RP MK MARITIME ECONOMICS (EKONOMI SISTEM KELAUTAN)

	SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**

COURSE	**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
MARITIME ECONOMICS (EKONOMI SISTEM KELAUTAN)	**ME 185101**	**RAMS**	**3**	**I**	

AUTHORIZATION	**Developer RP**	**Coordinator RMK**	**Ka PRODI**
	SG	**DN**	**SG**

Study Outcomes (CP)	**CPL-PRODI**	
	See study program learning outcomes in curriculum documents	
	CP MK	
	Able to develop an understanding of economic theories and applications and analytical tools to be used in decision making in the maritime sector and understand management concepts and theories that have relevance to the maritime world, and be able to develop and apply them.	
Short Description of MK	Maritime business, shipping management, port operations, shipyard management, economic engineering.	
Main Subject / Study Material	Topology of maritime industry services and products; Basic port and shipping management; Efforts to maintain class standards; Maritime funding sources; Logistics Basics; Introduction to Shipyard Management; Economic engineering	
Literature	**Main:**	

	1. Gurning, S. Hand-out Bisnis Maritim, ITS, Surabaya, 2016 2. Nasution, A.A, .Manajemen Transportasi, Erlangga, Jakarta, 2000 3. Gurning, S dan Budianto, E.H, Manajemen Bisnis Pelabuhan, Primus IT Services, Surabaya, 2016 **Supporting :** 1. Agus W.R, dan Gurning, S., Usaha Mempertahankan Klas Kapal; Materi Pelatihan Manajemen Perawatan Kapal Bagi Awak Kapal PT. Pertamina, FTK-ITS, 1998 2. Stopford, M., Maritime Economics, London, 2010 3. Shuo, Ma.,Maritime Economics, World Maritime University, Sweden, 2000
Learning Media	**Software:** / **Hardware :** 1. PC 2. LCD Projector
Team Teaching	SG
Course Requirements	

Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students understand the scope of the marine system economics course and have an overview of its development	• Systematic understanding of lectures and its relation to the study program • General understanding of the maritime economy and its needs • Understanding of business theory and business applications	Non-Test: • papers on cluster patterns of economic entities and maritime business	• Lectures and brainstorming [TM: (3x50")] • (Task 1: writing a paper on maritime entity services in [TM: 2x(3x50")]	•	• Initialization of Lectures • Learning motivation - Lesson Plans - Study rules • Lecture Objectives • SpaceScope • System assessment, textbooks/library resources • Definition of maritime and marine	**5%**

2	Students are able to develop their abilities regarding the concepts of the marine economic system	• An understanding of the development of maritime and marine service categories • An understanding of the development of interactions between various maritime entities, both maritime operations and services • An understanding of the latest developments regarding the condition of maritime business needs in Indonesia	Non-Test: • Explore various maritime service entities in Surabaya • Determine development opportunities for entities that are considered underdeveloped in Surabaya and in Indonesia.		• Lectures and case studies on port services, shipping, and activities related to Indonesian maritime and maritime affairs [TM: (3x50")]	• Principles and terminology of marine ecosystems and marine ecosystems maritime • Definition of maritime market Bis • terminology maritime • its services Maritime service operation activities Comparison of maritime • operations and services with other modes • Maritime business conditions exist globally and in Indonesia	**5%**
3-4	Students are able to develop an understanding and application of the concept of the blue economy.	• Understanding of the latest developments in the concept of blue economy and its application • An understanding of development related to the implementation of the blue economy concept. • An understanding of the identification of factors that influence the	Non-Test: • Re-explaining the blue economy concept. • Make a literature review paper related to the principles and application of the blue economy.		• Lectures and studies on the concept and implementation of the blue economy. • Discussion of the impact of the implementation of the blue economy. • Demonstration of software and exercise [TM: (3x50")]	• The definition of the blue economy program is related to maritime services. • The impact of the blue economy on maritime activities. • Implementation of the blue economy program. • Factors that influence the implementation of	**10%**

		application of the blue economy concept.		• (Task 3: students conduct and compile literature reviews of papers discussing the blue economy) [BT+BM: (4)x(3x50")]	the blue economy, especially for the Indonesian maritime • Case studies of the implementation of blue economy programs in the world and in Indonesia.	
5-6	Students are able to develop an understanding of the maritime	• An understanding of the development of concepts, implementation, and interactions of maritime entities • An understanding of development of concepts and technology for ports, shipping, and shipyards in the face of the latest industrial developments	• review of the latest developments of maritime entities • Literaturemaritime titas in presentation	• Lectures and studies of concepts and implementation of maritime entity • Concepts The latest developments in port, shipping, and shipyard concepts and technologies to support the advancement of maritime entity management Literature reviews the latest developments in maritime entity management	• entity concept Definition of the maritime entity concept - Type and characteristics - Tramper characteristics shipping - Organization system shipping - Selection • Basic port operations Port - Functions and types - General patterns of ports - Various operators related - To indonesian port conditions - General port performance • Basic shipyard operations ships and facilities	**5%**
7	Students are able to develop the					**30%**

	concept of sustainable maritime management.	• An understanding of the development of the concept of sustainability in relation to marine and maritime management • An understanding of the development of implementation of sustainability in the world, especially in Indonesia	• Literaturemarine and maritime management • Exposure Literature reviews the development of the concept of sustainability in marine and maritime management in the form of a presentation	• Lectures and studies of concepts and implementation of maritime entity • Concepts The latest developments in port, shipping, and shipyard concepts and technologies to support the advancement of maritime entity management • Literature reviews the latest developments in maritime entity management		• Definition of the concept of sustainability to support the management of maritime services, and management of marine and fishery resources. • Problems faced in the management of maritime services, and management of marine and fishery resources within the scope of sustainability • Implementation of the concept of sustainability in maritime management • Factors that influence the implementation of the concept of sustainability • Case studies of the implementation of the concept of sustainability in the world, especially in Indonesia	
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK						
9	Students are able to develop an understanding		• literature review of the latest regulations and			• Definition of the concept of the	**5%**

	related to IUU Fishing in Indonesia	• An understanding of the development of IUU Fishing regulations • An understanding of the methods that can be used to minimize the occurrence of IUU Fishing	methods to minimize IUU Fishing • Exposure An overview of the current regulatory review literature and methods to minimize IUU Fishing	• Lectures and studies of the concept and implementation of IUU Fishing • Discussions on the development of IUU Fishing regulations • . Literature reviews the implementation of IUU fishing and the impact of its implementation.	development of laws and regulations, and international standards related to IUU Fishing IUU Fishing • problems in the World and in Indonesia • Methods that can minimize the potential for IUU fishing. • Case studies of the implementation of IUU Fishing in the World and in Indonesia	
10-12	Students are able to develop an understanding related to the Fishing Economy	• Understanding of the concept of fishing economy • Understanding of methods that can be used to improve the welfare of fishermen and fisheries business actors	• Literature review of problems and solutions related to the fisheries economy • Presentation of literature review of related problems and solutions with fishery economy	• Lectures and studies on fishing economy • Discussions on the development of fishermen's welfare and n fisheries business actors • Literature review of developments in improving the health of fishermen and fishery business actors	• Definition of economic concepts in marine and fishery development • Economic problems that occur in fishing activities • The latest methods that can increase the economic value and welfare of fishermen and fishery business actors • Case studies on the implementation of methods to improve the welfare of fishermen and	**10%**

					fishery business actors	
13-15	Students are able to develop an understanding of the Measuring Economy of Maritime	• Understanding of T ime value of money for long-term investment • Understanding economic concepts of long-term investment techniques • Understanding long-term investment patterns for new ships	Non-Test : • Determining the value of ROI, NPV, PBP, IRR investment • Simulation using excel facilities • Assignments are given in groups	Lectures and discussions	• Basics • Long-term and short-term • Investment the concept of investment costs • Money and time • General principles of preparing long-term investment calculation documents calculation of long-term • investment parameters: ROI, IRR, Payback period, NPV, depreciation, sensitivity factor, capital cost • Preparation of long-term investment diagram • Case study of long-term assessment of dry bulk cargo ships and passenger ships	**30%**
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK And Evaluation of CPL achievement charged to MK**					
Total						**100%**

Notes :

1. **Learning Outcomes of Graduates of Study Programs (CPL-PRODI**) are abilities possessed by each graduate of PRODI which are the internalization of attitudes, mastery of knowledge and skills according to the level of study programs obtained through the learning process.

2. **The CPL that is charged to the course** is a number of learning outcomes for study program graduates (CPL-PRODI) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course CP (CPMK)** is the ability that is specifically described from the CPL that is charged to the course, and is specific to the study material or learning material for the course.
4. **Subject Sub-CP (Sub-CPMK)** is the ability that is specifically described from the CPMK that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** the ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for raters so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Form of assessment**: test and non-test.
8. **Forms of learning**: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods**: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning Materials** are details or descriptions of study materials that can be presented in the form of several subjects and sub-topics.
11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.

RP MK RELIABILITY ENGINEERING AND OPERATION RESEARCH (REKAYASA KEANDALAN DAN RISET OPERASI)

	SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**					
COURSE		**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
RELIABILITY ENGINEERING AND OPERATION RESEARCH (REKAYASA KEANDALAN DAN RISET OPERASI)		**ME185102**	**RAMS**	**3**	**I**	
AUTHORIZATION		**Developer RP**	**Coordinator RMK**	**Ka PRODI**		
		DN	**DN**	**SG**		
Study Outcomes (CP)	**CPL-PRODI**	Program learning outcomes in the course curriculum document				
	CP MK	Students develop an understanding of reliability and availability theory as well as system modeling and apply it to evaluate and analyze various marine system reliability both qualitatively and quantitatively, and be able to relate the material to risk assessment, both with individual and group performance in teamwork.				
Short Description of MK	Reliability (reliability), Availability (availability), Introduction to risk assessment (introduction to risk)					

Main Subject / Study Material	Introduction to system reliability, Review of Fundamental reliability concepts, Simple Network Modeling system, Complex Network Modeling system, Introduction to Markov and Monte Carlo Simulation, Markov Discrete Chains and Markov Continuous Processes, Economics and Reliability, Introduction to risk assessment
Literature	**Main:** 1. Reliability Evaluation of Engineering System, R. Billinton 2. Risk Assessment of Subsea Gas Pipelines, KBA, DN, MA, KS 3. Handout Lecture on Reliability and Maintenance Management I **Supporting :** 1. Reliability System Theory, Hoyland 2. Reliability, maintainability, AKS Jardine 3. Statistics for Engineers and economics, Anderson
Learning Media	**Software:** 1. Relex (Opsim, Markov, Weibull, ETA, FMEA) **Hardware :** 1. PC
Team Teaching	DN / DW
Course Requirements	

Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students are able to relate the theory of reliability and maintenance management [C2, A2]	• Understanding of lecture systematics and its relation to supporting lectures previous (engineering statistics)	Non-Test • Papers on the application of reliability in engineering	• Lectures and brainstorming [TM: (3x50")] • (Task 1: writing a paper on the application of reliability in marine	•	• Initialization of Lectures - Learning motivation - Lesson plans - Study rules	**5%**

RP MK ADVANCED CONTROL OF MARINE ENGINEERING (SISTEM PENGENDALIAN KELAUTAN LANJUT)

	SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**				
COURSE	**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
ADVANCED CONTROL OF MARINE ENGINEERING (SISTEM PENGENDALIAN KELAUTAN LANJUT)	**ME 185103**	**MEAS**	**3**	**I**	
AUTHORIZATION	**Developer RP**	**Coordinator RMK**	**Ka PRODI**		
	AA	**SD**	**SG**		
Study Outcomes (CP)	**CPL-PRODI**				
	CP MK Students are able to design and develop a tested and innovative automatic control system design independently or in the form of a Study Materials Description team				
Short Description of MK	Engine combustion technology, propulsion system,				
Main Subject / Study Material	Mathematical models of physical systems on ships and marine vessels.				

	Differential and integral equations: state-space models, transfer functions, and the use of simulation models as analysis and problem solving tools. Kind of stability control and performance when closed-loop feedback systems' linear vs. nonlinear systems, linearization, Laplace transform, time response, frequency response, block diagrams, Bode plots, feedback and feed-forward control loops. Basic topology and configuration of marine control systems; eg auto pilot system, marine propulsion plant, power management system, minimization of fuel consumption.	
Literature	**Main:** 1. Benjamin C. Kuo, "Automatic Control System", 7'th edition. 2. Automatic Control Engineering by Katsuhiko Ogata 3. Modern Control System Theory and Application by Stanley M Shinners 4. Automatic Control Engineering by FH Raven **Supporting :** 1. AI in Process Control by Mitchel Stock 2. Marine Control Practice, 2nd Edition, by DA Taylor	
Learning Media	**Software:** 1. Simulink MATLAB	**Hardware :**
Team Teaching	AA	
Course Requirements		

Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Knowing and understandingAdvanced Marine Control System which includes learning objectives, learning materials, assessment criteria and assignments, as	Students have a good understanding of learning objectives, programs, assessment processes and goals for each task, as well as the urgency of the Control System in Marine Engineering.	Lectures and videos	Teaching Center Learning	•	Provide an understanding of the objectives of the Advanced Marine Control System course, the rules of the game and the literature as a reference.	

	well as the rules of the game.					
2	Able to master and apply the theory of Laplace Transformation, determinants, Differential Equations, Fourier transformations, etc., for the application of marine vehicle control system design applications	Students understand the use of Laplace Transformations, differential equations, determinants, etc. in the application of control systems	Lectures, sample questions and discussions, work exercises, group studies	Teaching Center Learning		Laplace Transformation, Differential Equations, Determinants	
3-4	Able to transform and develop control systems in block concepts and signal flow diagrams.	Students can transform examples of driving system cases	Lectures, videos and examples, group studies, group discussions	Teaching Center Learning		The latest developments in control systems, advantages and disadvantages of using a control system, Transfer Function modeling, Block Diagrams and their simplification, signal flow diagrams	
5	Able to develop a tested control system stability analysis Control system	Students are able to analyze the stability of a system	Lectures and examples, group studies, group discussion	Teaching Center Learning, discussions, group studies,		Stability Concept: - Stability Criteria Pole positioning - Hurwitz Stability - Criteria Stability Criteria Routh-Hurwitz	
6							

	Able to develop state space theory on the ship control system	Students are able to understand and master state space theory	Lectures and examples, group studies, group discussions	Teaching Center Learning, discussion, group study,	State Space Modeling - Terms of - State Space Representation for MIMO system - Relationship between Transfer Function and State Space Equations State Space - Representation for Dynamic System	
7	Able to develop work action based control system designs such as Proportional, Integral, Derivative or a combination of them and Fuzzy logic	Students are able to understand and master control design theory	Lectures and examples, group studies, group discussions	Teaching Center Learning, discussions, group studies,	Control design theory based self-employment, On-Off, Proportional, Integral, Derivative or a combination of them and Fuzzy logic	
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK					
9	Control design theory based self-employment, On-Off, Proportional, Integral, Derivative or a combination of them and Fuzzy logic	Students understand the mathematical modeling of the auto pilot system on the ship and get the Transfer Function either by simplification, using block diagrams or by using determinants	Lectures, videos and examples, group studies, group discussions	Teaching Center Learning, discussions, group studies ,	Modeling procedures, the solution is good by using simplification, block diagrams and with determinants	
10-12	Able to transform and develop mathematical models of ship propulsion systems	Students understand modeling mathematics of the propulsion system and obtaining its Transfer Function either by simplification, using block	Lectures, videos and examples, group studies, group discussionsTask completion time is 2 weeks from being given	Teaching Center Learning, discussions, group studies,	• Types of propulsion systems, configurations, components and control systems	

	(mechanical, electrical & hybrid)	diagrams or by using determinants			• Simplification with block diagrams and with determinants	
13	Able to transform and develop mathematical models of power generation systems on ships	Students understand the mathematical modeling of pneumatic systems and get the Transfer Function either by simplification, using block diagrams or by using determinants	Lectures and examples, group studies, group discussions	Teaching Center Learning, discussions, group studies,	Modeling procedures, solving them well by using simplification, block diagrams or with determinants	
14	Able to transform and develop a mathematical model of a fuel consumption control system	Students understand the mathematical modeling of the hydraulic system and get the Transfer Function either by simplification, using block diagrams or by using determinants	Lectures and examples, group studies, group discussions	Teaching Center Learning, discussions, group studies,	Modeling procedure, the solution is good by using simplification, block diagrams or with the determinants	
15	Able to transform and develop mathematical models of power generation system management on ships	Students understand the mathematical modeling of hydraulic systems and get the Transfer Function either by simplification , using block diagrams or by using determinants	Lectures and examples, group studies, group discussions	Teaching Center Learning determinants, discussions, group studies,	Modeling procedure, the solution is good by using simplification, block diagrams or with the determinants	
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK And Evaluation of CPL achievement charged to MK**					
Total						

Notes :

1. **Learning Outcomes of Graduates of Study Programs (CPL-PRODI**) are abilities possessed by each graduate of PRODI which are the internalization of attitudes, mastery of knowledge and skills according to the level of study programs obtained through the learning process.
2. **The CPL that is charged to the course** is a number of learning outcomes for study program graduates (CPL-PRODI) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course CP (CPMK)** is the ability that is specifically described from the CPL that is charged to the course, and is specific to the study material or learning material for the course.

4. **Subject Sub-CP (Sub-CPMK)** is the ability that is specifically described from the CPMK that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** the ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for raters so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Form of assessment**: test and non-test.
8. **Forms of learning**: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods**: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning Materials** are details or descriptions of study materials that can be presented in the form of several subjects and sub-topics.
11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.

