Program overview

29-Apr-2021 12:06

Year	**2020/2021**
Organization	**Mechanical, Maritime and Materials Engineering**
Education	**Master Mechanical Engineering**

Code	Omschrijving	ECTS	p1 p2 p3 p4 p5
ME-MME Track Multi-Machine Engineering			
ME-MME Obligatory Courses (29 ECTS)			
ME44101	Dynamics and Interaction of Material and Equipment	4	
ME44105	Structural Design with FEM	4	
ME44110	Integration Project Multi-Machine Systems	5	
ME44200	Operations and Maintenance	3	
ME44206	Quantitative Methods for Logistics	5	
ME44300	Multi-Machine Coordination for Logistics	3	
ME44305	System Analysis and Simulation	5	
ME-MME Elective Courses			
ME44115	Discrete Element Method (DEM) simulation	4	
ME44125	Reliability and Maintenance of Transport Equipment	3	
ME44311	Advanced Operations and Production Management	5	
ME44312	Machine Learning for Transport and Multi-Machine Systems	3	
MT44000	Mechatronics in MT	5	
ME-MME Graduation Project Obligatory (45 ECTS)			
ME54010-20	ME-MME Literature Research	10	
ME54035	ME-MME MSc Thesis	35	
ME-MME Electives: Select 1 out of 2 (15 ECTS)			
ME54015	ME-MME Research Assignment	15	
TUD4040	Joint Interdisciplinary Project	15	

Year	**2020/2021**
Organization	**Mechanical, Maritime and Materials Engineering**
Education	**Master Mechanical Engineering**

ME-MME Track Multi-Machine Engineering	
Responsible Program Employee	Ir. M.B. Duinkerken
Contact for students	If you have questions regarding this track, contact the coordinator: Ir. Mark Duinkerken E-mail: m.b.duinkerken@tudelft.nl Tel: +31 (0)15 27 81790 (82889 secretary)
Program Coordinator	Ir. Mark Duinkerken T +31 15 278 1790 E M.B.Duinkerken@tudelft.nl
Introduction 1	Society faces tremendous challenges to meet demands on efficiency, sustainability, and safety of complex processes. In the logistics and production domain Multi-Machine Engineering address these challenges with an integrated perspective that combines core (mechanical systems) design with real-time operation and distributed machine-machine interactions. In the track MME you develop the skills necessary to design such integrated multi-machine systems, combining science-based methodologies, with state-of-the-art tools, and hands-on lab and industrial case experience.
Exit Qualifications	The exit qualifications for the master Mechanical Engineering can be found in the common section of this studyguide. For the track Multi-Machine Engineering, the specific exit qualifications are: 1. Competent in the scientific discipline Mechanical Engineering A graduate in Mechanical Engineering Multi-Machine Engineering is able to analyse and explain the characteristics and mechanical behaviour of material during transport and storage analyse and model different types of transport equipment and transport facilities analyse and model the logistics of complex transport systems and networks 3. Competent in designing A graduate in Mechanical Engineering Multi-Machine Engineering is able to model the dynamics of the interaction between equipment and materials design, control and automate transport equipment and facilities develop, monitor and control components for transport and logistic systems and networks 7. Considering the temporal and social context A graduate in Mechanical Engineering Multi-Machine Engineering is able to explain the importance of transport systems and logistics in society
Program Structure 1	First year: Obligatory courses for all ME masters: 17 ECTS Compulsory courses for the track MME : 29 ECTS Elective courses (including ethics): 14 ECTS Second year: Literature Assignment: 10 ECTS Research Assignment: 15 ECTS MSc master project: 35 ECTS

Year	**2020/2021**
Organization	**Mechanical, Maritime and Materials Engineering**
Education	**Master Mechanical Engineering**

ME-MME Obligatory Courses (29 ECTS)

ME44101	Dynamics and Interaction of Material and Equipment	4
Responsible Instructor	Dr.ir. Y. Pang	
Responsible Instructor	Dr.ir. D.L. Schott	
Co-responsible for assignments	E.F.L. Stok	
Contact Hours / Week x/x/x/x	4/0/0/0	
Education Period	1	
Start Education	1	
Exam Period	1 2	
Course Language	English	
Required for	ME44115	
Course Contents	This course focuses on modelling and designing machine-cargo interactions and using those interactions to conceptually design equipment taking into account the transport demands and logistics processes. The course starts with the logistic context with emphasis on (bulk and container) terminal level, for which the functionality of equipment types will be addressed with regard to the cargo type (dry bulk, container, piece goods) and its characteristics. Specific equipment types will be discussed, analysed and designed, such as a belt conveying systems used for bulk materials (e.g. iron ore and coal) as well as for baggage and parcel handling. The interaction between cargo and equipment will be explicitly taken into account. Specifically for the bulk solid cargo type, an experimental assignment to determine the properties of a particular bulk solid material is part of the course. Bulk solid materials include granular materials such as coal, sand, limestone, iron ore, grain. These materials can be free flowing through bunkers and chutes as well as stored in silos, handled by stackers and reclaimers or transported by conveyors. With the experimentally determined properties conceptual design of a silo and belt conveyor will be undertaken. State-of-the-art particle based simulation with Discrete Element Method (DEM) will be introduced. The parameters, algorithms, and applications will be addressed, as well as the procedure for validation of DEM simulations to obtain realistic bulk material behaviour in a virtual environment. It will be shown how DEM has led to new breakthroughs and developments in the field of port handling equipment.	
Study Goals	In general, the student will be able to: explain the functionalities of continuous and discontinuous transport equipment and facilities analyze processes and equipment determining key design parameters design transport systems and involved equipment according to logistic requirements More specifically, the student will be able to: Cargo and material characterization and behaviour Describe and explain the fundamental difference between a fluid and particulate material. Describe and explain relevant material characteristics for handling systems, and choose appropriate test setup to obtain material (behaviour) characteristics and machine cargo interaction characteristics in a specific application. Experimentally determine different mechanical properties of a particular bulk solid material, and relate the material properties to each other and perform calculations Explain the different principles behind mixing, segregation with bulk materials Equipment level Explain the design procedure, incl requirements and choices for the design of equipment (e.g. baggage handling system, belt conveyor, silo, chutes, feeders) Design equipment on headlines (using test results and supported by calculations) Describe the advantages/disadvantages of different equipment and describe the physical working principles. Determine the equipment design suitable for a given situation, supported with calculations. Describe typical/characteristic/maximum values for equipment (e.g. belt speed, width, max angles, etc.) Interaction Material and Equipment Explain the material characteristics and interaction parameters relevant for material behaviour in interaction with equipment Recognize and motivate weak points in a given material handling configuration and propose solutions to overcome those. Discrete Element Method (particle based simulation method) Explain the theory and algorithm used for DEM calculations Describe and explain the input parameters (particle level, simulation level) and their possible effects on the output (bulk behaviour, erratic behaviour)	
Education Method	Lectures, including guest lectures from industry experts. Practical for testing and characterising bulk solid materials and it's material equipment interaction properties by experiments.	
Course Relations	ME44115 DEM simulations	
Literature and Study Materials	Schulze, D., Powders and Bulk Solids - Behavior, Characterization, Storage and Flow, Springer, 2008 ISBN 978-3-540-73767-4 (print), 978-3-540-73768-1 (online), DOI: 10.1007/978-3-540-73768-1 http://www.springerlink.com/content/l55416/?p=fbeb6748815f4e4c92f56519a15f8837&pi=0 Rhodes, M., Introduction to Particle Technology by Martin Rhodes, John Wiley & Sons, 2008. ISBN 978-0-470-01427-1 (print), 9780470727102 (online), DOI: 10.1002/9780470727102 http://www3.interscience.wiley.com/cgi-bin/bookhome/117932420?CRETRY=1&SRETRY=0 Slides and supplementary material provided during lectures	
Assessment	Because of measures resulting from COVID-19, the prescribed assessment will be as follows: 1. practical assignment - remote (25% of the mark) 2. written exam - remote open book with several fraud prevention measures (75% of the mark) If the opportunity arises for examinations on campus, the method of assessment will be: 1. practical assignment (25% of the mark) 2. written exam - closed book (75% of the mark). The final mark can be obtained only if both the practical assignment and written exam are passed with a 6 or higher.	
Enrolment / Application	Please enroll yourself as soon as possible. It helps us to schedule and setup enrollment for practical (in pairs or threesomes)	

