University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Material Science							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MEC205	II	Fall	3	4	3	0	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	20	20	40
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Chf. Eng. Volkan Varışlı** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 volkan.varisli@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	The *Material Science* course provides a comprehensive study of the properties, structure, and applications of engineering materials, with a particular focus on marine systems. Students are introduced to fundamental concepts of material science, including the terminology and classifications used in modern engineering. The course covers the structural and phase diagrams of metals and alloys, highlighting the relationship between microstructure and material properties. Emphasis is placed on the production methods, designation, and classification of cast iron, steel, and non-ferrous metals, as well as the analysis and selection of materials for various engineering applications. Students gain knowledge of non-metallic materials and their performance characteristics, along with an understanding of how materials behave under different types of stress. Practical applications are explored through topics such as heat treatment of metals, welding technologies, metal casting principles, and the integration of metallic constructions in marine vessels. The course also examines performance assessment techniques and material selection criteria relevant to marine engineering. Through theoretical study, laboratory exercises, and case studies, students develop the ability to evaluate, select, and apply materials effectively, ensuring their suitability for engineering and marine applications. Mid-term and final examinations are conducted to assess understanding and application of material science principles.
Course Aims and Objectives	The aim of the *Material Science* course is to provide students with a thorough understanding of the fundamental principles, properties, and applications of engineering materials, particularly within the context of marine engineering. The course seeks to develop students' ability to analyze, evaluate, and select materials suitable for diverse engineering and marine applications, considering performance, safety, and environmental factors. • To introduce the fundamental concepts, terminology, and classifications of engineering materials. • To explain the structures, phase diagrams, and behavior of metals and alloys under various conditions. • To familiarize students with production methods, designation systems, and classification criteria for cast iron, steel, and non-ferrous metals. • To provide knowledge of non-metallic materials and their properties in engineering applications. • To develop skills in assessing material performance under stress and understanding their mechanical and thermal behavior. • To examine heat treatment processes, welding technology, and metal casting principles relevant to marine and industrial systems.

	• To enable students to select appropriate materials for engineering applications based on mechanical, thermal, and environmental considerations. • To enhance students' problem-solving skills through case studies, laboratory exercises, and practical analysis of material-related engineering challenges.
Course Learning Outcomes	**LO1 – Knowledge and Understanding** Explain the fundamental principles of material science, including the structure, properties, and classification of metals, alloys, and non-metallic materials. Demonstrate understanding of material production methods such as casting, forging, alloying, and modern metallurgical techniques. **LO2 – Application of Knowledge** Apply knowledge of heat treatment, welding, and metal joining processes to improve material performance. Assess material selection for marine and industrial engineering systems, considering operational requirements, environmental conditions, and safety standards. **LO3 – Analytical and Technical Skills** Analyze phase diagrams, material behavior under thermal and mechanical conditions, and interpret material testing and characterization results. Evaluate materials for engineering applications based on mechanical, thermal, and chemical performance criteria. **LO4 – Evaluation and Critical Thinking** Integrate theoretical knowledge with practical applications to solve problems in design, maintenance, and repair of marine systems. Evaluate the suitability and performance of materials under various operational and environmental conditions. **LO5 – Communication and Interpretation** Communicate technical information effectively, preparing clear reports, documentation, and presentations related to material analysis, assessment, and selection. **LO6 – Problem-Solving and Decision-Making** Demonstrate problem-solving and decision-making skills in selecting, treating, and utilizing materials for specific marine and industrial applications, ensuring compliance with performance and safety standards.

Content of the Course

Week	*Subject*
1	Introduction to material science and terminology
2	Structures and phase diagrams of metals and its alloys.
3	Engineering materials and applications on main and auxiliary technologic systems
4	The methods of production of cast iron, steel and non-ferrous metals
5	Designation and classification of steel, cast iron and non ferrous material
6	Material analysis and technics of metallurgic material choice
7	Mid-Term Examination
8	Non-metallic materials
9	The principles and description of materials under stress
10	Material assessment and performance knowledge on marine concept
11	The heat treatment of metals
12	Welding technology and principles of welding on marine applications
13	The principle of metal casting
14	Metal constructions on different marine vessel systems.
15	Final Exams

Methods and Techniques Used in the Course

Lectures and Interactive Discussions

- Presentation of fundamental concepts of material science, material properties, and phase diagrams.
- Encouraging active student participation through Q&A sessions and problem-solving discussions.

Laboratory Work and Practical Sessions

- Hands-on experiments to study the properties of metals, alloys, and non-metallic materials.
- Practical exercises in material testing, metallographic analysis, and evaluation of mechanical and thermal properties.

Case Studies and Application-Based Learning

- Analysis of material selection and performance in real-world marine engineering applications.
- Study of failures and troubleshooting in metal and alloy components.

Use of Simulation and Modeling Tools

- Computer-based simulations to model phase changes, stress-strain behavior, and heat treatment effects.
- Visualization of microstructures and material responses under different conditions.

Problem-Solving and Critical Thinking Exercises

- Assignments focusing on material selection, stress analysis, and corrosion prevention.
- Group discussions to develop analytical skills and decision-making in engineering contexts.

Technical Reports and Documentation

- Preparation of reports on laboratory results, material testing, and metallurgical analysis.
- Emphasis on professional communication and documentation of scientific observations.

Quizzes, Mid-Term, and Final Exams

- Periodic assessments to evaluate theoretical understanding, practical skills, and application knowledge.
- Combination of multiple-choice, short-answer, and problem-solving questions.

Sample Questions

Multiple Choice Questions (MCQs)

- Which of the following is the main strengthening mechanism in steel alloys?
  a) Grain boundary strengthening
  b) Precipitation hardening
  c) Work hardening
  d) All of the above
- Which property of a material is primarily measured by a tensile test?
  a) Thermal conductivity
  b) Elastic modulus and ultimate tensile strength
  c) Electrical resistivity
  d) Density
- In the phase diagram of a binary alloy, the eutectic point represents:
  a) Maximum solubility at high temperature
  b) Complete miscibility of the two metals
  c) The temperature and composition where liquid transforms into two solid phases
  d) A metastable state
- Which of the following non-metallic materials is commonly used for marine insulation due to its corrosion resistance?
  a) Epoxy resin
  b) Aluminum
  c) Cast iron
  d) Copper

Short Answer Questions

- Explain the difference between cast iron and steel in terms of composition and mechanical properties.
- Describe the effect of heat treatment on the microstructure and mechanical properties of steel.

- What is the purpose of using welding technology in marine applications, and what are the key factors affecting weld quality?

Problem-Solving / Applied Questions

- A marine component made of aluminum alloy is subjected to tensile stress. Determine the appropriate aluminum alloy selection considering corrosion resistance, strength, and machinability.
- Analyze a hypothetical scenario where a steel shaft on a ship fails prematurely. Identify possible metallurgical causes and suggest preventive measures.
- Using a given phase diagram, determine the solidification path and phase composition for a copper-nickel alloy at 800°C.

Essay / Discussion Questions

- Discuss the advantages and limitations of using non-ferrous metals versus ferrous metals in marine engineering.
- Explain how material science principles are applied in the design of heat exchangers, pumps, and hull components on ships.
- Evaluate the role of modern metallurgical techniques (such as HCCI engines or alternative heat treatments) in improving the efficiency and longevity of marine machinery.

Materials Used in the Course

Textbooks and Reference Books

- Callister, W. D., & Rethwisch, D. G. (Latest Edition). *Materials Science and Engineering: An Introduction*.
- Smith, W. F., & Hashemi, J. (Latest Edition). *Foundations of Materials Science and Engineering*.
- Ashby, M. F., & Jones, D. R. H. (Latest Edition). *Engineering Materials 1 & 2*.
- Totten, G. E. (Ed.). *Steel Heat Treatment Handbook*.
- ASTM Standards and Codes related to metals, alloys, and marine applications.

Laboratory Equipment and Tools

- Metallographic microscopes and imaging systems
- Tensile and compression testing machines
- Hardness testers (Rockwell, Brinell, Vickers)
- Universal testing machines for mechanical property evaluation
- Thermocouples and furnaces for heat treatment experiments
- Welding equipment for demonstration of marine welding processes

Software and Simulation Tools

- Material property databases (MatWeb, CES EduPack)
- CAD software with material property analysis (SolidWorks, AutoCAD)
- Finite Element Analysis software for stress and deformation studies

Supplementary Learning Materials

- Lecture slides and notes provided by the instructor
- Research articles and case studies on marine material applications
- Videos and tutorials demonstrating casting, welding, and heat treatment processes
- Laboratory manuals for practical sessions

Safety and Protective Materials

- Safety goggles, gloves, and aprons for metallurgical labs
- Ventilation and fume extraction equipment for welding and casting exercises

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	3	3	2	2	3	2
PO2	2	3	3	2	2	3
PO3	2	2	3	3	2	3
PO4	1	2	2	2	3	3
PO5	1	2	3	3	2	3
PO6	2	3	3	2	2	3
PO7	1	1	2	2	2	2
PO8	1	2	2	2	1	2
PO9	1	1	1	2	2	2
PO10	2	2	3	3	2	3
PO11	1	2	2	2	2	3
PO12	1	1	2	2	2	3

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1 – Knowledge & Understanding	Lectures, Multimedia Presentations, Conceptual Discussions	Written Exams, Quizzes, Short Answer Questions
CLO2 – Application of Knowledge	Tutorials, Laboratory Sessions, Case Studies, Hands-on Exercises	Homework Assignments, Lab Reports, Practical Problem Sets
CLO3 – Analytical & Technical Skills	Material Testing Labs, Simulations, Case Analysis	Lab Reports, Analytical Assignments, Problem-Solving Exams
CLO4 – Evaluation & Critical Thinking	Scenario-Based Learning, Design Projects, Group Discussions	Project Reports, Case Study Analysis, Oral Presentations
CLO5 – Communication & Interpretation	Technical Writing Workshops, Team Exercises, Report Preparation	Project Reports, Presentations, Documentation Assessment
CLO6 – Problem-Solving & Decision-Making	Problem-Based Learning, Applied Engineering Tasks, Case Studies	Practical Problem-Solving Exercises, Decision-Making Reports, Capstone/Project Evaluation

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**2**	**30**
Lectures	**15**	**3**	**45**
Midterm Exam	**1**	**3**	**3**
Preparation for Midterm Exam	**1**	**10**	**10**
Final Exam	**1**	**3**	**3**
Preparation for Final Exam	**1**	**10**	**10**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	**2**	**5**	**10**
Group Work	-	-	-
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	-	-	-
Assignment(s)/Homework/Class Works	**4**	**5**	**20**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**131**
ECTS Credit			**4**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Homework/Assignments	4	20
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	2	10
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	40
Total	**10**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Thermodynamics I							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MEC207	II	Fall	3	5	3	0	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				-	50	30	20
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Prof. Dr. Şenol Başkaya** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4060 senol.baskaya@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	The course is designed for third semester engineering students. The objective of the course is to teach basic principles of classical thermodynamics, to train students to identify, formulate and solve engineering problems in thermodynamics, and to teach the application of second law analysis methods for thermodynamic systems.
Course Aims and Objectives	Properties of substances, thermodynamic equilibrium, ideal gas equation of state, energy. Transfer of energy between system and its surrounding, thermodynamic processes, reversible and irreversible processes, simple system, enthalpy, constant-volume and constant-pressure specific heats, pure substance thermodynamic surfaces. The first law of thermodynamics for a control volume. The second law of thermodynamics, entropy, numerical value of entropy. The second law of thermodynamics for a control volume, efficiency. Exergy and thermodynamic analysis of processes.
Course Learning Outcomes	LO1: Gain the ability to find thermodynamic properties. LO2: Gain the ability to apply the first law of Thermodynamics on closed systems. LO3: Gain the ability to apply the first law of Thermodynamics on open systems. LO4: Gain the ability to apply the second law of thermodynamics. LO5: Gain the ability to understand and apply the exergy analysis on closed and open systems.

Content of the Course

Week	*Subject*
1	Introduction
2	Basic Concepts and Definitions
3	Energy and Energy Transfer
4	General Energy Analysis
5	Properties of Pure substances
6	First law of Thermodynamics: Closed Systems
7	Closed System Analysis
8	First law of Thermodynamics: Open Systems
9	Open System Analysis
10	The second law of Thermodynamics
11	Introduction to Entropy
12	Entropy Analysis
13	Introduction to Exergy
14	Exergy Analysis
15	Irreversibility and Availability

Methods and Techniques Used in the Course

Lectures – Structured presentations covering fundamental concepts, laws, and theoretical frameworks of thermodynamics.

Problem-Solving Sessions – Step-by-step analysis of quantitative problems, including energy balances, entropy calculations, and exergy analysis.

Case Studies – Application of thermodynamic principles to real-world engineering systems, including marine propulsion, HVAC, and energy conversion systems.

Computer-Assisted Simulations – Use of simulation tools to model thermodynamic processes, analyze cycles, and visualize energy transformations.

Group Discussions – Interactive sessions to promote critical thinking and collaborative learning in solving complex thermodynamic scenarios.

Homework Assignments – Reinforcement of theoretical knowledge through structured exercises and applied calculations.

Quizzes and Concept Checks – Regular short assessments to monitor understanding and identify areas requiring additional focus.

Analytical and Conceptual Exercises – Encouraging the development of reasoning skills to assess system efficiency, irreversibility, and energy utilization.

Sample Questions

Conceptual Questions

- Define energy, work, and heat, and explain the differences between them.
- Explain the physical meaning of entropy and its relevance to the second law of thermodynamics.
- Discuss the concept of exergy and how it relates to energy efficiency in engineering systems.

Analytical / Calculation Problems

- A closed system undergoes a cyclic process. Given the heat interactions and work done, calculate the net change in internal energy.
- Analyze a steady-flow open system and determine the energy transfer using the first law of thermodynamics.
- Calculate the entropy change of a substance undergoing a reversible isothermal expansion.