RP MK THERMAL AND FLUID SYSTEM DESIGN (PERENCANAAN SISTEM TERMAL DAN FLUIDA)

SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**					
COURSE	**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
THERMAL AND FLUID SYSTEM DESIGN (PERENCANAAN SISTEM TERMAL DAN FLUIDA)	**ME 185104**	**MMS**	**3**	**I**	
AUTHORIZATION	**Developer RP**	**Coordinator RMK**	**Ka PRODI**		
	SP	**AG**	**SG**		
Study Outcomes (CP)	**CPL-PRODI** see the learning outcomes of the Study Program in the curriculum document				
	CP MK 1. Able to develop science, technology, and its applications through research and innovation in the scope of thermal and fluid systems, which consist of engineering machinery and piping applied to ships, marine structures, and marine and fishery facilities. 2. Able to develop air technology & refrigeration systems, air conditioning processes, and fluid engineering systems based on effective, efficient, ergonomic, and environmentally friendly principles in systems on ships, marine buildings, and marine and fishery facilities based on applicable standards and regulations in design, fabrication & installation, supervision, and operations.				
Short Description of MK	Ducting, Heating Systems (Heating), Air Ventilation Systems (Ventilation), Air Conditioning Systems (Air Conditioning), Refrigeration Systems (Refrigeration).				

Main Subject / Study Material	Concepts and working principles of HVAC-R, Psychometrics and various air conditioning processes systems, Air heating systems on ships/offshore buildings, Ventilation systems, Air conditioning systems, Refrigeration systems, steam and thermal oil systems, engineering analysis Thermal systems optimization and simulation of thermal systems
Literature	**Main:** 1. Heat Transfer, 4th edition, 2015 2. Stoecker, Industrial Refrigeration Handbook, 1998 3. ASHRAE Handbook, 2005 4. Yunus A. Cengel, Heat Transfer: a Practical Approach, 2nd Edition, 2002 5. Further references will be submitted during the course **Supporting :** 1. Hara, S. "Refrigeration and Air Regulation," Translated Second Edition, Erlangga Publisher, Jakarta, 1987 2. Class Rules for Marine HVAC & R 3. Arthur A. Bell, "HVAC : Equations, Data and Rules of Thumb ", McGraw-Hill, 2000
Learning Media	**Software:** / **Hardware :** 1. PC & LCD Projector 2. Refrigration Demonstrator
Team Teaching	SP
Course Requirements	

Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1					•	• Lecture initiation	

	Student understands the scope of the marine system economics course and has an overview of its development	• Lecture systematic understanding • General understanding of thermal and fluid system planning • Understanding of theory and recent developments	Question and answer discussion	Lecture and brainstorming [TM: (3 x 50 minutes)]	• Learning motivation • Objectives Lecture • Scope • Definition of thermal and fluid system planning	
2	Students are able to develop and apply the basic concepts of fluid flow	• An understanding of the development of fluid flow engineering • An understanding of the development of fluid flow engineering applications • An understanding of the identification of influencing factors in fluid flow engineering	Non-Test : Representing fluid flow in the form of discussion	Lectures and studies of fluid flow engineering concepts	• Definition of fluid flow • Engineering Implementation of industrial scale fluid flow engineering, especially ships, ports, installations, and marine buildings • Flow engineering methods fluids	**10%**
3-4	Displacement Heat	• An understanding of the development of heat transfer engineering concepts • An understanding of the development of heat transfer engineering application methods • Understanding of m About the factors that influence heat transfer engineering innovation	• Literature review of the development of heat transfer engineering methods and applications Literature review review of the development of heat transfer engineering • Methods and applications	• Heat transfer engineering implementation Lectures and studies of concepts and implementation of heat transfer engineering • Discussion of the development of heat transfer engineering concepts and technology • Literature review of the development of heat exchange engineering	• Definition of heat transfer engineering • Implementation and application of heat transfer engineering in ships, ports, installations, and marine structures • Current methods related to heat transfer • Factors influencing heat transfer engineering	**10%**

					• Case studies	
5-6	Heat exchanger design	• An understanding of the development of heat exchanger design engineering concepts • An understanding of the development of heat transfer design application methods • An understanding of the influencing factors in heat exchanger design engineering innovation	• Literature rev iew development of heat exchanger design engineering methods and applications • Literature review review of heat exchanger design engineering development methods and applications	• implementation Lectures and studies of heat exchange design engineering concepts and implementations • Discussion of heat exchange design engineering concepts and technology • development Literature review of exchange engineering developments heat	• Definition of heat exchange design engineering • Implementation and application of heat exchanger design in ships, ports, installations , and marine buildings • Current methods related to heat exchanger design • Factors influencing heat exchanger design engineering • Case studies of heat exchange engineering	**10%**
7	Thermal steam and oil	• An understanding of the development of engineering concepts of steam and thermal oil systems • An understanding of the development of application methods for steam and thermal oil systems • An understanding of the influencing factors in thermal engineering	• Literature review of the development of methods and applications of thermal steam and oil system engineering • Literature presentation reviewing the development of steam and thermal oil system engineering applications	• Lectures and concept studies and implementation of thermal steam and oil systems engineering • Discussion of concept development and technology engineering steam and thermal oil systems • Literature review of the development of steam	• System Definition of thermal oil and steam system engineering • Implementation and application of thermal oil and steam system design in ships, ports , installations, and marine structures	**10%**

		innovation steam and thermal oil stem		and thermal oil systems engineering Teaching Center Learning, discussions, group studies,	• Current methods related to steam and thermal oil systems Factors influencing thermal steam and oil • System engineering Case studies of thermal steam and oil systems engineering implementation	
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK					
9-11	Thermal engineering	• An understanding of the development of concepts of thermal engineering steam and oil systems • An understanding of the development of methods application of steam and thermal oil systems • An understanding of the influencing factors in thermal engineering analysis	• Literature review of the development of thermal engineering analysis methods Literature review of the development of thermal engineering • Analysis methods	• Lectures and studies of concepts and implementation of thermal engineering analysis • Discussion of the development of concepts and technology of thermal engineering analysis • Literature review of the development of thermal engineering steam and oil systems	• Analysis Definition of thermal engineering analysis • Implementation and application of thermal engineering in ships, ports, installations, and marine structures • Current methods related to thermal engineering analysis • Factors influencing thermal engineering analysis • Case studies of implementation of thermal	**15%**

					engineering analysis	
12-13	Reefer technology	• Understanding of concept development refrigeration engineering • An understanding of the development of steam and thermal oil system application methods • An understanding of the influencing factors in thermal engineering analysis	• Literature review of the development of thermal engineering analysis methods • Exposure literature review development of thermal engineering analysis methods	• Lectures and concept studies and analysis of thermal engineering analysis • Discussion of developments in cooling concepts and technology • Literature review of refrigeration engineering developments	• Definition of reefer technology • Implementation and application of reefer technology on ships, ports, installations, and marine structures • Current methods related to reefer technology • Factors influencing reefer technology • Case studies of reefer technology	**15%**
14-15	Optimization and simulation of thermal systems	• Ofthermal • An understanding of the development of application methods for thermal steam and oil systems • An understanding of the influencing factors in thermal engineering analysis	• Literature review of the development of thermal engineering analysis methods • Assigning case studies of optimization and simulation thermal system using relevant software	• and • thermal • simulation	• Definition of optimization and simulation of thermal systems • Implementation of optimization and simulation of thermal systems in ships, ports, installations, and marine structures • Current methods related to optimization and simulation of thermal systems • Factors – Factors affecting optimization • Systems	**30%**
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK**					

	And Evaluation of CPL achievement charged to MK	
Total		**100%**

Notes :

1. **Learning Outcomes of Graduates of Study Programs (CPL-PRODI**) are abilities possessed by each graduate of PRODI which are the internalization of attitudes, mastery of knowledge and skills according to the level of study programs obtained through the learning process.
2. **The CPL that is charged to the course** is a number of learning outcomes for study program graduates (CPL-PRODI) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course CP (CPMK)** is the ability that is specifically described from the CPL that is charged to the course, and is specific to the study material or learning material for the course.
4. **Subject Sub-CP (Sub-CPMK)** is the ability that is specifically described from the CPMK that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** the ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for raters so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Form of assessment**: test and non-test.
8. **Forms of learning**: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods**: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning Materials** are details or descriptions of study materials that can be presented in the form of several subjects and sub-topics.
11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.

RP MK RESEARCH METHODOLOGY (METODOLOGI PENELITIAN)

SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**					
COURSE	**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
RESEARCH METHODOLOGY (METODOLOGI PENELITIAN)	**ME185201**	**General**	**2**	**VII**	
AUTHORIZATION	**Developer RP**	**Coordinator RMK**	**Ka PRODI**		
	BZ	**BZ**	**SG**		
Study Outcomes (CP)	**CPL-PRODI**				
	Program learning outcomes in the course curriculum document				
	CP MK				
	Students are able to formulate and apply research methods according to scientific procedures that can be accounted for and apply in the form of preparing a final assignment report. Students are also able to express the framework of their Thesis in the presentation.				
Short Description of MK	Research methods, presentation techniques, research report writing techniques.				
Main Subject / Study Material	Introduction to research and research strategies, research techniques, research methods in engineering, research design and data collection techniques, scientific writing methods, presentation techniques, presentation of scientific papers.				

Literature	**Main:** 1. Kothari, CR 1985. Research Methodology. New Age International Publisher: New Delhi 2. Nasir Moch[1999] “Research Methods” Ghalia Indonesia, Fourth Edition **Supporting :** 1. Guidelines for Research Implementation, LEMLIT-ITS, 1997 2. Guidelines for Research Implementation, DRPM-Menristek Dikti, Edition X, 2016 3. Dix Alan [1997], Research techniques, School of Computing, Staforgdshire University. 4. Surachmad Winarno [1998] "Introduction to Scientific Research, Basics, Methods and Techniques"						
Learning Media	**Software:**			**Hardware :** 1. PC 2. LCD Projector			
Team Teaching	BZ						
Course Requirements							

Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	• Understanding teaching materials and being able to determine learning evaluations • Understanding the definition of research and being able to determine the steps for implementing a research and working on a thesis	An understanding of the process and evaluation of learning, as well as an understanding of the nature and meaning of research in all aspects, especially in the preparation	Non-Test	Lectures and discussions (2x50)	•	Initialization of Lectures motivation Learning Plans Learning rules	**10%**

2-4	Understand how to find research problems Research	An understanding of how to apply a research theory to a research problem based on existing rules.	Non-Test		Lectures and discussions (2x50)	• Techniques 1. study the writings of others. 2. listen to other people's words. 3. see other people's products. 4. plan your own work.	**15%**
5-7	• Understand how to choose research • Understand how to plan research	• Understanding of choosing the right research method so that it fits the goals and benefits. • Have an understanding of the planning process of research methods	Non-Test		Lectures and discussions (2x50)	• Methods Research Methods in the Field of Engineering 1. Descriptive research methods. 2. Theoretical research methods. 3. Experimental research methods. 4. Engineering research methods • Designs Research Design And Data Collection Techniques	**20%**
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK						
9-10	Understand how to write scientifically	Depth understanding of the process of writing a research	Non-Test			Scientific Writing Methods	**10%**

				Lectures and discussions (2x50)	1. types-2 scientific writing 2. formats and outlines of scientific writing 3. scientific writing techniques.	
11	1. Writing a thesis proposal correctly 2. Mastering scientific writing	Skill of making a final project proposal according to the rules of research methods.	Non-Test	Assignment (2x50)	• Methods Scientific Writing Methods 1. types-2 scientific writing 2. scientific writing formats and outlines 3. writing techniques scientific.	**15%**
12-13	1. Make presentation preparations properly 2. Able to present properly and correctly.	Understanding of presentation skills on research work	Non-test	Lectures and discussions (2x50)	• Presentation Techniques 1. Material preparation. 2. use of assistive devices. 3. communication techniques. 4. field mastery techniques	**15%**
14-15	1. Present the thesis proposal in written form correctly. 2. presenting a thesis proposal presentation well.	In-depth understanding in writing a work in the form of a final assignment proposal.	Non-test	Assignment (2x50)	Presentation of Scientific Work 1. Writing a draft of a thesis proposal 2. Practicing a proposal presentation	**15%**
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK And Evaluation of CPL achievement charged to MK**					
Total						**100%**

Notes :

1. **Learning Outcomes of Graduates of Study Programs (CPL-PRODI**) are abilities possessed by each graduate of PRODI which are the internalization of attitudes, mastery of knowledge and skills according to the level of study programs obtained through the learning process.
2. **The CPL that is charged to the course** is a number of learning outcomes for study program graduates (CPL-PRODI) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course CP (CPMK)** is the ability that is specifically described from the CPL that is charged to the course, and is specific to the study material or learning material for the course.
4. **Subject Sub-CP (Sub-CPMK)** is the ability that is specifically described from the CPMK that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** the ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for raters so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Form of assessment**: test and non-test.
8. **Forms of learning**: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods**: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning Materials** are details or descriptions of study materials that can be presented in the form of several subjects and sub-topics.
11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.

RP MK ADVANCED MARINE PROPULSION SYSTEMS (SISTEM PROPULSI KELAUTAN LANJUT)

SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**					
COURSE	**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
ADVANCED MARINE PROPULSION SYSTEMS (SISTEM PROPULSI KELAUTAN LANJUT)	**ME185202**	**MPP**	**4**	**II**	
AUTHORIZATION	**Developer RP**	**Coordinator RMK**	**Ka PRODI**		
	MA	**BC**	**SG**		

Study Outcomes (CP)	**CPL-PRODI** See the learning outcomes of the Study Program in the curriculum document
	CP MK 1. Having the ability to innovate effectively and efficiently in development Mastering the concepts and theories of Ship Resistance and Propulsion 2. Have the ability to innovate effectively and efficiently in designing/reviewing the propulsion system, supervising and maintaining the propulsion system for marine vehicles. 3. verbally in the working group
Short Description of MK	Prisoner; Propulsion
Main Subject / Study Material	Ship resistance theory, Ship resistance prediction methods, Relationship between hull shape and ship resistance, Types of ship propulsion,

	Propeller theory, Self propulsion test model, Propeller design, Engine-propeller matching, Speed power prediction, Ship propulsion system configuration, Visualization of model test in towing-tank
Literature	**Main:** 1. Carlton JS, Marine Propellers and Propulsion, Butterworth – Heinemann Ltd, 1994 2. Edward V. Lewis, Princile of Naval Architecture 2, SNAME, Jersey City, 1988. 3. AA Harvald, Resistance and Propulsion of Ships, John Wiley & Sons, 1983 4. TC Gillmer & Bruce Johnson, Introduction to Naval Architecture, Naval Inst Press, Maryland, 1982 **Supporting :**

Learning Media	**Software:**	**Hardware :**
	1. Maxsurf 2. Ansys 3. CFD	1. PC 2. LCD Projector 3. Propeller Model
Team Teaching	MA	
Course Requirements		

Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Able to develop scientific relationship between ship resistance and thrust	• Understanding of ship resistance (C2) • Understanding of basic concepts of propulsion system power requirements (C2) • Understanding of the relationship between	Non-Test : Resume Basic concepts and the relationship between ship resistance and thrust	• Lectures and discussions on basic concepts and the relationship between Ship Resistance and Thrust [TM:2x(2x50")] • (Task 1: Make a resume about the relationship	•	• General explanation of lectures - Lesson plan - Rules for implementing learning - Lecture contracts	

		ship resistance and thrust (C2)		between ship resistance and thrust) [BT+BM:(2+2)x(2x50")]	• Basic concepts of ship resistance and thrust • The relationship between ship resistance and the need for propulsion	
2	Able to develop small flow phenomena in sinking and floating bodies, and can reduce the ship resistance formula through dimensional analysis	• Understanding of fluid flow phenomena (C2) • Ability to distinguish types of fluid flow (C2) • Ability to derive the formula for ship resistance through dimensional analysis (P2)	Non-Test : • Resume about the phenomena and types of fluid flow • Resume about the reduction of the ship's resistance formula throug	• Lecture and discussion on phenomena and types of fluid flow [TM:2x(2x50")] • (Task 2: Make a resume about phenomena and types -type of fluid flow) [BT+BM:(2+2)x(2x50")] • Lectures and discussions on dimensional analysis [TM:1x(2x50")] • (Task 3: Make a resume about the reduction of ship resistance formula through dimensional analysis) [BT+BM:(1+1)x(2x50")]	• Flow Phenomenon - Ideal Fluid Flow - Real Fluid Flow • Types of fluid flow - Potential flow. - Viscous flow. - Wavemaking. - Flow separation - Circulation/Vortex motion. - Cavitation. - Hydrofoil flow. - Elastic/ Compressible flow • Dimensional analysis - Ship resistance as a function of Reynold number and Froude Number	
3	Able to develop knowledge and distinguish the components of resistance for ship type displacement and planning	• Understanding of the understanding and calculation of ship resistance components (C2) • Ability to distinguish types of vessel prisoners (C2)	Non-Test : Resume on the component of ship resistance and the proportional component of resistance due to ship speed	• Lectures and discussions on Components of ship resistance and Proportional component of resistance due to ship speed [TM:3x(2x50")]	• Components of Ship Resistance - Friction Resistance - Resistance Eddy- Prisoner of the Waves- Prisoner of Air a- Additional	

