Reviewed and adopted by the Programme Board 28.02.2018

Course catalogue

National Joint PhD Programme in Nautical Operations (PH-NAUT)

Maritime HTO (Human-Technology-Organisation) and Innovation

Name	**Maritime HTOI (Human-Technology-Organisation and Innovation)**
Course code	MFA-8010
Semester	Autumn and Spring, the duration of the course is one full academic year.
Scope	10 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT).
Relevance in the PH-NAUT Programme	The course gives state-of-the-art knowledge of the maritime industry with particular focus on human, technology, organization and innovation in the maritime domain.
Type of course	Human Factors/ Technical/ Organisational This course is compulsory for PhD students enrolled in the PH-NAUT Programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the ones responsible for the course.
Responsible	Ph.d.-leader USN (USN-module) Ph.d.-leader HVL (HVL-module) Ph.d.-leader UiT (UiT-module) Ph.d.-leader NTNU (NTNU-module) The deputy leader of the programme board for PH-NAUT holds overall responsibility for the course.
Content	The course includes present and future maritime trends and challenges within the following dimensions; **Human**

	• The human element in the maritime domain. • Trends and future challenges for the maritime human individual. **Technology** • Definitions and applications of maritime technologies. • Technological development and future trends in the maritime domain. **Organisation** • Organisational structure in the maritime domain. • Trends and future challenges for maritime organisations. **Innovation** • Innovation and new business models in the maritime domain. • Drivers and barriers for radical innovation in the maritime domain. **Individual Project** • The student will be given a final assignment to write a manuscript based on the module topics covered in the course and connected to their own PhD project.
Learning outcomes	**Knowledge** The candidate: • has advanced knowledge of the HTO dimension in the maritime domain, • has advanced knowledge of innovation and new business models, • can evaluate the related challenges and opportunities of HTO and innovation in the maritime domain. **Skill** The candidate can: • handle complex academic issues involving requirements for HTO and innovation in the maritime domain, • propose, carry out and evaluate maritime research projects of a high international standard in accordance with HTO and innovation requirements, • critically examine the maritime HTO and innovation issues in order to identify the related viability and limitations. **Competence** The candidate can: • identify and understand the limitations and possibilities of maritime HTO and innovation, • describe and manage the complex relationship between maritime HTO and innovation, • develop and carry out new research projects in the international maritime domain, • communicate new knowledge of maritime research and development projects.

Teaching format and coursework requirements	The course consists of 4 condensed modules organised as seminars/workshops containing pre-course assignments, presentation and discussion of pre-assignments, lectures, workshop/group-work, laboratory exercises, industry presentations/visits. The 4 modules are held at the 4 cooperating institutions which have designed the course: the University of South-Eastern Norway (campus Borre), the Western Norway University of Applied Sciences (campus Haugesund), the Norwegian University of Science and Technology (campus Ålesund) and UiT The Arctic University of Norway (campus Tromsø). Each module is taught over 2-3 full-time workdays in a row. The preparation instructions and the programme will be sent at the latest two weeks before each module. All modules are mandatory, but up to 20% absence from the entire course is accepted.
Examination and assessment	The student will be given a final assignment to write a manuscript based on the module topics covered in the course and connected to their own PhD project. The assignment will be graded as 'Passed' or 'Not Passed'. *Instructions for the final assignment* Write a manuscript of 4-6000 words excluding references (Word count must be given), applying contents covered in the Maritime HTO-course to your own research project. The manuscript must be equivalent to an academic article in its depth and quality, and should be critical and reflective in nature. The manuscript shall have the following structure: 1) Introduction, describing the Ph.D. project (max 450 words). 2) Four main sections, connecting the four main course dimensions, the human element, organization, innovation and technology to the project through presentation and discussion. 3) Conclusion, summing up the result of the main sections (max 450 words). For each main section, the curriculum for each module shall be used. The student is expected to find additional research articles for references to support the link between the dimensions and the student's project topic. In each section, the distribution between the HTO course curriculum and additional references is expected to be about 50/50. If the student finds one or more of the dimensions not to be relevant for the Ph.d. project, the student has to argue why. Technical manuscript specifications: font: Arial, font size: 12, single space. Word count.
Re-sit exam	In the event the final assignment receives the grade 'Not Passed', a re-sit exam will be offered. The student will then have to re-write the final assignment, correcting the issues pointed out by the external evaluators. The student will also have to write a separate short note

	explaining how and where each point raised by the evaluators has been addressed in the revised version of the final assignment.
Prerequisites for participation and recommended prior knowledge	Relevant master`s degree.
Syllabus	To be announced at the start of each semester.
Teaching and examination language	English
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this. The one responsible for each module will conduct evaluations after their module, compile the results in a report and send it to the students up to 2 weeks after the module. The PhD coordinator will conduct an annual evaluation of the whole course.
Approval date/last update	Approval date: 21.02.2019. Last update: 09.11.2018.

