University of Kyrenia

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Maritime Law and Conventions I							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
LAW301	III	Fall	4	4	4	0	0
Course type: Compulsory				**Prerequisite: x**		**Language:** English	
% Contribution to the Professional Fundamental Component				**Fundamental Legal Knowledge (Core)**	**Legal Method & Reasoning**	**Legal Skills (Research & Writing)**	**General Education**
				60%	20%	10%	10%
Course Venue and Time				E-6016 (14.30 - 17.20)			
Instructor information				**Lect. Halil Emre Gürler** Faculty of Law halilemre.gurler@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course provides a comprehensive introduction to maritime law, international conventions, and regulations governing the safety, operation, and management of ships at sea. It covers fundamental legal principles, the structure of national and international maritime legislation, and the legal responsibilities of shipowners, captains, and crew members. Students will gain knowledge of essential maritime conventions, including SOLAS, MARPOL, STCW, COLREG, UNCLOS, and related IMO codes, as well as conventions governing liability, compensation, search and rescue, and the transport of passengers and cargo. The course also emphasizes practical applications of maritime law, English terminology for ship documentation, and compliance with national and international regulations, providing students with the legal framework necessary for safe and effective maritime operations.
Course Aims and Objectives	The course aims to provide students with a thorough understanding of the legal framework governing maritime activities, including national and international maritime law, conventions, and regulations. It seeks to equip students with the knowledge and skills necessary to interpret, apply, and comply with maritime legal requirements, ensuring safe, lawful, and efficient ship operations. • Explain the fundamental principles, sources, and types of law, including international and national legal systems. • Define and classify maritime law, including its scope, purpose, and key components. • Understand the legal responsibilities and authorities of shipowners, captains, crew, and port authorities. • Identify and interpret essential international maritime conventions and regulations (e.g., SOLAS, MARPOL, STCW, COLREG, UNCLOS). • Apply maritime legal knowledge to practical situations, including ship documentation, safety compliance, and cargo operations. • Understand maritime English terminology for legal documents, vessel operations, and cargo management.

	• Recognize legal procedures related to maritime accidents, salvage, liability, and environmental protection. • Demonstrate awareness of national and international regulatory organizations, their roles, and enforcement mechanisms.
Course Learning Outcomes	**CLO1:** Define and explain the fundamental principles, sources, and types of law relevant to maritime operations. **CLO2:** Describe the scope and classification of maritime law, including national and international regulations. **CLO3:** Identify the legal responsibilities, authorities, and obligations of shipowners, captains, crew members, and port authorities. **CLO4:** Interpret and apply major international maritime conventions and protocols, such as SOLAS, MARPOL, STCW, COLREG, UNCLOS, and ILO Maritime Labour Convention. **CLO5:** Demonstrate the ability to read, understand, and use maritime English terminology in legal, operational, and cargo documentation. **CLO6:** Analyze maritime incidents, including collisions, salvage operations, and pollution events, and determine the legal implications and applicable conventions. **CLO7:** Evaluate compliance requirements for ship certification, documentation, and inspection processes under national and international law. **CLO8:** Apply knowledge of maritime law to practical scenarios, including cargo handling, vessel operations, and environmental protection measures. **CLO9:** Communicate effectively with stakeholders using internationally recognized maritime legal terminology.

Content of the Course

Week	*Subject*
1	**Introduction to Law** • Definition, sources, and types of law • Fundamental principles of law • Basic legal terminology • International law vs. national law: applications and sanctions
2	**Introduction to Maritime Law** • Definition and classification of maritime law • Key principles of international maritime law • Structure and sources of national maritime legislation
3	**Maritime Safety and Legal Requirements** • Laws on the protection of life and property at sea • Seafarers' employment rights and obligations (Maritime Labour Law) • Role, authority, and responsibilities of the ship captain
4	**Ship Documentation and Records** • Definition and types of ships and seaworthiness requirements • Mandatory onboard documents and records • Maritime accidents, collisions, and general average
5	**Maritime Administration and English Terminology** • National maritime organizations and regulations • International maritime organizations and conventions • Ship inspection and certification procedures • Insurance terminology and claims
6	**English for Ship and Cargo Documentation** • Deck documents and port documents • Cargo-related documentation in English
7	**Introduction to International Maritime Organization (IMO)** • IMO structure, committees, and functions • General Assembly, Council, Committees, and Secretariat
8	**SOLAS and Related Codes** • SOLAS 1974 and Protocols (1978, 1988) overview • Related codes: IBC, IMSBC, LSA, FSS, ISM, ISPS, IMDG, FTP, HSC, IGC, INF, BCH • IAMSAR Volume III and International Code of Signals
9	**MARPOL and Pollution Prevention Conventions** • MARPOL 1973 and Protocol 1997 • Annexes and record books: Oil Record, Garbage Record, Sulphur Content Monitoring, Ballast Water • Introduction to environmental protection at sea