		• Understanding of the influence of ship speed on the proportional component of resistance (C2)		• (Task 4: Make a resume about Components of ship resistance and Proportional components of resistance due to ship speed) [BT+BM:(3+3)x(2x50")]	Prisoners- Shallow water effect • Proportional component of resistance due to ship speed	
4	Develop knowledge in terms of testing procedures for ship model prisoners, and develop scientific correlation between ship resistance and models	• Understanding of The laws of equality in ship resistance testing (C2) • Knowing the equipment and ship resistance testing procedures (C1) • Understanding the correlation between model and ship resistance (C2)	• Tests: - Calculation of the correlation between model and ship resistance from a test data • Non -Tests: - Resume on the laws of equality in ship resistance testing	• Lectures and discussions on ship resistance testing and video showing the process of resistance testing for various types of ships [TM:3x(2x50")] • (Project 1: Perform calculations on the correlation between model and ship resistance from a test data) [BT +BM:(1+1)x(2x50")] • (Task 5: Making a resume on the Laws of Equality in Ship Resistance Testing) [BT+BM:(2+2)x(2x50")]	• Law- law of similarity in ship resistance testing • Geometrical similarity - Dynamic similarity • Equipment and Procedures for Ship Resistance Testing • Correlation between model resistance and ships	**5%**
5	Able to develop appropriate		• Tests:			**10%**

	theories and methods in estimating the resistance of merchant ship types	• Accuracy in the use of the method and calculation of prisoners ship type "Merchant ship" (C3, P2) • Ability to use program packages in estimating ship resistance (C3,P2)An understanding of the influencing factors in thermal engineering innovation steam and thermal oil stem	Calculation of prisoners with appropriate methods and comparing	• Discussion of the methods in estimating vessel resistance [TM:2x(2x50")] • Discussion on Estimating vessel resistance using Program Packages [TM:2x(2x50")] • (Project 2: Performing the calculation of prisoners using the appropriate method and comparing it with the use of the Program package) [BT+BM:(5+5)x(2x50")]	• Ship Resistance Estimation Method- Taylor Method- AJW Van Lap Method- Guldhammer and Har Method vald- Holtrop Method • Estimation of vessel prisoners using the Program Package	
6	Able to technically justify the types of propulsors and their application to other types of ships .	• Understanding of the types of propulsors and the development of marine screw propellers (C2)	• Non-Test : - Group presentations - Resume about the types of propulsors and the development of marine screw propellers	• Presentation and discussion about types of propulsors and development of marine screw propeller [TM:1x(2x50")] • (Task 6: Making a resume about types of propulsors and development of marine screw propeller) [BT+BM:(2+ 2)x(2x50")]	• Development of Marine Screw Propeller • Types of Propulsors - Marine Propeller- CPP- Ducted Propeller- Contra-Rotating Propeller- Tandem Propeller- Z-drive unit- Podded Azimuthing Propeller- Waterjet Propulsion- Cycloidal Propeller- Paddle Wheel- Lateral Thrust Unit- Other propulsor	
7	Able to develop science on the effect of interactions between the hull	• Understanding the effect of the interaction between the stomach and the propulsion	• Non-Test: - Resume on the effect of the interaction between the hull and the	• Lecture and discussion on Wake and Thrust Deduction [TM:1 x(2x50")]	• Wake and Thrust Deduction - Wake fraction - Thrust Deduction	

	and propulsion device to propulsive coeficient	device on the propulsive coefficient (C2)	propulsion device on the propulsive coefficient	• (Task 6: Resume about Wake and Thrust Deduction) [BT+BM:(1+1)x(2x50")]	- Nominal and Effective wake - Wake distribution	
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK					
9	Able to develop scientific basic concepts of propeller work and characteristics propelle	• Understanding on propeller theory (C2) • Understanding of the basic concepts of propeller work and propeller characteristics (C2) • Ability to read propeller characteristic charts (C2)	Non-Test : Resume on the basic concepts of propeller work and propeller characteristics	• Lectures and discussions on the basic concepts of propeller work and propeller characteristics [TM:2x(2x50")] • (Task 7: Make a resume about the basic concepts of propeller work and propeller characteristics) [BT+BM:(2+2)x(2x50")]	• Propeller theory - Momentum theory - Leaf element theory - Circulation theory • Propeller geometry • Propeller characteristics • Propeller testing • Kq-Kt-J diagram • Bp-d diagram • Propeller efficiency • Cavitation	
10	Able to design and draw propellers optimal design for a particular ship	• Accuracy in designing the propulsion system and drawing the propeller (C5, P2)	• Tests: Designing the optimal propulsion system and drawing the propeller for a particular ship	• Discussion on the optimal design and drawing of the propeller for a particular vessel [TM:2x(2x50")] • (Project 3: Perform calculations on the propulsion system and propeller drawing) [BT+ BM:(2+2)x(2x50")]	• Propeller Design • Propeller Drawing	
11	Able to analyze the interaction between the propeller and hull and Engine-Propeller Matching	• Accuracy of determination of propeller loading and operating point on engine (C4)	• Tests: Determination of interaction between propeller and hull and Engine-Propeller Matching	• Discussion on the interaction between propeller and hull and Engine-Propeller Matching [TM:3x(2x50")]	• Hull-Propeller Interaction - Propeller Loading - Propeller Load Characteristic • Engine-Propeller Matching	

		• Accuracy of analyzing engine propeller matching (C4)		• (Project 4: Perform Engine-Propeller Matching process) [BT+BM:(2+2)x(2x50")]	- Propeller Cu rve - Engine rating - Operating point on the engine	
12	Able to analyze ship propulsion system configuration	• Accuracy in analyzing the configuration of the ship's propulsion system (C4)	Test: analysis of the ship's propulsion system configuration	• Discussion on ship propulsion system configuration [TM:1x(2x50")] • (Project 5: Analyze ship propulsion system configuration) [BT+BM:(1+1)x(2x50")]	• Propulsion system configuration	**5%**
13	Able to develop scientific methods of determining resistance and propulsion systems for non-Merchant ships	Understanding of the method of determining resistance and propulsion systems for non-Merchant vessels (C2)	Non-Test : • Group presentation • Resume on methods of determining resistance and propulsion systems for non-Merchant vessels	• Presentation and discussion on resistance determination methods and propulsion systems for non-Merchant vessels [TM:2x(2x50")] • (Task 8: Make a resume on methods for determining resistance and propulsion systems for non-Merchant vessels) [BT+BM :(2+2)x(2x50")]	• Special ship resistance and propulsion - HSC - Semi-Displacement Craft - Planning Craft, etc.	**5%**
14-15	Able to develop scientific concept of hybrid propulsion system	Understanding of the concept of the hybrid propulsion system (C2)	Non-Test : • Group Presentation • Resume about the concept of the hybrid propulsion system	• Presentation and discussion on hybrid propulsion system concept [TM:2x(2x50")] • (Task 9: Make a resume about hybrid propulsion system concept) [BT+BM :(2+2)x(2x50")]	• Hybrid propulsion system concept	**5%**
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK**					

	And Evaluation of CPL achievement charged to MK	
Total		

Notes :

1. **Learning Outcomes of Graduates of Study Programs (CPL-PRODI**) are abilities possessed by each graduate of PRODI which are the internalization of attitudes, mastery of knowledge and skills according to the level of study programs obtained through the learning process.
2. **The CPL that is charged to the course** is a number of learning outcomes for study program graduates (CPL-PRODI) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course CP (CPMK)** is the ability that is specifically described from the CPL that is charged to the course, and is specific to the study material or learning material for the course.
4. **Subject Sub-CP (Sub-CPMK)** is the ability that is specifically described from the CPMK that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
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6. **Assessment Criteria** are benchmarks used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for raters so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Form of assessment**: test and non-test.
8. **Forms of learning**: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods**: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning Materials** are details or descriptions of study materials that can be presented in the form of several subjects and sub-topics.
11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.

RP MK SAFETY AND MAINTENANCE MANAGEMENT SYSTEM (SISTEM MANAJEMEN KESELAMATAN & PEMELIHARAAN)

	SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**					
COURSE		**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
SAFETY AND MAINTENANCE MANAGEMENT SYSTEM (SISTEM MANAJEMEN KESELAMATAN & PEMELIHARAAN)		**ME185301**	**RAMS**	**3**	**OPTIONS**	
AUTHORIZATION		**Developer RP**	**Coordinator RMK**		**Ka PRODI**	
		DW	**DN**		**SG**	
Study Outcomes (CP)	**CPL-PRODI**					
	Program learning outcomes in the course curriculum document					
	CP MK					
	Students can develop an understanding and implementation of safety management systems and maintenance management in various industrial scales, especially for ship operations.					
Short Description of MK	Reliability - Maintenance Philosophy; Strategic Maintenance Planning; Managing Maintenance Resources; Maintenance Systems Documentation.					

Main Subject / Study Material	Maintenance Philosophy; Maintenance Management Model; Failure Characteristics & Maintenance; Maintenance Business Process; Maintenance Organizations; Maintenance Life Plan; Planning and Scheduling; Condition Monitoring; Introduction to RCM; Maintenance Audits.
Literature	**Main:** 1. Strategic Maintenance Planning, Anthony Kelly, 1st ed, Elsevier 2006 2. Managing Maintenance Resource, Anthony Kelly, 1st ed, Elsevier 2006 3. Maintenance Systems and Documentation, Anthony Kelly, 1st ed, Elsevier 2006 **Supporting :**

Learning Media	**Software:**	**Hardware :**
	1. RCM Software	1. Laptop 2. LCD Projector 3. Post - It

Team Teaching	DW
Course Requirements	

Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students are able to understand the relationship between Reliability and Maintenance Management	• Cognitive: • Understanding of lecture systematics and its relation to previous supporting lectures (C2). • Understanding of maintenance concepts from the point of view of reliability theory (C2)	Non-Test: • Assignment 1: Gathering a summary of RAM concepts	• Face-to-face activities, interactive discussions with "David Sibbet's visual meeting concept" : (3 x 50'). • Structured and independent learning activities Summarizing the concept of RAM: (3 x 100')	•	Relationship between the RAM concept and the maintenance management concept.	

2	Students are able to develop understanding and apply various Maintenance Best Practice Models as a basis for designing maintenance management implementation.	Cognitive: • Understand and compare the key elements in the maintenance best practice model (C2). • Affective: • Attitude in accepting and appreciating a concept (A3)	Non-Test : • Assignment 2: Blunts Reviews of One Model of Maintenance Management.	• Face-to-face lectures and interactive discussions with "David Sibbet's visual meeting concept" : (3 x 50'). • Structured and independent learning activities: Refer and review one of the maintenance management models: 2x(3x100').		An introduction to maintenance best practice models: Campbell's Model; Wireman's Model; Maintenance Excellence Model; Anthony Kelly's Model; PAS55 Model	
3-4	Students are able to develop an understanding of various types of failure characteristics / asset patterns and choose appropriate maintenance activities based on their failure characteristics	Cognitive: • Understanding the concept of failure mechanism, bathup curve and failure pattern (C2). • Categorize failure characteristic assets (C3) • Select maintenance strategy activities based on failure pattern assets (C4). Affective: • Attitude in accepting and appreciating a concept (A3)	Non-Test : • Assignment 3: Collecting a portfolio of assessment support systems with the topic of selecting asset maintenance activities according to their failure characteristics.	• Face-to-face lectures and interactive discussions with "David Sibbet's visual meeting concept" : 2x(3 x 50'). • Structured and independent learning activities: Determining the failure characteristics and equipment of one of the main engine support systems: 2x(3x100')		Failure mechanism; Bathing curve; failure patterns; Failures prevention tactics; Maintenance strategy; Maintenance objectives	**10%**
5-7	Students are able to develop understanding and apply the main business processes of care management.	Cognitive: • Understand the various key business processes of care management that exist in an organization (C2). Affective:	Non-Test : • Assignment 4: Collecting learning outcomes assignments make up one of the main business processes of care management.	• Face-to-face lectures and interactive discussions with David Sibbet's "visual meeting concept" " :3x(3 x 50').		• Business process concept. Translating the maintenance best practice model into the main	**10%**

		• Attitude in accepting and appreciating a concept (A3).		• Structured and independent learning activities: Make one of the main business processes of care management: 3x(3x100') • Lecture and discussion on Wake and Thrust Deduction [TM:1 x(2x50")] • (Task 6: Resume about Wake and Thrust Deduction) [BT+BM:(1+1)x(2x50")]	maintenance business processes. Helicopter view of the main maintenance business processes. • Business processes: planning & scheduling, planned maintenance (planned maintenance), failure/damage reports (failure reporting), unplanned maintenance (unplanned maintenance), continuous improvement	
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK					
9-10	• Students are able to develop an understanding of the organizational structure of asset maintenance management in the organization. • Students develop an understanding and application of a maintenance life plan of a main	• Cognitive: Understanding the basic forms of maintenance management organization (C2). • Affective: Attitude in accepting and appreciating • Cognitive: Understand various maintenance strategies throughout the life of the asset (C2).	• Non-Test: Exploring the material. • Non-Test: Assignment 5: Collecting a portfolio of assessment support systems with the topic of preparing a maintenance life plan.	• Face-to-face lectures and interactive discussions with "David Sibbet's visual meeting concept": (3 x 50'). • Structured and independent learning activities: Observing and rewriting the maintenance	• Geographical organizational structure; Reporting structures; Maintenance staff. • Plant items and their failure characteristics; Preventive maintenance decision problems; Maintenance	**20%**

	engine support system on a ship.	Develop a maintenance life plan of a main engine support system on the ship (C3). • Affective: Attitude in accepting and appreciating a concept (A3).		management structure of a company engaged in the maritime industry.: (3x100') • Face-to-face lectures and discussions: 2x(3 x 50'). • Structured and independent learning activities: Develop a maintenance life plan of equipment one of the main engine support systems: 2x(3x100')	actions; maintenance policy.	
11-12	Students are able to develop planning and scheduling concepts in maintenance management and apply them to simple systems.	• Cognitive: Understand the concept of planning and scheduling (C2). Develop planning and scheduling of a main engine support system on board (C3). • Affective: Attitude in accepting and appreciating a concept (A3).	• Non-Test: Assignment 6: Collecting a portfolio of assessment support systems with the topic of scheduling maintenance preparation.	• Face-to-face lectures and discussions:(3 x 50'). • Structured and independent learning activities: Arrange maintenance scheduling of equipment one of the main engine support systems: (3x100')	• Planning horizon • Planning & Scheduling tools • Planning and scheduling sequence • Backlog management model.	**10%**
13	Students are able to develop an understanding of proper monitoring conditions to monitor the potential failure of assets.	• Cognitive: Understanding the concept and category of condition monitoring (C2). Determine the proper monitoring condition of a main engine support system on board (C3). • Affective: Attitude in accepting and appreciating a concept (A3).	• Non-Test: Assignment 7: Collecting a portfolio of assessment support systems with the topic of determining the right monitoring conditions for equipment contained in a main engine support system on board.	• Face-to-face lecture and discussion:(3 x 50'). • Structured and independent learning activities: Determining the right monitoring conditions for equipment contained in a main engine support system on board: (3x100')	• Condition monitoring category • Dynamic monitoring • Particle monitoring • Chemical monitoring • Physical effect monitoring • Temperature monitoring	**10%**

					• Electrical effect monitoring	
14	Students are able to develop understanding and use the right KPIs to measure the implementation of maintenance management.	• Cognitive: Understanding the hierarchy of key performance indicators (C2). Determine the right KPI from a main engine support system on board (C3). • Affective: Attitude in accepting and appreciating a concept (A3).	Non-Test: Material deepening.	• Face-to-face lectures and discussions:(3 x 50'). • Structured and independent learning activities: (3x100')	• Key performance indicators pyramid. • Tactical & functional performance indicators.	**10%**
15	Students develop an understanding of the concept of RCM as a tool for maintenance improvement and can develop RCM analysis for simple systems.	Cognitive: • Understand the concept and implementation of RCM (C2). • Develop RCM analysis for simple systems. Affective: • Attitude in accepting and appreciating a concept (A3)	Non-Test: • Assignment 8: Collecting a portfolio of RCM results for equipment contained in a main engine support system on board.	• Face-to-face lectures and discussions: 2x(3 x 50'). • Structured and independent learning activities: Compile the results of RCM analysis for equipment contained in a main engine support system on board: (3x100') • Presentation and discussion on hybrid propulsion system concept [TM:2x(2x50")] • (Task 9: Make a resume about hybrid propulsion system concept) [BT+BM :(2+2)x(2x50")]	• Maintenance strategy development framework; Diagnostic assessments; Benchmarking & Gap analysis.	**30%**
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK And Evaluation of CPL achievement charged to MK**					
Total						**100%**

Notes :

1. **Learning Outcomes of Graduates of Study Programs (CPL-PRODI**) are abilities possessed by each graduate of PRODI which are the internalization of attitudes, mastery of knowledge and skills according to the level of study programs obtained through the learning process.
2. **The CPL that is charged to the course** is a number of learning outcomes for study program graduates (CPL-PRODI) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course CP (CPMK)** is the ability that is specifically described from the CPL that is charged to the course, and is specific to the study material or learning material for the course.
4. **Subject Sub-CP (Sub-CPMK)** is the ability that is specifically described from the CPMK that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** the ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for raters so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Form of assessment**: test and non-test.
8. **Forms of learning**: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods**: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning Materials** are details or descriptions of study materials that can be presented in the form of several subjects and sub-topics.
11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.