Remarks	MSc ME track Multi Machine Engineering MSc TIL Engineering specialisation
Percentage of Design	20%
Design Content	Conceptual design of material handling equipment considering cargo characteristics and interaction parameters between cargo and equipment Dynamics of Material and Equipment Interaction
Department	3mE Department Maritime & Transport Technology

ME44105	**Structural Design with FEM**	**4**
Responsible Instructor	Ir. W. van den Bos	
Instructor	X. Jiang	
Contact Hours / Week x/x/x/x	0/6/0/0	
Education Period	2	
Start Education	2	
Exam Period	2 3	
Course Language	English	
Expected prior knowledge	basic mechanical engineering knowledge is expected. Experience with FEA programs is not required.	
Summary	Design a ship-shore crane according to Dutch design Standards. And check and verify the structural integrity with the use of a finite element model. For complete information see brightspace!	
Course Contents	Design a ship-shore crane according to the Dutch Standards (NEN 2017 to 2023) and control your design with the use of a finite element model (Femap and SDC Verifier) For special groups as the "FORMULA STUDENT Design Team" alternative designs can be the subject of this course for detailed description and or examples see brightspace . This course is a continuation of the original course wb3416 Design with FEM.	
Study Goals	The general objective of this course is to apply the finite element method in a proper way to design and evaluate the structural strength and durability of transport equipment as a crane. After the course the student is able to: 1. use the Finite Element method as a Design Tool 2. To understand the fundamental basis of FEM including the underlining linear and non-linear theory 3. To develop a reasonable FEM model and Judge the FEM results correctly 4. design according to standards 5. understand the structural failure mechanisms, buckling, plate buckling, crippling, fatigue and static overload (yielding) and how these failure modes influence the checks implemented in design standards	
Education Method	weekly 2 hours theory lectures and 4 hours computer room time to work on the assignment.	
Assessment	The assessment consists of two parts- practical part and theoretical part. The practical part will be assessed through an oral exam of 1/2 hour on the final structural design report. The report contains the complete description of the structural design, the design specification and the translation of these specification into loads the design, and the final result of the FEA calculation. The FEA results should prove that the crane is structural save by complying with the design standard to be used. The theoretical part will be assessed based on a written exam. Because of measures resulting from COVID-19, the written exam will be online type of examination- Remote open book with several fraud prevention measures. If the opportunity arises for examinations on campus, the method of assessment will be a written exam on campus (closed book). Detail information will be announced on Bright space in due time. The practical part and the theoretical part account for 75% and 25% of final grade respectively. Both parts are compulsory so as to complete the course and obtain the final grade.	
Percentage of Design	50 % or more	
Design Content	Make a structural Design of a ship to shore crane.	
Department	3mE Department Maritime & Transport Technology	

ME44110	Integration Project Multi-Machine Systems	5
Responsible Instructor	Ir. W. van den Bos	
Instructor	Dr. J. Jovanova	
Contact Hours / Week x/x/x/x	0/0/2/2	
Education Period	3 4	
Start Education	3	
Exam Period	4	
Course Language	English	
Course Contents	The course Integration Project Multi-Machine Systems brings together the skills students develop throughout their studies. The students groups work together to develop designs of specific port equipment (ex: cranes; autonomous vehicles) and complex multi-machine systems (ex: floating terminals, bulk material terminals). Students are encouraged to use acquired knowledge in their previous studies and apply it to solve real engineering problems. They need to make multiple decisions in the design process and justify it based on their previous knowledge and experience. The students are expected to raise their technical confidence and learn how to combine the skills gained from other courses to design complex multi-machine systems. A graduate in Mechanical Engineering MME track is able to model the dynamics of the interaction between equipment and materials design, control and automate transport equipment and facilities develop, monitor and control components for transport and logistic systems and networks. This course Integration Project Multi-Machine Systems brings them a step closer to a real working scenario. Exit qualification Competent in designing. A graduate in Mechanical Engineering MME track is able to model the dynamics of the interaction between equipment and materials design, control and automate transport equipment and facilities develop, monitor and control components for transport and logistic systems and networks. The course Integration Project Multi-Machine Systems teaches to students of how to apply their knowledge in design of complex systems. The course is in Q3 and Q4 (the second semester) so the students are expected to already have high level of accumulated knowledge. As the course is project based, groups of students (6 -7) work on different tasks within a project. This allows for students from different entry levels to work together and support each other in the process. Another exit qualification is considering the temporal and social context. In this course the importance of transport systems and logistics in society is stressed as well as designs that are safer, more efficient and sustainable.	
Study Goals	The learning goals are: LO1: Review on design principles for multi-machines. LO2: Apply different design conceptual approaches (unit level, system level, integration level). LO3: Use standards for equipment design. LO4: Asses and recommend system integration (market availability, custom designs) LO5: Design a project for multi-machine system	
Assessment	Report	
Department	3mE Department Maritime & Transport Technology	