10	**Key International Conventions** • UNCLOS 1982 (United Nations Convention on the Law of the Sea) • STCW 1978 and its amendments • COLREG 1972 (Collision Regulations) • Load Line Conventions (LL 1966, LL Protocol 1988) • Tonnage Measurement 1969
11	**Maritime Labour and Safety Codes** • ILO Maritime Labour Convention 2006 • IMO Codes of Safe Practice: CSS, BLU, TDC, OSV • FAL 1965: ship and port declarations, crew and passenger lists, dangerous goods
12	**Maritime Labour and Safety Codes** • ILO Maritime Labour Convention 2006 • IMO Codes of Safe Practice: CSS, BLU, TDC, OSV • FAL 1965: ship and port declarations, crew and passenger lists, dangerous goods
13	**Liability and Compensation Conventions** • CLC 1969 and CLC Protocol 1992 • FUND 1971 and FUND Protocol 2003 • HNS 1996 (Hazardous and Noxious Substances) • OPRC-HNS 2000 Protocol
14	**Liability and Compensation Conventions** • CLC 1969 and CLC Protocol 1992 • FUND 1971 and FUND Protocol 2003 • HNS 1996 (Hazardous and Noxious Substances) • OPRC-HNS 2000 Protocol
15	**Suppression of Unlawful Acts and Final Review** • SUA 1988 and Protocol 2005 (Suppression of Unlawful Acts Against Maritime Navigation) • Summary and integration of maritime conventions • Case studies and discussion of practical implications

Methods and Techniques used in the Course

Lectures and Presentations: Instructor-led theoretical sessions supported with visual materials and case examples.

Classroom Discussions: Interactive discussions to encourage critical thinking and deeper understanding of maritime legal issues.

Case Study Analysis: Examination of real-life maritime incidents, accidents, and disputes to apply relevant conventions and legal principles.

Document and Convention Review: Practical exercises on reading, interpreting, and analyzing international conventions, ship documents, and legal texts.

Problem-Solving Exercises: Scenario-based activities requiring application of maritime law to operational and legal problems.

Group Work and Presentations: Collaborative tasks where students prepare and present analyses of selected maritime law topics.

Simulation and Role-Play: Mock legal or operational exercises (e.g., collision responsibility, salvage agreement, or port authority inspection) to practice real-world applications.

Use of Maritime English Terminology: Emphasis on practicing and applying specialized English vocabulary in written and oral form.

Independent Study and Research: Assignments and projects requiring students to explore maritime legal resources, conventions, and academic literature.

Sample Questions

Short Answer / Definition Questions:

- Define the term *avarya (general average)* and explain its significance in maritime law.
- What are the main sources of maritime law at both national and international levels?
- Briefly describe the duties and responsibilities of a shipmaster under international maritime law.
- What is the primary purpose of the *International Convention on Load Lines (1966)*?
- List the essential ship certificates required to be carried on board under SOLAS.

Essay / Long Answer Questions:

- Discuss the role and structure of the **International Maritime Organization (IMO)** and explain how its conventions influence national maritime legislation.
- Explain the legal consequences of a collision at sea under the **COLREG 1972** Convention, including the allocation of liability.
- Analyze the scope and application of **MARPOL 73/78** with specific reference to oil pollution prevention measures.
- Evaluate the impact of the **STCW 1978 Convention** on the training and certification of seafarers.
- Compare and contrast the concepts of *salvage* and *towage* in maritime law.