Applied / Case Study Problems

- A marine engine operates between two temperature reservoirs. Determine its maximum theoretical efficiency and compare it with actual engine performance.
- Given a refrigeration cycle, calculate the exergy destruction in each component and suggest ways to improve system efficiency.
- Evaluate the effect of irreversibility on the availability of energy in a thermal power plant.

Short Answer / Reasoning Questions

- Explain why no real process can be completely reversible.
- Describe the differences between closed and open system analyses in thermodynamic applications.
- Discuss the role of thermodynamic properties in the design of energy systems, such as turbines or heat exchangers.

Materials Used in the Course

Textbooks and Reference Books

- Çengel, Y.A., Boles, M.A., Kanoğlu, M., Thermodynamics: An Engineering Approach, 9th Ed., McGraw-Hill, 2020.
- Sonntag, R. E., Borgnakke, C., & Van Wylen, G. J., *Fundamentals of Thermodynamics*, 9th Edition, Wiley.
- Moran, M.J., Shapiro, H.N., Boettner, D.D., Bailey, M.B., Fundamentals of Engineering Thermodynamics, 7th Ed., John Wiley & Sons, 2011.
- Van Wylen, G. J., & Sonntag, R. E., *Classical Thermodynamics*, 3rd Edition, Wiley.

Lecture Notes and Course Materials

- Weekly lecture slides and annotated notes prepared by the instructor.
- Supplementary problem sets and solution manuals for practice.
- Case studies and example calculations relevant to marine engineering systems.

Software and Simulation Tools

- MATLAB or Python for thermodynamic calculations and plotting property diagrams.
- EES (Engineering Equation Solver) for energy, entropy, and exergy analyses.
- Thermodynamic property software/databases (e.g., NIST REFPROP).

Online Resources

- Educational videos and tutorials on thermodynamic cycles and principles.
- Interactive online platforms for thermodynamic simulations and exercises.

Laboratory Materials (if applicable for demonstration purposes)

- Demonstration setups for heat transfer, work, and energy experiments.
- Measurement instruments: pressure gauges, thermocouples, flow meters.
- Steam tables, Mollier diagrams, and psychrometric charts for practical exercises.

All the above listed books are available at UoK's Grand Library

Program Outcomes	
PO1	Ability to demonstrate strong technical competence in mechanical system design, solid mechanics, thermodynamics, fluid mechanics, heat transfer, and control systems.
PO2	Ability to apply mathematics, physics, and engineering principles to identify, formulate, and solve complex mechanical engineering problems.
PO3	Ability to use modern engineering tools, CAD software, simulation environments (FEA/CFD), and manufacturing-related software effectively.
PO4	Ability to design mechanical components, processes, and systems that meet performance, safety, and sustainability requirements.
PO5	Ability to communicate effectively and apply teamwork, leadership, and project management skills in multidisciplinary engineering environments.
PO6	Ability to utilize knowledge of materials science, advanced manufacturing processes, machine design, and maintenance technologies.
PO7	Ability to perform experimental work, collect and interpret data, and use laboratory and measurement techniques effectively.
PO8	Ability to adopt engineering practices aligned with relevant standards, regulations, and industrial quality/safety requirements.
PO9	Ability to internalize ethical engineering behavior, professional responsibility, and awareness of societal and environmental impacts of engineering solutions.
PO10	Ability to recognize the need for lifelong learning and follow international technological, industrial, and academic advancements.
PO11	Ability to integrate Industry 4.0 concepts, automation systems, digital manufacturing, and AI-based tools into mechanical engineering applications.

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	3	3	3	3	3	-
PO2	2	2	2	2	2	-
PO3	0	0	0	0	0	-
PO4	2	2	2	2	2	-
PO5	0	0	0	0	0	-
PO6	1	1	1	1	1	-
PO7	0	0	0	0	0	-
PO8	1	1	1	1	1	-
PO9	1	1	1	1	1	-
PO10	2	2	2	2	2	-
PO11	0	0	0	0	0	-

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1 – Knowledge & Understanding	Theoretical lecture	Midterm examinations and final exam
CLO2 – Application of Knowledge	Theoretical lecture	Midterm examinations and final exam
CLO3 – Analytical & Technical Skills	Theoretical lecture	Midterm examinations and final exam
CLO4 – Evaluation & Critical Thinking	Theoretical lecture	Midterm examinations and final exam
CLO5 – Communication & Interpretation	Theoretical lecture	Midterm examinations and final exam

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**4**	**60**
Lectures	**15**	**3**	**45**
Midterm Exam	**2**	**1,5**	**3**
Preparation for Midterm Exam	**2**	**12**	**24**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**15**	**15**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	-	-	-
Group Work	-	-	-
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	-	-	-
Assignment(s)/Homework/Class Works	-	-	-
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**149**
ECTS Credit			**5**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Homework/Assignments	-	-
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	2	60
Final/Oral Exams	1	40
Total	**3**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Operations and Maintenance of Main and Auxiliary Machinery I							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED201	II	Fall	3	3	2	2	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	30	30	20
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Chf. Eng. Volkan Varışlı** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 volkan.varisli@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course provides an in-depth study of the operation, maintenance, and safety of main and auxiliary machinery onboard ships. Students will gain comprehensive knowledge of shipboard maintenance practices, the operational principles of large-bore diesel engines, and their auxiliary systems. The course emphasizes both theoretical and practical aspects of marine engineering, including combustion engine operations, propulsive system mechanics, and machinery performance evaluation. The course also covers key aspects of shipboard safety, maintenance planning, and documentation. Students will learn the principles of preventive and corrective maintenance, including fault analysis, troubleshooting, and the use of electronic Planned Maintenance Systems (PMS). Practical applications include operation and maintenance of fuel, lubrication, cooling, and compressed air systems, as well as boiler operation and auxiliary machinery handling. Hands-on training and case studies provide students with experience in monitoring engine parameters, maintaining operational logs, evaluating system performance, and implementing safety procedures during engine room watch-keeping. Additionally, the course addresses emergency procedures, decision-making in critical situations, and the effective management of maintenance activities to ensure the reliability and safety of ship machinery. The course structure includes theoretical lectures, laboratory applications, group projects, assignments, mid-term and final examinations to equip students with both academic knowledge and practical skills essential for a career in marine engineering.
Course Aims and Objectives	**Course Aims** The course aims to provide students with comprehensive knowledge and practical skills required for the safe and efficient operation and maintenance of main and auxiliary machinery onboard ships. It focuses on developing students' technical understanding of marine diesel engines, propulsive systems, auxiliary machinery, and associated operational and safety procedures. **Course Objectives** By the end of this course, students will be able to: • Understand the principles of shipboard maintenance, machinery operations, and engine room safety culture. • Demonstrate operational knowledge of main engines, auxiliary systems, and propulsive machinery. • Apply preventive and corrective maintenance techniques to ensure reliability and performance of ship machinery. • Analyze machinery faults, evaluate potential risks, and implement appropriate corrective actions. • Utilize documentation and record-keeping systems for maintenance planning and performance monitoring. • Develop decision-making and problem-solving skills in engine room operations, including emergency situations. • Integrate theoretical knowledge with practical applications through laboratory exercises, case studies, and group projects.

Course Learning Outcomes	**CLO1:** Apply technical knowledge of marine diesel engines and auxiliary machinery to shipboard operational procedures. **CLO2:** Demonstrate safe operational practices in engine rooms and machinery spaces in accordance with international safety standards and regulations. **CLO3:** Perform routine and preventive maintenance on main engines, auxiliary systems, and propulsion equipment following established procedures. **CLO4:** Identify, diagnose, and rectify machinery faults, evaluating their potential impact on overall ship operations. **CLO5:** Utilize Planned Maintenance Systems (PMS) and related record-keeping tools to plan, document, and manage maintenance activities effectively. **CLO6:** Analyze operational performance data and engine parameters to support decision-making and optimize machinery performance.

Content of the Course

Week	*Subject*
1	Shipboard Maintenance and ship safety, approach of marine engineering methods
2	Internal Combustion Engine maintenance and repair activities. Understanding of Large-bored engines & engines auxiliary systems
3	Combustion engine operations and measurement culture with records of investigational facts
4	Propulsive requirements, propeller types, shaft, mid-bearings, reduction gears, stern-tube and shaft sealing systems
5	Operation and maintenance of propulsive systems, major failures, possible results of faults
6	Diesel engine operations and maintenance and records of quantitative elements
7	Diesel engines fuel system, fuel pumps, Injectors and cyl.head part's, drive mechanism maintenance
8	Mid-Term Exam Application (Case Study - Failure analysis and act of avoidance)
9	Engine Auxiliary system operations and maintenance: Separators, pumps and heat exchangers, in relation with Lub oil, fresh water and seawater systems with their treatment methods.
10	Compressed air system Operation of pressurized air systems and distribution. Air compressor operation and maintenance.
11	Boilers safety and brief operational activities of boiler, maintenance of boilers and boiler water.
12	Planned maintenance concept: Literature root of maintenance, control of electronic planned maintenance systems (PMS) and reporting in these systems.
13	Performance control and evaluations. Watch-keeping in engine room rules and duties, emergency acts and decision-making theory Engine logbook and engine temperature, pressure & all values reporting and control evaluations.
14	Maneuverings faults, testing systems, main and emerg. marine eng. applications
15	Final exam Application (Case-study - Maintenance perspective and requirements)

Methods and Techniques Used in the Course

Lectures and Theoretical Instruction

- Presentation of fundamental concepts of marine engines, auxiliary systems, and propulsive equipment.
- Explanation of operational procedures, safety regulations, and maintenance principles.

Laboratory and Workshop Applications

- Hands-on practice with diesel engines, auxiliary machinery, pumps, boilers, and compressed air systems.
- Measurement and monitoring of operational parameters (temperature, pressure, flow rates).
- Exercises in fault identification, troubleshooting, and minor repairs.

Case Studies and Practical Scenarios

- Analysis of real-world machinery failures and preventive maintenance approaches.
- Critical thinking exercises for decision-making in emergency operations.
- Application of maintenance strategies and corrective actions.

Group Work and Collaborative Projects

- Team-based assignments to simulate engine room operations, maintenance planning, and monitoring.
- Cooperative problem-solving and discussion of operational best practices.

Assignments and Technical Reports

- Individual and group assignments to reinforce theoretical knowledge.
- Documentation and reporting of maintenance activities, engine logbooks, and operational data.

Simulation and Engine Room Monitoring

- Use of engine room simulators (if available) to practice watchkeeping, system monitoring, and fault response.
- Visualization of real-time operational and auxiliary system behaviors.

Mid-term and Final Evaluations

- Assessments through written exams, practical evaluations, and project presentations.
- Application of knowledge to both theoretical and operational problem-solving.

Sample Questions

Theoretical Questions:

- Explain the main differences between trunk piston engines and crosshead diesel engines.
- Describe the principles of internal combustion and the function of pre-combustion and combustion chambers in marine diesel engines.
- What are the main types of propellers used on ships, and how do they influence engine operation and efficiency?
- Explain the purpose and operational principles of the ship's compressed air system.
- Discuss the key elements of engine room watchkeeping and the decision-making process during machinery emergencies.
- Outline the procedure for performing a planned maintenance inspection on a marine diesel engine.
- Describe the function and maintenance requirements of heat exchangers, separators, and pumps in auxiliary systems.

Practical / Application Questions:

- Given a scenario of abnormal temperature rise in a main engine cylinder, outline the steps to diagnose and rectify the issue.
- Demonstrate, with a diagram, the flow of lubricating oil through a diesel engine and identify potential points of failure.
- Analyze a case study where a fuel injector failure led to partial engine shutdown. Suggest preventive measures for future operations.
- Perform a risk assessment for hot-work operations in the engine room, highlighting key safety precautions.
- Given engine logbook data, calculate the engine efficiency and propose corrective actions if deviations are observed.

Materials Used in the Course

Textbooks and Reference Books:

- **"Marine Engineering"** – Roy L. Harrington, McGraw-Hill
- **"Shipboard Machinery"** – A. H. S. Twigg, Butterworth-Heinemann
- **"Marine Auxiliary Machinery"** – H.D. McGeorge, Elsevier
- **"Marine Diesel Engines: Maintenance, Troubleshooting and Repair"** – Nigel Calder
- **"Ship Knowledge: Marine Engineering"** – Jon J. Van der Walt

Standards and Regulations:

- **IMO Conventions and Annexes** (SOLAS, MARPOL, STCW)
- **Classification Society Rules** (Lloyd's Register, DNV, ABS, Bureau Veritas)
- **ISM Code – International Safety Management Code**

Course Materials & Supplementary Resources:

- Engine manuals from major marine diesel engine manufacturers (MAN, Wärtsilä, Caterpillar)
- Engine room workshop guidelines and safety manuals
- Marine engineering simulation software (e.g., Wärtsilä Engine Simulator, MAN Diesel Simulator)
- Engine logbooks, PMS documentation, and operational checklists
- Case study materials for maintenance, troubleshooting, and failure analysis

Laboratory / Workshop Equipment:

- Diesel engine models (cutaway or small-scale demonstrators)
- Auxiliary machinery (pumps, compressors, heat exchangers)
- Measurement instruments: Vernier calipers, micrometers, pressure and temperature gauges
- Tools for maintenance practice: wrenches, torque tools, alignment devices
- Safety equipment for engine room and workshop training

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	1	2	2	2	3	2
PO2	2	3	3	3	3	3
PO3	1	2	2	2	2	2
PO4	1	2	2	2	2	2
PO5	3	1	1	1	1	2
PO6	1	1	1	1	1	2
PO7	1	1	1	1	1	2
PO8	1	1	1	1	1	2
PO9	1	1	1	1	1	1
PO10	0	2	2	2	2	3
PO11	2	1	1	1	1	2
PO12	3	1	1	1	1	2