ME44200	Operations and Maintenance	3
Responsible Instructor	Dr.ir. Y. Pang	
Instructor	Dr. V. Reppa	
Contact Hours / Week x/x/x/x	0/0/2/0	
Education Period	3	
Start Education	3	
Exam Period	3	
Course Language	English	
Course Contents	This course focuses on intelligent control to optimize the operational performance and to maintain the reliability of multi-machine systems in large-scale transport and logistics domain. Along with the understanding of diverse transport systems and logistic processes, including the dynamic interactions of the equipment and facilities involved, the control for multi-machine systems contains two folds, the integrated control for efficient operations and the intelligent decision-making for reliability control. To ensure efficient and reliable operations at both equipment level and system level, technologies and methodologies of automated data acquisition, remote communication, intelligent data analysis and integrated operational decision-making will be studied. Condition-based maintenance of systems and equipment will be analyzed and discussed in combination with on-line techniques for monitoring the health of the sensors used for maintenance. During the course industrial case studies will be given to present the state-of-the-art development and foreseen challenges. The course is concluded by practical assignments where such intelligent control systems will be researched and conceptually designed.	
Study Goals	to understand the complexity of the operations and interactions of multi-machine systems; to identify the properties that determine efficient operation and reliable performance; to understand the concept of intelligent control for operational support systems and advanced maintenance strategies; to analyze and model the interactions and operational processes of multiple equipment and facilities; to design intelligent control system in term of mathematical models and integrated control methods; to apply the methodologies of assessing the efficiency and reliability of both individual machine and overall multi-machine system; to understand the basic concepts of on-line fault diagnosis with respect to detection, isolation and identification; to design the methods for sensor fault detection and isolating multiple sensor faults.	
Education Method	Lectures (2 hours per week), case study, practical assignments	
Literature and Study Materials	Handouts and references to relevant literature and media. To be indicated during lectures and available via Brightspace. Expected prior knowledge: ME44101	
Assessment	Group assignment: Report & Oral Exam.(*) In case of a grade less than 6, the group can have one opportunity to improve the design of the same assignment towards a maximum retake grade of 6. (*) After a successful delivery of the group assignment report, the Oral Exam will be a presentation and defense on campus. In case of unforeseen circumstances or measures resulting from COVID-19, the prescribed Oral Exam will be a presentation and defense online.	
Department	3mE Department Maritime & Transport Technology	

ME44206	Quantitative Methods for Logistics	5
Responsible Instructor	Dr. B. Atasoy	
Instructor	Ir. M.B. Duinkerken	
Contact Hours / Week x/x/x/x	2/2/0/0	
Education Period	1 2	
Start Education	1	
Exam Period	2 3	
Course Language	English	
Course Contents	The course contains of two parts; roughly 7 weeks each. In the first part of the course an introduction to basic operations research techniques will be presented: - linear programming (simplex, duality etc.) - integer programming (IP, BIP, MILP etc.) - basic probability and statistics; brief overview of models to deal with uncertainty This part of the course will be largely be based on the first chapters of the book by Hillier and Liebermann. During the first quarter students must complete a practical assignment using Python together with Gurobi as a solver. In the second part of the course several common quantitative methods for transportation and logistics are presented. - queueing theory: overview of basic models and results. - networks and routing: network flow problem, facility location problems, transportation problem, transshipment problem, vehicle routing problem and other standard problems; standard algorithms i.e. the branch and bound method. During the second quarter students must complete a practical assignment on a case study with a transportation network again using Python.	
Study Goals	At the end of this course the students will be able to: - Explain the importance and use of operations research techniques to analyze and improve systems (i.e. queuing, simulation, forecasting, routing, scheduling) - Formulate mathematical models of real-life problems (e.g., resource allocation, production planning, transportation) with operations research techniques - Verify and validate mathematical models - Evaluate operation research techniques based on strengths and weaknesses (in terms of accuracy and efficiency) for improving real-life problems - Apply basic operation research techniques to small scale problems as well as realistic case studies	
Education Method	The students are expected to be prepared by studying the online material that is indicated every week. Lectures in two parts: First 45 min course content, Second 45 min assignment Course content includes a short intro and exercises related to the subject. Assignment part will be dedicated to introduction of the software (Python+Gurobi), introduction of the assignments and any further needed assistance and feedback. It is strongly recommended to bring a laptop to the lectures. There will be also additional reading material that will be provided during the course.	
Books	Hillier & Lieberman. Introduction to Operations Research. 10th Edition, McGraw-Hill, ISBN 9781259253188 The book can be bought at https://www.studystore.nl/	
Assessment	Practical Q1 - 25% (Python implementation and report) Practical Q2 - 25% (Python implementation and report) Exam Q2 - 50%. (In case of measures resulting from COVID-19, the prescribed assessment will be an online examination. If the opportunity arises for examinations on campus, the method of assessment will be on campus.	
Remarks	TIL-students: please be aware that there is an overlap in content between CIE4835 (elective T&P 3.1) and ME44205 (compulsory TIL). You are only allowed to choose one of the courses in your degree program	
Department	3mE Department Maritime & Transport Technology	