Maritime Technologies in Polar Waters

Name	**Maritime Technologies in Polar Waters**
Course code	MFA-8030
Semester	Autumn
Scope	10 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	
Type of course	The course is a technical joint course between UiT and Tokyo University of Marine Science and Technology. The course will be given as a condensed course with participants from both universities. This course is an elective course for students enrolled in the PH-NAUT programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the ones responsible for the course.
Responsible	Egil Pedersen Etsuro Shimizu
Content	The course contains the following core parts: Winterization in cold areas, de-icing technology, marine icing theory, advanced navigation systems. **Winterization in cold areas and de-icing technology** • Safety regulations. • Automation and technology. • Anti-icing and de-icing. **Marine icing theory** • Threats connected to icing on ships, in particular sea-spray icing.

	• Different ship-icing prediction models and methodologies, their limitations and feasibility for safety planning. • Key environmental parameters connected to icing. • Uncertainties related to weather parameters applied into the icing models. • Information about large scale weather patterns as e.g. polar lows. **Advanced navigation systems** • Remote monitoring/control system and its related technology. • Control technology for ship. • Data analysis and optimization. • Ship weather routing.
Learning outcomes	**Knowledge** The student: • has advanced knowledge on de-icing systems on ships operating in Polar waters and the threats connected to icing on ships, in particular sea-spray icing • can evaluate technical limitations in de-icing systems with respect to available power and load, • can evaluate limitations in de-icing systems with respect to meteorological and icing conditions, • can contribute to ship-icing prediction models and methodologies, their limitations and feasibility for safety planning, • has advanced knowledge of the key environmental parameters connected to icing and how to obtain information about these parameters, • can evaluate and asses the uncertainties related to weather parameters applied into the icing models, • has advanced knowledge of how information about large scale weather patterns obtained by predictions from ensemble prediction systems can be applied for planning, • is in the forefront of knowledge of state-of-the-art technologies used in the maritime segment of operations in Polar waters, • has a thorough knowledge of the key environmental factors affecting the performance of maritime operations in the Polar regions, • can evaluate the application of data analysis and optimization related to ship operation, • has advanced knowledge of control engineering related to ship operation. **Skills** The student: • can handle and ensure the safety on board by assessing the technical limitations in de-icing systems • can handle limitations in icing models and weather parameters applied into the models, • can formulate plans to ensure the safety of navigation based on weather information related to icing,

	• can analyse and deal critically with basic heat flux calculations applied in icing models, • has state-of-the-art knowledge of the limitations in control engineering for ship operation, • can formulate suitable courses etc. for ship operations (weather routing). **Competence** The student can: • manage complex situations based on knowledge about the capabilities of the de-icing systems to ensure the safety on board • handle complex situations which involves how accumulated ice limits the operation of a vessel • manage and plan safe trips in areas where icing is a possible risk factor by utilizing necessary weather information • make manage complex navigational situations based on knowledge about the capabilities of control engineering, • participate in scientific discussions in international forums related to maritime technologies in Polar waters.
Teaching format and coursework requirements	Lectures are concentrated in a span of two weeks and include group-work, self-studies, and colloquium. Compulsory exercises must be approved. (They will be specified at the beginning of the semester.) An attendance of minimum 80% is required.
Examination and assessment	Scientific report and oral exam. The scientific report and oral exam count 50% each in the final grading. Letter grading A – F, where F is failed. Students enrolled in the National Joint PhD Programme in Nautical Operations (PH-NAUT) will have to get a grade of A or B for this course in order for it to be accepted as part of their PhD degree´s coursework component.
Re-sit exam	None.
Prerequisites for participation and recommended prior knowledge	A Master's Degree in Nautical Science, Maritime/Marine Technology, or equivalent qualifications. Mathematics and physics as for a master's degree in engineering.
Syllabus	Kalnay, E. Historical overview of numerical weather prediction. In Atmospheric Modeling, Data Assimilation and Predictability, chapter 1, pages 1-31. Cambridge University Press, 2003. Leutbecher, M. and Palmer, T. N. Ensemble forecasting. Journal of Computational Physics, 227(7):3515-3539, 2008 Løset, S., Shkinek, K. N., Gudmestad, O. T., and Høyland, K. V. Actions from ice on arctic offshore and coastal structures, chapter 6 Icing in the Ocean, pages 191{206. LAN, St. Petersburg, 2006. Student's Books for Institutes of Higher Education. Special Literature. Lozowski, E. P., Szilder, K., and Makkonen, L. Computer simulation of marine ice accretion. Philosophical Transactions of the Royal Society of