Problem-Solving / Case Study Questions:

- A cargo ship suffers a fire at sea and jettisons part of its cargo to save the vessel. Discuss the legal implications for the shipowner and cargo owners under the principle of general average.
- A tanker collides with another vessel in international waters, causing oil pollution. Apply the relevant conventions (COLREG, CLC, MARPOL) to determine liability and possible compensation mechanisms.
- During a port inspection, authorities discover that a vessel's *Garbage Record Book* has not been properly maintained. Identify the applicable convention and discuss potential consequences for the ship and the master.
- A seafarer claims his employment contract has been violated under the Maritime Labour Convention (MLC 2006). Discuss the rights and remedies available to the seafarer.
- A ship is detained at a foreign port due to deficiencies in its safety equipment. Explain which international conventions and codes may apply to this case.

Materials Used in the Course

Primary References:

- International Maritime Organization (IMO) Conventions and Protocols:
  - SOLAS 1974 (International Convention for the Safety of Life at Sea)
  - MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships)
  - COLREG 1972 (Convention on the International Regulations for Preventing Collisions at Sea)
  - STCW 1978 (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers)
  - UNCLOS 1982 (United Nations Convention on the Law of the Sea)
  - LL 1966 (Load Line Convention) and 1988 Protocol
  - ILO Maritime Labour Convention, 2006 (MLC 2006)
  - Other relevant IMO codes (ISM, ISPS, IMDG, LSA, FSS, CSS, BLU, TDC, OSV Codes, etc.)

Secondary References:

- Özdemir, H. (Latest Edition). *Maritime Law: National and International Perspectives.*
- Berlingieri, F. *International Maritime Conventions.*
- Mukherjee, P.K., & Brownrigg, M. *Farthing on International Shipping.*
- Churchill, R.R., & Lowe, A.V. *The Law of the Sea.*
- Tetley, W. *Marine Cargo Claims.*

IMO Publications:

- International Code of Signals (INTERCO)
- IAMSAR Manual (Vol. III)
- Oil Record Book, Garbage Record Book, Ballast Water Record Book
- IMO Safety and Environmental Circulars

Legislation and Regulations:

- National Maritime Legislation (relevant laws, regulations, and decrees)
- Port State Control guidelines and procedures
- Case law and judicial precedents in maritime law

Supplementary Materials:

- Lecture slides and course notes prepared by the instructor
- Case studies and practical scenarios from real maritime incidents
- Legal documents such as bills of lading, charter parties, crew contracts, insurance policies
- Access to IMO's online databases and digital libraries

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**	
PO1	2	2	1	1	2	1	3	3	1	
PO2	2	2	1	2	2	1	2	2	2	
PO3	2	3	2	1	2	1	1	3	3	
PO4	2	2	3	3	3	2	2	2	2	
PO5	1	2	2	2	3	3	2	2	1	
PO6	3	3	3	3	3	2	3	3	2	
PO7	2	2	2	2	1	2	3	3	2	
PO8	1	2	2	2	2	1	1	3	3	
PO9	2	2	2	3	2	2	2	3	3	
PO10	3	3	3	3	3	3	3	3	3	
PO11	2	2	2	2	3	3	3	2	2	
PO12	2	3	3	3	3	3	3	2	2	

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1 – Fundamental Principles of Maritime Law	Lecture, Multimedia Presentation, Case Studies	Quizzes, Assignments, Participation
CLO2 – Scope & Classification of Maritime Law	Lecture, Group Discussions, Tutorials	Quizzes, Written Assignments, Midterm Exam
CLO3 – Legal Responsibilities of Stakeholders	Case Studies, Role-Playing, Problem-Based Learning	Assignments, Observation, Practical Exercises
CLO4 – International Maritime Conventions	Lecture, Workshops, Simulation Exercises	Assignments, Midterm Exam, Practical Case Analysis
CLO5 – Maritime English Terminology in Legal Contexts	Lecture, Guided Practice, Document Analysis	Written Exercises, Quizzes, Assignments
CLO6 – Analysis of Maritime Incidents	Case Studies, Scenario-Based Learning, Group Work	Practical Case Reports, Assignments, Participation
CLO7 – Compliance & Certification Requirements	Lecture, Tutorials, Simulation	Assignments, Quizzes, Practical Exercises
CLO8 – Application of Maritime Law in Operations	Problem-Based Learning, Simulation, Workshops	Case Study Reports, Practical Exams, Assignments
CLO9 – Communication Using Maritime Legal Terminology	Role-Playing, Group Exercises, Presentations	Oral Presentations, Assignments, Observation