RP MK SAFETY OF NAVIGATION (KESELAMATAN NAVIGASI)

	SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**					
COURSE		**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
SAFETY OF NAVIGATION (KESELAMATAN NAVIGASI)		**ME185302**	**RAMS**	**3**	**OPTIONS**	
AUTHORIZATION		**Developer RP**	**Coordinator RMK**		**Ka PRODI**	
		BZ	**DN**		**SG**	
Study Outcomes (CP)	**CPL-PRODI**					
	Program learning outcomes in the course curriculum document					
	CP MK					
	Students are able to understand aspects of safety on ships, regulations regarding safety on ships, and understand the use of Formal safety assessment (FSA) in evaluating the implementation of a regulation.					
Short Description of MK	Introduction of stakeholders in ship safety, international and domestic regulations and Formal Safety Assessment.					
Main Subject / Study Material	Introduction to Ship Safety Lectures, Stakeholders in the maritime field, international regulations (SOLAS, MARPOL, STCW, MLC, ISM etc.) and domestic (KM 70 of 1998), Remedial Regulations, and Formal Safety Assessment (FSA))					
Literature	**Main:**					

	1. IMO, Guideline for Formal Safety Assessment 2. Kristiansen, S. (2005) 3. Maritime Transportation Safety Management and Risk Analysis, Elsevier Butterworth-Heinemann 4. IMO, Safety of Life at Sea 5. IMO, International Maritime Dangerous Good Code 6. IMO, International safety Management Code 7. IMO, Civil Liability Compensation 8. IMO, Fund Convention 9. IMO, Bunker Convention 10. Tools and Applications **Supporting :**						
Learning Media	**Software:**			**Hardware :** 1. PC 2. LCD Projector			
Team Teaching	BZ						
Course Requirements							
Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students develop an understanding of the background of the need for lectures the safety	• Systematic understanding of lectures • General understanding of navigational safety • Understanding of theory and recent developments	Question and answer discussion	• Lectures and brainstorming [TM: (3 x 50 minutes)]	•	Learning Contract Ship; Overall Lecture Overview; Background of the need for Ship Safety; Description and explanation of Ship Accidents in	

					Indonesia and the world; Emergence of International (IMO Reg) and National Regulations	
2-3	Students develop an understanding of stakeholders that affect the operational safety of ships	• Understanding of navigation safety stakeholders • Understanding of developing navigational safety engineering methods related to maritime stakeholders • Understandingregarding the factors that influence the innovation of improving navigational safety related to maritime stakeholders.	• Literature reviews the development of methods for improving navigational safety related to stakeholders der maritime • Exposure to literature reviewing the development of methods for improving navigational safety related to maritime stakeholders	• Lectures and studies of safety concepts and implementations in ship operations • Discussion of the development of ship operational safety engineering concepts and technologies • Literature review of ship operational safety developments	• Ship Safety Stakeholders • Explanation of the Flag State (Traditional Flag State, Opened Registry) • Explanation of the Port State Control (Port State Control) • Ship Insurance (eg: Hull and Machinery, P&I Club) • Classification Board (International Association Classification Society)	
4-5	Students develop an understanding of several international regulations in the maritime field	• An understanding of the development of the concept of international regulations in the maritime field • An understanding of the development of methods for the application of international regulations in the maritime field • An understanding of the factors that influence the implementation of	• Literature review of the development of methods and applications of international regulations in the maritime field. • Literature review	• Lectures and studies on concepts and implementation of international regulations in the maritime sector • Discussion on the development of international regulatory concepts in the field hot maritime	• verview of international and national regulations in the maritime sector (Statutory Regulations) • Overview of Safety of Life at Sea (SOLAS) regulations • Overview IMDG Code	

		internal regulations in the maritime field.		• Literature review of the development of international regulations in the maritime field	• Overview ISPS Code • Overview Standard Training Certification and Watchkeeping (STCW) 78/95 • (KM 70 1998, regarding manning of ships. • Overview of ILO Convention • Marine Pollution (MARPOL) 73/78 • IBC Code • Load Line Convention • Tonnage Measurement Convention • etc.	
6	Students develop an understanding of the implementation of International Safety Management in the shipping industry	• An understanding of the development of the concept of International Safety Management in the shipping industry • An understanding of the development of International Safety Management application methods in the shipping industry • An understanding of the factors that influence the implementation of	• Literature review of the development of methods and applications of International Safety Management in the shipping industry • Literature review	• Lectures and studies of concepts and implementation of International Safety Management in the shipping industry • Discussion of the development of the concept of International Safety Management in the shipping industry	• Implementation of ISM Code. Background to the need for ISM Code. • Implementation of ISM Code	

		International Safety Management in the shipping industry		• Literature reviews the development of International Safety Management in shipping. industry		
7	Students develop an understanding of the function of regulations relating to compensation for pollution Marine	• An understanding of the development of regulationsrelating to compensation due to marine pollution • An understanding of the development of regulatory application methods relating to compensation due to marine pollution • An understanding of the influencing factors in the implementation of regulations relating to compensation due to marine pollution	• Literature review of regulatory developments relating to compensation due to marine pollution • Literature review	• Lecture and study of concepts and implementation of regulations relating to compensation due to marine pollution • Discussion on the development of the concept of implementing regulations relating to compensation due to marine pollution • Literature review of regulations relating to compensation due to marine pollution • Lecture and discussion on Wake and Thrust Deduction [TM:1 x(2x50")] • (Task 6: Resume about Wake and Thrust Deduction) [BT+BM:(1+1)x(2x50")]	• Remedial Regulation: Civil liability Compenstaion Fund Convention	
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK					
9-10	Students develop an understanding of the function of regulations related	• Understanding of the development of the concept of bunker convention regulations	• Literature review of the development of methods and applications of bunker convention regulations	• Lectures and studies on concepts and	• Remedial Regulation: Bunker Convention LLMC	

	to compensation for marine pollution	• An understanding of the development of application methods for the bunker convention regulations • Understanding of the factors that influence the bunker convention regulations	• Presentation of the literature review	implementation of Bunker Convention regulations • Discussion of concept and technology developments in applying the rules of the Bunker Convention • Literature review of the Bunker Convention		
11-12	Students develop understanding and apply the SHELL method and Hybrid Model for accident	• An understanding of the development of ship accident investigation concepts using the SHELL method • An understanding of the development of ship accident investigation application methods using the SHELL method An understanding of the factors that influence ship accident investigations using the SHELL method SHELL method	• Review on the development of methods and applications of shipwreck investigation using the SHELL method • Literature	• Lecture and study of concept and implementation of shipwreck investigation using SHELL method • Discussion on the development of ship accident investigation concepts and technology using the SHELL method • Literature review of ship accident investigations using the SHELL method	• Investigation Accident Investigation Method • Background of the need for ship accident investigation • SHELL (Software-Hardware-Environmet-Liveware) • Hybrid Model Model	
13-15	Students develop understanding and risk analysis using Formal Safety Assessment (FSA) to prevent ship accidents	• Understanding of Formal Safety Assessment • Understanding of the development of Formal Safety Assessment methods • Understanding of influencing factors in Formal Safety Assessment	• Literature review of development of Formal Safety Assessment methods • FSA duties	• Lectures and concept studies and Implementation of Formal Safety Assessment • Discussion of the development of the concept of Formal Safety Assessment • Literature review of Formal Safety Assessment	• Methods for taking proactive accident prevention measures Formal Safety Assessment (FSA) Risk Analysis Methods Preliminary Hazard Analysis HAZOPFTAEvent Tree Analysis	

				• Presentation and discussion on hybrid propulsion system concept [TM:2x(2x50")] • (Task 9: Make a resume about hybrid propulsion system concept) [BT+BM :(2+2)x(2x50")]		
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK And Evaluation of CPL achievement charged to MK**					
Total						

Notes :

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11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.

Learning Plan: Renewable Marine Energy and Simulation

<table>
<tr><td colspan="2">INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FACULTY OF MARINE TECHNOLOGY
DEPARTMENT OF MARINE ENGINEERING
MASTER PROGRAMME (S2)</td></tr>
<tr><td colspan="2">
<table>
<tr><th>COURSE</th><th>CODE</th><th>Course Cluster</th><th>CREDIT (SKS)</th><th>SEMESTER</th><th>Compilation Date</th></tr>
<tr><td>RENEWABLE MARINE ENERGY AND SIMULATION</td><td>ME 185504</td><td>MPP (Marine Power Plant)</td><td>3 SKS</td><td>Elective Course</td><td></td></tr>
</table>
</td></tr>
<tr><td>AUTHORIZATION</td><td>
<table>
<tr><th>Learning Plan Developer</th><th>Coordinator of Course Cluster</th><th>Head of Study Programme</th></tr>
<tr><td>Prof. Ir. Aguk Zuhdi M. Fathallah., M.Eng., Ph.D</td><td>Beny Cahyono, S.T., M.T., Ph. D</td><td>Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.</td></tr>
</table>
</td></tr>
<tr><td>Learning Outcomes (LOs)</td><td>CPL-PRODI

See learning outcome Study Program on curriculum document(PLO-1, PLO-4, PLO-6)

CP MK

Understand the theory of the latest technological developments regarding alternative energy and the environment to understand the right solutions and applications to find new renewable energy sources and minimize pollution, especially with regard to systems on ships.</td></tr>
<tr><td>Course Description</td><td>Learn about combustion motor technology, shipping electrical installations, system design on ships</td></tr>
<tr><td>Subject / Study Material</td><td>Pollution in the sea due to machinery,
New and renewable types of energy,
Engine update to adapt to renewable fuels,
Alternative fuel applications for marine engineerings,
The concept of Energy Efficiency Design Index (EEDI),</td></tr>
</table>

	The concept of Energy Efficiency Operational Indicator (EEOI)						
References	**Primary :** 1. Climate Change and the Shipping Response. London: IMO.International Maritime Organization, 2016 2. Ship Energy Efficiency Regulations and Related Guidelines. London: IMO 3. .. **Secondary :** 1. International Renewable Energy Agency, 2015. Renewable Energy Options for Shipping. UK: 2. International Energy Agency, 2009. Energy Sector Methane Recovery and Use: The Importance of Policy. Paris: IEA. 3. Journal and proceeding						
Learning Media	**Software :**			**Hardware :**			
				PC & LCD Projector			
Team Teaching	Prof. Ir. Aguk Zuhdi M. Fathallah., M.Eng., Ph.D						
Prerequisites	-						
Week-no	**Final abilities at each stage of learning (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]**		**Learning Materials [Reference]**	**Assessment Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Online**	**Offline**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students understand the scope of renewable marine energy courses and have an overview of their development	• Understanding the systematics of lecture • General understanding of thermal and fluid system planning • Understanding the latest theories and developments	Q&A discussion	• Lecture and brainstorming TM: (3 x 50 minute)	•	• Initiation of lectures • Motivation to learn • Purpose of the lecture • Scope of lectures • Definition of renewable marine energy	
2	Students can develop understanding and	• Understanding the development of the	Q&A discussion			• Definition of Energy Efficiency	

	application of the Concept of Energy Efficiency Design Index (EEDI)	energy efficiency design index (EEDI) concept • Understanding the development of energy efficiency design index (EEDI) methods • Understanding the factors that influence the Energy Efficiency Design Index (EEDI)		• Lectures and concept studies and implementation of the Energy Efficiency Design Index (EEDI) • Discussion of the development of energy efficiency design index (EEDI) concepts and technologies • Literature review of the development of energy efficiency design index (EEDI) engineering development TM = … BT = .. BM = …	Design Index (EEDI) • Implementation and application of Energy Efficiency Design Index (EEDI) in ships, ports, installations, and marine buildings • Current methods related to energy efficiency design index (EEDI) analysis • Factors that affect the Energy Efficiency Design Index (EEDI) • Case study of energy efficiency design index (EEDI) analysis implementation	
3	Students can develop understanding and application of the Concept of Energy Efficiency Operational Indicator (EEOI)	• Understanding the development of the Energy Efficiency Operational Indicator (EEOI) Concept • Understanding the development of the Energy Efficiency Operational Indicator (EEOI) method • Understanding the factors that affect the Concept of Energy	Q&A discussion	• Lectures and concept studies and implementation of Energy Efficiency Operational Indicator (EEOI) Concepts • Discussion of the development of the Concept of Energy Efficiency Operational Indicator (EEOI)	• Definition of Energy Efficiency Operational Indicator (EEOI) Concept Analysis • Implementation and application of Energy Efficiency Operational Indicator (EEOI) Concept in ships, ports, installations,	**5%**

		Efficiency Operational Indicator (EEOI)		• Literature review of the development of engineering Concept Energy Efficiency Operational Indicator (EEOI) TM = … BT = .. BM = …	and marine buildings • Current methods related to the Concept of Energy Efficiency Operational Indicator (EEOI) • Factors that influence the Concept of Energy Efficiency Operational Indicator (EEOI) • Case study of the Energy Efficiency Operational Indicator (EEOI) Concept	
4	Students can develop an understanding and application of pollution mitigation at sea due to machinery	• Understanding of the development of pollution engineering in the sea due to machinery. • Understanding of the development of pollution engineering applications in the sea due to machinery. • Understanding the identification of factors that affect the Concept of Energy Efficiency Operational Indicator (EEOI)	Q&A discussion	• Lectures and concept studies and implementation of technological engineering minimize pollution in the sea due to machinery • Discussion of technological engineering developments to minimize pollution in the sea due to machinery. • Literature review of the development of engineering Concept	• Definition of pollution in the sea due to machinery • The latest methods of engineering technology to minimize pollution in the sea due to machinery	**5%**

				Energy Efficiency Operational Indicator (EEOI)		
5-8	Students can develop understanding and application of new and renewable types of energy	• An understanding of the development of new and renewable energy concepts, technologies, and applications • Understanding the development of new and renewable energy concepts, technologies, and applications • Understanding of the factors that influence the application of new and renewable energy	• Literature reviews the development of new and renewable energy concepts, technologies, and applications • Exposure to literature studies of new and renewable energy concepts, technologies, and applications • Exposure in group form	• Lectures and studies of new and renewable energy types • Discussion of the development of new and renewable energy concepts, technologies, and applications • Literature reviews the concepts, technologies, and applications of new and renewable energy		• Definition of renewable energy engineering • Implementation and application of heat transfer engineering in ships, ports, installations, and marine buildings • The latest methods related to heat transfer • Factors that affect heat transfer engineering • Case studies of heat transfer engineering implementation	**30%**
9	Midterm Evaluation (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been done)						
10-12	Students can develop understanding and application of engine updates to adapt to renewable fuels	• Understanding of the development of concepts, technologies, and the application of engine update to adapt to alternative fuels • Understanding of the development of concepts, technologies, and the application of engine additions to adapt to alternative fuels	• Literature reviews the development of concepts, technologies, and the application of engine updates to adapt to alternative fuels • Exposure to literature studies of concepts, technologies, and the application of engine update to adapt to alternative fuels	• Lectures and engine update studies to adapt to alternative fuels • Discussion of the development of concepts, technologies, and the application of engine improvements to		• Definition of engine update engineering to adapt to alternative fuels • Implementation and application of engine update to adjust to alternative fuels • The latest methods related	30%

			• Presentation in group form	adapt to alternative fuels • Literature reviews concepts, technologies, and the application of engine updates to adapt to alternative fuels TM = … BT = .. BM = …	to engine updates to adapt to alternative fuels • Factors – factors that affect the engineering of engine update to adjust to alternative fuels • Case studies implementation engine update engineering to adjust to alternative fuels	
13-15	Students can develop understanding and application of alternative fuel applications to marine engineering	• An understanding of the development of concepts, technologies, and application of alternative fuel engineering to marine engineerings • An understanding of the development of concepts, technologies, and the application of alternative fuel engineering for marine engineering	• Literature reviews the development of concepts, technologies, and applications of alternative fuel engineering to marine engineerings • Exposure to literature studies of concepts, technologies, and applications of alternative fuel engineering to marine engineerings • presentation in group form	• Lectures and studies of alternative fuel engineering for marine engineerings • Discussion of the development of concepts, technologies, and applications of alternative fuel engineering to marine engineerings • Literature reviews concepts, technologies, and applications of alternative fuel	• Definition of alternative fuel engineering for marine engineerings • Implementation and application of alternative fuel engineering for marine engineerings • Current methods relating to alternative fuel engineering for marine engineerings affect the engineering of	**30%**

				engineering for marine engineering TM = … BT = .. BM = …	steam systems and thermal oils • Case study of alternative fuel engineering implementations for marine engineering	
16	**Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)**					
Total						100%

Catatan :

1. **Capaian Pembelajaran Lulusan PRODI (CPL-PRODI)** adalah kemampuan yang dimiliki oleh setiap lulusan PRODI yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-PRODI) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CP Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
6. **Kriteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.

11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. **TM**=Tatap Muka, **PT**=Penugasan terstruktur, **BM**=Belajar mandiri.