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1	Lecture, Question-Answer, Discussion, Productional application,	Application, Quiz, Midterm Exam, Final Exam
CLO2	Lecture, Problem-Solving Sessions, Group Discussion, Production	Assignments, In-Class Application, Term Project, Midterm Exam
CLO3	Lecture, Problem-Solving, Hands-on Practice, Brainstorming, Production	Project, Assignments, Quizzes, Midterm Exam, Final Exam
CLO4	Lecture, Demonstration, Hands-on Practice	Productional applicationi Assignments, Midterm Exam, Final Exam
CLO5	Lecture, Practice Sessions, In-Class Activities	Application, Assignments, Quizzes, Midterm Exam, Final Exam
CLO6	Lecture, Question-Answer, Discussion, Brain Storming	Midterm Exam, Final Exam

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	-	-	-
Lectures	**15**	**4**	**60**
Midterm Exam	**1**	**2**	**2**
Preparation for Midterm Exam	**1**	**6**	**6**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**6**	**6**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	-	-	-
Group Work	**2**	**4**	**8**
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	**2**	**4**	**8**
Assignment(s)/Homework/Class Works	**4**	**4**	**16**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**108**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	2	10
Field Work	2	10
Special Course Internship (Work Placement)	-	-
Homework/Assignments	4	20
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	30
Total	**10**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Marine Engines Simulator							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED203	II	Fall	2	3	1	2	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	-	30	50
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Chf. Eng. Volkan Varışlı** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 volkan.varisli@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	The Marine Engines Simulator course provides students with practical and theoretical training on the operation, management, and troubleshooting of marine propulsion and auxiliary systems using the TECHSIM5000, TRANSAS etc. simulator. The course emphasizes safe, efficient, and environmentally compliant shipboard engineering practices, integrating modern engine room management techniques and simulator-based exercises. Students will gain hands-on experience in monitoring, operating, and maintaining marine engines and auxiliary machinery, including diesel engines, fuel systems, lubricating oil systems, boilers, turbo generators, and power distribution systems. Key areas include emergency procedures, cold/blackout operations, fuel management, hydraulic, pneumatic, and automatic control systems, and watchkeeping responsibilities. The course also covers team-based operations, decision-making under realistic operational constraints, and compliance with international maritime regulations (MARPOL Annexes I–VI). Simulator sessions are complemented by assignments, group projects, and case studies to reinforce the practical application of engineering principles. Through the course, students will develop technical proficiency, operational awareness, and collaborative skills necessary for managing engine room operations effectively and safely in a professional maritime environment.
Course Aims and Objectives	**Course Aims:** The course aims to provide students with a comprehensive understanding of marine engine operations, auxiliary machinery, and engine room management through hands-on simulator training. It seeks to develop technical competence, operational awareness, and decision-making skills in real-time maritime scenarios while emphasizing safety, environmental compliance, and teamwork. **Course Objectives:** By the end of the course, students will be able to: • Operate and monitor main and auxiliary machinery in a simulated engine room environment. • Apply safe work practices and emergency procedures onboard ships, including dead-ships, cold-ships, and blackout situations. • Manage fuel, lubricating oil, and other consumables efficiently while understanding regulatory compliance. • Utilize hydraulic, pneumatic, and automatic control systems for vessel operation and propulsion. • Demonstrate effective watchkeeping and team management in engine room operations. • Identify, analyze, and troubleshoot machinery faults using systematic approaches. • Maintain accurate records of operations, fuel consumption, and machinery performance in line with maritime regulations. • Integrate engineering knowledge with environmental and safety regulations (MARPOL, IMO) in simulated operational scenarios.

Course Learning Outcomes	**CLO1:** Demonstrate proficiency in operating main and auxiliary engines using marine engineering simulators (e.g., TECHSIM5000, TRANSAS). **CLO2:** Apply safe engine room practices and perform emergency procedures under various operational scenarios. **CLO3:** Analyze and troubleshoot faults in propulsion and auxiliary systems effectively. **CLO4:** Manage fuel, lubricating oil, and other consumables efficiently while ensuring compliance with international regulations. **CLO5:** Operate hydraulic, pneumatic, and automatic control systems and interpret relevant control and monitoring data. **CLO6:** Execute proper engine room watchkeeping duties and coordinate personnel in accordance with STCW requirements.

Content of the Course

Week	*Subject*
1	Orientation of Marine Engine' Simulator TECHSIM5000 -Class / components, user references, limitations, simulation theory and evaluation model: Briefing/de-briefing and self-evaluation methods
2	Machinery diagnosis, local and remote measurement, alarms and extensions, reflex of a watch-duty engineer, sense and engine room entry requirements
3	Dead-ship, cold-ship, black-out and recovery, emergency generator, Emergency switchboard (ESB) related systems and their operation
4	Fuel systems, lubricating oil and bunkering procedures, fuel transfer, fuel separation and cleaning, fuel calculations, voyage requirements and waste management
5	Ship Auxiliary systems and equipment: Piping systems (HT-LT-SW-FW-C/A and compressed air), use of local and remote stop/start mechanisms, Emergency mechanisms, quick-closing and avoidance from fire, detection systems and fire-fighting systems
6	Main switchboard and power generation/Diesel generators, power synchronization, parallel operations and power locking mechanism, rules and regulations
7	Boilers, heat transfer, steam production, turbo generators, evaporators, operational limitations and start-up, watch-duty references
8	Mid-term exam Application (Combined self and team management performance)
9	Hydraulic, Pneumatic & Automatic control systems onboard ships, management strategies of watchkeeping and standards
10	Aux. machinery's remote-control systems, st-by functions, alarm and auxiliary safety systems, refrigeration and conditioning
11	Main engine start-up and power integrity I and propulsion with readiness
12	Main engine start-up and power integrity II /maneuvering safety systems
13	Safe watch-keeping, logs and engine room awareness, Marpol Annex I-IV & VI brief explanation, records, reports and daily journals (Use of Simulator TECHSIM5000 –E/R)
14	Auxiliary engine room equipment running conditions, faults and integrity. Team management in Engine Room and resources, bridge and deck integration and stand-by applications.
15	Final exam Application (Combined team operational management skills' performance)

Methods and Techniques Used in the Course

Simulator-Based Practical Sessions: Hands-on operation of TECHSIM5000, TRANSAS etc., to simulate main and auxiliary engine operations, emergency situations, and system failures.

Case Studies: Realistic scenarios involving fault diagnosis, fuel management, and watchkeeping practices to enhance problem-solving and decision-making skills.

Group Exercises: Collaborative tasks to practice team coordination, engine room management, and bridge-deck integration.

Instructor-Led Demonstrations: Step-by-step guidance on simulator use, emergency procedures, and operation of hydraulic, pneumatic, and automation systems.

Self-Assessment and Peer-Assessment: Students evaluate their own and peers' performance to reinforce learning outcomes and operational awareness.

Practical Reporting and Documentation: Recording operational data, performance logs, and maintenance actions in compliance with standard marine engineering practices.

Interactive Discussions: Classroom and simulator debriefing sessions to analyze operational decisions, emergency responses, and best practices.

Problem-Solving Exercises: Analytical exercises using simulator scenarios to identify, investigate, and resolve engine room issues.

Sample Questions

Theoretical Questions:

- Explain the main differences between local and remote control of shipboard machinery.
- Describe the procedure for fuel transfer and separation on board and explain how fuel quality affects engine performance.
- What are the operational limitations of a diesel generator during parallel operation with the main switchboard?
- Define the key elements of watchkeeping responsibilities in the engine room.

Scenario-Based / Application Questions:

- You observe a sudden drop in lubricating oil pressure on the main engine during simulation. Describe your immediate actions and steps to prevent damage.
- During simulator operations, the ship experiences a blackout. Outline the sequence of restoring power using emergency generators and switchboard operations.
- A fault occurs in the hydraulic control system of a deck crane. Explain how you would diagnose the issue and restore safe operation.

Case Study / Critical Thinking Questions:

- Analyze a simulated voyage scenario where fuel consumption exceeds the planned values. Suggest corrective measures considering operational, environmental, and safety regulations.
- During an emergency maneuver, the main engine fails to respond to remote commands. Discuss possible causes and solutions, considering both human error and system faults.
- Prepare a short report evaluating team coordination during a complex simulator scenario involving multiple engine room systems and bridge communications.

Materials Used in the Course

Textbooks & Reference Books:

- *Marine Auxiliary Machinery* – H.D. McGeorge
- *Marine Engineering* – Roy L. Harrington
- *Shipboard Marine Engineering Practice* – D.A. Taylor
- *Marine Diesel Engines: Maintenance, Troubleshooting and Repair* – Nigel Calder
- ISM Code Guidelines and relevant IMO publications
- Engine Manufacturer Manuals (e.g., MAN, Wärtsilä, Mitsubishi)
- Simulator User Manuals (TECHSIM5000, TRANSAS or equivalent)

Software & Simulation Tools:

- TECHSIM5000, TRANSAS etc., Marine Engine Simulator
- Engine Room Automation Software
- Control Systems Simulation Packages (Hydraulic, Pneumatic, and Automatic Control Modules)

Practical / Laboratory Equipment:

- Engine room mock-up panels for practical exercises
- Hydraulic and pneumatic control panels
- Fuel and lubricating oil handling tools
- Measurement devices: pressure gauges, flow meters, temperature sensors, etc.
- Personal protective equipment (PPE) for simulator and lab exercises

Supporting Materials:

- Case studies from shipping companies
- Maintenance logs and engine room operational reports
- Safety and emergency procedure guidelines

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	1	2	2	2	3	2
PO2	2	3	3	3	3	3
PO3	1	2	2	2	2	2
PO4	1	2	2	2	2	2
PO5	3	1	1	1	1	2
PO6	1	1	1	1	1	2
PO7	1	1	1	1	1	2
PO8	1	1	1	1	1	2
PO9	1	1	1	1	1	1
PO10	0	2	2	2	2	3
PO11	2	1	1	1	1	2
PO12	3	1	1	1	1	2

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1	Lecture, Question-Answer, Discussion, Productional application,	Application, Quiz, Midterm Exam, Final Exam
CLO2	Lecture, Problem-Solving Sessions, Group Discussion, Production	Assignments, In-Class Application, Term Project, Midterm Exam
CLO3	Lecture, Problem-Solving, Hands-on Practice, Brainstorming, Production	Project, Assignments, Quizzes, Midterm Exam, Final Exam
CLO4	Lecture, Demonstration, Hands-on Practice	Productional applicationi Assignments, Midterm Exam, Final Exam
CLO5	Lecture, Practice Sessions, In-Class Activities	Application, Assignments, Quizzes, Midterm Exam, Final Exam
CLO6	Lecture, Question-Answer, Discussion, Brain Storming	Midterm Exam, Final Exam

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	-	-	-
Lectures	**15**	**3**	**45**
Midterm Exam	**1**	**2**	**2**
Preparation for Midterm Exam	**1**	**6**	**6**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**6**	**6**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	-	-	-
Group Work	**4**	**3**	**12**
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	**6**	**3**	**18**
Assignment(s)/Homework/Class Works	**4**	**3**	**12**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**103**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	6	20
Field Work	4	10
Special Course Internship (Work Placement)	-	-
Homework/Assignments	4	10
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	30
Total	**16**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Marine Diesel Engines II							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED205	II	Fall	3	3	2	2	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	30	30	20
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Chf. Eng. Volkan Varışlı** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 volkan.varisli@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course provides an in-depth study of modern marine diesel engines, focusing on advanced combustion processes, fuel injection systems, performance analysis, and engine management techniques. Students will explore the principles of fuel combustion, injection timing, and electronic control systems, as well as the analysis of engine efficiency using P-V and T-S diagrams. The course covers variable injection timing, electronic governors, and performance metrics, including the identification and troubleshooting of injection failures. Emphasis is placed on the integration of supercharging and turbocharging systems, air charge management, and the optimization of engine operation for maximum efficiency. Students will also study dual-fuel and tri-fuel engines, as well as new-generation marine engine models. Practical aspects include cooling and lubrication systems, starting and control air mechanisms, and waste gas treatment in compliance with MARPOL Annex VI regulations for air pollution prevention. The course combines theoretical understanding with applied case studies, such as engine failure analysis and efficiency management. Additionally, students will gain knowledge of safe engine operations during maneuvering, port operations, and watchkeeping, including abnormal running conditions and torsional vibrations. By the end of the course, students will have acquired the skills necessary for analyzing, operating, and optimizing marine diesel engines under various operational and environmental conditions.
Course Aims and Objectives	The primary aim of this course is to provide students with a comprehensive understanding of advanced marine diesel engine technology, including combustion processes, fuel injection systems, engine performance, and efficiency optimization. The course also aims to develop students' practical skills in engine monitoring, troubleshooting, and operational management in accordance with international regulations. • Understand advanced combustion principles and fuel injection techniques used in marine diesel engines. • Analyze engine performance using P-V and T-S diagrams and other performance metrics. • Identify, diagnose, and troubleshoot common engine failures, including injection and combustion-related issues. • Apply electronic control systems, variable injection timing, and governor technologies for engine optimization. • Understand and operate dual-fuel, tri-fuel, and next-generation marine engines. • Manage engine auxiliary systems such as cooling, lubrication, starting, and control air systems. • Comply with environmental regulations, including MARPOL Annex VI, for exhaust gas and pollution control. • Conduct safe engine operations during maneuvering, port operations, and watchkeeping. • Apply theoretical knowledge to practical scenarios through case studies on engine failure analysis and efficiency management. This course equips students with both theoretical knowledge and practical skills necessary for the efficient, safe, and environmentally compliant operation of marine diesel engines.

Course Learning Outcomes	**CLO1:** Explain advanced combustion processes and the functions of fuel injection systems in marine diesel engines. **CLO2:** Interpret and analyze engine performance using P–V and T–S diagrams to identify efficiency losses and improvement opportunities. **CLO3:** Diagnose common marine engine failures and apply appropriate troubleshooting techniques using specialized tools and automation systems. **CLO4:** Apply concepts of electronic injection, electronic governors, and variable injection timing to optimize engine performance. **CLO5:** Compare and evaluate dual-fuel, tri-fuel, and next-generation marine diesel engine technologies in terms of efficiency and environmental impact. **CLO6:** Operate and manage key auxiliary systems, including cooling water, lubrication, and starting/control air systems, in accordance with operational standards.