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**	**15**	**15**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**20**	**20**
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	**1**	**10**	**10**
Individual Reading / Research	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**139**
ECTS Credit			**4**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	15	10
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Homework/Assignments	1	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	50
Total	**4**	**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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Heat Transfer							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MEC301	III	Fall	3	3	2	2	0
Department: Marine Engineering							
Course type: Elective				**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. 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 **Heat Transfer** course provides students with a comprehensive understanding of the mechanisms of energy transfer in the form of conduction, convection, and radiation. The course begins with an introduction to the basic concepts of heat transfer and progresses to the derivation and application of the heat conduction equation, both in steady and transient conditions. Students will learn analytical and approximate methods to solve heat transfer problems, including the use of the thermal resistance concept and extended surfaces (fins). The course covers convection heat transfer fundamentals with emphasis on external and internal forced convection, as well as natural convection phenomena. Special attention is given to the practical applications of finned surfaces for heat transfer enhancement. Radiation heat transfer, its governing laws, and analytical methods are also introduced. The course concludes with the study of mass transfer, highlighting the similarities and differences between heat and mass transfer processes. Through theoretical lectures and practical applications, students will develop the ability to analyze, model, and solve heat and mass transfer problems in engineering systems. The course builds a strong foundation for applications in thermal system design, energy technologies, and industrial processes.
Course Aims and Objectives	The aim of this course is to provide students with a solid theoretical and practical foundation in the principles and applications of heat and mass transfer, enabling them to analyze, design, and optimize engineering systems involving thermal processes. • Introduce the fundamental mechanisms of heat transfer: conduction, convection, and radiation. • Develop the ability to apply the heat conduction equation to steady and transient problems. • Teach the use of analytical and approximate methods for solving heat transfer problems in different geometries and boundary conditions. • Provide knowledge on convection heat transfer, including external and internal forced convection, and natural convection. • Explain the thermal resistance concept and its application in composite systems and finned surfaces for heat transfer enhancement. • Introduce the principles of radiation heat transfer and analytical techniques for radiation exchange. • Establish the relationship between heat and mass transfer, emphasizing analogies and engineering applications. • Strengthen problem-solving, analytical thinking, and engineering judgment in the context of thermal systems. • Prepare students for advanced courses in thermal sciences and for solving real-world engineering problems related to energy, propulsion, and industrial processes.

Course Learning Outcomes	**CLO1 — Explain Fundamental Heat Transfer Mechanisms** Understand and explain conduction, convection, radiation, and the fundamental principles governing heat and mass transfer. **CLO2 — Apply Conduction and Transient Heat Transfer Analysis** Apply steady-state and transient heat conduction equations to solve one-dimensional and multi-dimensional engineering problems. **CLO3 — Analyze Thermal Resistance Networks and Extended Surfaces** Evaluate thermal resistance networks, composite materials, and finned surfaces to assess system performance. **CLO4 — Evaluate Convective and Radiative Heat Transfer** Analyze internal and external convective heat transfer (natural and forced) and perform radiation heat transfer calculations using surface interactions and radiation networks. **CLO5 — Apply Heat–Mass Transfer Analogies and Solve Engineering Problems** Use heat–mass transfer analogies and analytical techniques to solve practical engineering problems with appropriate approximations and engineering judgment. **CLO6 — Integrate Theory with Applications and Optimize Thermal Systems** Integrate heat/mass transfer theory with practical applications—including heat exchangers, cooling systems, and thermal management—and evaluate/optimize systems for efficiency, safety, and sustainability.

Content of the Course

Week	*Subject*
1	Introduction and basic concepts
2	Heat conduction equation
3	Analytical solutions
4	Steady heat conduction
5	Thermal resistance concept, finned surfaces
6	Introduction to transient heat conduction
7	Transient heat conduction calculations
8	Fundamentals of convection
9	External forced convection
10	Internal forced convection
11	Natural convection
12	Finned surfaces
13	Fundamentals of thermal radiation
14	Radiation heat transfer analysis
15	Mass transfer

Methods and Techniques Used in the Course

Lectures – Comprehensive explanation of heat transfer theories, principles, and governing equations.