ME44300	Multi-Machine Coordination for Logistics	3
Responsible Instructor	Dr. V. Reppa	
Instructor	Prof.dr. R.R. Negenborn	
Contact Hours / Week x/x/x/x	0/0/0/2	
Education Period	4	
Start Education	4	
Exam Period	4	
Course Language	English	
Course Contents	In this course students will get familiar with automatic control techniques and their benefits and applications for real-time coordination of actions of large-scale transport systems. Theoretical concepts mostly related to model predictive control are discussed, as well as their application to real-world transport systems. Illustrative examples of large-scale systems include among others intermodal / synchromodal (i.e. road, waterborne, rail) transport networks. The operation of these networks relies on the interoperability of various machines such as cargo ships, trains, road tracks, automated guided vehicles, quay/yard cranes and many more.	
Study Goals	Students are able to: LO1. apply system theory to describe large-scale machines and transport systems LO2. explain the design of an automatically controlled system and of the automatic coordination of several controlled systems LO3. explain the design of control architectures for large-scale interconnected machines and transport systems (centralized, distributed, single-agent, multi-agent, single-level, multi-level) LO4. evaluate the pros and cons of different control architectures and their impact on multi-machine coordination for transport LO5. design an optimal control strategy for a single machine used in the transport network (truck, ship, crane, etc) LO6. develop a multi-agent framework based on model predictive control for real-time logistics of large-scale transport systems	
Education Method	Study material will be provided to support the lectures during which new concepts will be discussed and explained. Small groups of students will be created to conduct a project that will help them to develop deeper understanding of the theoretical (optimal) control and coordination concepts applied to a specific machine that is part of a larger transport network. Throughout the course there are also exercise sessions for understanding and implementing different the theoretical concepts.	
Course Relations	The course is related to the exit qualifications 1.b, 1.c, 3.b, 3.c and 7.a of the track MME of the Master Programme Mechanical Engineering, and to the specialization Engineering of the Master Programme Transport, Infrastructure and Logistics. Prior knowledge in automation of transport systems, optimization and simulation is recommended.	
Literature and Study Materials	We will discuss chapters from the book "Intelligent Infrastructures", Negenborn et al., Springer, Dordrecht, The Netherlands, 2010. ISBN: 978-90-481-3597-4. Additional handouts and references to relevant scientific literature and media will also be provided.	
Assessment	Assessment will be based on a written group project report (50%) and on a written (individual) exam (50%). In principle, the written exam will take place on campus. In case of unforeseen circumstances or measures resulting from COVID-19, the on campus exam may be replaced by an online multiple-choice exam.	
Tags	Information & Communication Modelling Optimalisation Project Transport & Logistics	
Department	3mE Department Maritime & Transport Technology	
Contact	Dr. Vasso Reppa (v.reppa@tudelft.nl)	

ME44305	System Analysis and Simulation	5
Responsible Instructor	Ir. M.B. Duinkerken	
Instructor	Dr. F. Schulte	
Contact Hours / Week x/x/x/x	0/0/2/2	
Education Period	3 4	
Start Education	3	
Exam Period	4	
Course Language	English	
Required for	Transport Engineering & Logistics Multi-Machine Engineering	
Expected prior knowledge	Basic programming	
Parts	Systems and Data Analysis Discrecte-Event and Agent-Based Simulation	
Course Contents	The course is an introduction to "Problem Engineering"; how to formulate a well-defined problem in a complex situation. The course introduces a systems approach to define the elements and structure of a problem situation and the process approach of discrete simulation to understand and quantify the time-dependent relations (behavior)	
Study Goals	- Structure complex industrial problem situations into conceptual models - differentiate between steady state and innovation - differentiate between control and excution - describe behaviour in a process-oriented way - experiment with and interpret results of simulation runs	
Education Method	lectures + group assignments	
Computer Use	Windows laptop with Python	
Literature and Study Materials	"The Delft Systems Approach, Analysis and Design of Industrial Systems", 2008, H.P.M.Veeke, J.A.Ottjes,G. Lodewijks, Springer, ISBN 978-1-84800-176-3 Lecture notes	
Assessment	Report of group assignment	
Exam Hours	80 for assignment	
Tags	Abstract Broad Challenging Design Industry Logics Modelling Process Programming Programming concepts Prototyping Stochastics Transport & Logistics	
Percentage of Design	50%	
Design Content	Logistic systems	
Department	3mE Department Maritime & Transport Technology	

Year	**2020/2021**
Organization	**Mechanical, Maritime and Materials Engineering**
Education	**Master Mechanical Engineering**

ME-MME Elective Courses

ME44115	Discrete Element Method (DEM) simulation	4
Responsible Instructor	Dr.ir. D.L. Schott	
Instructor	J. Moon	
Instructor	Y. Yan	
Instructor	M.P. Fransen	
Instructor	M. Mohajeri	
Instructor	R.N. Roeplal	
Contact Hours / Week x/x/x/x	0/0/4/0	
Education Period	3	
Start Education	3	
Exam Period	3	
Course Language	English	
Expected prior knowledge	ME44101 or ME44100	
Course Contents	This hands on course teaches the use of particle based simulations using Discrete Element Method (DEM). DEM can be applied to any system that handles or consists out of (groups of) particles. DEM models individual particles (microscopic level) with the aim to model realistic behaviour of a the system of particles (macroscopic level). DEM can be used as an engineering tool to provide insight in influencing factors (e.g. particle size, shape and density) in particle processes, such as segregation and mixing. It can help to analyse and solve bottlenecks in industrial systems, but then validation of the model is required. After validation DEM can be used as a virtual prototyping environment for design of equipment that handles particulate materials. The application range is wide: from powder handling (small particle sizes, cohesive materials in food or pharmaceutical industry) to large scale systems such as rock dumping (e.g. 300 kg stones, 500 mm in size), and anything in between including bulk handling. Next to the theoretical background of DEM, the major part of this hands on course is to perform an assignment using the software EDEM. In this assignment you will model and redesign or optimise a (part of a) handling system with a given particulate material. This might also require laboratory work to measure real material properties on a macroscopic level such as angle of repose and wall friction angle. Your DEM model has to represent realistic material behaviour and realistic interaction between material and equipment. With the properly working DEM model you will analyse influential parameters and where possible improve performance of equipment. Typical application areas for DEM modelling are: bulk handling of materials coal and iron ore, also including solid biomass such as wood pellets or biocoal mining offshore food industry, handling of powders pharmaceutical industry, powders and tablets agricultural industry, for planting and soil preparation, post harvesting, fruit handling and sorting machines pavement engineering, creating mixtures and more.	
Study Goals	During the course the student will learn to: 1. explain the Discrete Element Method (DEM) theory 2. define the performance criteria of the system to be modeled 3. choose an appropriate contact model for material-material and material-equipment interaction in a DEM simulation 4. choose and implement a simplified but appropriate representation of the system in the simulation environment 5. calibrate and verify the model with experiments, experimental data or analytical solutions 6. test the influence of different simulation parameters on the performance of the system 7. analyse datasets obtained from simulations and experiments 8. define confidence intervals for simulation and experimental results due to numerical and measurement errors	
Education Method	Lectures and assignment (computer and possibly lab)	
Computer Use	60%	
Course Relations	ME44101	
Literature and Study Materials	Study materials will be provided throughout the course	
Assessment	The examination will be as follows: 1. presentation on model development (20%) 2. report on model and results with oral assessment (80%) In case of unforeseen circumstances or measures resulting from COVID-19, the prescribed assessment will be: 1. remote presentation on model development (20%) 2. report and remote presentation on model and results with remote oral assessment (80%).	
Enrolment / Application	As soon as possible via Brightspace	
Special Information	Design Lab Research Mechanics Modelling Practicals Prototyping Software Transport & Logistics Contact Models Offshore Mining Particle Interaction Equipment	
Department	3mE Department Maritime & Transport Technology	

