterworth-Heinemann, 1998		
Knowledge	On completion of the course successfully, students will be able to: (1) review the ship – its functions, features and types, (2) discuss ship stresses and shipbuilding materials, (3) identify common features and terminology of a ship hull, (4) discuss the dimension and evolution of shape, (5) discuss line plan, (6) explain Archimedes law of buoyancy and flotation and displacement and weight relationship, (7) identify and discuss underwater hull coefficients, (6) discuss intact and damage stability, (8) discuss trim, (9) identify and discuss strength, shear forces, bending moments, and longitudinal strength, (10) analyze motion in a seaway, (11) identify propeller and engine, (12) identify major structural items, (13) identify major outfit elements and systems, (14) discuss organisations and regulations.		
Skills	The ability to use the acquired knowledge to solve practical problems.		
Other social competences	Improvement of social and personal competencies including self-awareness, self-management, social awareness, relationship skills, responsible decision-making and others. Encouraging dialogue and mutual respect between peoples of different nations, cultures and faiths.		