Content of the Course

Week	*Subject*
1	Combustion activity and aspects of fuel injection with exhaust outputs
2	Fuel systems, Injection models and injection failures and ANNEX VI Limitations
3	Variable injection timing model, electronic injection, electronic governors and performance metrics
4	Performance analysis of the Diesel engines, P-V and T-S Diagrams, failure analysis with special tools/remote automation facilities, engine losses and recovery
5	Charging air and premature air charge, supercharging, turbochargers and modular integration of combustion control systems, combustion element's temperature and pressure
6	Combustion power management of diesel engines and engine power calculation. Optimal engine operation and efficiency with engine attachments
7	Dual-fuel, tri-fuel engines and new generation models
8	Mid-term Exam / Application (Case study: Engine failure analysis)
9	Engine cooling systems, cooling water systems, water quality parameters and onboard tests, sea cooling water systems
10	Theory of lubrication, lubricating oil systems, oil quality and onboard tests, Starting and control air systems with their mechanisms
11	Waste gas systems, Exhaust gas systems and Economizer, Regulations for the Prevention of Air Pollution from Ships Marpol Annex VI and waste gas treatment applications
12	Operation for maneuvering (Preparation, engine starting and stop)
13	Principle of watch-keeping at sailing and port / testing of engine safety control devices
14	Abnormal running conditions, torsional vibration and emerg. running applications.
15	Final Exams / Application (Case study: Engine efficiency management)

Methods and Techniques Used in the Course

Lectures and Presentations – Core theoretical concepts such as combustion processes, fuel injection, turbocharging, and emission control are explained through structured lectures supported by multimedia presentations.

Case Studies and Problem-Solving Sessions – Real-life examples of engine failures, efficiency management, and emission-related issues are analyzed, allowing students to develop critical thinking and decision-making skills.

Laboratory Applications and Simulations – Engine performance analysis, cooling and lubrication system tests, and exhaust gas monitoring are practiced using simulation software and laboratory equipment.

Demonstrations and Practical Training – Demonstrations of engine components, fuel injection models, governors, and auxiliary systems are provided to enhance practical understanding.

Class Discussions and Collaborative Learning – Group activities and discussions encourage teamwork, knowledge sharing, and problem-solving related to operational scenarios.

Use of Engine Room Simulators (ERS) – Advanced simulators replicate shipboard conditions, enabling students to practice maneuvering, watchkeeping, and emergency running procedures in a safe training environment.

Regulation-Oriented Learning – MARPOL Annex VI and IMO requirements are integrated into coursework to familiarize students with international maritime standards and legal responsibilities.

Assignments and Projects – Students complete technical reports, efficiency analysis projects, and documentation tasks to develop their research and academic writing skills.

Midterm and Final Case Study Applications – Assessments include applied case studies on engine failure analysis and efficiency management, ensuring students can connect theory with practice.

Sample Questions

Short-Answer / Knowledge Questions

- Define the role of fuel injection timing in diesel engine performance and emission control.
- What are the primary causes of cavitation in cooling water systems, and how can they be prevented?
- Explain the differences between supercharging and turbocharging in marine diesel engines.
- List the main pollutants regulated under **MARPOL Annex VI** and explain their environmental impact.
- What are the common types of failures in fuel injection systems? Provide at least two examples.

Analytical / Problem-Solving Questions

- A marine diesel engine operating at 85% load shows increased exhaust gas temperature and reduced efficiency. Identify possible causes and suggest corrective measures.
- Given a **P-V diagram** of a diesel engine cycle, calculate the **indicated mean effective pressure (IMEP)** and comment on the engine's performance.
- An engine shows signs of abnormal torsional vibration during maneuvering operations. Explain how this condition can be detected, its potential risks, and corrective actions.

Application / Case Study Questions

- During a voyage, the lubricating oil analysis shows high levels of metallic particles. As the ship's engineer, what steps would you take to identify the source of contamination and mitigate the issue?
- A dual-fuel engine is experiencing misfiring when operating on LNG. Discuss potential causes and propose troubleshooting methods.
- Prepare a brief **checklist for engine room staff** before maneuvering operations, including safety and performance checks.

  In case of exhaust gas economizer fouling, explain how it would affect engine performance and compliance with emission regulations.

Essay / Discussion Questions

- Discuss the importance of **engine efficiency management** in modern shipping in relation to both economic and environmental sustainability.
- Compare the advantages and disadvantages of **electronic fuel injection systems** versus traditional mechanical systems in marine diesel engines.
- Evaluate the role of **remote monitoring and automation systems** in detecting engine failures. What are their limitations?

Materials Used in the Course

Textbooks and Reference Books

- Heywood, J. B. *Internal Combustion Engine Fundamentals*. McGraw-Hill.
- Woud, H. K., & Stapersma, D. *Diesel Engine Systems Design*. Springer.
- Pounder, C. C., & Bailey, M. *Pounder's Marine Diesel Engines and Gas Turbines*. Butterworth-Heinemann.
- MAN Energy Solutions & Wärtsilä Technical Manuals (selected chapters).

International Regulations and Guidelines

- **MARPOL Annex VI** – Regulations for the Prevention of Air Pollution from Ships.
- **SOLAS Convention** (Safety of Life at Sea) – relevant engine room safety provisions.
- **IMO Guidelines** on ship energy efficiency and emission control.

Lecture Materials and Handouts

- Instructor-prepared lecture slides, notes, and supplementary reading materials.
- Case studies and technical reports on engine performance and failures.
- Diagrams and charts (P–V, T–S diagrams, fuel injection schematics, turbocharger systems).

Multimedia and Digital Resources

- Engine simulation software and performance monitoring tools.
- Video demonstrations of fuel injection systems, turbochargers, and failure analysis.
- Online resources from marine engine manufacturers (e.g., MAN, Wärtsilä, Caterpillar).

Laboratory and Onboard Training Materials

- Engine models and cutaway parts for visualization of fuel, cooling, and lubrication systems.
- Diagnostic instruments and testing kits for oil/water quality.
- Onboard training manuals for watchkeeping, maneuvering, and emergency operations.

Language and Communication Support

- IMO Standard Marine Communication Phrases (SMCP).
- English terminology guides for technical documentation and reporting.

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	1	2	2	2	3	2
PO2	2	3	3	3	3	3
PO3	1	2	2	2	2	2
PO4	1	2	2	2	2	2
PO5	3	1	1	1	1	2
PO6	1	1	1	1	1	2
PO7	1	1	1	1	1	2
PO8	1	1	1	1	1	2
PO9	1	1	1	1	1	1
PO10	0	2	2	2	2	3
PO11	2	1	1	1	1	2
PO12	3	1	1	1	1	2

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1	Lecture, Question-Answer, Discussion, Productional application,	Application, Quiz, Midterm Exam, Final Exam
CLO2	Lecture, Problem-Solving Sessions, Group Discussion, Production	Assignments, In-Class Application, Term Project, Midterm Exam
CLO3	Lecture, Problem-Solving, Hands-on Practice, Brainstorming, Production	Project, Assignments, Quizzes, Midterm Exam, Final Exam
CLO4	Lecture, Demonstration, Hands-on Practice	Productional applicationi Assignments, Midterm Exam, Final Exam
CLO5	Lecture, Practice Sessions, In-Class Activities	Application, Assignments, Quizzes, Midterm Exam, Final Exam
CLO6	Lecture, Question-Answer, Discussion, Brain Storming	Midterm Exam, Final Exam

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**1**	**15**
Lectures	**15**	**4**	**60**
Midterm Exam	**1**	**2**	**2**
Preparation for Midterm Exam	**1**	**4**	**4**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**6**	**6**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	-	-	-
Group Work	**2**	**4**	**8**
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	**2**	**4**	**8**
Assignment(s)/Homework/Class Works	**4**	**4**	**16**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**121**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	2	10
Field Work	2	10
Special Course Internship (Work Placement)	-	-
Homework/Assignments	4	20
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	30
Total	**8**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Hydraulic, Pneumatic and Automatic Control							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED207	II	Fall	2	3	1	2	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	30	30	20
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Chf. Eng. Volkan Varışlı** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 volkan.varisli@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course provides a comprehensive introduction to hydraulic, pneumatic, and automatic control systems used in marine engineering and ship operations. Students will gain both theoretical understanding and practical experience in designing, operating, and maintaining shipboard control systems, focusing on safety, efficiency, and automation. The course covers the fundamental principles of hydraulic and pneumatic systems, including the production and transmission of hydraulic power, components such as pumps, motors, cylinders, valves, accumulators, and pneumatic lines with fittings. Students will learn to interpret engineering drawings and diagrams and understand the functional operation of these systems. The course also emphasizes automatic control and automation systems, including PID controllers, analog and digital control, feedback systems, stability of open and closed-loop systems, and modeling of control systems. Students will explore shipboard applications, such as steering gear, hydro-bow thrusters, deck machinery, auxiliary engines, propeller systems, oil mist systems, and alarm and safety monitoring systems. Practical exercises, case studies, and simulations will enable students to analyze system performance, troubleshoot failures, and implement preventive maintenance, ensuring operational readiness and reliability. The course integrates principles of marine automation, process control, and instrumentation, providing students with the skills to manage modern ship control systems effectively. By the end of the course, students will be able to operate, maintain, and optimize hydraulic, pneumatic, and automation systems onboard, applying both theoretical knowledge and hands-on experience to real-world maritime engineering challenges.
Course Aims and Objectives	**Course Aims** The course aims to equip students with a solid understanding of **hydraulic, pneumatic, and automatic control systems** used in maritime engineering. It emphasizes both theoretical concepts and practical applications to prepare students for the operation, maintenance, and troubleshooting of shipboard control systems. The course also seeks to develop students' analytical and problem-solving skills in modern marine automation and control technologies. **Course Objectives** By the end of the course, students will be able to: • Comprehend the fundamental principles of **hydraulic and pneumatic systems**, including power production, system components, and flow control. • Interpret **engineering diagrams, symbols, and technical drawings** for hydraulic and pneumatic systems. • Understand the principles of **automatic control systems**, including PID controllers, analog and digital feedback, and open/closed-loop stability. • Operate, maintain, and troubleshoot **hydraulic, pneumatic, and automation systems** onboard ships. • Apply control system theory to practical **shipboard applications**, including steering gear, thrusters, deck machinery, and auxiliary engines.

	• Develop preventive maintenance strategies and evaluate the **performance and reliability** of ship control systems. • Integrate knowledge of marine automation to ensure **safe, efficient, and environmentally compliant operations**.
Course Learning Outcomes	**CLO1:** Explain and apply the principles of hydraulic and pneumatic systems, including pumps, motors, cylinders, valves, and accumulators. **CLO2:** Interpret and use technical drawings, schematics, and control symbols for hydraulic, pneumatic, and automation systems. **CLO3:** Operate and maintain shipboard hydraulic and pneumatic systems—such as steering gear, deck machinery, and auxiliary systems—safely and efficiently. **CLO4:** Analyze and troubleshoot system failures using diagnostic techniques for hydraulic, pneumatic, and automated control systems. **CLO5:** Understand and implement automation and control concepts, including PID control, analog/digital systems, feedback loops, and system stability. **CLO6:** Apply control system theory to shipboard applications, including engine synchronization, propeller automation, tank level systems, and safety alarm systems.

Content of the Course

Week	*Subject*
1	Principle of basic Hydraulic & Pneumatic control systems, requirements of marine remote and automation control
2	Production of hydraulic power, hydraulic systems, hydraulic pumps, hydraulic motors and cylinders & hydraulic lines fittings with drawing details. HPP systems and components, recovery and accumulator support, hydraulic lines and fittings
3	Production of compressed air, pneumatic systems, cylinders and valves, supply of air and air-controlled locking devices. Pneumatic lines, fittings with drawing details
4	Principles of Control systems on Hydraulics & pneumatics systems. Basic components, drawings, symbols and control procedure function.
5	Operation and maintenance of hydraulic & pneumatic systems onboard: Steering gear, hydro-bow thruster and deck machinery applications. Deck cranes, cargo cranes, hose handling cranes, hydraulic davit systems. Special applications: Tanker applications, framo systems and hydraulic car carrier doors.
6	Failures of hydro-pneumatic systems and trouble shooting
7	Mid-term Exam Application (Hydraulic and pneumatic control simulations)
8	Principle of automation control systems and related supplementary.
9	Characteristic of PID and process control, gain values controllers and control diagrams, calculations of electrical feed-back requirements
10	Analog and digital control systems, Calculation of digital control system and function data, Measurement and control, Measurement systems, Control equipment, Sensors, Measurement of signal amplifiers, noise reduction techniques, software versional control systems
11	Modeling of control systems, Inlet and outlet functions of control systems, Diagrams of control systems and transfer functions, Stability Open and closed loop control systems. Hydro-pneumatic control applications. Remote control mentality and Piston speed and In-line controls,
12	Vessel automatic control systems, remote automation controls & applications: Auxiliary engines and their synchronization's automation, propeller and main engine automation systems including oil mist systems. Level indication, Tank leveling and indicational other systems
13	Vessel automatic control system components: Signalization, measurement, sensing elements, transducers and transmitters, Remote automation controls & applications: Engine governing, power synchronization, alarm and safety systems, open and closed-loops: fire-detection system.
14	Operation, maintenance of automation systems, alarm and watch-keeping systems. Function of protecting devices, Failures troubleshooting with software-controlled systems
15	Final Exams / Application (Automatic control simulations)

Methods and Techniques Used in the Course

Lectures and Interactive Presentations

- Detailed explanation of hydraulic, pneumatic, and automation system principles.
- Use of diagrams, schematics, and technical drawings to illustrate system design and operation.

Laboratory Applications and Simulations

- Hands-on exercises with hydraulic and pneumatic components, including pumps, cylinders, valves, and fittings.
- Simulation of control systems and automation processes to visualize system responses.
- Troubleshooting exercises on realistic operational scenarios.

Case Studies

- Analysis of shipboard systems failures and preventive maintenance strategies.
- Evaluation of real-life applications, such as steering gear, deck machinery, and auxiliary automation systems.