	London. Series A: Mathematical, Physical and Engineering Sciences, 358 (1776):2811-2845, 2000. Makkonen, L., Brown, R. D., and Mitten, P. T. Comments on "Prediction of vessel icing for near-freezing sea temperatures". Weather and Forecasting, 6:565-567, 1991. Mertins, H. O. Icing on shing vessels due to spray. Marine Observer, 38(221):128-130, 1968. Overland, J. E., Pease, C. H., Preisendorfer, R. W., and Comiskey, A. L. Prediction of vessel icing. Journal of Climate and Applied Meteorology, 25(12). Samuelsen, E. M., Løset, S., and Edvardsen, K. Marine icing observed on KV Nordkapp during a cold air outbreak with a developing polar low in the Barents Sea. In Proceedings of the 23rd International Conference on Port and Ocean Engineering under Arctic Conditions, number 87, pages 1{14, Norwegian University of Science and Technology, Trondheim, 2015. Samuelsen, E. M. Ship-icing prediction methods applied in operational weather forecasting (in progress). Weather and Forecasting, 2017. Samuelsen, E. M., Edvardsen, K., and Graversen, R. G. Modelled and observed sea-spray icing in Arctic-Norwegian waters. Cold Regions Science and Technolgy (submitted, September 2016), 2016. Shellard, H. C. The meteorological aspects of ice accretion on ships. Technical Report 10, World Meteorological Organization, 1974. Marine Science Aairs Report. Zakrzewski, W. P. Splashing a ship with collision-generated spray. Cold Regions Science and Technology, 14(1): 65. Syllabus related to advanced navigation systems is to be announced at the beginning of the semester.
Teaching and examination language	English
Overlapping	70% overlap with TEK-3030 Maritime Technologies in Polar Waters.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
Approval date/last update	28.02.2018

Advanced Maritime Operations

Name	**Advanced Maritime Operations** 
Course code	MFA-8020
Semester	Autumn
Scope	5 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course gives insight into the operational characteristics of navigation, manoeuvring and the underlying technology that enables nautical operations.
Type of course	Technical. This course is an elective course for students enrolled in the PH-NAUT programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the one responsible for the course.
Responsible	Egil Pedersen
Content	**Introduction** • The ocean environment • Operational challenges with emphasis on Polar waters **Environmental loads** • Kinematics and dynamics of ocean waves • Wave, current, wind and ice loads on vessels **Dynamic motions and manoeuvring of vessels** **Environmental criteria** • Weather window • Weather forecasting **Advanced collision avoidance** **Weather routing in the Arctic** • Optimisation criteria Methods of solution
Learning outcomes	**Knowledge** The candidate shall:

	• have a thorough understanding of nautical operations with emphasis on how the environment is affecting the operations, • have a thorough understanding of the key environmental factors affecting the performance of nautical operations, • understand the hydrodynamics on a theoretical basis for operations in the surface zone, • be able to determine the operational window based on weather conditions, • have an overview of operational challenges, • have thorough knowledge of how nautical operations can be modelled and simulated. **Skills** The candidates shall be able to: • handle appropriate SW tools to perform static and dynamic analyses of nautical operations, • handle limitations in modelling and simulation of nautical operations, • formulate and evaluate solutions for planning of effective operations, • carry out research to acquire new and more advanced knowledge related to work tasks and operations within the marine field. **Competence** • The candidate is able to work in multidisciplinary project teams of nautical operations. • He/she has can manage and lead multidisciplinary teams in research projects on nautical operations. The candidate can contribute to debates regarding relevant nautical operations in international forums.
Teaching format and coursework requirements	Lectures, group-work, self-studies. A number of compulsory exercises must be approved. (They will be specified at the beginning of the semester). An attendance of minimum 80% is required.
Examination and assessment	The exam is comprised of 1) the submission of a project report with relevance to the theme of the seminar, and 2) a final oral examination. Letter grading A – F, where F is failed. Students enrolled in the National Joint PhD Programme in Nautical Operations (PH-NAUT) will have to get a grade of A or B for this course in order for it to be accepted as part of their PhD degree´s coursework component.
Re-sit exam	None. Students with valid grounds for absence will be offered a postponed examination.
Prerequisites for participation and recommended prior knowledge	Technical master`s degree.
Syllabus	Selected chapters from: Faltinsen, O. M. (1990). *Sea Loads on Ships and Offshore Structures*, Cambridge University Press.