Learning Plan: Fuel Technology and Operation

<table>
<tr><td></td><td colspan="6">INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FACULTY OF MARINE TECHNOLOGY
DEPARTMENT OF MARINE ENGINEERING
MASTER PROGRAMME (S2)</td></tr>
<tr><td colspan="2">COURSE</td><td>CODE</td><td>Course Cluster</td><td>CREDIT (SKS/ECTS)</td><td>SEMESTER</td><td>Compilation Date</td></tr>
<tr><td colspan="2">FUEL TECHNOLOGY AND OPERATION</td><td>ME 185505</td><td>MPP (Marine Power Plant)</td><td>3 SKS/4.8 ECTS</td><td>Elective Course</td><td></td></tr>
<tr><td colspan="2" rowspan="2">AUTHORIZATION</td><td colspan="2">Learning Plan Developer</td><td colspan="2">Coordinator of Course Cluster</td><td>Head of Study Programme</td></tr>
<tr><td colspan="2">Prof. Semin, S.T., M.T., Ph.D.</td><td colspan="2">Beny Cahyono, S.T., M.T., Ph. D</td><td>Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.</td></tr>
<tr><td rowspan="2">Learning Outcomes (LOs)</td><td>CPL-PRODI</td><td colspan="5">see Study Program learning outcomes in curriculum documents</td></tr>
<tr><td>CP MK</td><td colspan="5">Students are able to develop an understanding of various types of fuel; they are the process of production, availability and stock, and use of fuels and processes during combustion itself</td></tr>
<tr><td colspan="2">Course Description</td><td colspan="5">Learn about combustion engine technology; shipping electrical installations; system design on the ship</td></tr>
<tr><td colspan="2">Subject / Study Material</td><td colspan="5">Conventional fuels, fluids, and gases, such as gasoline, diesel,
CNG and LNG, Hydrogen;
Alcohol, eg methanol, ethanol;
Renewable fuels, such as biogas and biodiesel;
Fuel cell technology</td></tr>
</table>

	Hybrid fuel						
References	**Primary :** 1. Climate Change and the Shipping Response. London: IMO.International Maritime Organization, 2016 2. Ship Energy Efficiency Regulations and Related Guidelines. London: IMO 3. .. **Secondary :** 1. International Renewable Energy Agency, 2015. Renewable Energy Options for Shipping. UK: 2. International Energy Agency, 2009. Energy Sector Methane Recovery and Use: The Importance of Policy. Paris: IEA. 3. Journal and proceeding						
Learning Media	**Software :**			**Hardware :**			
				PC & LCD Projector			
Team Teaching	Prof. Semin, S.T., M.T., Ph.D.						
Prerequisites	-						
Week-no	**Final abilities at each stage of learning (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]**		**Learning Materials [Reference]**	**Assessment Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Online**	**Offline**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students understand the scope of the fuel technology and operation course and have an overview of its development	• Understanding of lecture systematics • General understanding of technology planning and fuel operation • Understanding of the latest theory and developments	Question and answer discussion	•	•	• Study initiation • Motivation to learn • Study goals • Scope of the study • Definition of fuel technology and operation	
				• Lectures and brainstorming TM: (3 x 50 minutes)			
2	Students are able to develop and apply an understanding of conventional fuels	• Understanding of conventional fuel concept development	Question and answer discussion			• Definition of conventional fuel • Implementation and application of	
				• Lectures and studies of conventional fuel			

		• Understanding of the development of conventional fuel methods • Understanding of the factors that influence the use of conventional fuel		concepts and implementations • Discussion on the development of conventional fuel concepts and technologies • Literature review the development of conventional fuel engineering TM = … BT = .. BM = …	conventional fuels in ships, ports, installations, and marine structures • The latest methods relate to conventional fuels • Factors that affect conventional fuel • Case study implementation of conventional fuel analysis	
3	Students are able to develop and apply an understanding of CNG and LNG, Hydrogen;	• Understanding of the development of the use of CNG and LNG, Hydrogen • An understanding of the development of the use of CNG and LNG, Hydrogen An understanding of the factors that influence the use of CNG and LNG, Hydrogen	Question and answer discussion	• Lectures and concept studies and implementation of CNG and LNG, Hydrogen • Discussion on the development of CNG and LNG, Hydrogen • Literature review of engineering developments using CNG and LNG, Hydrogen TM = … BT = .. BM = …	• Definitions of CNG and LNG, Hydrogen • Implementation and application of CNG and LNG, Hydrogen in ships, ports, installations, and marine structures • The latest method of using CNG and LNG, Hydrogen • Factors that influence the use of CNG and LNG, Hydrogen • Implementation case studies, Hydrogen	**5%**
4	Students are able to develop and apply	• Understanding of fuel cell technology	Q&A discussion			**5%**

	an understanding of Fuel cell Technology	engineering development • Understanding of the development of fuel cell technology engineering applications • Understanding of the identification of influencing factors in fuel cell technology		• Lecture and study of concepts and implementation of fuel cell technology engineering • Discussion on the development of fuel cell technology engineering • Literature reviews the development of fuel cell technology	• Definition of fuel cell technology • The latest methods of engineering fuel cell technology	
5-8	Students are able to develop and apply an understanding of renewable fuels, such as biogas and biodiesel;	• Understanding of the development of new and renewable energy concepts, technologies, and applications • Understanding of the development of new and renewable energy concepts, technologies, and applications • understanding of the influencing factors in the application of new and renewable energy	• Literature reviews the development of new and renewable energy concepts, technologies, and applications • Exposure to the literature study of new and renewable energy concepts, technologies, and applications • Group presentation	• Lectures and studies on new and renewable energy types • Discussion on the development of new and renewable energy concepts, technologies, and applications • Literature reviews concepts, technologies, and applications of new and renewable energy	• Renewable fuel engineering definition • Renewable fuel engineering implementation and application • The latest methods related to renewable fuels • Factors influencing renewable fuel engineering • Renewable fuel engineering implementation case study	**30%**
9	Midterm Evaluation (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been done)					
10-12	Students are able to develop and apply an understanding of alcohol, for example, methanol, ethanol;	• Understanding of concept development, technology, and application of alcohol as a ship fuel • Understanding of concept development, technology, and	• The literature reviews the development of the concept, technology, and application of alcohol as a ship fuel • Exposure to the literature study of the concept, technology, and	• Lectures and studies alcohol as ship fuel • Discussion on the development of the concept, technology,	• Definition of alcohol as ship fuel • Implementation and application of alcohol as ship fuel	30%

		application of alcohol as ship fuel	application of alcohol as a ship fuel • Group presentation	and application of alcohol as a fuel for ships • Literature reviews the concept, technology, and application of alcohol as a ship fuel TM = … BT = .. BM = …	• Current methods deal with alcohol as ship fuel • Factors influencing the engineering of alcohol as a ship fuel • Case study on the implementation of engineering alcohol as a ship fuel	
13-15	Students are able to develop and apply an understanding of hybrid fuels	• Understanding of concept development, technology, and application of hybrid fuels on ships • Understanding of concept development, technology, and application of hybrid fuel on ships	• Literature reviews the development of the concept, technology, and application of hybrid fuel engineering on ships • Exposure to the literature study of the concept, technology, and application of hybrid fuels on ships • Group presentation	• Hybrid fuel engineering lectures and studies on board • Discussion on the development of the concept, technology, and application of hybrid fuel on ships • Literature review of the concept, technology, and application of hybrid fuel engineering on ships TM = … BT = .. BM = …	• Definition of onboard hybrid fuel engineering • Hybrid fuel engineering implementation and application on ships • Up-to-date methods related to onboard hybrid fuel engineering • Case study of hybrid fuel engineering implementation on ships	**30%**
16	**Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)**					
Total						100%

Catatan :

1. **Capaian Pembelajaran Lulusan PRODI (CPL-PRODI)** adalah kemampuan yang dimiliki oleh setiap lulusan PRODI yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-PRODI) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CP Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
6. **Kriteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. **TM**=Tatap Muka, **PT**=Penugasan terstruktur, **BM**=Belajar mandiri.

Learning Plan: Efficient Ship and Fleet Operation

<table>
<tr><td colspan="2">INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FACULTY OF MARINE TECHNOLOGY
DEPARTMENT OF MARINE ENGINEERING
MASTER PROGRAMME (S2)</td></tr>
<tr><td colspan="2">
<table>
<tr><th>COURSE</th><th>CODE</th><th>Course Cluster</th><th>CREDIT (SKS/ECTS)</th><th>SEMESTER</th><th>Compilation Date</th></tr>
<tr><td>EFFICIENT SHIP AND FLEET OPERATION</td><td>ME 185506</td><td>RAMS (Marine Reliability, Availability, Management, and Safety)</td><td>3 SKS/4.8 ECTS</td><td>Elective Course</td><td></td></tr>
</table>
</td></tr>
<tr><td>AUTHORIZATION</td><td>
<table>
<tr><th>Learning Plan Developer</th><th>Coordinator of Course Cluster</th><th>Head of Study Programme</th></tr>
<tr><td>Dr.-Ing. Wolfgang Busse</td><td>A.A.B. Dinariyana Dwi P., S.T., MES., Ph.D.</td><td>Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.</td></tr>
</table>
</td></tr>
<tr><td>Learning Outcomes (LOs)</td><td>CPL-PRODI

see Study Program learning outcomes in curriculum documents

CP MK

• Students are able to develop maritime management concepts and theories in making decisions that have economic consequences
• Students are able to develop management concepts and theories by regulating, monitoring and controlling maritime processes that perform well and efficiently</td></tr>
<tr><td>Course Description</td><td>Learn about Maritime Economics and Business; Shipping System Reliability</td></tr>
<tr><td>Subject / Study Material</td><td>Ship & fleet management:
Key Performance Indicators (KPIs) in delivery;
Commercial, navigational & technical ship operations;</td></tr>
</table>

	Technical ship management - goals, tasks, processes, resources; Integrated maritime management information system; Technical performance and commercial performance: Costs (fixed, operating, shipping costs), revenue, financial performance, commercial value of the ship; Parameters of technical performance, availability, reliability, power performance, energy efficiency, safety and environmental performance; The effect of technical performance on financial performance and commercial value; Influence of O&M strategy; Efficient performance management and vessel asset management: Technical appraisal and commercial appraisal of ships; Voyage and vessel performance monitoring; Operation and maintenance cost structure; Ship performance and ship value versus operating and maintenance costs; Condition monitoring and condition based maintenance; Maintenance versus replacement;
References	**Primary :** 1. Climate Change and the Shipping Response. London: IMO.International Maritime Organization, 2016 2. Ship Energy Efficiency Regulations and Related Guidelines. London: IMO 3. .. **Secondary :** 1. Grid Integration of Wind Energy Conversion Systems 2. Mohan Undeland Robbins, Power electronics 3. Power System Stability And Control, Prabha Kundur
Learning Media	**Software :** / **Hardware :** PC & LCD Projector
Team Teaching	Dr.-Ing. Wolfgang Busse
Prerequisites	-

Week-no	Final abilities at each stage of learning (Sub-CP-MK)	Assessment		Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]		Learning Materials [Reference]	Assessment Weight (%)
		Assessment Indicator	Criteria & Assessment Form	Online	Offline		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1					•	• Study initiation	

	Students understand the scope of the course for efficient ship and fleet operations and have an overview of their development	• Understanding of lecture systematics • General understanding of efficient operation of ships and fleets • Understanding of the latest theory and developments	Question and answer discussion	• Lecture and brainstorming TM: (3 x 50 minute)	• Motivation to learn • Study goals • Scope of study • Definition of renewable marine energy	
2	Able to develop understanding and application related to ship & fleet management	• Understanding of ship and fleet management concept development • Understanding of developing ship and fleet management methods • Understanding of influencing factors in ship and fleet management	Question and answer discussion	• Lecture and study of concepts and implementation of ship and fleet management • Discussion on the development of ship and fleet management concepts and technologies • Literature reviews developments in ship and fleet management engineering TM = … BT = .. BM = …	• Definition of ship management concept • Ship and fleet management implementation and application • Up-to-date methods relating to ship and fleet management • Factors affecting ship and fleet management • Case studies of ship and fleet management implementationimplementation	
3	Able to develop understanding and application related to Key Performance Indicators (KPI) in delivery	• Understanding of the development of Key performance concepts in delivery • Understanding of the development of key performance methods in delivery	Q&A discussion	• Lectures and studies of key performance concepts and implementations in delivery • Discussion of key performance	• Definition of key performance indicators in delivery • Implementation and application of key performance in delivery	**5%**

		• Understanding of factors that influence key performance in delivery		developments in delivery • Literature reviews major performance engineering developments in delivery TM = … BT = .. BM = …	• Current methods related to key performance indicators delivery (EEOI) • Factors that affect the main performance in delivery • Case studies of key performance implementations in delivery	
4	Able to develop understanding and application related to commercial, navigation & technical ship operation	• Understanding of commercial, navigational & technical ship operations engineering development • Understanding of commercial, navigational & technical ship operations development • An understanding of the identification of influencing factors in commercial, navigational & technical ship operations	Question and answer discussion	• Lecture and study of concepts and implementation of commercial, navigational & technical ship operations • Discussion of engineering developments for commercial, navigational & technical ship operations • Literature reviews developments in commercial, navigational & technical ship operations engineering	• Definition of commercial, navigational & technical ship operations • methods of engineering commercial, navigational & technical ship operations	**5%**
5-8	Able to develop understanding and application related	• Understanding of developing efficient performance	• Literature reviews the development of the concept of efficient	• Lectures and studies on efficient	• Definition of efficient performance	**30%**

	to efficient performance management and vessel asset management	management concepts and vessel asset management • Understanding of developing efficient performance management concepts and vessel asset management • Understanding of influencing factors in efficient performance management and vessel asset management	performance management and vessel asset management • Exposure to the literature study on the concept of efficient performance management and ship asset management • Group presentation	performance management and ship asset management • Discussion on the development of concepts, technologies and implementation of efficient performance management and vessel asset management • Literature reviews concepts, technologies and applications of efficient performance management and vessel asset management	management and vessel asset management • Implementation and application of efficient performance management and vessel asset management • Up-to-date methods related to efficient performance management and vessel asset management • Factors affecting efficient performance management and vessel asset management • Case studies of efficient performance management implementation and vessel asset management	
9	Midterm Evaluation (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been done)					
10-12	Able to develop understanding and application related to operating and maintenance cost structure	• Understanding of concept development, technology and application of operating and maintenance cost structures	• Literature reviews the development of concepts, technology and application of operating and maintenance cost structures	• Lecture and study of operating and	• Definition of operation and maintenance cost structure • Implementation and application of	30%

		• Understanding of concept development, technology and application of operating and maintenance cost structures	• Presentation of the literature study of concepts, technology and application of the operating and maintenance cost structure. Presentation in the form of groups	maintenance cost structure • Discussion on the development of the concept of operating and maintenance cost structure • Literature review concept, technology and application of operating and maintenance cost structure TM = … BT = .. BM = …	operating and maintenance cost structure • The latest method deals with the cost structure of operation and maintenance • Factors affecting the operating and maintenance cost structure • Case study implementation of operation and maintenance cost structure	
13-15	Able to develop understanding and application related to vessel performance and vessel value versus operating and maintenance costs	• Understanding of value analysis and ship performance with operating and maintenance costs • Understanding of value analysis and ship performance with operating and maintenance costs	• The literature reviews the development of concepts, technology and the application of value analysis and ship performance with operating and maintenance costs • Exposure to the literature study of concepts, technology and application of value analysis and ship performance with operating and maintenance costs • Group presentation	• Lectures and studies on the value and performance analysis of ships with their operating and maintenance costs • Discussion on the development of analysis of the value and performance of ships with their operating and maintenance costs	• Definition of vessel performance and vessel value and operating and maintenance costs Implementation and engineering applications of alternative fuels for shipping systems • Comparison of the value and performance of ships with their operating and maintenance costs • Case study of the implementation of analysis of ship	30%

				• Literature review of concepts, technology and application of value analysis and ship performance with operating and maintenance costs TM = … BT = .. BM = …	value and performance with operating and maintenance costs	
16	**Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)**					
Total						100%

Catatan :

1. **Capaian Pembelajaran Lulusan PRODI (CPL-PRODI)** adalah kemampuan yang dimiliki oleh setiap lulusan PRODI yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-PRODI) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CP Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
6. **Kriteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.

9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. **TM**=Tatap Muka, **PT**=Penugasan terstruktur, **BM**=Belajar mandiri.

Learning Plan: Ship Maneuvering/Propulsion and Navigation Integration

INSTITUT TEKNOLOGI SEPULUH NOPEMBER **FACULTY OF MARINE TECHNOLOGY** **DEPARTMENT OF MARINE ENGINEERING** **MASTER PROGRAMME (S2)**					
COURSE	**CODE**	**Course Cluster**	**CREDIT (SKS/ECTS)**	**SEMESTER**	**Compilation Date**
SHIP MANEUVERING/PROPULSION AND NAVIGATION INTEGRATION	**ME 185507**	**MEAS (Marine Electrical and Automation System)**	**3 SKS/ 4.8 ECTS**	**Elective Course**	
AUTHORIZATION	**Learning Plan Developer**	**Coordinator of Course Cluster**	**Head of Study Programme**		
	Prof. Ir. Aguk Zuhdi M. Fathallah., M.Eng., Ph.D	**Beny Cahyono, S.T., M.T., Ph. D**	**Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.**		
Learning Outcomes (LOs)	**CPL-PRODI** see Study Program learning outcomes in curriculum documents				
	CP MK Students can develop an understanding and broad application of the principles of modern propulsion/maneuvering systems and ship handling simulation systems about technical concepts, characteristics, and various applications, discussion of pros & cons about complex analysis of energy, environmental, and safety aspects.				
Course Description	Learn about combustion engine technology; shipping electrical installations; system design on the ship				

Subject / Study Material	• Integrated Maneuvering/Propulsion Systems:
	  • Azimuth-Propeller/Azipods
	  • Voith Propeller and rotating rudder propellers
	  • Waterjet-Thrusters
	  • Wing-in-Ground Effect Vessels				

	• Propulsion systems based on alternative energy • Sails, kites • Flettner Rotors, others • Simulation exercises and case studies for those specific vessels. • Ship handling simulation: • Definition and purpose of simulation • Principles of linear and angular momentum • Equation of motion of ships (resistance, thrust, environmental forces) • Numerical methods for differential equations • Simulation of ship modules in suitable software
References	**Primary :** 1. Capability of Ship Manoeuvring Simulation Models for Approach Channels and By Permanent International Association of Navigation Congresses. Permanent Technical Committee II 2. Ship Handling: Theory and Practice By D. J. House 3. Ship Resistance and Propulsion: Practical Estimation of Propulsive Power By Anthony F. Molland 4. Ship Automation: For Marine Engineers and ETOs Book by Alexandr Yakimchuk **Secondary :** 1. Measurement of hydrodynamic characteristics from ship maneuvering trials by system identification MA Abkowitz – 1980 2. A practical calculation method of ship maneuvering motion, S Inoue 3. An intelligent integrated ship guidance system, RS Burns - IFAC Proceedings Volumes, 1992

Learning Media	**Software :**	**Hardware :**
	MATLAB	PC & LCD Projector
Team Teaching	Dr. Eddy Setyo Koenhardono, S.T., M.Sc.	
Prerequisites	-	

Week-no	**Final abilities at each stage of learning (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]**		**Learning Materials [Reference]**	**Assessment Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Online**	**Offline**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