Group Projects and Collaborative Exercises

- Design and implementation of small-scale automation control setups.
- Team-based problem-solving exercises to simulate shipboard control challenges.

Assignments and Reports

- Individual and group homework assignments analyzing control system performance, calculations, and design improvements.
- Documentation and reporting of laboratory exercises to reinforce technical communication skills.

Examinations and Assessments

- Mid-term and final exams to evaluate theoretical knowledge, problem-solving abilities, and practical understanding.
- Continuous assessment through lab performance and project contributions.

Technical Discussions and Tutorials

- Interactive sessions to clarify complex concepts and reinforce learning.
- Application of control theory to real shipboard automation scenarios.

Sample Questions

Theoretical Questions

- Explain the basic principles of hydraulic and pneumatic control systems and discuss their differences in marine applications.
- Describe the role of accumulators in hydraulic systems and explain their function in maintaining pressure stability.
- Outline the key components of a PID controller and discuss its relevance in marine automation systems.
- Discuss the safety considerations when operating and maintaining hydraulic and pneumatic systems onboard ships.
- Explain the concept of remote automation in ship systems, providing examples of applications such as engine governing and tank level monitoring.

Calculation / Problem-Solving Questions

- A hydraulic cylinder has a piston diameter of 0.15 m and operates at 7 MPa. Calculate the maximum force exerted by the cylinder.
- Determine the flow rate required to achieve a piston speed of 0.25 m/s in a hydraulic cylinder with a piston area of 0.02 m^2.
- A PID controller has proportional gain Kp = 2, integral time Ti = 4 s, and derivative time Td = 1 s. Calculate the controller output for a given error signal e(t) = 5 units at a specific time instant.
- A pneumatic actuator operates at 6 bar pressure and moves a load of 500 kg. Determine the cylinder bore diameter required to lift the load.

Practical / Application-Based Questions

- Design a simple hydraulic circuit for a deck crane, including pump, cylinder, and directional control valve. Explain the operation sequence.
- Analyze a failure scenario in a ship's steering gear hydraulic system and propose corrective maintenance steps.
- Simulate the control of an auxiliary engine automation system using a digital feedback loop and explain the impact of adjusting PID parameters on system stability.
- Explain how to perform preventive maintenance for a pneumatic system controlling cargo crane operations and discuss common faults to check.

Materials Used in the Course

Textbooks

- **"Fluid Power with Applications"** – Anthony Esposito
- **"Hydraulics and Pneumatics: A Technician's and Engineer's Guide"** – Andrew Parr
- **"Automatic Control Systems"** – Benjamin C. Kuo & Farid Golnaraghi
- **"Marine Control Systems: Guidance and Control of Ships, Rigs and Underwater Vehicles"** – R. J. Barron

Reference Books

- **"Marine Auxiliary Machinery"** – H.D. McGeorge & A. Caplen
- **"Practical Hydraulic Systems: Operation, Maintenance, and Troubleshooting"** – R. Smith
- **"Process Control: Modeling, Design, and Simulation"** – B. Wayne Bequette
- **"Instrumentation and Control Systems"** – W. Bolton

Supplementary Materials

- Lecture slides and notes prepared by the instructor
- Technical datasheets of hydraulic pumps, motors, valves, and pneumatic actuators
- Engineering drawings for system simulations
- Manuals of onboard control and automation systems (e.g., steering gear, main engine governors, tank level indicators)
- Case studies of shipboard automation and failure scenarios
- Simulation software (e.g., MATLAB/Simulink, FluidSIM) for modeling and practicing control systems

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	1	2	2	2	3	2
PO2	2	3	3	3	3	3
PO3	1	2	2	2	2	2
PO4	1	2	2	2	2	2
PO5	3	1	1	1	1	2
PO6	1	1	1	1	1	2
PO7	1	1	1	1	1	2
PO8	1	1	1	1	1	2
PO9	1	1	1	1	1	1
PO10	0	2	2	2	2	3
PO11	2	1	1	1	1	2
PO12	3	1	1	1	1	2

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1	Lecture, Question-Answer, Discussion, Productional application,	Application, Quiz, Midterm Exam, Final Exam
CLO2	Lecture, Problem-Solving Sessions, Group Discussion, Production	Assignments, In-Class Application, Term Project, Midterm Exam
CLO3	Lecture, Problem-Solving, Hands-on Practice, Brainstorming, Production	Project, Assignments, Quizzes, Midterm Exam, Final Exam
CLO4	Lecture, Demonstration, Hands-on Practice	Productional applicationi Assignments, Midterm Exam, Final Exam
CLO5	Lecture, Practice Sessions, In-Class Activities	Application, Assignments, Quizzes, Midterm Exam, Final Exam
CLO6	Lecture, Question-Answer, Discussion, Brain Storming	Midterm Exam, Final Exam

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**1**	**15**
Lectures	**15**	**3**	**45**
Midterm Exam	**1**	**2**	**2**
Preparation for Midterm Exam	**1**	**6**	**6**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**6**	**6**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	-	-	-
Group Work	**2**	**4**	**8**
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	**3**	**4**	**12**
Assignment(s)/Homework/Class Works	**4**	**4**	**16**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**112**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	3	10
Field Work	2	10
Special Course Internship (Work Placement)	-	-
Homework/Assignments	4	20
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	30
Total	**11**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Marine Electrotechnology							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED209	II	Fall	2	3	1	2	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	20	30	30
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Chf. Eng. Volkan Varışlı** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 volkan.varisli@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	**Marine Electrotechnology** provides students with a comprehensive foundation in marine electrical and electrotechnical systems used on board ships. The course covers the basic principles of electricity, including Ohm's and Kirchhoff's laws, electrical power and energy formulations, and circuit analysis. Students will learn about both low and high-voltage marine electrical equipment, AC/DC power generation, distribution systems, and electrical safety requirements specific to the maritime environment. Key topics include electrical motors and starters, transformers, alternators, batteries, and short-circuit/earth fault protection, as well as the operation and maintenance of shipboard electrical systems. The course also addresses fundamental safety regulations, inspection and measurement techniques, electromagnetic interference, and troubleshooting practices. Through theoretical lectures, practical applications, and fault-finding exercises, students will develop the ability to understand, operate, maintain, and repair marine electrical equipment and systems in compliance with international maritime standards. This course emphasizes problem-solving, safety awareness, and teamwork, preparing students for operational and maintenance-level responsibilities on board ships.
Course Aims and Objectives	**Course Aims:** • To introduce students to the fundamental principles of marine electrical and electrotechnological systems used on board ships. • To develop the ability to analyze, operate, maintain, and troubleshoot shipboard electrical equipment safely and efficiently. • To ensure students gain awareness of international maritime electrical safety standards and best practices. • To provide hands-on experience with electrical circuits, motors, switchboards, and shipboard power distribution systems. **Course Objectives:** By the end of this course, students will be able to: • Understand the characteristics and functions of marine electrical components and systems, including both low and high-voltage applications. • Apply Ohm's and Kirchhoff's laws, and perform calculations for electrical work, energy, and power in marine environments. • Interpret and analyze electrical circuit diagrams and identify components using correct symbols and designations. • Explain the principles of AC/DC power generation, distribution, protection, and fault detection on board ships. • Operate and maintain electrical motors, transformers, alternators, and related shipboard electrical machinery. • Conduct safe maintenance and inspections using appropriate electrical measuring and diagnostic tools. • Identify and mitigate electromagnetic interference, noise, and other signalization problems affecting marine electrical systems. • Demonstrate practical troubleshooting and teamwork skills through applications and group projects in compliance with maritime safety regulations.

Course Learning Outcomes	**LO1 – Knowledge and Understanding** Define the fundamental concepts, terminology, and principles related to marine electrical and electrotechnological systems, including low and high voltage applications, AC/DC power generation, distribution, and protection mechanisms. **LO2 – Application of Knowledge** Apply Ohm's and Kirchhoff's laws to analyze simple and complex marine electrical circuits. Operate and maintain electrical motors, transformers, alternators, and switchboards safely and efficiently. **LO3 – Analytical and Technical Skills** Interpret electrical circuit diagrams, identify components using proper symbols, perform inspections, use measurement tools to detect faults, and evaluate system performance. Analyze electromagnetic interference and noise issues affecting marine electrical and automation systems. **LO4 – Evaluation and Critical Thinking** Evaluate system performance, assess operational risks, and implement mitigation strategies for faults, interference, and other electrical issues. Integrate theoretical knowledge with practical problem-solving in marine electrical systems. **LO5 – Communication and Teamwork** Demonstrate teamwork and communicate technical information effectively through group assignments, practical applications, and documentation in maritime contexts. **LO6 – Problem-Solving and Decision-Making** Apply problem-solving and decision-making skills to troubleshoot, maintain, and repair shipboard electrical systems in compliance with safety standards and operational requirements.

Content of the Course

Week	*Subject*
1	General aspects of Marine Electrotechnical equipment, characteristics, low and high voltage
2	Reminder tutorial of Ohm and Kirchhoff laws and resistance
3	Electrical work, energy, power formulations Electrical circuit line systems and circuit diagrams, understanding of the components with their symbols and literature denominations
4	Electrical power production, AC/DC voltage requirements, conductors, isolation, batteries, short-circuit and earth fault. Impedance & inductance
5	Electrical power distribution, Main switchboard (MSB) & Emergency Switchboard (ESB), marine power cables and signalization cables
6	Electrical motors and motor starters with main and auxiliary wiring systems, megger tests
7	AC/DC Motors, transformers, alternators and breakers and maintenance
8	Mid-term Application (Theoretical fault-finding and maintenance)
9	Fundamental safety regulations, electrics/electro technological marine electrical components' safety requirements, mechanism and maintenance.
10	Electrical inspection system, measurements and use of determination tools
11	Fundamental maintenance regulations, electrical systems maintenance regulations, damage tests with measurements appliances
12	Fault finding, electromagnetic waves and spread, noise and reduction in signalization
13	Shipboard Electrotechnology's I: Motors, starter panels, switchboards and distributor board with main switchboards A/C
14	Shipboard Electrotechnology's II: Device starter panels, switchboards, distributor board, safety and automation boards with auxiliary D/C
15	Final Exam Application (Acting for troubleshooting and repair)

Methods and Techniques Used in the Course

Lectures

- Deliver foundational knowledge of marine electrical systems, circuit theory, and electrotechnical principles.
- Use diagrams, illustrations, and real-world examples to explain complex concepts.

Laboratory Sessions / Practical Applications

- Hands-on practice with electrical circuits, motors, transformers, switchboards, and measurement tools.
- Fault-finding exercises and simulations of shipboard electrical operations.
- Application of safety procedures in handling electrical equipment and automation systems.

Case Studies / Application Exercises

- Realistic shipboard scenarios for troubleshooting and repair.
- Analysis of electrical failures, signal noise reduction, and preventive maintenance strategies.

Assignments and Projects

- Individual assignments for circuit analysis, component identification, and calculations.
- Group projects for simulated system maintenance, fault diagnostics, and repair planning.

Simulation / Demonstration Techniques

- Use of software and simulator tools for electrical system monitoring, measurement, and control exercises.
- Visualization of AC/DC system behavior and protection mechanisms in different scenarios.

Assessments

- Mid-term and final exams to evaluate theoretical understanding and applied knowledge.
- Continuous evaluation of practical work, case studies, assignments, and group project performance.

Interactive Discussions and Q&A Sessions

- Encouraging critical thinking and problem-solving in practical and theoretical contexts.
- Discussion of safety regulations, operational standards, and emerging technologies in marine electrotechnology.

Sample Questions

Theoretical Questions:

- Explain the differences between AC and DC systems on a ship. Include examples of where each system is used.
- Describe the function and components of a shipboard Main Switchboard (MSB) and Emergency Switchboard (ESB).
- Discuss the importance of insulation, earth fault protection, and short-circuit safety in marine electrical systems.
- Explain Ohm's Law and Kirchhoff's Laws and illustrate their application in a marine electrical circuit.
- Define the principles of electrical power generation onboard and the characteristics of marine alternators.
- Explain how electromagnetic interference can affect shipboard electronics and methods to reduce its impact.

Practical / Application Questions:

- Identify and describe the function of the main components of a marine AC motor.
- Perform a fault-finding procedure on a simulated electrical system with a burned-out fuse and a malfunctioning motor starter. Outline the steps.
- Calculate the power consumption of a shipboard device given voltage, current, and power factor.
- Demonstrate how to use a megger tester to verify insulation resistance of a motor or cable.
- Analyze a scenario where the MSB has tripped during peak load: identify probable causes and corrective actions.
- Interpret a simplified electrical schematic of a shipboard auxiliary system and locate potential points of failure.

Critical Thinking / Case Study:

- A ship's emergency generator fails during a drill. List all safety and corrective steps that should be followed according to standard marine practice.
- Discuss the integration of low- and high-voltage systems in a ship's electrical network and the safety implications for maintenance personnel.

Materials Used in the Course

Textbooks:

- **"Marine Electrical and Electronic Equipment"** – By H.D. McGeorge *Comprehensive overview of shipboard electrical systems, motors, switchboards, and safety regulations.*
- **"Marine Electrical Technology"** – By Elstan A. Fernandez *Covers principles of AC/DC systems, electrical machines, and troubleshooting on ships.*
- **"Practical Marine Electrical Knowledge"** – By G. T. Smith *Focuses on practical maintenance, inspection techniques, and fault-finding exercises.*

Standards and Codes:

- **SOLAS (Safety of Life at Sea) Chapter II-1 & V** – Electrical safety, navigation systems, and power requirements.
- **IEC 60092 series** – Electrical installations in ships.
- **IMO Guidelines for Electrical Systems and Safety** – Recommendations for shipboard electrical safety, grounding, and protection.

Laboratory / Simulation Tools:

- Shipboard electrical simulators (AC/DC motor and switchboard simulations).
- Megger insulation tester and multimeters for practical exercises.
- Circuit kits with resistors, capacitors, diodes, and transistors for hands-on applications.
- Electrical schematic diagrams and maintenance manuals for practical fault-finding exercises.