	Selected sections from: Weintrit, A. and Neumann, T. (2011). *Methods and Algorithms in Navigation*, CRC Press, Taylor & Francis Group. Pedersen, E. et al. (2003). *Simulator Studies on a Collision Avoidance Display that Facilitates Efficient and Precise Assessment of Evasive Manoeuvres in Congested Waterways*. J. Navigation, The Royal Institute of Navigation, Cambridge Journals.
Teaching and examination language	English.
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
Approval date/last update	28.02.2018

Maritime Measurement Science

Name	**Maritime Measurement Science** 
Course code	MFA-8040
Semester	Spring
Scope	5 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course gives insight in measurement science and the application of measurement of physical properties of relevance to maritime operations.
Type of course	**Technical.** The course is elective for students enrolled in the PH-NAUT Programme. Other PhD students enrolled in Norwegian/European PhD programmes and the required prerequisites can also take it as a stand-alone course. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the one responsible for the course.
Responsible	Peter Wide
Content	The aim of this course is to provide the student with an understanding of data collected by sensors, other information and merged with human experience. The course consists of the following elements: • introduction to measurement science. • understanding the principles of physical measurement science in maritime applications • use of the measurement system performance • human perception in measurement • the interaction between artificial systems and human perception • how to build a measurement system • selected topics in data science • case projects
Learning outcomes	**Knowledge** The candidate will be able to: • explain the definitions and concepts of measurement principles in computer-based data collection, analysis and visualization.

	• understand principles and methods used in maritime applications involving physical and/or human systems/ perception, • explain some of the available standard equipment and SI units. • have an overview of the performance in sensor data, systems and perception. **Skills** The candidate will be able to: • understand and make use of existing knowledge, theories of measurement science and applications in real situations, • understand the performance of measurement systems, • adopt the principles of using sensor based systems and human perception when identifying and sensing a physical phenomenon, • identify suitable approaches and methods for designing measurement tasks in maritime operations. • understand limitations and benefits in human-operated systems **Competence** The candidate will be able to: • apply measurement systems in maritime operations and use the computer to make automatic measurement, analyses and presentations, • reflect on their professional practice, work in groups and multidisciplinary teams, write articles and reports, and make presentations, • contribute to safer maritime operations by understanding the use of relevant data in maritime operations.
Teaching format and coursework requirements	The course will consist of 2 concentrated weeks of work during the semester at UiT. preliminary week 4 and 18. Lectures, written reports and presentations, laboratory activities and scientific reading of articles, books etc. A number of compulsory exercises must be approved. (They will be specified at the beginning of the semester). Attendance at the concentrated work weeks is required as well as the case projects.
Examination and assessment	The exam is comprised of the submission of a scientific report based on the candidates own topic of research that supplements his/her doctoral thesis. The course will be graded as 'Passed'/'Not Passed'.
Re-sit exam	None. Candidates with valid grounds for absence will be offered the opportunity to take a postponed examination.
Prerequisites for participation and recommended prior knowledge	The course is aimed specifically for PhD-students. The students are expected to have passed the MFA-8010 course "Maritime HTO (Human-Technology-Organisation)" or a similar course in maritime technology, and measurement science as well as MATLAB.
Syllabus	To be announced at the beginning of the semester.

Teaching and examination language	English
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
Approval date/ Last update	28.02.2018 (approval date)/ 15.01.2018 (last update)

Task analysis in maritime socio-technical systems

Name	**Task Analysis in maritime socio-technical systems** HSN University College of Southeast Norway
Course code	PN-TA9000
Semester	Autumn 2017
Scope	5 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course provides methods to decompose and analyse human work and the performance of socio-technical systems.
Type of course	Human Factors/Social science methods This course is an elective course for students enrolled in the PH-NAUT programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the one responsible for the course.
Responsible	Kjell Ivar Øvergård
Content	There are multiple approaches to human factors; however, the one method common to all human factors practitioners and researchers is the task analysis. Focus on the task is the backbone for all human factors and the task analysis is the key method. Task analysis is widely used in a number of domains, including the process control and power generation industries, military applications, civil aviation and the maritime industry. Task analysis has been adapted for use in many human factors applications including training, engineering, design and risk analysis. Topics include: • Human factors research methods considerations such as validity and reliability matters, and consideration about the use of quantitative and qualitative methods. • The history of task analysis and the in-depth theoretical foundation of task analysis including some of the critics against decomposition of tasks. • The most recent published research on task analysis relevant for maritime human factors. • In-depth teaching and practical exercises in the procedures of two types of task analysis: hierarchical task analysis (HTA) and cognitive task analysis (CTA).