1	Students understand the scope of the ship maneuvering system integration course and have an overview of its development	• Understanding of lecture systematics • General understanding of ship maneuvering system planning • Understanding of the latest theory and developments	Question and answer discussion	• Lecture and brainstorming TM: (3 x 50 minute)		• Study initiation • Motivation to learn • Study goals • Scope of study • Definition of ship maneuvering system integration	
2	Students are able to develop understanding and application of Azimuth-Propeller/Azipods	• Understanding of Azimuth-Propeller/Azipods concept development • Understanding of the development of the Azimuth-Propeller/Azipods engineering method • Understanding of the factors that influence the use of Azimuth-Propeller/Azipods	Question and answer discussion	• Lecture and study of the concept and implementation of Azimuth-Propeller/Azipods • Discussion on the development of the Azimuth-Propeller/Azipods concept and technology • Literature review of Azimuth-Propeller/Azipods engineering developments TM = … BT = .. BM = …		• Definition of the concept of Azimuth-Propeller/Azipods • Azimuth-Propeller/Azipods implementation and application in ships, ports, installations and marine structures • The latest methods relate to Azimuth-Propeller/Azipods • Factors influencing the implementation of Azimuth-Propeller/Azipods • Azimuth-Propeller/Azipods implementation case study	
3	Students are able to develop an understanding and application of Voith Propeller and rotating rudder propellers	• An understanding of the development of the Voith Propeller Concept and rotating rudder propellers • Understanding of developing Voith	Question and answer discussion	• Lectures and concept studies and implementation of Voith Propeller Concepts and		• Definition of Voith Propeller Concept analysis and rotating rudder propellers • Implementation and application of the Voith Propeller	**5%**

		Propeller and rotating rudder propellers engineering methods • An understanding of the factors that influence the application of the Voith Propeller Concept and rotating rudder propellers		rotating rudder propellers • Discussion on the development of the Voith Propeller Concept and rotating rudder propellers • Literature review of engineering developments Voith Propeller Concept and rotating rudder propellers TM = … BT = .. BM = …	Concept and rotating rudder propellers in ships, ports, installations and marine structures • Current methods related to Voith Propeller Concept and rotating rudder propellers • Factors influencing the application of the Voith Propeller Concept and rotating rudder propellers • Case study of the implementation of the Energy Efficiency Operational Indicator (EEOI) Concept	
4	Students are able to develop understanding and application of Waterjet-Thrusters	• Understanding of Waterjet-Thrusters engineering development. • Understanding of the development of Waterjet-Thrusters engineering applications. • Understanding of the identification of influencing factors in the application of Waterjet-Thrusters	Question and answer discussion	• Lectures and studies of concepts and engineering implementation of Waterjet-Thrusters. technology • Discussion on the development of Waterjet-Thrusters engineering technology. • Literature review of the development of the	• Definition of Waterjet-Thrusters • The latest methods of engineering Waterjet-Thrusters. technology	**5%**

				Waterjet-Thrusters. engineering		
5-8	Students can develop an understanding and application of ship simulation with non-conventional propulsion	• Understanding of concept development, technology and application of ship simulation with non-conventional propulsion • Understanding of concept development, technology and application of ship simulation with non-conventional propulsion • Understanding of influencing factors in ship simulation with unconventional propulsion	• Literature reviews the development of new and renewable energy concepts, technologies and applications • Exposure to the literature study of new and renewable energy concepts, technologies and applications • Ship simulation tasks with unconventional propulsion • Group presentation	• Lectures and studies on ship simulation with unconventional propulsion • Discussion of concept development, ship simulation technology with unconventional propulsion • Literature review concept, technology and application of ship simulation with unconventional propulsion • Designing ship simulations with unconventional propulsion	• Definition of ship simulation with unconventional propulsion • Implementation and application of ship simulation with unconventional propulsion • The latest method deals with ship simulation with unconventional propulsion • Factors that affect ship simulation with unconventional propulsion • Case study of ship simulation implementation with unconventional propulsion	**30%**
9	Midterm Evaluation (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been done)					
10-12	Students are able to develop understanding and application of mathematical modeling of ship motion (resistance, thrust, environmental forces)	• Understanding of concept development, technology and application of mathematical modeling of ship motion (resistance, thrust, environmental forces) • Understanding of concept development, technology and	• Literature reviews the development of concepts, technology and the application of mathematical modeling of ship motion (resistance, thrust, environmental forces) • Exposure to the literature study of concepts, technology and the	• Lectures and studies on mathematical modeling of ship motion (resistance, thrust, environmental forces) • Discussion on the development of concepts, technology	• Definition of mathematical modeling of ship motion (resistance, thrust, environmental forces) • Implementation and application of mathematical	30%

		application of mathematical modeling of ship motion (resistance, thrust, environmental forces)	application of mathematical modeling of ship motion (resistance, thrust, environmental forces)	and the application of mathematical modeling of ship motion (resistance, thrust, environmental forces) • Literature review of concepts, technology and application of mathematical modeling of ship motion (resistance, thrust, environmental forces) TM = … BT = .. BM = …		modeling of ship motion (resistance, thrust, environmental forces) • The latest method is related to mathematical modeling of ship motion (resistance, thrust, environmental forces) • Factors that influence the mathematical modeling of ship motion (resistance, thrust, environmental forces) • Case study of the implementation of mathematical modeling of ship motion (resistance, thrust, environmental forces)	
13-15	Students are able to develop understanding and application of ship motion simulation	• Understanding of simulation methods with relevant software	• Literature review and simulation assignments			• Ship maneuvering simulation assignment	**30%**

				• Doing ship motion simulation design TM = … BT = .. BM = …		
16	**Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)**					
Total						100%

Catatan :

1. **Capaian Pembelajaran Lulusan PRODI (CPL-PRODI)** adalah kemampuan yang dimiliki oleh setiap lulusan PRODI yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-PRODI) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CP Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
6. **Kriteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project-Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.

12. **TM**=Tatap Muka, **PT**=Penugasan terstruktur, **BM**=Belajar mandiri.

Learning Plan: OPERATION, MONITORING, AND SYSTEM MAINTENANCE

	INSTITUT TEKNOLOGI SEPULUH NOPEMBER **FACULTY OF MARINE TECHNOLOGY** **DEPARTMENT OF MARINE ENGINEERING** **MASTER PROGRAMME (S2)**

COURSE	CODE	Course Cluster	CREDIT (SKS/ECTS)	SEMESTER	Compilation Date
OPERATION, MONITORING, AND SYSTEM MAINTENANCE	ME185508	MPP (Marine Power Plant)	3 SKS/ 4.8 ECTS	Elective Course	

AUTHORIZATION	Learning Plan Developer	Coordinator of Course Cluster	Head of Study Programme
	Dr. Eng. M. Badrus Zaman, S.T., M.T.	Beny Cahyono, S.T., M.T., Ph. D	Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.

Learning Outcomes (LOs)	**CPL-PRODI**	see Study Program learning outcomes in curriculum documents
	CP MK	Students are able to develop an understanding of the calculation of ship performance parameters and energy efficiency applications on ships based on operation, monitoring, and system maintenance
Course Description		Learn about Ship Performance and Energy Efficiency
Subject / Study Material		Ship Performance: Ship Performance, Engine Performance & Optimization, Operational Performance, Ship Support And Reporting, Life Cycle Support, Research, And Development. Energy Efficiency: Ship Energy Efficiency Management, MARPOL ANNEX VI, Introducing SEEMP, Ship Fuel Saving, Identify Cause Of Fuel Consumption.
References	**Primary :**	

	1. Harrington, RL (Ed), Marine Engineering, SNAME, New York, 1992. 2. Taylor, DA, Introduction to Marine Engineering, Butterworth, 1983. 3. Benjamin, PP, Modeling Ship Performance, 2009. **Secondary :** 1. The latest journals on ship performance and energy efficiency.						
Learning Media	**Software :**			**Hardware :**			
				PC/Laptop & LCD Projector			
Team Teaching	Prof. Semin, S.T., M.T., Ph.D.						
Prerequisites	Engineering Statistics						
Week-no	**Final abilities at each stage of learning (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]**		**Learning Materials [Reference]**	**Assessment Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Online**	**Offline**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1-2	Students are able to explain and understand about ship performance	• Understanding the types of ship performance	Non-Test:		•	• Ship Performance	10%
				• Lecture and brainstorming [TM: 1x(4x50")] • Task 1: Create a Ship Performance Resume.)			
3-4	Students are able to develop an understanding of engine performance and optimization.	• Understand engine performance and optimization	Non-Test : • Resume engine performance and optimization			• Engine Performance and Optimization	10%
				• Boiler Classification Discussion [TM: 1x(4x50")]			
5-6	Students are able to develop an understanding of	• • Understanding of operational performance	Non-Test:			• Operational Performance	10%

	operational performance			• Lecture and brainstorming [TM: 1x(4x50")] • Task 2: Make a Resume on Operational Performance.		
7-8	Students are able to develop an understanding of ship support and reporting	• Ability to understand ship support and reporting	Non-Test : • Resume ship support and report and presentation	• Ship Support and Reporting Discussion [TM: 1x(4x50")] TM = … BT = .. BM = …	• Ship Support and Reporting	10%
9-10	Students are able to develop an understanding of life cycle support	• Understanding of life cycle support	Non-Test:	• Lectures and brainstorming [TM: 1x(4x50")]	• Life cycle support	10%
11-12	Students are able to develop an understanding of research and development of ship performance	• Understanding of research and development ship performance	Non-Test : • Resume about research ad development of ship performance and presentation	• Task 3: Make Resume Research and Development of Ship Performance. • Boiler Design Discussion [TM: 1x(4x50")]	• Research and Development of Ship Performance	10%
ENERGY EFFICIENCY						
13	Students are able to develop an understanding of ship energy efficiency management	• Understanding of ship energy efficiency management	• Non-Test : Resume and presentation	• Lectures and brainstorming [TM: 1x(2x50")] • Task 5: Resume ship energy efficiency and management	• Ship Energy Efficiency and Management	10%

9	Midterm Evaluation (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been done)					
14	Students are able to develop an understanding of Marpol Annex VI Introduction To SEEMP	• Understanding of Marpol Annex VI Introduction to SEEMP	• Non-Test : • Resume of Marpol Annex VI Introduction to SEEMP and its presentation	• Lectures and brainstorming [TM: 1x(2x50")] • Task 5: Making a Resume of Marpol Annex VI Introduction to SEEMP	• Marpol Annex VI Introduction to SEEMP	10%
15	Students are able to develop an understanding of saving fuel saving	• Understanding of fuel saving	• Non-Test : • Fuel saving resume and presentation	• Lectures and brainstorming [TM: 1x(2x50")] • Task 7: Make a Resume save Fuel saving	• Lubrication And Bearing	
16	Students are able to develop an understanding of Identification Cause of Fuel Consumption	• Understanding of Identification Cause of Fuel Consumption	• Non-Test : • Resume Identification of Cause of Fuel Consumption and its presentation	• Lecture and brainstorming [TM: 1x(2x50")] • Task 8: Making a Resume Identification of Cause of Fuel Consumption	• Identification of Cause of Fuel Consumption	10%
16	**Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)**					
Total						100%

Catatan :

1. **Capaian Pembelajaran Lulusan PRODI (CPL-PRODI)** adalah kemampuan yang dimiliki oleh setiap lulusan PRODI yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-PRODI) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CP Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.

5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.
6. **Kriteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. **TM**=Tatap Muka, **PT**=Penugasan terstruktur, **BM**=Belajar mandiri.

Learning Plan: Maritime Operation System

	INSTITUT TEKNOLOGI SEPULUH NOPEMBER **FACULTY OF MARINE TECHNOLOGY** **DEPARTMENT OF MARINE ENGINEERING** **MASTER PROGRAMME (S2)**

COURSE	CODE	Course Cluster	CREDIT (SKS/ECTS)	SEMESTER	Compilation Date
MARITIME OPERATION SYSTEM	ME185509	MMS (Marine Machinery and System)	2 SKS/ 3.2 ECTS	Elective Course	

AUTHORIZATION	Learning Plan Developer	Coordinator of Course Cluster	Head of Study Programme
	Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.	Sutopo Purwono Fitri, S.T., M.Eng., Ph.D.	Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.

Learning Outcomes (LOs)	**CPL-PRODI**	see Study Program learning outcomes in curriculum documents
	CP MK	Students are able to improve understanding in terms of formulating and applying loading and unloading operations of port equipment (non-ship gear) in accordance with the needs of ship operations in ports for the container, dry bulk, liquid bulk, and general cargo operations
Course Description		Learn about the principle of cargo service at the port, lifting and unloading equipment, optimization of loading and unloading equipment selection.
Subject / Study Material		The concept of port handling operations and ship cargo in port, the principle of lifting and moving operations, and the suction and pumping of cargo, as well as the basics of their operation, inspection, and maintenance.

References	**Primary :** 1. Agerschou, H., 2004, Planning, and design of ports and terminals, 2nd ed, Thomas Telford, London-UK. 2. Gotwald, 2010, Port handling equipment, 1st edition, Gotwald 3. House, D.J., 2005, Cargo work for maritime operations, Marine engineering series, Butterworth-Heinneman, UK 4. ISGOT, 2000, Oil and Gas terminal handbook, ISGOT, London-UK 5. Liebher, 2011, Port handling crane, Libher, Germany 6. Magala, M., 2010, Basic port management. Australian Maritime College (AMC), Tasmania-Australia 7. PELINDO III, 2011, Kinerja Bongkar-Muat Pelabuhan Tanjung Perak, PELINDO III, Tanjung Perak-Surabaya 8. Peters, C., 1998, An introduction to material handling equipment selection. CICMHE- Department of DecisionSciences and Engineering Systems, Rensselaer Polytechnic Institute. 9. StoneTrust, 2010, Basic Forklift Operation, StoneTrust 10. Thoresen, C.A., 2003, Port designer's handbook, 1st ed, Thomas Telford, London-UK 11. Various loading-unloading equipment spec 12. Lecture hand-outs **Secondary :** 1. House, D.J., 2005, Cargo work for maritime operations, Marine engineering series, Butterworth-Heinneman, UK 2. ISGOT, 2000, Oil and Gas terminal handbook, ISGOT, London-UK 3. Liebher, 2011, Port handling crane, Libher, Germany 4. Magala, M., 2010, Basic port management. Australian Maritime College (AMC), Tasmania-Australia						
Learning Media	**Software :**			**Hardware :**			
				PC/Laptop & LCD Projector			
Team Teaching	Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.						
Prerequisites							

Week-no	**Final abilities at each stage of learning (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]**		**Learning Materials [Reference]**	**Assessment Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Online**	**Offline**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

1	• Knowing the description of the syllabus and SAP of the lecture contract including the procedure for carrying out lectures	• An understanding of the learning process and evaluation, as well as an understanding of the nature and meaning of loading and unloading equipment, especially in the process of selecting and operating it in ports	• Non-Test	• Lectures and discussions (2x50)		• Lecture Initialization • Learning Motivation • Lesson Plan • Study Rules	
2	• Students can develop and explore types of maritime cargo and port classifications • Students can develop an understanding and application of types of lifting equipment and general cargo transfers in ports	• Understanding of basic port and shipping operations and types of cargo served at ports	• Non-Test	• Lectures and discussions (2x50)		• 1. Principles and terminology of maritime and its services • 2. Maritime service operation activities • 3. Types of cargo and their transportation • 4. General principles, and the basis of port operations and service activities for shipping cargo	
3	• Students can develop an understanding and application of types of lifting equipment and general cargo transfers at ports	• Understanding of types of cargo lifting and transfer equipment	• Non-Test	• Lectures and discussions (2x50)		• 1. Basic operation of cargo handling and stevedoring • 2. Basic principle of lifting operation and its equipment (lifting appliances)3. Basic operation transfer (transferring and conveying system)4.	

					Main and auxiliary propulsion arrangements	
4	• Students can develop an understanding and application of the principles of loading and unloading operations specifically for general cargo	• Understanding of general operations and stages for general cargo, containers, and dry bulk	• Non-Test	• Lectures and discussions (2x50)	• 1. General-cargo loading and unloading process • Container loading-unloading process • Dry bulk loading-unloading process	
5	• Students can develop an understanding and application of loading and unloading operating principles specifically for general cargo regarding goods and vehicles including passengers	• Understand the selection of loading and unloading equipment for vehicles, passengers, crude, LNG, and LPG	• Non-Test	• Lectures and discussions (2x50)	• loading-unloading process for vehicles and passengers for Ro/Ro Ferry • Process for loading-unloading passengers • Process loading-unloading Crude Oil • LNG loading-unloading Process • LPG loading-unloading Process	
6	• Students can develop an understanding and application of the basic principles of the general portal arrangement.	• Have an understanding of the arrangement of driving machinery and equipment controllers	• Non-Test	• Lectures and discussions (2x50)	• General principles of portal general arrangement • Machinery system for loading-unloading tools • Electrical systems, electronics, and control of loading-unloading tools.	