ME44125	Reliability and Maintenance of Transport Equipment	3
Responsible Instructor	X. Jiang	
Contact Hours / Week x/x/x/x	0/0/4/0	
Education Period	3	
Start Education	3	
Exam Period	3	
Course Language	English	
Expected prior knowledge	Technical academic BSc	
Course Contents	Transport equipment is in general a mechanical system, growing in size, capacity and complexity in order to accommodate continuous development of transport. It is essential to ensure sufficient safety, serviceability and durability of the equipment at the reduced cost in order to maintain the effectiveness of the transport system. This belongs to the research context of system reliability.Typically,a transport equipment consists of multiple subsystems or components with different function, and they would fail in different failure modes with different mechanism behind. Contributed by various nondestructive techniques and online sensoring system, potential failure of the equipment (fault, defect, damage) could be detected and mitigated in such a way that the occurrence of a catastrophic accident would be prevented,although with some extent of uncertainty caused by,i.e.,the sensitivity of NDTs, environmental noise, etc. Upon the detection of a fault(or damage),a follow-up maintenance strategy shall be made in order to determine whether, when,where and how to repair/ maintain the equipment, constrained by available budget, facilities and resources, etc. The overall objective of the course is to prepare engineering graduates with an in-depth knowledge of system reliability, maintainability and availability. A series of modules will be given covering the fundamental theory embedded in the reliability and maintenance of transport equipment. Application of the theory in practice will be exemplified and practiced through in-class exercises and discussion, weekly assignments and final written report. One or two guest lectures will be introduced to demonstrate the implication of system reliability in the operation and maintenance of the transport equipment and the infrastructure.	
Study Goals	After successfully completing the course, students will be able to: Explain the theory of NDT techniques and the conditional monitoring to detect defects/ fault. Define system reliability and describe basic reliability measures Estimate reliability measures based on the acquired data Perform system reliability evaluation Define system maintainability and describe related basic measures Define system availability and describe related basic measures Determine a maintenance strategy from both component and system perspectives Analyze and develop a reasonable maintenance strategy for a simplified transport equipment/system.	
Education Method	Lectures and supplementary material provided during lectures, in class exercises and discussions, weekly assignment, group work on final written report and presentation.	
Assessment	30% weekly assignments + 70% final report and associated presentation (50/50). Completion of weekly assignments with grades above sufficiency is compulsory. The final presentation and evaluation will take place on campus. In case of unforeseen circumstances or measures resulting from COVID-19, the final presentation and evaluation will then be given online. Detail information will be announced on Brights pace in due time.	
Remarks	Reference books: 1. Marvin Rausand, Arnljot Høyland, System Reliability Theory: Models, Statistical Methods, and Applications. 2.Kumar, U. D., Crocker, J., Knezevic, J., & El-Haram (2000), M. Reliability, Maintainability and Logistic Support - A Lifecycle Approach. 3. Charles E. Ebeling (2010), An Introduction to Reliability and Maintainability Engineering. 4 Wieslaw Ostachowicz · J. Alfredo Güemes (2013), New Trends in Structural Health Monitoring.	
Department	3mE Department Maritime & Transport Technology	

ME44311	Advanced Operations and Production Management	5
Responsible Instructor	Dr. W.W.A. Beelaerts van Blokland	
Contact Hours / Week x/x/x/x	0/0/2/2	
Education Period	3 4	
Start Education	3	
Exam Period	Different, to be announced	
Course Language	English	
Expected prior knowledge	BSc in engineering from TU Delft, specifically for students following TIL, MME and MT Students without the BSc degree are not allowed to join the course. Students work in Q4 in project groups and need social skills to obtain their own project. The Lector will assist students to find a project.	
Course Contents	The goal of the course is to involve the students with the body of knowledge on Operations and Production Management and the process improvement methodologies linked with Lean Manufacturing. Main supporting theories and relations in between needs to be understood to analyse the flow of (internal) processed and transported components via stations by coordination to assemble the final capital good specifically regarding aerospace, shipbuilding, automotive, airline MRO and industry in general.	
Study Goals	After the course the students are able to; - apply theories supporting Advanced Operations and Production Management comprises Lean manufacturing, value chain and system, supply chain, value engineering, value leverage and value creation by innovation. - analyse the relations between these theories and how to measure operations performance with KPI's regarding the flow of components or sub systems. - analyse the process performance regarding the coordination of assets and resources within a current state assembly processes. design an improved future state process supported by theories on Lean Manufacturing and Continuous Improvement (CI) methods in a company. - Report and Present re-design to the customer - share the obtained knowledge by an academic paper.	
Education Method	COURSE APPROACH: PART ONE in Q3: Lectures on theory / Cases by Guest Lectures and workshop. The lectures needs to be attended to built-up the fundamentals of knowledge on Operations and Production Management. Discussions and sharing questions-answers are an important part of the learning process in Q3. PART TWO in Q4 the obtained knowledge must be applied for a process analysis or optional research paper. Q4 is focused on your assignment with coaching on a personal basis. In the second part of the course the students learn to further develop the theories or how to apply the theories in practice. Students are working in groups for the assignments. The value stream or processes analysis assignments were executed for instance in cooperation with KLM-E&M, KRONE, Fokker aerostructures, SEW-Eurodrive, Deloitte, Heineken, Allseas, IHC, DAMEN or a company of your choice. Q5 is available for the students if preferable for their time scheduling. All assignments can be submitted end of Q4 or end of Q5. The deliverable is a report consisting of two parts PART One: theories / cases by guest lectures / Lean SCAN, and the workshop. PART TWO: Obtained knowledge is applied in assignnment Option 1 Process analysis or Opetion 2 Research Paper. The groups need to reflect on the course regarding their learning journey consiting of theories, learnings, practice experiences and own observations and READ a BOOK from the literature list to reflect on the process analysis and the theories.	
Literature and Study Materials	Students read a book with the group and reflect the content of the book on the assignment process analysis. 1)The machine that changed the world (Womack, Jones, Roos, 1990) 2)The Goal (Goldratt, 1986) 3)Learning to see; Value stream Mapping (The Lean Enterprise Institute, 1999) 4)Lean Enterprise Value, insights from MIT's Lean Aerospace initiative (Murman et al, 2002) 5)Lean Six Sigma; combining SixSigma Quality with lean speed (George, 2002) 6)Lean thinking, (Womack, 2003) 7)The Toyota Way (Liker, 2004) 8)Creating a lean culture (Mann, 2010) 9)The Lean Six Sigma guide to doing more with less (George, 2010) 10)The Lean Start-Up (Ries, 2014) 11)Various papers on BB 12) The Lean Start-UP	
Assessment	The deliverable is a report containg all aspects of the course laid down in the specifically designed assignments consisting of two parts: PART ONE: theories / cases by guest lectures, Lean SCAN,READ a BOOK and the workshop (optional). PART TWO: Option 1: Process analysis based upon theoretical aspects using theories and analysis tools. Option 2: Research Paper on automotive, aerospace or shipbuiling. Groups are allowed to submit all deliverables end of Q5.	
Remarks	1) Students work in groups for all assignments 2) Course deliverables can be submitted up to Q5. 3) Students are allowed to perform do the PART TWO Option 1 Assignment Process Analysis in an international active company also abroad.	