	Applications of task analysis in accident investigation and engineering and related methods that build on task analysis such as human error identification (HEI) and human reliability assessment (HRA).
Learning outcomes	**Knowledge** The candidate: •has advanced knowledge of the methodological issues for task analysis, •can evaluate the suitability of the application of hierarchical task analysis and cognitive task analysis, •has advanced knowledge of the state-of-the-art knowledge on task analysis relevant for maritime human factors, •has advanced knowledge of the limitations in decomposing and analysing a nautical operation. **Skill** The candidate shall be able to: • plan, and carry out a task analysis for a maritime task involving a sociotechnical system, • formulate solutions for the planning of effective nautical operations based upon task analyses. **Competence** The candidate shall be able to: • manage complex human factors research challenges and carry out research work of high international standard, • communicate research and participate in debates in the field in international maritime and human factors forums.
Teaching format and coursework requirements	The course will consist of a condensed session comprised of 4-5 full workdays of lectures, group and individual work on assignments, laboratory exercises, self-studies and discussions at the University College of Southeast Norway. A minimum of 80% attendance is required.
Examination and assessment	After the course session, the course participants (PhD candidates) are expected to solve and submit homework assignments. Write a research paper with relevance to the theme of the seminar based on your own research project. Grading will be `Passed` or `Not Passed`. Students enrolled in the National Joint PhD Programme in Nautical Operations (PH-NAUT) will have to get a grade of A or B for this course in order for it to be accepted as part of their PhD degree´s learning component.
Re-sit exam	None. Students with valid grounds for absence will be offered a postponed examination.
Prerequisites for participation and recommended prior knowledge	
Syllabus	
Teaching and examination language	English

Overlapping	
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
Approval date/last update	28.02.2018 (approval date)/ 08.03.2018 (last update)

Decision Making and Performance Assessment

Name	Decision Making and Performance Assessment HSN University College of Southeast Norway
Course code	PN-DM9000
Semester	Spring 2018 (week 9)
Scope	5 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course gives an understanding on how to make unbiased consistent judgments based on multiple pieces of evidence and how to apply this to the evaluation of dynamic work performance in nautical operations.
Type of course	Technical This course is an elective course for students enrolled in the PH-NAUT programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the one responsible for the course. Maximum number of participants – 20. Priority criteria: Home institution/PH-NAUT/External
Responsible	Salman Nazir
Content	Introduction • The dynamic nature of organization and socio-technical systems • Behavioural approaches to decision-making and performance assessment (biasness, subjectivity, objectivity) • Perspectives on decision making (rational decision making, satisficing, bounded rationality naturalistic decision making) Criteria for Performance Assessment and Decision Making • Complexity of modern systems • How complexity of organization and decisions impact the cognitive capabilities • Commonalities among Decision Making and Performance Assessment • Existing theories for defining evaluation criteria

	Models and methods
	• Models and mathematics behind performance assessment and multi-criteria decision making
	• Analytical Hierarch Process
	• Understanding decision making in situ
	  o Rational Choice, satisfying & muddling through
	  o Naturalistic Decision Making/ Recognition Primed Decision/Applied Cognitive Task Analysis
	• Cognitive control and complexity
	  o Cognitive Systems
	  o Contextual Control Model
	  o Extended Contextual Control Model
	
	Training and Performance Assessment
	• Training methods
	• Training Evaluation, performance indices, matrices, and pairwise comparison
	• Impact of Training on Decision making
	
	Applications in Maritime domain
	-Individual case study of one maritime case
	Discussion and presentation of case studies

Learning outcomes	Knowledge The student shall: • To discuss the nature of qualitative decision-making. • To provide rationale for developing and using a systematic and structured approach for qualitative decision making and performance assessment • To identify and explain the fundamental steps in qualitative and quantitative decision making and performance assessment. • To provide a method for structuring each step of the decision making process and performance assessment • To understand the training needs as per the performance requirements Skills The students shall be able to: • Learn various mathematical tools used for Decision Making and Performance assessment: • Analytical Hierarch Process • Learn techniques for analysing decision making in socio-technical systems • Apply one or more methods to a specific case to critically assess decision making/performance in the maritime domain Competence • The student will be able to understand the dynamic nature of organization, especially maritime organization, the decisions making and performance assessment methodology among

	these organization. In addition, learn the tools, which can enable unbiased decision-making and performance assessment. • The final report will enable the students to structure their learnt outcomes in an academic manner
Teaching format and coursework requirements	Intensive workshops/seminars with lectures, group-work and self-studies condensed into 5 modules/days. A number of compulsory exercises must be approved. (They will be specified at the beginning of the semester.) A minimum of 80% attendance is required
Examination and assessment	Report reflecting the implementation of contents covered in the course. The course participants are expected to solve and submit a homework assignment based upon their own research problem. The paper will be graded 'Passed' or 'Not Passed'.
Re-sit exam	None. Students with valid grounds for absence will be offered a postponed examination.
Prerequisites for participation and recommended prior knowledge	The participants are expected to have a basic knowledge in *decision making and Performance assessment*. The course is aimed specifically at PhD students, but the course is also recommended for industrial operators and engineering scientists. University staff and final year M.Sc. students are welcome as well.
Syllabus	To be announced at the beginning of the semester.
Teaching and examination language	English
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this. Course evaluation/feedback in the middle of course will be conducted.
Approval date/last update	28.02.2018 (approval date) /06.12.2017 (last update)