Supplementary Resources:

- Technical datasheets and manuals of marine electrical components (motors, alternators, breakers, starters).
- Online databases for IMO circulars, SOLAS updates, and maritime electrical publications.
- Reference materials on automation, control systems, and marine electronics integration.

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	3	3	2	2	3	2
PO2	2	3	3	2	2	3
PO3	2	2	3	3	2	3
PO4	1	2	2	2	3	3
PO5	1	2	3	3	2	3
PO6	2	3	3	2	2	3
PO7	1	1	2	2	2	2
PO8	1	2	2	2	1	2
PO9	1	1	1	2	2	2
PO10	2	2	3	3	2	3
PO11	1	2	2	2	2	3
PO12	1	1	2	2	2	3

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method (Instructional Strategy)**	**Assessment Method (Evaluation)**
CLO1 – Knowledge & Understanding	Lectures, Multimedia Presentations, Conceptual Discussions	Written Exams, Quizzes, Short Answer Questions
CLO2 – Application of Knowledge	Tutorials, Circuit Labs, Hands-On Exercises, Simulations	Practical Labs, Assignments, Circuit Analysis Reports
CLO3 – Analytical & Technical Skills	Electrical Diagram Workshops, Fault-Finding Exercises, Simulations	Lab Reports, Problem-Solving Exercises, Technical Reports
CLO4 – Evaluation & Critical Thinking	Scenario-Based Learning, Case Studies, Group Discussions	Case Study Reports, Analytical Assignments, Oral Presentations
CLO5 – Communication and Teamwork	Team Projects, Group Assignments, Peer Discussions	Project Reports, Group Presentations, Peer Assessment
CLO6 – Problem-Solving and Decision-Making	Problem-Based Learning, Troubleshooting Exercises, Applied Projects	Practical Problem-Solving Tasks, Capstone/Project Evaluation, Reports

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**1**	**15**
Lectures	**15**	**3**	**45**
Midterm Exam	**1**	**2**	**2**
Preparation for Midterm Exam	**1**	**6**	**6**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**6**	**6**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	-	-	-
Group Work	**2**	**4**	**8**
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	**4**	**4**	**16**
Assignment(s)/Homework/Class Works	**2**	**4**	**8**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**108**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	4	20
Field Work	2	10
Special Course Internship (Work Placement)	-	-
Homework/Assignments	2	10
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	30
Total	**10**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Theory of Marine Steam Engines and Boilers							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED211	II	Fall	3	3	3	0	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	-	30	50
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Prof. Dr. Deniz Ünsalan** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 deniz.unsalan@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course provides an advanced study of marine steam engines, boilers, and modern energy conversion systems in maritime engineering. It begins with a comprehensive review of conventional power cycles, including Rankine, Otto, Diesel, Sabathe, and Brayton cycles, highlighting their operational principles, efficiencies, and limitations. Modifications to internal combustion cycles are explored to improve efficiency and reduce harmful emissions, including Atkinson and Miller cycles, common rail injection systems, homogeneous charge compression ignition (HCCI), reactivity-controlled compression ignition (RCCI), reactivity-controlled spark ignition (RCSI), and hydrogen combustion engines. The course addresses environmental compliance in maritime operations, covering the International Maritime Organization (IMO) regulations for reducing carbon, NOx, and SOx emissions, as well as exhaust gas treatment systems, including selective catalytic reduction (SCR) and sulfur oxide filtration. Students are introduced to emerging alternative energy sources, including fuel cells, photovoltaic conversion systems, nuclear batteries, wind and water turbines, and osmotic power systems such as pressure-retarded osmosis (PRO) and reverse-osmosis desalination. Advanced thermodynamic cycles, including Kalina and Organic Rankine cycles, are examined in the context of energy efficiency and marine propulsion. The course also covers alternative fuels, including LNG, methanol, ammonia, liquefied hydrogen, biodiesel, and biogas, as well as methods for energy storage in thermal, magnetic, and mechanical forms. Practical applications and case studies are integrated into the course, including discussions of alternative propulsion and energy systems, as well as regulatory frameworks such as IMO MEPC 82, Initial GHG Strategies (ISWG-GHG-17), Carbon Intensity Indicator (CII) revisions, Global Fuel Standards (GFS), and greenhouse gas (GHG) strategies. Through these analyses, students gain the knowledge required to assess, implement, and manage sustainable and compliant energy solutions in maritime operations. The course combines theoretical foundations with applied exercises, case studies, and regulatory discussions, preparing students for future challenges in marine engineering and sustainable ship propulsion.
Course Aims and Objectives	The aim of this course is to provide students with a comprehensive understanding of marine steam engines, boilers, and modern energy systems used in maritime engineering. The course emphasizes thermodynamic principles, cycle analysis, environmental regulations, and alternative propulsion technologies. Students will develop the ability to analyze engine performance, evaluate energy efficiency, apply emission reduction strategies, and understand the integration of alternative energy sources in marine applications. • Review and analyze conventional and modified power cycles (Rankine, Otto, Diesel, Sabathe, Brayton, Atkinson, Miller, HCCI, RCCI, RCSI, and hydrogen combustion engines). • Understand and apply IMO regulations for carbon, NOx, and SOx emission reduction in maritime operations. • Evaluate exhaust gas treatment systems, including selective catalytic reduction (SCR) and sulfur oxide filtration.

	• Examine alternative energy systems and fuels, such as fuel cells, photovoltaic conversion, wind and water turbines, osmotic power, LNG, methanol, ammonia, hydrogen, biodiesel, and biogas. • Analyze advanced thermodynamic cycles, including Kalina and Organic Rankine cycles, for marine energy efficiency. • Conduct case studies on alternative propulsion systems, energy strategies, and IMO regulations related to greenhouse gas emissions and carbon intensity. • Assess the operational, environmental, and economic impacts of various marine energy technologies. • Integrate theoretical knowledge with practical applications in marine propulsion, energy management, and regulatory compliance.
Course Learning Outcomes	**LO1 – Knowledge and Understanding** Demonstrate knowledge of conventional and modified thermodynamic cycles (Rankine, Otto, Diesel, Sabathe, Brayton, Atkinson, Miller, HCCI, RCCI, RCSI), alternative fuels, and advanced propulsion systems. Understand IMO regulations, emission control technologies, and environmental impact metrics such as CII and GFS. **LO2 – Application of Knowledge** Apply thermodynamic principles and regulatory requirements to analyze power cycles, emission control systems, alternative propulsion methods, and energy management techniques in marine engineering systems. **LO3 – Analytical and Technical Skills** Evaluate performance characteristics of conventional and modified power cycles, emission control systems, and alternative energy sources. Conduct environmental impact assessments, including carbon, NOx, and SOx emissions, and analyze case studies related to marine propulsion systems. **LO4 – Evaluation and Critical Thinking** Critically assess the efficiency, sustainability, and environmental compliance of marine propulsion and energy systems. Integrate technical, operational, and regulatory knowledge to propose improvements and optimize system performance. **LO5 – Communication and Interpretation** Interpret and communicate findings from thermodynamic analyses, emission assessments, and case studies using appropriate technical language, diagrams, and reports to support decision-making and regulatory compliance. **LO6 – Problem-Solving and Decision-Making** Develop critical thinking and decision-making skills to propose effective solutions for sustainable, efficient, and environmentally compliant marine propulsion and energy systems based on operational, technical, and environmental data.

Content of the Course

Week	*Subject*
1	Review of conventional power cycles Rankine, Otto, Diesel, Sabathe and Brayton cycles
2	Modifications of internal combustion cycles for higher efficiencies and less harmful emissions a. Atkinson / Miller cycles b. Common rail injection schemes c. Homogeneous charge - compression ignition (HCCI) engines d. Reactivity-controlled compression ignition (RCCI) engines e. Reactivity-controlled spark ignition (RCSI) engines f. Hydrogen combustion engines
3	International Maritime Organization's rules for reduced Carbon emissions and NOX-SOX emissions and exhaust gas filtering systems – Selective catalytic reduction (SCR) and sulfur oxides filtration of exhaust gases
4	Fuel cells, theory and types
5	Theory of semiconductors and photovoltaic electric conversion, nuclear batteries
6	Wind turbines and water turbines
7	Osmotic power systems: Pressure-retarded osmosis (PRO) power generation and reverse-osmosis freshwater generation
8	Mid-Term Exam / Application (where applicable)
9	Kalina and Organic Rankine cycles
10	Alternative fuels – LNG, Methanol, Ammonia, Liquefied Hydrogen, Biodiesel and Biogas.
11	Storage of energy in heat, magnetic and mechanical forms
12	Case Study 1: Alternative propulsion discussions in marine engineering
13	Case Study 2: Alternative energy discussions in marine engineering
14	Case Study 3: Discussions of IMO MEPC 82, Initial GHG Strategies (ISWG-GHG-17), Carbon Intensity Indicator (CII) revision, Global Fuel Standard (GFS) and greenhouse gas (GHG) Strategies and future of energy efficiency regulations
15	Final exam / Application (Where applicable)

Methods and Techniques Used in the Course

Lectures and Interactive Presentations:

- Systematic explanation of conventional and modified power cycles, alternative fuels, and emission control systems.
- Use of diagrams, charts, and animations to visualize thermodynamic processes, engine components, and energy systems.

Case Studies and Real-World Applications:

- Analysis of IMO MEPC strategies, CII, GFS, and alternative propulsion systems in marine engineering.
- Group discussions and problem-solving exercises based on real ship operations and energy efficiency challenges.

Problem-Based Learning (PBL):

- Thermodynamic calculations of engine cycles, fuel consumption, and emission levels.
- Scenario-based problem solving to optimize engine efficiency and assess environmental impacts.

Simulations and Software Tools:

- Use of marine engineering simulation software to model Rankine, Brayton, and alternative cycles.
- Performance analysis of boilers, fuel cells, and renewable energy systems.

Laboratory Demonstrations and Experiments (where applicable):

- Practical demonstrations of combustion processes, thermodynamic measurements, and emission monitoring.
- Hands-on experience with energy storage systems and fuel cell setups.

Independent and Group Projects:

- Research assignments on alternative fuels, environmental compliance, and energy efficiency strategies.
- Group projects to analyze case studies and prepare technical reports on marine propulsion systems.

Mid-Term and Final Assessments:

- Written exams, calculations, and application-based problem-solving tests.
- Evaluation of case studies and students' ability to apply theoretical knowledge to practical scenarios.

Discussion and Feedback Sessions:

- Interactive question-and-answer sessions to reinforce theoretical concepts.
- Peer-to-peer discussions to enhance critical thinking and collaborative learning.

Sample Questions

Thermodynamics & Engine Cycles

- Compare and contrast the Rankine, Brayton, Otto, Diesel, and Sabathe cycles in terms of efficiency, work output, and practical marine applications.
- Calculate the thermal efficiency of an ideal Rankine cycle given boiler pressure, condenser pressure, and turbine inlet temperature.
- Discuss how modifications like the Atkinson or Miller cycles improve efficiency in internal combustion engines.

Alternative Fuels & Combustion

- Explain the advantages and challenges of using LNG, Methanol, Ammonia, or Hydrogen as marine fuels.
- Analyze the environmental impacts of NOx and SOx emissions from marine engines and the techniques used to reduce them, including SCR and exhaust gas filtration systems.
- Describe the principles of Homogeneous Charge Compression Ignition (HCCI) and Reactivity-Controlled Compression Ignition (RCCI) engines.

Marine Energy Systems & Regulations

- Evaluate the impact of IMO MEPC 82 strategies, Global Fuel Standards (GFS), and Carbon Intensity Indicator (CII) revisions on ship propulsion and energy efficiency.
- Discuss the role of Kalina and Organic Rankine cycles in marine energy recovery systems.
- Case Study Question: Propose an alternative propulsion system for a mid-sized cargo vessel to reduce greenhouse gas emissions while maintaining operational efficiency.

Energy Conversion & Storage

- Explain the working principles of fuel cells and photovoltaic energy conversion in marine applications.
- Compare osmotic power generation and reverse-osmosis freshwater generation as alternative energy sources on ships.
- Discuss the methods of storing energy mechanically, thermally, and magnetically on marine vessels.

Application & Problem-Solving

- Perform a performance analysis of a given marine steam engine based on operational data provided.
- Identify potential failures in a marine boiler system and propose corrective actions.
- Analyze the effects of supercharging, turbocharging, or sequential turbocharging on the performance of marine engines.

Materials Used in the Course

Textbooks & Reference Books

- *Marine Steam Engineering* – A. D. Bates
- *Marine Boilers* – J. H. Davies
- *Internal Combustion Engines: Applied Thermosciences* – T. H. Cengel & J. M. Cimbala
- *Marine Engineering* – D. S. Taylor
- IMO publications on *Emission Control and Energy Efficiency*

Lecture Notes & Handouts

- Instructor-prepared slides and notes covering thermodynamic cycles, marine steam engines, and boiler systems.
- Case study handouts on alternative fuels and IMO regulations.
- Problem sets for calculations related to thermal efficiency, emissions, and engine performance.

Software & Simulation Tools

- MATLAB / Simulink for cycle analysis and engine performance simulations.
- Thermodynamic cycle simulation software (e.g., EES – Engineering Equation Solver).
- Virtual lab tools for boiler and engine operation simulations.

Standards & Regulations

- IMO MEPC guidelines and regulations (CII, GFS, MARPOL Annex VI).
- Classification society rules (DNV, Lloyd's Register, ABS) relevant to marine boilers and engines.
- ISO and ASTM standards for fuels and emissions.

Multimedia & Online Resources

- Instructional videos on marine engine and boiler operations.
- Webinars and online case studies from marine engineering associations.
- Interactive e-learning modules for emission control technologies and alternative fuel engines.

Laboratory & Practical Materials

- Engine and boiler models for demonstration in laboratory sessions.
- Tools and instruments for measuring pressure, temperature, and emissions in practical exercises.
- Manuals and checklists for marine engine operation and maintenance exercises.