					• Construction system • Emergency system	
7	• Students can develop understanding and application in calculating lifting/transporting capacity, moving, loading/discharging loading and unloading equipment	• Have an understanding of the general process of calculating lifting and carrying capacity	• Case study assignments	• Case study discussion and presentation (2x50)	• Basic principles of mechanics and arm moments • Arrangement of pulleys and lift systems • Estimated lifting capacity • Estimated conveying (transfer) capacity • Estimated loading/discharging • Dry bulk conveyor system detail design	5%
8	• Students can develop an understanding and application of the principles of loading and unloading equipment construction and the calculation process	• An integrated understanding of the construction system and the stability level of dry bulk loading and unloading equipment, port cranes, and Container Cranes	• Case study assignments	• Case study discussion and presentation (2x50)	• The main principles of stress and its distribution in equipment construction • The principle of stability and dynamics of equipment • The principle of the type of construction material and the deformation characteristics of the equipment material • Calculation of operational and external expenses of equipment	10%

					• Simulation of equipment stability and strength	
9	• Students can develop an understanding and application of basic and practical principles of loading and unloading equipment selection	• Selection skills based on basic technical, operational, and commercial criteria	• Case study assignments	• Tasks (2x50)	• Important concepts and parameters in the selection • Selection of harbor-crane portal • Selection of conveyor system • Container Crane Selection	15%
10	• Students can develop understanding and application in the selection of LNG/LPG handling equipment	• Selection skills based on basic technical, operational, and commercial criteria	• Case study assignments	• Lectures and discussions(2x50)	• ISGOT standards for terminal operations • Principles of regasification and reliquification at LNG/LPG terminals. • The principle of the booster system in terminal • Main principles of tanks, distribution systems, and auxiliary equipment	
11-12	• Students can develop an understanding and application of equipment and machinery for loading and unloading machinery	• Understanding of the basic operation of the equipment and the loading and unloading machinery auxiliary fleet	• Non-Test	• Lectures and discussions (2x50)	• Types of auxiliary equipment • Fundamentals of forklift operation • Fundamentals of forklift hydraulic operation4. Safety equipment	
13			• Case study assignments			**10%**

	• Students can develop understanding and application in terms of the main activities of inspection and maintenance of loading and unloading equipment	• Understanding of loading and unloading equipment inspection and maintenance operation		• Case study discussion and presentation (2x50)	• Class regulations/standards on loading and unloading equipment • General principles of loading and unloading equipment inspection • General principles of loading and unloading equipment maintenance and repair • Operation of loading and unloading equipment testing Case study of Jamrud Bulk Terminal and Tanjung Perak Container Terminal (TPS)	
14	• Students can develop understanding and application in the design and selection of loading and unloading equipment for a case study	• Able to design scenarios for selecting loading and unloading equipment in accordance with port conditions and operations	• Individual case study major	• Presentation and discussion (2x50)	• Students are asked to estimate and design loading and unloading equipment requirements for a new port • Students are asked to prepare specifications and basic technical capabilities of	**30%**

					loading and unloading equipment • Students are asked to explain what regulations are related to the provision of loading and unloading equipment	
15-16	• Presenting a draft proposal for the selection, installation, and maintenance of loading and unloading equipment	• Understanding of general operations of maintenance, installation, and repair of loading and unloading equipment	• Case study major assignments in the form of group presentations	• Presentation and discussion (2x50)	• Students are asked to prepare inspection and survey processes • Prepare scenarios for maintenance or repair of equipment • Safety equipment	**30%**
Total						100%

Catatan :

1. **Capaian Pembelajaran Lulusan PRODI (CPL-PRODI)** adalah kemampuan yang dimiliki oleh setiap lulusan PRODI yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-PRODI) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CP Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.

6. **Kriteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. **TM**=Tatap Muka, **PT**=Penugasan terstruktur, **BM**=Belajar mandiri.

Learning Plan: Maritime Operation System

	INSTITUT TEKNOLOGI SEPULUH NOPEMBER **FACULTY OF MARINE TECHNOLOGY** **DEPARTMENT OF MARINE ENGINEERING** **MASTER PROGRAMME (S2)**				
COURSE	**CODE**	**Course Cluster**	**CREDIT (SKS/ECTS)**	**SEMESTER**	**Compilation Date**
ADVANCE MARINE POWER PLANT	**ME185510**	**MPP (Marine Power Plant)**	**3 SKS/ 4.8 ECTS**	**Elective Course**	
AUTHORIZATION	**Learning Plan Developer**	**Coordinator of Course Cluster**	**Head of Study Programme**		
	Prof. Ir. Aguk Zuhdi M. Fathallah., M.Eng., Ph.D & Beny Cahyono, S.T., M.T., Ph. D	**Beny Cahyono, S.T., M.T., Ph. D**	**Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.**		
Learning Outcomes (LOs)	**CPL-PRODI**	see Study Program learning outcomes in curriculum documents			
	CP MK	Able to develop understanding in terms of analyzing and designing marine vehicle engine rooms as a form of adaptability to environmental problems encountered in solving marine, energy, and environmental problems. Able to develop understanding in terms of mastery of marine vehicle engine room design theory which includes design and analysis of marine vehicle engine room design so as to produce an effective management system. Able to make decisions in the process of analysis and design scientifically and independently in leading a limited working group. and have the ability to communicate, behave ethically, aesthetically, appreciatively and participatively in his/her profession.				
Course Description	Learn about engine room design				

Subject / Study Material	Ergonomics Applications in Marine Systems; Ship Design Procedures; Marine Engineering Special Requirements; Selection of Drive and Selection of Main Propulsion System; Space and War Requirements; Engine Room Design, Engine Room and Central Room Layout; Machinery Design, Placement of Tanks and Paths and Stairs
References	**Primary :** 1. Marine Engineering edited by RL Harrington - 2. Diktat Guest Lecture by Prof. Grossman - 3. Layout of Engine Room by Sname Japan **Secondary :** 1. Related journals and proceedings
Learning Media	**Software :** Microsoft Office **Hardware :** PC/Laptop & LCD Projector
Team Teaching	Prof. Ir. Aguk Zuhdi M. Fathallah., M.Eng., Ph.D & Beny Cahyono, S.T., M.T., Ph. D
Prerequisites	

Week-no	Final abilities at each stage of learning (Sub-CP-MK)	Assessment		Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]		Learning Materials [Reference]	Assessment Weight (%)
		Assessment Indicator	Criteria & Assessment Form	Online	Offline		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-2			• Lectures and videos		•	• Introduction	

	• Students are able to develop their understanding of the types of ships and the arrangement of piping systems	• Understanding of the types of ships and the arrangement of the piping system		• Lectures and discussions on types of ships and arrangement of piping systems [TM:2x(2x50")] • (Task 1: Resume types of ships and arrangement of piping systems) [BT+BM:(2+2)x(2x50")]	• Ship type • Outfitting in pipe	
3	• Students are able to develop their understanding of the guidelines in designing the engine room layout	• Understanding of the guidelines in the design of the engine room layout	• Lectures, sample questions and discussions, working exercises, group studies; literature review	• Lectures and discussions on guidelines in engine room layout design [TM:(2x50")]	• Guidelines for engine room layout • Design & Arrangement • Ergonomic Ship	
4	• Students are able to develop their understanding of the rules regarding the installation of machinery on ships	• Understanding of the rules regarding the installation of machinery on ships	• Lectures, videos and examples, group studies, group discussions; literature review	• Lectures and discussions on the rules of machinery installation on ships [TM:(2x50")]	• Rules for machinery installations • Marine Use • Land Use	
5	• Students are able to develop their understanding of the ship design process	• Understanding of the ship design process	• Lectures, videos and examples, group studies, group discussions; literature review	• Lectures and discussions about the ship design process [TM:(2x50")]	• Ship design process	
6	• Students are able to develop their understanding of the layout of the propulsion system	• Understanding of the layout of the propulsion system	• Lectures, videos and examples, group studies, group discussions; literature review	• Lectures and discussions on the layout of the propulsion system [TM:(2x50")]	• Marine Propulsion Plant	
7						

	• Students are able to develop their understanding of the layout of the main engine and its supporting systems in the engine room	• Understanding of the layout of the main engine and its supporting systems in the engine room	• Lectures and examples, group studies, group discussions; literature review	• Lectures and discussions on the layout of the main engine and its supporting systems in the engine room [TM:(2x50")]	• Diesel Engine and Engine Room Layout	
8	• Students are able to develop their understanding of the placement of the Engine Control Room, Engine Casing and platform layout	• Understanding of the placement of Engine Control Room, Engine Casing and platform layout	• Lectures and examples, group studies, group discussions; literature review	• Lecture and discussion on Engine Control Room placement, Engine Casing and platform layout [TM:(2x50")]	• Engine Control Room • Platform • Engine Casing	
9	**Mid-Semester Evaluation (Formative Evaluation-Evaluation intended to improve the learning process based on the assessment that has been carried out)**					
10	• Students are able to develop their understanding of the design and layout of machinery	• Understanding of machining design and layout	• Lectures and examples, group studies, group discussions; literature review	• Lectures and discussions on machining design and layout [TM:(2x50")]	• Machinery design and layout	
11	• Students are able to develop their understanding of the placement of pumps and ladders	• Understanding of Placement of pumps and ladders	• Lectures and examples, group studies, group discussions; literature review	• Lecture and discussion on Placement of pumps and ladders [TM:(2x50")]	• Placement of pumps and ladders	
12	• Students are able to develop their understanding of Understanding General Arrangements	• Understanding of General Arrangements	• Lectures and examples, group studies, group discussions; literature review	• Lecture and discussion on General Arrangement [TM:(2x50")]	• General Arrangement	
13					• Stern tube	

	• Students are able to develop their understanding of the placement of the stern tube	• Understanding of the placement of the stern tube	• Lectures and examples, group studies, group discussions; literature review	• Lecture and discussion on stern tube placement [TM:(2x50")]		
14	• Students are able to develop their understanding of laying pumps and piping	• Understanding of the laying of pumps and piping	• Lectures and examples, group studies, group discussions; literature review	• Lectures and discussions on laying pumps and piping [TM:(2x50")]	• Pumps and piping	
15	• Students are able to develop their understanding of the design of electric propulsion systems	• Understanding of electric propulsion system design	• Lectures and examples, group studies, group discussions; literature review	• Lectures and discussions on the design of electric propulsion systems [TM:(2x50")]	• Electrical Propulsion	
16	**Final Semester Evaluation (Evaluation intended to determine the final achievement of student learning outcomes)**					
Total						100%

Catatan :

1. **Capaian Pembelajaran Lulusan PRODI (CPL-PRODI)** adalah kemampuan yang dimiliki oleh setiap lulusan PRODI yang merupakan internalisasi dari sikap, penguasaan pengetahuan dan ketrampilan sesuai dengan jenjang prodinya yang diperoleh melalui proses pembelajaran.
2. **CPL yang dibebankan pada mata kuliah** adalah beberapa capaian pembelajaran lulusan program studi (CPL-PRODI) yang digunakan untuk pembentukan/pengembangan sebuah mata kuliah yang terdiri dari aspek sikap, ketrampulan umum, ketrampilan khusus dan pengetahuan.
3. **CP Mata kuliah (CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPL yang dibebankan pada mata kuliah, dan bersifat spesifik terhadap bahan kajian atau materi pembelajaran mata kuliah tersebut.
4. **Sub-CP Mata kuliah (Sub-CPMK)** adalah kemampuan yang dijabarkan secara spesifik dari CPMK yang dapat diukur atau diamati dan merupakan kemampuan akhir yang direncanakan pada tiap tahap pembelajaran, dan bersifat spesifik terhadap materi pembelajaran mata kuliah tersebut.
5. **Indikator penilaian** kemampuan dalam proses maupun hasil belajar mahasiswa adalah pernyataan spesifik dan terukur yang mengidentifikasi kemampuan atau kinerja hasil belajar mahasiswa yang disertai bukti-bukti.

6. **Kriteria Penilaian** adalah patokan yang digunakan sebagai ukuran atau tolok ukur ketercapaian pembelajaran dalam penilaian berdasarkan indikator-indikator yang telah ditetapkan. Kreteria penilaian merupakan pedoman bagi penilai agar penilaian konsisten dan tidak bias. Kreteria dapat berupa kuantitatif ataupun kualitatif.
7. **Bentuk penilaian:** tes dan non-tes.
8. **Bentuk pembelajaran:** Kuliah, Responsi, Tutorial, Seminar atau yang setara, Praktikum, Praktik Studio, Praktik Bengkel, Praktik Lapangan, Penelitian, Pengabdian Kepada Masyarakat dan/atau bentuk pembelajaran lain yang setara.
9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.
12. **TM**=Tatap Muka, **PT**=Penugasan terstruktur, **BM**=Belajar mandiri.

Learning Plan: Technology of Internal Combustion Engine

<table>
<tr><td colspan="2">  </td><td colspan="6">INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FACULTY OF MARINE TECHNOLOGY
DEPARTMENT OF MARINE ENGINEERING
MASTER PROGRAMME (S2)</td></tr>
<tr><td colspan="2">COURSE</td><td>CODE</td><td colspan="2">Course Cluster</td><td>CREDIT (SKS/ECTS)</td><td>SEMESTER</td><td>Compilation Date</td></tr>
<tr><td colspan="2">TECHNOLOGY OF INTERNAL COMBUSTION ENGINE</td><td>ME185511</td><td colspan="2">MPP (Marine Power Plant)</td><td>3 SKS/4.8 ECTS</td><td>Elective Course</td><td></td></tr>
<tr><td colspan="2" rowspan="2">AUTHORIZATION</td><td colspan="2">Learning Plan Developer</td><td colspan="2">Coordinator of Course Cluster</td><td colspan="2">Head of Study Programme</td></tr>
<tr><td colspan="2">Prof. Semin, S.T., M.T., Ph.D.</td><td colspan="2">Beny Cahyono, S.T., M.T., Ph. D</td><td colspan="2">Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.</td></tr>
<tr><td rowspan="2">Learning Outcomes (LOs)</td><td>CPL-PRODI</td><td colspan="6">see Study Program learning outcomes in curriculum documents</td></tr>
<tr><td>CP MK</td><td colspan="6">1. Capable of selecting, mastering working principles, marine diesel combustion processes, efficiently matching with propellers and designing support systems and selecting components of the support system of a main motor.
2. Mastering the selection of the main motor according to the needs, can analyze the performance of marine diesel and match it with the propeller and can design a support system including the selection of the required components.
3. Can make the right decisions in choosing marine diesel as the main motor, engine propeller matching and support systems.
4. Able to communicate well in a team work in the selection of marine diesel, engine propeller matching, engine performance analysis and design of supporting systems.</td></tr>
<tr><td colspan="2">Course Description</td><td colspan="6">Learn about main engine and main engine support system</td></tr>
</table>

Subject / Study Material	The design process and consideration for the selection of marine diesel, Basic principles of marine diesel, The principles of thermodynamics and the combustion process, how the turbocharger works and performance, marine diesel performance, engine propeller matching, Marine diesel support system.
References	**Primary :** 1. Woodyard D. 2004. Pounders Marine Engines Diesel and Gas Turbines, 8Th Ed Elsevier 2. Tailor D.A. Introduction to Marine Engineering, Revised 2nd Ed, Elsevier 3. A group of Authorities. 1992. Marine Engineering, Editor by Harington R.L, SNAME. **Secondary :** 1. Ferguson C.R, Kirkpatrick A.T. 2001. Internal Combustion Engine Applied Thermosciences, 2Nd Ed, John Weley & Sons 2. Related Article, Engine Manual and Journal
Learning Media	**Software :** / **Hardware :** PC & LCD Projector
Team Teaching	Prof. Ir. Aguk Zuhdi M. Fathallah., M.Eng., Ph.D., Dr. I. Made Ariana, S.T., M.T., Prof. Semin, S.T., M.T., Ph.D.
Prerequisites	-

Week-no	**Final abilities at each stage of learning (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]**		**Learning Materials [Reference]**	**Assessment Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Online**	**Offline**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Students are able to develop an understanding of the design process and considerations for choosing a ship's main engine	• Knowing about learning methods (C1) • Understanding the design process (C2) • Understanding choosing the main machine (C2)	notes	• Lectures and discussions on lesson plans 2 X 50 minutes • Lectures and discussions 1 x 50 ship design process	•	• Description of lesson plans • Design Process (Ref. 1 pp vii-xxix; Ref. 2 pp 2-8) • Main Machine Selection Considerations (Ref.	5%

				• Lectures and discussions on the selection of the main engine 1 x 50	1 pp 159-174; Ref. 2 pp 2-8)	
2-3	Students are able to develop an understanding of the basic principles of marine diesel	• Understand about the diesel motor as the main driver. (C2) • Understand the basic principles of diesel motors (C2) • Understand the types-2 and the main components of diesel motors (C2) • Attitude in accepting, responding and respecting opinions (A3	Reports on the results of discussions, teamwork and oral presentations	• Lectures and discussions on diesel motors as prime movers [TM 2 X50 minutes] • Lectures and discussions on the basic principles of diesel motors [TM 2 X 50 minutes] • Lectures and discussions on types and main components of diesel motors [TM2 X 50 minutes] • Group discussion on the basic principles of diesel motors [TM1X50min] • Presentation [TM1x50]	• Diesel motor as prime mover (Ref. 1 pp 1-63; Ref.2 pp 9-49) • Basic principles of diesel motor (Ref. 1 pp 1-63; Ref.2 pp 9-49) • Types of diesel engine types and components. (Ref. 1 pp 1-63; Ref. 2 pp 9-49)	**10%**
4-7	Students are able to develop an understanding of thermodynamic applications and combustion processes	• Understand the application of thermodynamics to the gas power cycle. (C2) • Understand the Otto cycle and Diesel cycle (C2) • Understand the gas turbine cycle (C2) • Understand the combustion process (C2)	Reports on the results of discussions, teamwork and oral presentations	• Lectures and discussions on the application of thermodynamics to the gas power cycle [TM 2 X 50 minutes] • Lectures and discussions on the otto and diesel cycles [TM 2 X 50 minutes]	• Thermodynamic Applications to Gas Power Cycles (Ref. 3 pp. 29-55) • Applications to Otto and Diesel (Ref. 3 pp. 29-55) • Gas Turbine Applications	**10%**