Maritime Logistics and Port Operation Management

Name	**Maritime Logistics and Port Operation Management** University College of Southeast Norway
Course code	PN-ML9000
Semester	Autumn
Scope	5 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course gives a state-of-the-art insight into Maritime Logistics and Port Operation Management.
Type of course	Organisational. This course is an elective course for students enrolled in the PH-NAUT programme. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision.
Responsible	Kenn Steger-Jensen
Content	The aim of the course is to provide the participants with a toolbox of theoretical knowledge, experimental insight, and competencies in tools, methods and models for analyses and synthesis that can be applied in the participants´ own projects. This PhD course will concentrate on theory and practice related to Maritime Logistics and Port Operation Management problems. The course is covering the following topics: **Topics include:** • Maritime Logistics • Value & Supply Chain management, Structure and Networks • Operation/Seaport Operation/Terminal Operation Management • Inventory Management • Tools for optimisation • Performance and Decision Making • Planning and Control Systems • Simulation and Emulation • Sustainability and Green Maritime Logistics and Port Operation Innovation
Learning outcomes	**Knowledge** The candidate: • has advanced knowledge within Maritime Logistics and Port Operation Management and masters the field´s philosophy of science,

	• can understand the common and distinguishing capabilities of different Maritime Logistics and Port Operations, • can contribute to the development of new knowledge, new theories, methods, interpretations and forms of documentation in Maritime Logistics and Port Operation Management, • can understand the factors affecting the performance of Maritime Logistics and Port Operation systems, • can understand the requirement of Innovation, Sustainability and Green in Maritime Logistics and Port Operation systems. **Skills** The candidate: • can formulate problems, plan and carry out research in Maritime Logistics and Port Operations, • can apply different descriptive and normative approaches for analyses and synthesis Maritime Logistics and Port Operation systems, • can carry out research of a high international standard within Maritime Logistics and Port Operation Management, • can handle complex academic issues and challenge established knowledge and practice in within Maritime Logistics and Port Operation Management, • can describe and explain how Maritime Logistics and Port Operation strategy helps drive competitiveness in terms of cost efficiency, quality, delivery responsiveness, and flexibility, • can describe and explain the use of control and coordination technologies in the Maritime Logistics and Port Operations, • can evaluate and apply different methods and models in Maritime Logistics and Port Operation Management.
Teaching format and coursework requirements	The course will consist of two condensed sessions comprised of 2 x 2 full workdays of lectures, work on assignments, laboratory exercises, and discussions at the University College of Southeast Norway. Between the sessions the student will work with or on the given homework assignment**s** as part of the student Ph.D project. After the course session, the course participants are expected to solve and submit homework assignment**s**. 80% attendance at workshops/seminars is required as well as solving and submitting homework assignments.
Examination and assessment	The basis for examination is the finalised homework assignment. The course will be graded as 'Passed'/'Not Passed'.
Re-sit exam	None. Students with valid grounds for absence will be offered a postponed examination.
Prerequisites for participation and recommended prior knowledge	The participants are expected to have a basic knowledge in *Maritime Logistics and Port Operation Management*. The course is aimed specifically at PhD students, but the course is also recommended for scientists university staff.

Syllabus	Bichou, K. (2016). Port Operations, Planning and Logistics (Lloyd's Practical Shipping Guides) 2nd Edition, , ISBN-13: 978-1616310240 Song, D.-W. & Panayides, P. M. (eds.)(2015) Maritime Logistics: A Guide to Contemporary Shipping and Port Management Second Edition by, ISBN-13: 978-0749472689 Cariou, P. (2011). Is slow steaming a sustainable means of reducing CO 2 emissions from container shipping?. *Transportation Research Part D: Transport and Environment*, *16*(3), 260-264. Corbett, J. J., Wang, H., & Winebrake, J. J. (2009). The effectiveness and costs of speed reductions on emissions from international shipping. *Transportation Research Part D: Transport and Environment,* 14(8), 593-598. Frémont, A., 2009. Shipping lines and logistics. Transport Reviews 29(4), 537-554. Hjelle, H. M. (2010). Short Sea Shipping's Green Label at Risk. *Transport Reviews,* 1(5), 617-640. Johnson, H., Johansson, M., Andersson, K. & Södahl, B. (2013). Will the ship energy efficiency management plan reduce CO_2 emissions? A comparison with ISO 50001 and the ISM code, *Maritime Policy & Management,* 40(2), 177-190. Notteboom, T. E. & Rodrigue, J.-P. (2008). Containerisation, box logistics and global supply chains: The integration of ports and liner shipping networks, *Maritime Economics & Logistics,* 10(1), 152-174. Panayides, P. M. and Song, D.-W., 2013. Maritime logistics as an emerging discipline. Maritime Policy & Management 40(3), 295-308. Styhre, L. (2009). Strategies for capacity utilisation in short sea shipping.*Maritime Economics & Logistics*, *11*(4), 418-437.
Teaching and examination language	English.
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
Approval date/last update	28.02.2018 (approval date)/15.11.2017 (last update)