	4) The study load is high as there are several assignments to deliver therefore planning is extremely important. 5) For international students it is advised to form groups taking the assignment " Research Paper" as it is difficult to obtain a project for process analysis. 6) Students need to obtain their own project for Process Analysis and Design for Improvement. 7)Groups work in Q4 on their projects, coaching is on a personal basis, there are no lectures in Q4. 8) Students should start with obtaining a project with the industry already in Q3 based upon the assignment posted a Brightspace.
Design Content	1) Analysis and re-design of a Process from a Process Excellence perspective 2) Analysis or re-design of a model from a Operations Performance Assessment Methodologies perspective.
Department	3mE Department Maritime & Transport Technology
Judgement	The report is judged by Dr W.Beelaerts van Blokland PART ONE contains 50% of the grading. PART TWO contains 50% of the grading The Project Process Analysis is co-judged by the company involved. The grading is based on a Rubric

ME44312	**Machine Learning for Transport and Multi-Machine Systems**	**3**
Responsible Instructor	Dr. F. Schulte	
Instructor	Dr. B. Atasoy	
Contact Hours / Week x/x/x/x	0/0/0/2	
Education Period	4	
Start Education	4	
Exam Period	4	
Course Language	English	
Expected prior knowledge	Basic programming	
Course Contents	The course gives an introduction to the basic concepts of machine learning (supervised, unsupervised, reinforcement learning) and puts them into relation to artificial intelligence and data analytics. Moreover, important machine learning algorithms are introduced and implemented in Python. On this basis, machine learning methods are applied to transport and multi-machine systems.	
Study Goals	-Understand the basic concepts of machine learning -Learn to implement widely-used machine learning algorithms -Apply machine learning methods to transport and multi-machine systems	
Education Method	-Lectures -Group Work -Programming excercises	
Computer Use	Python on laptop	
Assessment	Group report	
Elective	Yes	
Tags	Abstract Algorithmics Artificial intelligence Broad Business Design Group work Industry Modelling Optimalisation Programming Research Methods Stochastics Sustainability Technology Transport & Logistics Transport phenomena	
Percentage of Design	40%	
Design Content	Machine learning approaches for transport and multi-machine systems	
Department	3mE Department Maritime & Transport Technology	
Contact	f.schulte@tudelft.nl b.atasoy@tudelft.nl	

MT44000	Mechatronics in MT	5
Responsible Instructor	Dr.ir. A. Vrijdag	
Responsible Instructor	Dr.ir. P. de Vos	
Contact Hours / Week x/x/x/x	0/0/4/0	
Education Period	3	
Start Education	3	
Exam Period	3 4	
Course Language	English	
Expected prior knowledge	BSc courses on control engineering (incl. PID control), hydromechanics, marine engineering and signal analysis + processing. Matlab/Simulink.	
Course Contents	In this course students will learn how to integrate aspects of mechanics, electronics, and information technology in a typical maritime project. The goal of the course is to design a dynamic positioning (DP) system that will keep the model boat in its position against disturbances, such as waves, current, and/or wind. After designing a DP model in Matlab/Simulink environment, students get to implement their model in the working environment in the lab, and in conclusion to evaluate the strength and weaknesses of their DP models with respect to its performance. The course includes various aspects of marine engineering, control engineering, and digital signal processing that are essential for a successful evaluation, analysis, and design of (maritime) mechatronic systems (the DP system being a primary maritime example of such systems).	
Study Goals	After successfully completing the course, students will be able to: Describe basic principles of mechatronics Describe sensors and actuators in general and the ones specific to the project, Apply basics of signal processing relevant to mechatronic systems (sampling, filtering, signal resolution, A/D and D/A conversion), Use and tune computer based measuring and control systems, Analyse and interpret the performance of a miniature Dynamic Positioning system regarding theoretical and practical aspects, Evaluate the strength and weakness of a mechatronic system that was set up by the students themselves.	
Education Method	Activities Classroom: In the first four weeks students will get four lectures and four discussion events. The lectures contain theoretical aspects of the course while discussion events address 4 week assignments. Each week assignment contains a set of clear instructions and questions that help students to design a working DP model. Work at home/office: o Writing the report. o Modelling and programming in Matlab/Simulink. Lab (in groups): o Week assignments. o Model testing. During 8 weeks each group gets 4 hours per week to use the flume tank.	
Books	Reference material (books): Feedback Systems - An Introduction for Scientists and Engineers by Astrom and Murray (available online) Mechatronics by Cetinkunt Feedback Control of Dynamic Systems by Franklin, Powell, and Emami-Naeini Further material: Reader (available on Brightspace). Week assignments (available on Brightspace). Additional material supplied on Brightspace.	
Assessment	Students are evaluated based on their performance with respect to the following deliverables: Working model boat in DP mode (50%): o Good steady state behaviour o Adequate response to external disturbances Software assignment (30%): o Design an off-line DP model in Matlab/Simulink that simulates the DP behaviour of the boat used in the lab. Report (20%): o Description and analysis of the proposed DP solution as a mechatronic system.	
Remarks	Old course code: MT218 The maximum capacity of the course Mechatronics in MT is 40 students per period. The reason is the availability of the flume tanks, the boats, required charging time, etc. The course is primarily offered in p3 (feb - apr). Extension into p4 (apr - jun) is possible and sometimes necessary. Depending on the availability of required resources (e.g. the flume tanks), Mechatronics in MT can be followed outside of p3 as well. In such cases the course's educational method is self-study, i.e. with minimal guidance by the lecturer or his assistants.	
Department	3mE Department Maritime & Transport Technology	