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	3	3	2	2	3	2
PO2	2	3	3	2	2	3
PO3	2	2	3	3	2	3
PO4	1	2	2	2	3	3
PO5	1	2	3	3	2	3
PO6	2	3	3	2	2	3
PO7	1	1	2	2	2	2
PO8	1	2	2	2	1	2
PO9	1	1	1	2	2	2
PO10	2	2	3	3	2	3
PO11	1	2	2	2	2	3
PO12	1	1	2	2	2	3

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method (Instructional Strategy)**	**Assessment Method (Evaluation)**
CLO1 – Knowledge & Understanding	Lectures, Multimedia Presentations, Conceptual Discussions	Written Exams, Quizzes, Short Answer Questions
CLO2 – Application of Knowledge	Tutorials, Problem-Solving Sessions, Simulation Exercises	Homework Assignments, Practical Problem Sets, Lab Reports
CLO3 – Analytical & Technical Skills	Case Studies, Performance Analysis Workshops, Energy Cycle Simulations	Analytical Assignments, Case Study Reports, Problem-Solving Exams
CLO4 – Evaluation & Critical Thinking	Scenario-Based Learning, Comparative Cycle Evaluations, Group Discussions	Evaluation Reports, Case Study Presentations, Oral Assessments
CLO5 – Communication and Interpretation	Technical Writing Workshops, Report Preparation, Team Exercises	Project Reports, Presentations, Documentation Assessment
CLO6 – Problem-Solving and Decision-Making	Problem-Based Learning, Applied Engineering Tasks, Sustainability Projects	Practical Problem-Solving Reports, Decision-Making Exercises, Capstone/Project Evaluation

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**1**	**15**
Lectures	**15**	**3**	**45**
Midterm Exam	**1**	**3**	**3**
Preparation for Midterm Exam	**1**	**6**	**6**
Final Exam	**1**	**3**	**3**
Preparation for Final Exam	**1**	**6**	**6**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	**1**	**3**	**3**
Group Work	**3**	**3**	**9**
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	-	-	-
Assignment(s)/Homework/Class Works	**2**	**3**	**6**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**96**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Field Work	3	15
Special Course Internship (Work Placement)	-	-
Homework/Assignments	2	10
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	1	15
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	30
Total	**8**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Introduction to Marine Electronics							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MEL201	II	Fall	3	3	2	2	0
Course type: Elective				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				20	20	20	40
Course Venue and Time				Wednesday 09.30-12.20			
Instructor information				**Chf. Eng. Volkan Varışlı** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4095 volkan.varisli@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course provides students with the fundamental principles of marine electronics and their practical applications in shipboard systems. It introduces the basic electronic components, circuit theory, and analytical methods required to understand and maintain marine electronic equipment. Key subjects include the characteristics and functions of electronic circuit components, Ohm's law, and the analysis of simple and complex circuits. The course further covers semiconductor theory, diodes, transistors, feedback, amplification, and oscillation principles essential for marine automation and communication systems. Students will learn about modulation techniques, electromagnetic wave propagation, noise reduction, and the integration of electronic circuits with high-voltage marine equipment. Emphasis is placed on safety standards, inspection methods, measurement tools, and troubleshooting procedures. In addition, the course explores shipboard electronics such as radar systems, Doppler logs, antennas, communication equipment, alarm systems, detection systems, and automation technologies. The course combines theoretical knowledge with hands-on practice through laboratory exercises, group projects, and simulations aimed at developing diagnostic and maintenance skills for marine electronic systems. By the end of the course, students will have a foundational understanding of marine electronics and be prepared for advanced studies in maritime automation and navigation technologies.
Course Aims and Objectives	**Course Aims:** • To provide students with a fundamental understanding of electronic theory and components used in marine applications. • To introduce the principles of electronic circuit analysis and their application to shipboard systems. • To develop students' knowledge of safety standards, troubleshooting methods, and maintenance practices for marine electronic equipment. • To prepare students for further studies and professional applications involving marine automation, communication, and navigation electronics. **Course Objectives:** By the end of the course, students are expected to: • Understand the basic electrical and electronic concepts including Ohm's law, circuit analysis, and the function of common electronic components. • Explain the principles of semiconductors, diodes, transistors, amplification, feedback, and oscillation in electronic systems. • Analyze and interpret circuit diagrams and recognize components and their literature symbols. • Gain knowledge of electromagnetic waves, modulation principles, and signal noise reduction techniques relevant to marine environments. • Understand safety regulations, inspection and maintenance requirements, and diagnostic tools used in marine electronics. • Describe the working principles and operational requirements of shipboard electronic systems such as radars, antennas, alarm and detection systems. • Develop hands-on skills through applications, simulations, and case studies for troubleshooting and maintaining marine electronic devices.

Course Learning Outcomes	**LO1 – Understand Electrical & Electronic Fundamentals** Explain the basic principles of electricity and electronics, including Ohm's law, basic circuit analysis, and the operational principles of key electronic components such as resistors, capacitors, diodes, transistors, and amplifiers. **LO2 – Interpret and Analyze Electronic Circuits** Analyze, draw, and interpret marine electronic circuit diagrams using correct symbols and standards, and apply semiconductor theory, feedback, oscillation, modulation, and signal transmission concepts. **LO3 – Evaluate Electromagnetic & Signal Integrity Issues** Assess electromagnetic interference (EMI) problems in marine electronic systems and propose suitable noise reduction and signal integrity solutions. **LO4 – Apply Safety, Maintenance & Troubleshooting Procedures** Apply marine electronic safety regulations, conduct inspections, perform maintenance, and diagnose faults in shipboard electronic systems using standard troubleshooting techniques. **LO5 – Understand Shipboard Electronic Equipment Operation** Explain and evaluate the operation of essential marine electronic equipment, including radar, antennas, communication systems, alarms, sensors, and detection systems. **LO6 – Demonstrate Practical & Team-Based Problem-Solving Skills** Perform hands-on troubleshooting and diagnostics on simulated or real marine electronic systems, and collaborate effectively in teams to solve practical marine electronics case studies.

Content of the Course

Week	*Subject*
1	General aspects of Electronical Characteristics of Circuit board Components
2	Reminder tutorial of Ohm law and simple circuits analysis
3	Circuit line systems and circuit diagrams, understanding of the components with their symbols and literature denominations
4	Semi-conductor theory, diots, types and diot circuit
5	Transistors & amplification, amplificators and functions in the circuit
6	Feed-back theory and amplified feed-back components
7	Ossilation theory and ossilators,
8	Mid-term Application (Theoretical fault-finding)
9	Modulation and integrity with automational control elements
10	Electromagnetic waves and spread, noise and reduction in signalization
11	Integration of electronical circuit components with high voltage equipment
12	Fundamental safety regulations, electronical safety requirements, mechanisms and maintenance. Electronical inspection system, measurements and determination tools
13	Shipboard Electronics I: Radars, doppler logs, antennas and communication equipment
14	Shipboard Electronics: Alarm systems, detection systems and automation
15	Final Exam Application (Acting for troubleshooting)

Methods and Techniques Used in the Course

Lectures and Interactive Discussions:

Theoretical knowledge is delivered through interactive lectures supported by multimedia presentations, encouraging student participation and critical thinking.

Laboratory / Practical Applications:

Hands-on practice with electronic components, circuit building, and troubleshooting exercises are carried out in lab or simulator environments.

Minimum 4 application sessions are conducted throughout the semester.

Case Studies and Problem-Solving Sessions:

Analysis of real-world marine electronics failures and fault scenarios; students develop solutions and present findings.

Group Work and Collaborative Projects:

Students work in teams (*minimum 2 group assignments*) to analyze, design, and troubleshoot circuit diagrams and shipboard electronic systems.

Homework and Research Assignments:

Students complete *at least 2 individual homework assignments* on topics such as circuit analysis, safety procedures, and shipboard electronics.

Mid-term and Final Examinations:

Exams include both theoretical and application-based questions, testing understanding of electronics principles, shipboard equipment, and troubleshooting methods.

Use of Demonstration Tools and Simulations:

Electronic simulation software, circuit boards, and shipboard equipment models are used to reinforce theoretical knowledge with practical demonstrations.

Self-Evaluation and Feedback Sessions:

Briefing and debriefing activities to improve self-assessment and peer learning.

Sample Questions

Mid-term Exam Sample Questions

- **Explain Ohm's Law** and calculate the current passing through a 24 V circuit with a 12 Ω resistor.
- **Draw and label** the main components of a simple DC circuit and explain their functions.
- **Identify and describe** three types of diodes and their typical applications in marine electronics.
- A transistor circuit has a given input and output. **Explain how amplification is achieved** and sketch a simple transistor amplifier circuit.
- **Describe the concept of feedback in electronic circuits.** Provide one example of positive feedback and its effect on the system.

Application / Practical Sample Questions

- **Fault-finding:** Given a faulty circuit diagram, identify potential failure points and suggest troubleshooting steps.
- Using provided circuit symbols, **construct and label** a schematic for a power supply including a diode rectifier and an amplifier stage.
- **Explain and demonstrate** how oscillators generate signals, including the role of feedback components.
- **Case Study:** The radar antenna shows intermittent signal loss. Suggest probable causes related to electronic components and propose inspection methods.

Final Exam Sample Questions

- **Explain modulation** and how it integrates with automation control systems onboard.
- **Discuss electromagnetic interference (EMI):** What are its sources in marine environments and how can it be minimized?
- **Describe the safety measures** required when working with high-voltage shipboard electronic systems.
- **Differentiate** between analog and digital signals and their relevance to marine communication equipment.
- **Describe the working principles** of one shipboard electronic system (e.g., radar or Doppler log) and its integration into navigation operations.

Materials Used in the Course

Textbooks and References

- K. R. Fowler, *Marine Electronics Handbook*, latest edition.
- A. P. Anderson, *Basic Electronics for Engineers and Technicians*.
- Manufacturer manuals and technical documentation for marine electronic devices (e.g., radar, Doppler log, automation systems).
- IMO and SOLAS regulations related to electronic and automation systems on ships.

Lecture Materials

- Instructor-prepared lecture notes and multimedia presentations.
- Circuit diagrams and schematic libraries (digital and printed).
- Safety procedure manuals and guidelines for handling electronic equipment.

Laboratory / Practical Tools

- Breadboards, resistors, capacitors, diodes, and transistors for hands-on circuit design.
- Oscilloscopes, multimeters, and signal generators for testing and diagnostics.
- Marine electronics training kits for radar and communication systems simulations.
- Fault simulation boards for troubleshooting exercises.

Software and Simulation Tools

- Electronic circuit design and analysis software (e.g., Multisim, Proteus, or equivalent).
- Marine electronics simulator software for radar, alarms, and automation system demonstrations.
- Digital libraries and virtual labs for remote practice.

Supplementary Materials

- Safety manuals for electrical and electronic maintenance operations.
- IMO conventions: MARPOL, SOLAS, and ISM Code excerpts related to electronic equipment and safety.
- Case studies and example logs from real shipboard electronics incidents.

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution						
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**
PO1	2	2	2	3	3	2
PO2	2	3	3	3	3	3
PO3	1	2	2	2	2	2
PO4	1	2	2	2	2	2
PO5	2	2	3	2	3	3
PO6	1	2	2	3	3	2
PO7	1	1	1	2	2	2
PO8	1	1	2	2	2	2
PO9	1	1	1	1	2	2
PO10	1	2	2	3	3	3
PO11	1	1	1	2	2	2
PO12	2	1	1	2	2	2

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1	Lectures, interactive presentations, guided problem-solving	Midterm exam, quizzes
CLO2	Lectures, component demonstrations, circuit modeling sessions	Midterm exam, quizzes, homework
CLO3	Board work, circuit-drawing exercises, laboratory simulations	Quizzes, lab reports, midterm
CLO4	Lectures, multimedia demonstrations, case-based discussions	Midterm exam, final exam
CLO5	Problem-solving sessions, lab simulations, group analysis	Quizzes, lab reports, final exam
CLO6	Practical lab work, group activities, case studies	Lab reports, project work, final exam

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	-	-	-
Lectures	**15**	**4**	**60**
Midterm Exam	**1**	**2**	**2**
Preparation for Midterm Exam	**1**	**6**	**6**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**6**	**6**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	-	-	-
Group Work	**2**	**4**	**8**
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	**4**	**4**	**16**
Assignment(s)/Homework/Class Works	**2**	**4**	**8**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**108**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	4	20
Field Work	2	10
Special Course Internship (Work Placement)	-	-
Homework/Assignments	2	10
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	30
Total	**10**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check frequently the instructor's web page for the course announcements. • University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		

University of Kyrenia

Maritime Vocational School

Ship Machinery

Syllabus

Course name: Maritime Safety III							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
SAF201	II	Fall	3	3	2	2	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
				30	-	-	70
Course Venue and Time				Wednesday 14.30-17.20			
Instructor information				**Cpt. Çağrı Deliceırmak** Faculty of Maritime Studies Wednesday / 09:00 – 12:00 +90 (392) 650 26 00 / 4060 cagri.deliceirmak@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course offers comprehensive training in shipboard security, emergency management, and fire prevention for maritime professionals. It focuses on the role and responsibilities of the Ship Security Officer (SSO) and the Ship Security Plan (SSP) under international regulations, including the SOLAS, STCW, and ISPS Code. Students will gain knowledge of maritime security policies, risk assessment techniques, threat identification, vulnerability management, and firefighting organization and management. Additionally, this course provides comprehensive training in firefighting organization on ships, as well as search and rescue procedures for assisting vessels and people in distress. The course will be conducted in accordance with the IMO Model Courses 2.03, and 3.19, as well as the national regulation "Egitim Sinav Yonergesi 2025" of the Turkish Republic. Successful students will obtain mandatory STCW certificates of (1); Advanced Firefighting, (2); Ship Security Officer. Emphasis is placed on practical applications, including drills, simulations, and coordinated emergency procedures to ensure safe and effective shipboard operations. By integrating theoretical knowledge with practical exercises, the course prepares students to enhance firefighting and ship security organization, implement safety and security measures, respond effectively to onboard emergencies, and assist the vessels in distress in compliance with international maritime standards.
Course Aims and Objectives	The course aims to equip students with the knowledge, skills, and competencies necessary to ensure shipboard safety and security, advanced firefighting, and search-and-rescue capabilities. It emphasizes understanding maritime security policies, recognizing threats, managing risks, and effectively responding to emergencies, including fire and search-and-rescue operations. Students will also learn to operate and maintain onboard safety and security systems in accordance with international regulations. This combination of theoretical and practical training prepares students for real-world maritime safety and security challenges. • Understand the concept of maritime security. • Understand the duties and responsibilities of the Master, SSO, CSO, PFSO, as well as the content of the SSP and SSA. • Comprehend and identify potential security threats, vulnerabilities, and risks onboard a vessel, and implement suitable security measures to ensure effective security management. • Acquire and apply advanced competencies in firefighting and fire emergency management organizations. • Acquire knowledge and engage in the practice of operating, testing, and maintaining onboard firefighting and security equipment and systems. • Comprehend the significance of shipboard drills and simulations in preparing for emergencies.