Maritime Organisational Safety Management

Name	**Maritime organisational safety management** Western Norway University of Applied Sciences
Course code	PNO-902
Semester	Autumn 2018, 9-10 October
Scope	5 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course gives insight into the organisation of safety management in maritime operations.
Type of course	Organisational/ social sciences. This course is an elective course for students enrolled in the PH-NAUT programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the one responsible for the course. If no PhD students enrolled in the PH-NAUT programme sign up for this course, the course will be cancelled. The maximum number of participants is 10. PhD students enrolled in the PH-NAUT Programme will be given priority.
Responsible	Helle A. Oltedal
Content	**Introduction** *Maritime organisational safety management* will give you a thorough understanding of contemporary maritime safety and its management. It provides varying viewpoints on traditional safety topics in conjunction with critical discussions of the international safety management code and its application. The course also offers new perspectives on maritime safety such as ship and equipment design for safety and the relevance of safety management systems, in particular the application of the International Safety Management code to remote controlled or autonomous ships.

Learning outcomes	**The candidate will be able to:** **Knowledge** •have mastery of the most widely used accident causation and prevention theories, •evaluate how safety may be managed in maritime operations, •have a thorough understanding of key elements that influence the effectiveness of safety management processes. **Skills** •evaluate research designs that can investigate maritime safety management, •evaluate safety hazards in maritime operations, •understand the limitations of the use of safety management, •mitigate risks in nautical operations, •carry out research on organisational learning, •propose and evaluate research designs related to accident causation and prevention, •carry out research on the relationship between organisational, strategic and operational activities. **Competence** •identify safety hazards in maritime operations. •manage the dynamic nature of safety and risk in maritime operations. •critically examine causal arguments involving accident causation and prevention theories.
Teaching format and coursework requirements	The course consists of one condensed classroom session/seminar lasting two full workdays and comprising lectures, group-work on assignments, and discussions. The seminar is held at the Western Norway University of Applied Sciences at campus Haugesund. 100% attendance at the seminar is compulsory.
Examination and assessment	The course participants are expected to write a paper of 10-50 pages related to their own research problem. The paper will be graded as 'Passed'/'Not Passed'.
Re-sit exam	None. Students with valid grounds for absence will be offered a postponed examination.
Prerequisites for participation	Open for students enrolled in a PhD programme. For others, the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis.
Syllabus	Oltedal, H.A. and Lutzhoft, M. (red). (2018), *Managing Maritime Safety*. Routledge In addition, a selection of scientific papers will be announced at the start of each semester.

Teaching and examination language	English.
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
Approval date/last update	28.02.2018 (approval date)/27.11.2017 (last update)

Maritime Fire Safety and Evacuation

Name	**Maritime fire safety and evacuation** Western Norway University of Applied Sciences
Course code	PNO-901
Semester	Spring
Scope	5 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course gives insight into technical fire safety systems and the psychological processes in an evacuation incident.
Type of course	Organisational/ Technical. This course is an elective course for students enrolled in the PH-NAUT programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the ones responsible for the course.
Responsible	Xiaoqin Hu
Content	Upon completing this PhD course, the student will be able to identify, recognise and evaluate fire safety systems in a maritime context. The student will also be able understand, use and evaluate evacuation models including human psychological and physiological responses to fire, evacuation model assumptions and the capabilities and limitations of evacuation modelling software. The course will build upon state of the art fire safety theories and practice seen in relation to international maritime safety legislation and requirements.
Learning outcomes	**Knowledge** The candidate shall: • have a thorough understanding of methodological issues related to psychological and physiological responses to fire, • have a thorough understanding of evacuation from fire, • have a thorough understanding of evacuation model assumptions and the capabilities and limitations of evacuation modelling software, • have a thorough understanding of fire safety systems,

	• have a thorough understanding of international and national fire safety regulation for the maritime industries. **Skills** The candidate shall be able to: • formulate research problems and perform scholarly research on fire safety and evaluation in maritime operation, • carry out research on fire evacuation in the maritime domain, • understand, use and evaluate evacuation models, • plan, perform and report research related to fire safety systems used in maritime operations. **Competence** The candidate shall be able to: • participate in debates on the field of fire safety and evaluation in international forums. • discuss and evaluate research within fire safety and evacuation. • communicate evacuation research related to maritime operations in recognised international channels.
Teaching format and coursework requirements	The course consists of two intensive seminars lasting two full workdays each, containing lectures, self-studies, group-work on assignments, laboratory exercises and discussions at the Western Norway University of Applied Sciences. Assignments will be given between seminars. 80% attendance at workshops/seminars is required as well as solving and submitting homework assignments.
Examination and assessment	Students write a scientific report reflecting the implementation of contents covered in the course in their own research project. The course participants are expected to solve and submit a homework assignment based on their own research problem. The paper will be graded as 'Passed'/'Not Passed'.
Re-sit exam	None. Students with valid grounds for absence will be offered a postponed examination.
Prerequisites for participation and recommended prior knowledge	Technical master`s degree.
Syllabus	Selected chapters from SFPE handbook 5th Ed. on Evacuation, Human Behavior in Fire and Fire Safety Systems. Journal articles to be announced at the start of each semester.
Teaching and examination language	English.
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
maximum number of study places	Maximum 5 study places available for the students enrolled in the PH-NAUT programme