		• Understand Combustion stoichiometry (C2) • Understand excess water (C2) • Understand heat combustion and ignition theory (C2) • Understand the combustion process in diesel engines.(C2) • Attitude in accepting, responding and respecting opinions (A3		• Lectures and discussions on gas turbines [TM2 X 50 minutes] • Lectures and discussions on the combustion process [TM 2 x 50 minutes] • Lecture and discussion on combustion stoichiometry [TM 2 x 50 minutes] • Lecture and discussion on Exess air [TM 2X 50 Min] • Lecture and discussion on heat combustion and ignition theory [TM 2X50 Min] • Lecture and discussion combustion process in diesel engine [TM 2X50 Minutes] • Group discussion on thermodynamic application and combustion process [TM1X50min] • Presentation [TM 1 x 50]	• Combustion Processes (Ref. 3 pp. 57-80; Ref. 5) • Combustion Stoichiometry (Ref.3 pp. 57-80 ; Ref. 5) • Excess Air (Ref.3 pp. 57-80 ; Ref. 5) • Heat Combustion (Ref.3 pp. 57-80 ; Ref 5) • Ignition (Ref. 3 pp. 57-80 ; Ref. 5) Combustion process in diesel engines (Ref. 3 pp. 83-105; Ref. 5)	
8	Students are able to develop an understanding of turbocharger work and performance	• Understand the pressure charging method (C2) • Understand how the Turbocharger (C2) • Understand the performance of the turbocharger (C2)	non-test	• Lectures and discussions on pressure charging, how it works and turbocharge performance [TM 4 x 50 minutes]	• Pressure charging (Ref. 1. pp 175-226; Ref. 4) • Pressure charging method (Ref. 1. pp. 175-226; Ref. 4) • How turbocharges work (Ref. 1. pp. 175-226; Ref. 4)	**20%**

					• Turbocharge performance (Ref. 1. pp. 175-226; Ref. 4)	
9	Mid-Semester Evaluation (Formative Evaluation-Evaluation which is intended to improve the learning process based on the assessment that has been carried out					
10-13	Students are able to develop an understanding related to the performance of diesel motors	• Can calculate power, torque, and fuel requirements on diesel motors (C3) (P2) • Can test diesel motors experimentally on engine test beds.(C3) (P2) • Can make characteristics of diesel motors and can analyze and explain them orally, (C4)(A3)	• Reports on the results of practicum, teamwork and oral presentations	• Lectures and discussion of basic theory of calculating torque, power and fuel requirements [TM 4 x 50 minutes] • Group discussion making calculations of power, torque and fuel consumption using secondary data and plotting in tabular and graphical form [TM 4X 50 minutes] • Precision in collecting experimental data, calculating and making graphs [TM 4X 200 minutes] • Making practicum reports [BT+BM (1+1) 4 x 50 minutes] • Presentation of practicum reports [TM 4 x 50 minutes]	• Basic theory of torque and power calculation (Ref. 3 pp105-133) • Engine test bed (Ref. 3 pp105-133; Ref. 5) Experimental method (Ref. 3 pp105-133) • Data, data processing and analysis (Ref. 1pp 142-158	
14	Students are able to develop understanding related to engine propeller matching analysis	• Can use marine diesel engine rating. (C2) • Can analyze engine propeller matching and deliver in oral form. (C4) (P3)	• Small project reports, teamwork and oral presentations	• Lectures and discussions on Engine rating [TM 2 x 50 minutes]	• Engine rating (Ref. 5) • Engine propeller matching (Ref.5)	**20%**

		• Attitude in accepting, responding and respecting opinions (A3)		• Discussion on the use of an engine rating [TM 2 X 50 minutes] • Project:[BT+BM(1+1)(4x 50 minutes) • Project presentation [TM 4 X 50 minutes]		
15	Students are able to develop an understanding related to and calculate, choose tools for marine diesel engine support systems including fuel systems, lubricant systems, cooling systems and compressed air systems.	• Can calculate and select the tools used in a fuel system. (C3)(P2) • Can calculate and select the tools used in the lubricating system. (C3)(P2) • Can calculate, and select the tools used in the cooling system. (C3)(P2) • Can count and choose tools-2 compressed air systems (C3)(P2) • Attitude in accepting, responding and respecting opinions (A3)	• Small project reports, teamwork and oral presentations	• Lectures and discussions on fuel systems, lubrication systems, cooling systems and pressurization systems [TM: 2X 4 X 50 minutes] • Project: Counting and selecting tools for a particular system in a group [BT+BM: (2+2) (4X50 minutes) • Project presentation	• Fuel and fuel system. (Ref. 2 pp 147-154; Ref. 3 pp 307-333) • Lubricants and lubricating systems. (Ref. 2 pp 147-154; Ref. 3 pp 307-333) • Cooling system. (Ref. 2 pp 108-146; Ref. 5) • Compressed air systems. (Ref. 2 pp 130-146; Ref 4)	**10%**
16	**Final Semester Evaluation (Evaluation intended to find out the final achievement of student learning outcomes)**					
Total						100%

Catatan :

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Learning Plan: Ship & Bunkering Operation Modeling

<table>
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MASTER PROGRAMME (S2)</td></tr>
<tr><td colspan="2">COURSE</td><td>CODE</td><td>Course Cluster</td><td>CREDIT (SKS/ECTS)</td><td>SEMESTER</td><td>Compilation Date</td></tr>
<tr><td colspan="2">SHIP & BUNKERING OPERATION MODELING</td><td></td><td></td><td>2 SKS/ 3.2 ECTS</td><td></td><td>February 19, 2018</td></tr>
<tr><td colspan="2" rowspan="2">AUTHORIZATION</td><td colspan="2">Learning Plan Developer</td><td>Coordinator of Course Cluster</td><td colspan="2">Head of Study Programme</td></tr>
<tr><td colspan="2">Prof. Dr. Ketut Buda Artana, S.T., M.Sc.</td><td></td><td colspan="2">Raja Oloan Saut Gurning, S.T., M.Sc., Ph.D.</td></tr>
<tr><td>Learning Outcomes (LOs)</td><td>CPL-PRODI</td><td colspan="5">see Study Program learning outcomes in curriculum documents</td></tr>
<tr><td></td><td>CP MK</td><td colspan="5">Students have the ability to understand and analyze ship operating models and bunkering needs, especially in aspects of fuel selection (bunker properties and specifications), distribution process, measurement, utilization (according to the BSMA-100 standard or ISO 8217: 2010 standard). Furthermore, the fuel that has been selected will be further analyzed for the performance of the fuel system based on the existing system in the engine room on the ship; process and method of bunkering sampling (propiertary test), the process of requesting the amount of bunkering volume, and speed regulation including slow-steaming of ships.</td></tr>
<tr><td>Course Description</td><td colspan="6">Learn about process of selecting fuel, fuel analysis based on standard bunkering, analysis of ship’s fuel usage, operating model and vessel characteristic, and case study modeling selection, distribution, measurement, sampling, and ship utilization based on the ship's fuel system.</td></tr>
</table>

Subject / Study Material	1. Basic principles of ship fuel properties and specifications 2. International MARPOL and Fuel-Code conventions regarding ship and bunkering operations 3. Concept of distribution, measurement, and fuel consumption based on ISO 8217:2010 and BSMA-100 . standards 4. Fuel analysis (selection and verification of fuel according to ship's engine requirements) 5. Fuel sampling process and methodology 6. Interpretation of test results and problem-solving on test results 7. Fuel additive testing process 8. Analysis of performance and operating emissions of the ship's fuel system based on the type of fuel selected 9. Analysis of the calculation of the volume of fuel according to ship and port operating patterns 10. The main principle of commercial factors of bunkering operation 11. Shipping, ship and bunkering operating models
References	**Primary :** 1. Draffin.,N. 2012. An introduction to bunkering. Petrospot Limited, UK. 2. Draffin.,N. 2009. An introduction to fuel analysis. Petrospot Limited, UK. 3. Draffin.,N and Kassinger, R. 2012. Bunker fuel for marine engines: A technical introduction. Petrospot Limited, UK. **Secondary :** 1. Draffin.,N and Vermeulin, G. 2011. Commercial practice in bunkering. Petrospot Limited, UK.. 2. Harrison, T. 2011. Legal issues in bunkering: An introduction to the law relating to the sale and use of marine fuels. Petrospot Limited, UK. 3. Various journal and conference papers related to ship operating models and bunkering processes
Learning Media	**Software :** / **Hardware :** PC/Laptop & LCD Projector
Team Teaching	Prof. Dr. Ketut Buda Artana, S.T., M.Sc.
Prerequisites	-

Week-no	**Final abilities at each stage of learning (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods, and Assignments for Students [Time Estimation]**		**Learning Materials [Reference]**	**Assessment Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Online**	**Offline**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

1-2	Discuss the basic principles of fuel properties and specifications based on ISO 8217:2010 & BSMA 100 standards; as well as various parameters used in the fuel selection process	• Task 1 (Observation of activity in class)	• Discussion	• Interactive lecture	• Basic principles and analysis of ship fuel properties and specifications	
3-4	Explore MARPOL conventions and Fuel Code related to fuel quality and emissions required globally starting 2018/2019 for ship fuel production processes and onboard fuel systems	• Assignment 2 Presentation & Group Work in Class	• Interactive lecture	• Interactive lecture	• MARPOL and Fuel-Code Conventions related to ship bunkering operations	**10%**
5-6	Explore various processes and methods of distribution, measurement and use of fuel based on onboard	• Assignment 2 Presentation & Group Work in Class	• Interactive lecture	• Interactive lecture	• The concept of distribution, measurement and use of fuel based on ISO 8217:2010 standards, and BSMA 100	**10%**

	engine and fuel systems					
7-9	Explore and discuss the sampling test method and the analysis process for various fuel parameters. As well as the interpretation process, additional testing including testing in emergency conditions	• Assignment 3 Presentation & Group Work in Class	• Lecture	• Interactive lecture	• Fuel analysis and testing	**15%**
10-11	Analyzing the performance of the fuel system in the ship's engine room and estimating the number of emissions produced and their potential impact on the air environment	• Assignment 4 Presentation & Group Work in Class	• Lecture	• Interactive lecture	• Analyze fuel system operating performance and emissions based on selected fuel type	**10%**
12-13	Explore the amount of fuel needed based on the speed level of the ship, shipping	• Assignment 5 Presentations & Group Assignments in Class	• discussion	• Interactive lecture	• Analysis of vessel operational fuel volume requirements	**10%**

	distance (port destination), water conditions, bunkering operation patterns and ship load size					
14	Exploring and synthesizing commercial-related factors that affect vessel operations including prices, payment plans, hedging and claims related to the process of ordering and purchasing vessel fuel	• Assignment 6 Presentations & Group Assignments in Class	• discussion	• Interactive lecture	• The main principles of commercial factors of ship and bunkering operations	10%
15	Explore ship bunkering and operation models based on parameters of speed, distance, ship load, water conditions, commercial conditions and ship bunkering strategy	• Assignment 7 Presentations & Group Assignments in Class	• Interactive lecture	• Interactive lecture	• Shipping, ship and bunkering process operating models	15%
16		• Presentation in groups	• Presentation			20%

	Work on the case study model that will be given for a ship type, voyage plan, bunkering design, bunkering prices and costs		• Discussion	• Task in groups	• Case study model of ship operations and ship bunkering plans in UAS activities	
Total						100%

Catatan :

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9. **Metode Pembelajaran:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, dan metode lainnya yang setara.
10. **Materi Pembelajaran** adalah rincian atau uraian dari bahan kajian yg dapat disajikan dalam bentuk beberapa pokok dan sub-pokok bahasan.
11. **Bobot penilaian** adalah prosentasi penilaian terhadap setiap pencapaian sub-CPMK yang besarnya proposional dengan tingkat kesulitan pencapaian sub-CPMK tsb., dan totalnya 100%.

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RP MK RISK BASED DESIGN AND MARITIME EVACUATION (PERENCANAAN BERBASIS RESIKO & EVAKUASI LAUT)

	SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY **FACULTY OF MARINE TECHNOLOGY** **MARINE ENGINEERING DEPARTEMENT** **S2**				
COURSE	**CODE**	**Clump MK**	**WEIGHT (sks)**	**SEMESTER**	**Date of Preparation**
RISK BASED DESIGN AND MARITIME EVACUATION (PERENCANAAN BERBASIS RESIKO & EVAKUASI LAUT)	**ME185306**	**RAMS**	**3**	**OPTION**	
AUTHORIZATION	**Developer RP**	**Coordinator RMK**	**Ka PRODI**		
	KBA	**DN**	**SG**		

Study Outcomes (CP)	**CPL-PRODI** Program learning outcomes in the course curriculum document **CP MK** Students can understand the risk management framework and can carry out risk assessments on offshore and onshore systems as well as provide mitigation recommendations for simple cases of hydrocarbon releases.
Short Description of MK	Risk anatomy; Risk management framework; Structured hazards and risk identification; Likelihood assessment; Hydrocarbon event consequence modeling; risk measurement; Risk Mitigation / Risk reduction measures.
Main Subject / Study Material	Risk anatomy, risk management framework, hazard analysis, structured method for hazard identification.
Literature	**Main:** 1. Guidelines for Process Hazards Analysis, Hazards Identification & Risk Analysis, Nigel Hyatt, Dyadem Press 2003.

	2. A Guide to Quantitative Risk Assessment for Offshore Installations, John Spouge (Principal Author), DNV Technica 1999. **Supporting :** Journal related to						
Learning Media	**Software:**			**Hardware :** 1. PC 2. LCD Projector			
Team Teaching	KBA; DW; DN						
Course Requirements							
Week To-	**Final ability in each learning stage (Sub-CP-MK)**	**Assessment**		**Forms of Learning, Learning Methods and Student Assignments [Time Estimation]**		**Learning Materials [Library]**	**Rating Weight (%)**
		Assessment Indicator	**Criteria & Assessment Form**	**Daring (online)**	**Luring (offline)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	General risk management frameworks.	• Cognitive: Students can understand the concept and anatomy of risk and risk management framework in general (C2). • Affective: Attitude in accepting and appreciating a concept (A3).	Non-Test: Material deepening	• Face-to-face activities, interactive discussion with "David Sibbet's visual meeting concept" : 2 x (2 x 50')	•	• Helicopter view of risk management applications for marine and offshore applications. • Risk anatomy. • Anatomy of risk • Process Hazards and Risk Management alternatives • Risk Matrix	
3-4	Students develop an understanding of	• Cognitive:	Non-Test: Material deepening			• Geological background • Drilling	

	offshore activities that have high risks	Students can identify risky offshore activities (C2). • Affective: Attitude in accepting and appreciating a concept (A3).		• Face-to-face activities, interactive discussions with "David Sibbet's visual meeting concept" : 2 x (2 x 50')	• Production	
5-7	Students develop an understanding of hazard identification and use structured hazard analysis tools (C3)	• Cognitive: Students can use hazard analysis tools to identify hazards (C3). • Affective: Attitude in accepting and appreciating a concept (A3).	Assignment : • HAZOP Case Study • What-if / Checklist Case Study • FMEA Case Study • SLRA Case Study	• Face-to-face activities, interactive discussions with "David Sibbet's visual meeting concept" : 2 x 50' • Lecture and discussion on Wake and Thrust Deduction [TM:1 x(2x50")] • (Task 6: Resume about Wake and Thrust Deduction) [BT+BM:(1+1)x(2x50")]	• Introduction to hazard analysis tools. • HAZOP • What-If / Checklist • FMEA • Screening Level Risk Analysis	
8	Semester Evaluation – is an evaluation activity towards the achievement of sub CP MK					
9-13	Students develop an understanding of the consequences of modeling hydrocarbon releases (C3)	• Cognitive: Students can model the consequences of hydrocarbon release (C3). • Affective: Attitude in accepting and appreciating a concept (A3).	Assignment: Fire modeling with commercial software (ShellFred)	• Face-to-face activities, interactive discussions with "David's visual meeting concept Sibbet" :4 x (2 x 50')	• Discharge and Dispersion Model • Fire Modeling • Explosion Modeling • Impact of hydrocarbon release	
14	Students develop an understanding of the level of risk from hydrocarbon releases. (C3)	• Cognitive: Students can measure the risk of hydrocarbon release (C3). • Affective:	Non-Test: Material deepening	• Face-to-face activities, interactive discussion with "David Sibbet's visual	• Risk Matrix • Individual risk • Societal Risk	

		Attitude in accepting and appreciating a concept (A3).		meeting concept" : (2 x 50')		
15	Students develop understanding and provide recommendations for mitigating simple cases of risk from hydrocarbon releases.	• Cognitive: Students can give recommendations to mitigate simple cases of risk management (C3). • Affective: Attitude in accepting and appreciating a concept (A3).		• Face-to-face activities, interactive discussions with "David Sibbet's visual meeting concept" : 2 x (2 x 50') • Presentation and discussion on hybrid propulsion system concept [TM:2x(2x50")] • (Task 9: Make a resume about hybrid propulsion system concept) [BT+BM :(2+2)x(2x50")]	• Risk Reduction Measures	
16	**Final Semester Evaluation is an evaluation activity on the achievement of sub CP MK, and CP MK And Evaluation of CPL achievement charged to MK**					
Total						

Notes :

1. **Learning Outcomes of Graduates of Study Programs (CPL-PRODI**) are abilities possessed by each graduate of PRODI which are the internalization of attitudes, mastery of knowledge and skills according to the level of study programs obtained through the learning process.
2. **The CPL that is charged to the course** is a number of learning outcomes for study program graduates (CPL-PRODI) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Course CP (CPMK)** is the ability that is specifically described from the CPL that is charged to the course, and is specific to the study material or learning material for the course.
4. **Subject Sub-CP (Sub-CPMK)** is the ability that is specifically described from the CPMK that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** the ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.

6. **Assessment Criteria** are benchmarks used as measures or benchmarks for learning achievement in assessment based on predetermined indicators. Assessment criteria are guidelines for raters so that the assessment is consistent and unbiased. Criteria can be either quantitative or qualitative.
7. **Form of assessment**: test and non-test.
8. **Forms of learning**: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods**: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning Materials** are details or descriptions of study materials that can be presented in the form of several subjects and sub-topics.
11. **The weight of the assessment** is the percentage of assessment of each achievement of the sub-CPMK which is proportional to the level of difficulty of achieving the sub-CPMK, and the total is 100%.
12. **TM**= Face to face, **PT**= Structured assignments, **BM**= Self-study.