	• Enhance overall situational awareness, communication, and coordination skills during maritime emergencies. • Comprehend and proficiently execute search and rescue protocols at sea.
Course Learning Outcomes	**LO1**: Demonstrate a comprehensive understanding of maritime security policies, regulations, and conventions (SOLAS, STCW, ISPS). **LO2**: Identify, evaluate, and mitigate security risks, threats, and vulnerabilities on board vessels. **LO3**: Implement and effectively monitor ship security plans and related procedures. **LO4**: Demonstrate advanced knowledge and skills in firefighting operations and organizations on board. **LO5**: Operate, test, and maintain shipboard fire and security equipment. **LO6**: Plan and execute training sessions, drills, and simulations to ensure ongoing compliance with safety and security protocols and prepare detailed reports and evaluations of safety and security incidents for regulatory and operational purposes. **LO7**: Demonstrate advanced skills in situational awareness, communication, coordination, and decision-making during complex maritime emergencies. **LO8**: Effectively respond to the distress alerts of other ships and conduct search and rescue operations for the survivors at sea.

Content of the Course

Week	*Subject*
1	**Introduction to Maritime Security and Safety Policies** Terminology and related maritime English terms History of maritime criminal activities Current threats: piracy, armed robbery, terrorism, smuggling Ship and port operations overview Key definitions, terminology, and responsibilities of states under SOLAS Security organization: company, ship, and port facility responsibilities International regulations on maritime security
2	**Security Responsibilities** Terminology and related maritime English terms Purpose and structure of Ship Security Plans (SSP) Procedures for implementing SSP and reporting security incidents Maritime security levels and critical ship/port security measures Confidentiality and communication of security information Internal audits, inspections, and monitoring procedures
3	**Ship Security Plan Implementation and Oversight** Terminology and related maritime English terms Legal framework for Ship Security Officer (SSO) actions Role of the Master, SSO, Company Security Officer, Port Facility Security Officer Other personnel involved in maritime security
4	**Security Risk, Threat, and Vulnerability Assessment** Terminology and related maritime English terms Risk assessment methods and tools Security documentation and reporting Identification of potential threats, weapons, and hazardous materials Crowd management and coordination Handling sensitive information and security communications
5	**Onboard Security Inspections** Terminology and related maritime English terms Restricted area monitoring and control of access Monitoring of the deck and ship perimeter Security procedures for cargo handling and personnel movement Security measures and coordination in port and ship-to-ship operations
6	**Operation, Testing, and Calibration of Security Equipment** Terminology and related maritime English terms Security equipment types and operational limitations Alarm systems and onboard communication protocols Testing, calibration, and maintenance of security systems Security exercises, drills, training per IMO guidelines, and their evaluations Methods to improve security awareness and onboard readiness
7	**Advanced Fire-Fighting – Principles** Terminology and related maritime English terms

	Fire chemistry and classes of fire Fire prevention and firefighting equipment Organizational and tactical considerations in port and at sea Fire impact on vessel stability and corrective measures
8	**Advanced Fire-Fighting – Systems and Operations** Terminology and related maritime English terms Firefighting team organization and roles Fire detection, fixed and portable extinguishing systems Coordination, communication, and ventilation control
9	**Advanced Fire-Fighting – Systems and Operations** Terminology and related maritime English terms Firefighting team organization and roles Contingency Plans and Team Management Coordination, communication, and ventilation control
10	**Advanced Fire-Fighting – Systems and Operations** Terminology and related maritime English terms Firefighting involving fuel, chemical, and electrical systems Handling hazardous materials and storage safety Control of fuel and electrical systems Dangers caused by fire.
11	**Fire Incident Investigation and Reporting** Terminology and related maritime English terms Legal and classification society reporting requirements Fire event cause analysis Documentation and lessons learned
12	**Search and Rescue Operations** Terminology and related maritime English terms Assisting to a distressed ship, preparations, procedures, and legal aspects Surviving people from a distressed ship Emergency in port
13	**Search and Rescue Operations** Terminology and related maritime English terms IAMSAR Search and Rescue methods and techniques Coordination and communication in search and rescue operations
14	**Search and Rescue Operations** Terminology and related maritime English terms IAMSAR Search and Rescue methods and techniques Coordination and communication in search and rescue operations
15	**Review and Final Evaluation** Recap of maritime safety policies, risk assessment, and emergency procedures Practical assessment and scenario-based exercises Evaluation of student competence in shipboard safety and security operations

Methods and Techniques used in the Course

Lectures and Interactive Discussions – Covering maritime security policies, safety regulations, and risk management principles.

Case Studies – Analysis of real-world maritime security incidents, accidents, and emergencies.

Practical Drills and Simulations – Hands-on training for firefighting, emergency response, collision, grounding, and man-overboard scenarios.

Workshops – Focused sessions on the operation, calibration, and maintenance of safety and security equipment.

Role-Playing Exercises – Simulating shipboard emergencies to develop communication, teamwork, and leadership skills.

Shipboard Security and Safety Plan Exercises – Developing, implementing, and auditing security plans in simulated environments.

Multimedia Resources – Use of instructional videos, manuals, and interactive modules to reinforce theoretical knowledge.

Group Projects – Collaborative exercises on risk assessment, emergency planning, and safety audits.

Quizzes and Written Assignments – Assessing comprehension of regulations, safety procedures, and maritime security practices.

Assessment of Competency in Equipment Use – Practical evaluation of students' abilities to operate firefighting and safety systems effectively.

Sample Questions

- Define the role and responsibilities of a Ship Security Officer (SSO) under international regulations.
- Explain the procedures for implementing and monitoring a Ship Security Plan (SSP).
- Describe methods to identify and assess potential security threats, including piracy and armed robbery.
- Outline the steps for fire detection, alarm, and firefighting on board, and the coordination required among crew members.
- Discuss the correct use and maintenance of shipboard security equipment and systems.
- Describe how to conduct regular security inspections and audits to ensure compliance with ISPS Code.
- Describe the organization and training requirements of firefighting teams on board a vessel.
- Explain the search and rescue methods and techniques in a distress alert.

Materials Used in the Course

Textbooks and Reference Books

- Lecturer Notes, Related IMO Model Courses and STCW (Standards of Training, Certification, and Watchkeeping) manuals.
- SOLAS Consolidated Edition, ISPS Code, LSA Code, FSS Code, The Fire Fighting System Guidance, Fire Prevention and Fire Fighting, IAMSAR Manual
- Related IMO Model Courses and STCW (Standards of Training, Certification, and Watchkeeping) manuals.
- Maritime Safety textbooks covering ISPS and ship security, fire prevention and firefighting, shipboard emergency procedures, including SOLAS, STCW, ISPS Code, LSA Code, and FSS Code
    - SOLAS Consolidated Edition
    - ISPS Code Guidelines
    - LSA Code
    - FSS Code
    - The Fire Fighting System Guidance
    - Fire Prevention and Fire Fighting
    - IAMSAR Manual

Supplementary Resources

- Instructional videos demonstrate emergency response techniques, personal safety, and the use of protective equipment.
- Interactive simulations of onboard emergency scenarios, including collision, flooding, fire, and piracy attacks.
- CCTV, Hand-held VHF, detectors, sensors, and locking systems.
- Firefighting equipment, CO2 system, Fireman's Outfit and BA Sets, Hoses, Nozzles, Detection Systems and Alarms
- Shipboard training manuals and emergency plans.
- Practical drill checklists for emergency response.
- Evaluation sheets for ship security and firefighting operations.
- Risk assessment templates for security threats and onboard hazards.

All the above listed books are available at UoK's Grand Library

Program Outcomes Matrix

	Program Outcomes	*Level of Contribution				Targeted Competence Areas
		0	1	2	3	
1	Demonstrate comprehensive knowledge of marine engineering principles, systems, and machinery operations, and effectively apply this knowledge to ensure safe, efficient, and sustainable vessel performance in compliance with IMO and STCW standards.				✓	Technical Knowledge & Applied Sciences
2	Apply advanced engineering design principles to develop, adapt, and optimize mechanical, electrical, and control systems onboard ships and in shore-based industrial contexts, integrating safety, cost-efficiency, and environmental considerations.				✓	Analytical & Computational Skills
3	Perform engineering watchkeeping duties and operational management with professional responsibility, situational awareness, and adherence to international maritime conventions and best practices.				✓	Sustainable Design & Safe Operating
4	Identify, formulate, and analyze complex engineering problems using appropriate theoretical, computational, and experimental techniques to derive sound, data-driven solutions in marine and related engineering domains.			✓		Research & Experimentation
5	Integrate principles of safety culture, risk assessment, and environmental protection into all engineering practices, promoting sustainable operations aligned with IMO conventions such as MARPOL and SOLAS.			✓		Innovation & Digital Competence
6	Employ advanced digital tools, diagnostic systems, and automation technologies for monitoring, control, and performance assessment of marine and industrial systems, in line with the requirements of the evolving maritime digitalization era.				✓	Regulatory Frameworks & Safety
7	Demonstrate competence in planning, executing, and managing engineering projects, including resource allocation, budgeting, and maintenance planning, while ensuring quality, safety, and compliance with regulatory frameworks.				✓	Teamwork & Leadership
8	Function effectively as a leader and member of multidisciplinary and multicultural teams, fostering collaboration, ethical conduct, and efficient communication in dynamic and often high-stress maritime environments.				✓	Project Management & Entrepreneurship
9	Communicate effectively in both written and oral forms with clarity, professionalism, and technical precision in English and other relevant languages within maritime and industrial contexts.			✓		Ethics & Professionalism
10	Adhere to the ethical and professional standards of the engineering and maritime professions, demonstrating accountability, integrity, and a commitment to continuous professional development and lifelong learning.				✓	Lifelong Learning & Adaptability
11	Evaluate and implement sustainable engineering practices and emerging green technologies to minimize the environmental footprint of marine and industrial operations.			✓		Communication Competence
12	Exhibit the flexibility and interdisciplinary mindset required to transfer marine engineering knowledge and skills to diverse sectors, contributing effectively to innovation and technological advancement beyond the maritime industry.			✓		Global Vision & Societal Impact

***0:** No Contribution **1:** Little Contribution **2:** Partial Contribution **3:** Full Contribution

Program Outcomes /Course Learning Outcomes Matrix **Level of Contribution**:**0**-No Contribution **1**-Little Contribution **2**-Partial Contribution **3**-Full Contribution										
PO	**CLO1**	**CLO2**	**CLO3**	**CLO4**	**CLO5**	**CLO6**	**CLO7**	**CLO8**	**CLO9**	**CLO10**
PO1	3	3	3	3	3	3	3	3	x	x
PO2	3	3	3	3	3	3	3	3	x	x
PO3	3	3	3	3	3	3	3	3	x	x
PO4	2	2	2	2	2	2	2	2	x	x
PO5	3	3	3	3	3	3	3	3	x	x
PO6	3	3	3	3	3	3	3	3	x	x
PO7	3	3	3	3	3	3	3	3	x	x
PO8	2	2	2	2	2	2	2	2	x	x
PO9	2	2	2	1	1	1	1	1	x	x
PO10	3	3	3	3	3	3	3	3	x	x
PO11	3	3	3	3	3	3	3	3	x	x
PO12	3	3	3	3	3	3	3	3	x	x

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
LO1	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment
LO2	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment
LO3	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment
LO4	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment
LO5	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment
LO6	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment
LO7	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment
LO8	Lectures, Practical Applications, Case Studies, and Discussions	Midterm Exam, Practical Exam, Final Exam, Assignment

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**1**	**15**
Lectures	**15**	**3**	**45**
Midterm Exam	**1**	**1**	**1**
Preparation for Midterm Exam	**1**	**5**	**5**
Final Exam	**1**	**1**	**1**
Preparation for Final Exam	**1**	**5**	**5**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Research for Project(s)/Essay(s)	-	-	-
Project Writing	-	-	-
Group Work	-	-	-
In-class Discussion(s)	**15**	**1**	**15**
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory	-	-	-
Assignment(s)/Homework/Class Works	**2**	**5**	**10**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**97**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	1	10
Laboratory	-	-
Application	1	20
Field Work (Class Work)	-	-
Special Course Internship (Work Placement)	-	-
Assignment(s)/Homework/Class Works	2	20
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	-	-
Quiz	-	-
Midterms/Oral Exams	1	20
Final/Oral Exams	1	30
Total	**6**	**100**

	Percentage	**Course Grade**	**Coefficient**
Grading Policy	90-100	AA	4.0
	85-89	BA	3.5
	80-84	BB	3.0
	75-79	CB	2.5
	70-74	CC	2.0
	60-69	DC	1.5
	50-59	DD	1.0
	49 and below	FF	0.0
	Less than 70% attendance	NA	-
Course Requirements and Policies	• Alerted attendance at the lectures is essential! • Students are expected to check the instructor's web page frequently for the course announcements. • The University of Kyrenia honor code will be strictly enforced regarding any issues concerning cheating.		