Year	**2020/2021**
Organization	**Mechanical, Maritime and Materials Engineering**
Education	**Master Mechanical Engineering**

ME-MME Graduation Project Obligatory (45 ECTS)

ME54010-20	ME-MME Literature Research	10
Responsible Instructor	Ir. M.B. Duinkerken	
Contact Hours / Week x/x/x/x	x/0/0/0	
Education Period	None (Self Study)	
Start Education	1	
Exam Period	none	
Course Language	English	
Course Contents	Literature Assignment	
Study Goals	1. Get acquainted with the major information sources of a subject 2. Consolidate a large amount of information into a systematic, well-organized and logical argument 3. Judge often mutual contradictory literature and to arrive at a critical attitude 4. Make unordered literature accessible	
Education Method	Self study	
Assessment	Three tests: T1 Literature Research (written report) T2 Presentation (pass/fail) T3 Colloquium Attendance (pass/fail)	
Remarks	Old course code: ME2110-10	
Department	3mE Department Maritime & Transport Technology	

ME54035	ME-MME MSc Thesis	35
Responsible Instructor	Ir. M.B. Duinkerken	
Contact Hours / Week x/x/x/x	0/0/x/x	
Education Period	None (Self Study)	
Start Education	3	
Exam Period	none	
Course Language	English	
Expected prior knowledge	all obligatory and elective courses on the Individual Study Program ME54010 ME54015	
Course Contents	You will set up and carry out your own research project in the field of Transport Engineering and Logistics. The subject of research can be provided by the staff or a company, however it is also possible to propose your own project. The final project can be carried out in company or within the framework of ongoing research at the university, e.g. in our laboratory. If a student undertakes the graduation project at a company, a graduation agreement should be signed. In this respect, the template of the TUD-3mE graduation agreement should be used, which is available at the following link: https://www.tudelft.nl/en/student/faculties/3me-student-portal/education/related/student-forms/msc-forms/. If a student identifies a potential master assignment within a company or institute then he/she can only commit to that assignment after written confirmation of approval by the professor. If any case, it is not allowed to take on a master assignment that is part of a critical path in a project within a company. Your supervisors will be a staff member and a professor, and if applicable a supervisor from the company. More information is available from the TEL brightspace organisation and the assignment coordinator Yusong Pang.	
Study Goals	The overall objective of this assignment is to demonstrate a sufficient academic level in the field of Transport Engineering and Logistics	
Education Method	Self study with regular supervision from staff members and professor	
Assessment	Written report, oral presentation, oral defense, research process evaluation	
Remarks	Old course code: ME2190-35	
Department	3mE Department Maritime & Transport Technology	
Contact	Yusong Pang, y.pang@tudelft.nl	

Year	**2020/2021**
Organization	**Mechanical, Maritime and Materials Engineering**
Education	**Master Mechanical Engineering**

ME-MME Electives: Select 1 out of 2 (15 ECTS)

ME54015	ME-MME Research Assignment	15
Responsible Instructor	Ir. M.B. Duinkerken	
Instructor	Dr.ir. D.L. Schott	
Contact Hours / Week x/x/x/x	0/x/0/0	
Education Period	None (Self Study)	
Start Education	2	
Exam Period	none	
Course Language	English	
Expected prior knowledge	All ME-TEL obligatory courses finished.	
Course Contents	The research assignment can be either a design, experimental or programming/simulation assignment on a wide range of topics often related to ongoing research. To get an idea of subjects for assignments, you can check titles and summaries of the assignments that were carried out by other students. To get an assignment contact our assignment coordinator Yusong Pang. You will be supervised by a staff member. Design assignment (15 EC) Your assignment may vary from (re)designing a part of a piece of equipment to the design of a transportation process with accompanying equipment. Experimental assignment (15 EC) You will set-up and carry out experiments in close cooperation with and under the authority of a staff member. These experiments are often concerned with ongoing research at our department. Programming/simulation assignment (15 EC) You will use software or develop software/algorithms/procedures for solving technical problems, controlling, measuring, designing, data analysis related to technical problems. Developing or choosing the appropriate model and implementing the model in a simulation language, testing a model in the laboratory can also be part of the assignment.	
Study Goals	Design The main objective for the assignment is to create a design, thereby following a methodological approach and using all the necessary tools and calculations to converge to a most suitable design. Experimental The main objective for the assignment is to acquire experience in designing, building a testing methodology and measuring the relevant parameters. In scientific research experiments have to be repeatable in order to be valid, this means that the experiments have to have the same results when performed by a third party. Computer/Programming The main objective for the assignment is to acquire experience in designing and building a representative environment for experiments. The test environment can be a computer or physical model and should be designed "to purpose" which means the performance indicators are relevant and the results accurate enough to answer the research question.	
Education Method	Self study with regular supervision of a staff member	
Assessment	Report and research process evaluation. More details: a list of assignments is available at the Brightspace organisation TEL	
Remarks	Old course code: ME2130-15	
Department	3mE Department Maritime & Transport Technology	