Approval date/last update	28.02.2018 (approval date)/15.01.2018 (last update)

Maritime Systems Design and Methods

Name	**Maritime Systems Design and Methods** NTNU Norwegian University of Science and Technology
Course code	TS-8001
Semester	Spring (the duration of the course is one full academic semester)
Scope	10 ECTS
Programme offering the course	National Joint PhD Programme in Nautical Operations (PH-NAUT)
Relevance in the PH-NAUT Programme	The course gives insight into the design and methods of maritime systems, with particular focus on state of art literature, principles of maritime design, main methods and analysis of systems, systems of systems and subsystems, as well as a prime on decision-making exemplified by real industry case studies.
Type of course	Design Theory Applied to Maritime Engineering This course is an elective course for students enrolled in the PH-NAUT programme. Other PhD students enrolled in Norwegian/European PhD programmes can also take it as a stand-alone course. If the student is not enrolled in any PhD Programme and wants to take this course as a stand-alone course, then the prerequisite for enrollment is a completed relevant Master´s degree with a weighted grade average of B or higher for both the degree and the Master´s thesis. If less than 3 students sign up for the course, the course will be given in the form of individual supervision by the ones responsible for the course.
Responsible	Henrique M. Gaspar
Content	The course presents state-of-the-art knowledge on the maritime industry. **Principles of Marine Design** • Design for the Blue Ocean Environment • Design of Human Engineered Complex Structures • General concepts of Maritime Systems • From Mission to Operation (Form/Function) at Sea **Overview of Maritime Systems** • Offshore Units (Platform) • Ships • Subsea Structures • Wind and energy • Complex Equipment (crane, winch, tanks, plant) • Common and specific points (Form/Function) **Methods and Analysis** • Basic Design Methods (interactive process) • Systems Mission – Performance – Economics Assessment

	• Maritime Systems of Systems (e.g. fleet) and Subsystems (e.g equipment/propulsion/control) Analysis and Performance **Decision Making Methods** • Stakeholder Preferences and Perceptions • Ranking and Quantifying • Design Trade-offs • Identifying Design Strength and Weakness • Industry Case Studies
Learning outcomes	**Knowledge** The candidate should acquire knowledge in: • Principles of maritime design, with the human component in the form/function basic design process. • Overview of the big and complex structures that are used to explore the blue ocean environment. • Introduction and training on the main literature methods used to design, analyse and evaluate maritime systems. • Introduction to decision-making theory and common techniques used to rank and quantify designs. **Skills** At the end of the course the candidate should be able to: • Identify the main engineered maritime systems. • Understand the mission and performance concept in these systems. • Be acquainted with state of the art literature used to design and analysis such systems. • Create a concept design of such structures, with preliminary requirements, analyses and evaluation. **Competence** • Understanding the mapping between Form/Function of a maritime design problem. • Converging these basic design problems to a specific research question within maritime design. • Filter state-of-the-art literature of methods and analyses to specific problems of their research. • Identify these methods in real maritime systems, applying them to solve a specific problem from their research. • Use mission-performance-economics methods to quantify and evaluate her/his specific problem in design.
Teaching format and coursework requirements	The course will consist of lectures, literature reading, work on assignments, exercises, and discussions. The teaching is given as intensive seminars containing lectures, group-work and self-studies. A minimum of 80% attendance at workshops/seminars is required. Presentation must be given.
Examination and assessment	The student will write a review paper reflecting the implementation of contents covered in the course in the student`s individual

	research project. The paper must be equivalent in size and depth of an academic article following academic standards for publications. The course participants are also expected to solve and submit a number of homework assignments based on their own research problem during the classes. The homework assignments and paper will be graded as 'Passed'/'Not Passed'.
Re-sit exam	None. Students with valid grounds for absence will be offered a postponed examination.
Prerequisites for participation and recommended prior knowledge	MSc or equivalent in such areas as engineering, management, maritime technology, nautical science, maritime operations management.
Syllabus	To be announced at the start of each semester.
Teaching and examination language	English.
Overlapping	No overlap.
Quality assurance of the course	The course is evaluated in accordance with the Programme guidelines and plans for this.
Approval date/last update	28.02.2018 (approval date)/ 26.01.2018 (last update)