TUD4040	Joint Interdisciplinary Project	15
Responsible Instructor	Prof.dr.ir. J. Hellendoorn	
Project Coordinator	Ir. B.J.E. de Bruin	
Contact Hours / Week x/x/x/x	x/0/0/0	
Education Period	1	
Start Education	1	
Exam Period	Different, to be announced	
Course Language	English	
Summary	JIP consists of three sets of activities: 1. The project which takes place at a company. Students are responsible for the project work (collaboration, integration of different perspectives, the content quality of their work). They plan their activities via a scrum method, are challenged to realise field trips, consult with experts and realise the necessary research work. The team keeps a Scrum log, run a blog for interaction with the outside world and every team member keeps a personal development log. 2. Meeting Professionals lectures and workshops about specialised topics, by academic staff or senior professionals from the companies involved. 3. Plenary meetings and design reviews for all the teams, company coaches and academic staff. At the meetings the students present their intermediate resp. final outcomes and plans, and are provided with feedback.	
Course Contents	The aim of the Joint Interdisciplinary Project is to prepare students to contribute to solving impactful technological challenges. The projects not only demand good engineering working knowledge but also experience with interdisciplinary and systems theory, and both knowledge and mindsets of innovation and entrepreneurial behavior. The project brief is provided by renowned companies like Airbus, Arcadis, etc. Teams of interdisciplinary student teams guided by a company coach and offered academic and industry expertise, are invited to realise an innovative problem solution to a complex problem and contributing to the sustainable development goals.	
Study Goals	1. Cognitive abilities attributable to interdisciplinary learning Demonstrate the ability to engage in perspective-taking; Develop structural knowledge pertaining to the problem; Integrate knowledge and modes of thinking drawn from two or more disciplines; Produce an interdisciplinary understanding of complex problem or intellectual question. 2. Scientific and intellectual development Capable to analyze scientific and societal consequences (economic, social, cultural, environmental) of the innovation; 3. Research and design capabilities Demonstrate engineering skills: technical skills, interpreting results, creativity, usability for company/institute; Demonstrate that they are capable to independently apply relevant theory and/or knowledge to research and/or design; 4. Collaboration and communication in an interdisciplinary team Demonstrate behavioral competences and skills: taking initiative, responsibility, showing communication skills, independency, collaboration and the ability to respect different disciplines and adapt to different cultures); Show ability to write a technical report: structured/consistent, language proficient, with correct use of literature/references, use of figures/tables/equations, and has a concise format (30 pages); Present work performed in a structured way through an oral presentation to their peers and customer. 5. Self-adjustment and reflection capabilities Plan and control the project efficiently considering resources and methodology; Being able to reflect on personal functioning in an evaluation report: reflect on personal objectives, indicate personal strengths/weaknesses. Indicate future personal improvement, drawing conclusions for future career. Cognitive abilities attributable to interdisciplinary learning; The ability to integrate (scientific and practical technological)knowledge from different disciplines to solve complex problems Scientific and intellectual development The capacity to evaluate the ethical, scientific and societal consequences of the proposed innovation Research and design capabilities The ability to create reasonable and relevant research or design , according to the academic standards of the involved disciplines Collaboration and communication in an interdisciplinary team Demonstrate behavioural competences and skills relevant for teamwork and effective communication with different stakeholders Self-adjustment and reflection capabilities To carry out regular reflections on professional and personal development and being able to improve upon those reflections Understand contemporary and societal issues in their work.	
Education Method	Full-time project work in an interdisciplinary team of about five students. The project work is interspersed with some just in time seminars and workshops about specialized subjects, methods or practical situations that play an essential role in interdisciplinary project work.	
Assessment	The assessment criteria pertain to the process, product and presentation and are assessed at an individual and team level, during 3 review sessions at three levels of accomplishment (each review assesses at a different level): Interdisciplinary work Scientific reasoning and ethical mindset Innovation process Presentation and communication Academic staff, supported by the input from company coaches, grade the students during the Problem Statement, the Midterm and the Final Review. The final group mark for JIP is differentiated per person and is based on: The team presentations - 30% The Problem definition, progress report and final report 30% The individual contribution to the team 20% The final individual reflection report 5% The Blog 5%	
Remarks	Project Outcomes (product, model, system) are presented at: 1. Problem Statement Review 2. Midterm meeting 3. Final Review 4. Symposium presentation	

Dr. B. Atasoy

Unit	Mech, Maritime & Materials Eng
Department	Transport Engineering and Logistics
Telephone	+31 15 27 82706
Room	34.B-4-290

Dr. W.W.A. Beelaerts van Blokland

Unit	Mech, Maritime & Materials Eng
Department	Transport Engineering and Logistics
Telephone	+31 15 27 86680
Room	34.B-4-290

Ir. W. van den Bos

Unit	Mech, Maritime & Materials Eng
Department	Transport Engineering and Logistics
Telephone	+31 15 27 86766
Room	34.B-3-310

Ir. B.J.E. de Bruin

Department	Cognitive Robotics

Ir. M.B. Duinkerken

Unit	Mech, Maritime & Materials Eng
Department	Transport Engineering and Logistics
Telephone	+31 15 27 81790
Room	34.B-3-320

M.P. Fransen

Unit	Mech, Maritime & Materials Eng
Department	Transport Engineering and Logistics
Telephone	+31 15 27 86701

Prof.dr.ir. J. Hellendoorn

Department	College van Bestuur
Telephone	+31 15 27 89007
Room	34.F-2-440

Unit	Mech, Maritime & Materials Eng
Department	Cognitive Robotics
Telephone	+31 15 27 89007
Room	34.F-2-440

X. Jiang

Unit	Mech, Maritime & Materials Eng
Department	Transport Engineering and Logistics
Telephone	+31 15 27 88511
Room	34.B-3-320

Dr. J. Jovanova

Department	Transport Engineering and Logistics
Telephone	+31 15 27 83376
Room	34.B-4-220

M. Mohajeri

Department	Transport Engineering and Logistics
Telephone	+31 15 27 85705

Unit	Mech, Maritime & Materials Eng
Department	Transport Engineering and Logistics
Telephone	+31 15 27 85705

J. Moon

Department	Transport Engineering and Logistics

Telephone +31 15 27 86429
Room 34.B-4-330

Prof.dr. R.R. Negenborn

Unit Mech, Maritime & Materials Eng
Department Transport Engineering and Logistics

Telephone +31 15 27 86718
Room 34.B-3-300

Dr.ir. Y. Pang

Unit Mech, Maritime & Materials Eng
Department Transport Engineering and Logistics

Telephone +31 15 27 88685
Room 34.B-3-310

Dr. V. Reppa

Unit Mech, Maritime & Materials Eng
Department Transport Engineering and Logistics

Telephone +31 15 27 88545

R.N. Roeplal

Department Transport Engineering and Logistics

Telephone +31 15 27 82039

Dr.ir. D.L. Schott

Unit Mech, Maritime & Materials Eng
Department Transport Engineering and Logistics

Telephone +31 15 27 83130
Room 34.B-4-300

Dr. F. Schulte

Unit Mech, Maritime & Materials Eng
Department Transport Engineering and Logistics

Telephone +31 15 27 84414

E.F.L. Stok

Unit Mech, Maritime & Materials Eng
Department Support Marine and Transport Techology

Telephone +31 15 27 86839
Room 34.B-2-240

Dr.ir. P. de Vos

Unit Mech, Maritime & Materials Eng
Department Ship Design, Production and Operations

Telephone +31 15 27 81040
Room 34.B-4-220

Dr.ir. A. Vrijdag

Unit Mech, Maritime & Materials Eng
Department Ship Design, Production and Operations

Telephone +31 15 27 84682

Y. Yan

Unit Mech, Maritime & Materials Eng
Department Transport Engineering and Logistics

Telephone +31 15 27 84730