Problem-Solving Sessions – Step-by-step demonstrations of analytical solutions for conduction, convection, and radiation problems.

Tutorials – Guided practice on applying heat transfer concepts to real-world engineering scenarios, including marine and industrial applications.

Laboratory Experiments – Hands-on activities to observe heat transfer phenomena, measure temperature distributions, and validate theoretical models.

Case Studies – Analysis of practical engineering systems such as heat exchangers, cooling systems, and thermal management of machinery.

Simulations and Computational Tools – Use of software (e.g., MATLAB, ANSYS, or similar) to model and analyze heat transfer processes.

Group Work and Projects – Collaborative exercises to design, analyze, and optimize heat transfer systems.

Quizzes and Assignments – Continuous assessment through problem sets and short exercises to reinforce understanding of concepts.

Discussion and Interactive Learning – In-class discussions of recent research, technological applications, and engineering challenges in heat transfer.

Sample Questions

Conduction

- Derive the steady-state one-dimensional heat conduction equation for a plane wall with constant thermal conductivity.
- Calculate the temperature distribution along a fin of uniform cross-section and given boundary conditions.

Convection

- Determine the convective heat transfer coefficient for a fluid flowing over a flat plate under laminar flow conditions.
- Compare the Nusselt number correlations for internal forced convection in circular pipes for laminar and turbulent flow.

Radiation

- Explain the difference between blackbody and graybody radiation and compute the net radiative heat transfer between two surfaces.
- Solve a problem involving radiation exchange between multiple surfaces using the view factor method.

Transient Heat Conduction

- Derive the lumped capacitance model for a body with a small Biot number and solve for temperature as a function of time.
- Calculate the time required for a solid sphere to cool from an initial temperature to a final temperature using the transient heat conduction equation.

Combined Modes of Heat Transfer

- Analyze a system where conduction, convection, and radiation occur simultaneously, and compute the total heat transfer rate.
- Design a basic heat exchanger to achieve a given temperature difference between hot and cold fluids.

Mass Transfer (Optional / Coupled Heat-Mass Transfer)

- Solve a problem involving simultaneous heat and mass transfer, such as evaporation from a liquid surface.
- Determine the effect of diffusivity and convective coefficients on mass transfer rates in each system.

Materials Used in the Course

Textbooks

- Incropera, F. P., DeWitt, D. P., Bergman, T. L., & Lavine, A. S., *Fundamentals of Heat and Mass Transfer*, 8th Edition, Wiley, 2018.
- Çengel, Y. A., *Heat and Mass Transfer: Fundamentals and Applications*, 5th Edition, McGraw-Hill, 2019.
- Holman, J. P., *Heat Transfer*, 11th Edition, McGraw-Hill, 2010.

Reference Books

- Kakac, S., Liu, H., & Pramuanjaroenkij, A., *Heat Exchangers: Selection, Rating, and Thermal Design*, 3rd Edition, CRC Press, 2012.
- Bergman, T. L., Lavine, A. S., Incropera, F. P., & DeWitt, D. P., *Introduction to Heat Transfer*, Wiley, 2011.

Software & Simulation Tools

- MATLAB / Simulink – for solving transient and steady-state heat conduction problems.
- ANSYS Fluent – for computational fluid dynamics (CFD) simulations involving convection and radiation.
- EES (Engineering Equation Solver) – for solving coupled heat and mass transfer problems.

Academic Papers & Journals

- International Journal of Heat and Mass Transfer
- Applied Thermal Engineering
- Experimental Thermal and Fluid Science

Laboratory Equipment *(for practical sessions)*

- Heat conduction apparatus (plane wall, cylinder, and sphere models)
- Forced and natural convection rigs
- Radiation heat transfer setup with blackbody and graybody surfaces
- Finned surface heat transfer rigs
- Thermocouples, data loggers, and infrared thermometers

Supplementary Materials

- Lecture slides and notes provided by the instructor
- Example problem sets and solution manuals
- Case studies on industrial applications of heat transfer, e.g., heat exchangers, electronic cooling, and HVAC 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	3	3	2	2	2	3
PO2	2	3	3	3	3	3
PO3	2	2	2	2	2	3
PO4	1	2	2	3	3	3
PO5	2	2	2	2	2	3
PO6	1	2	2	2	2	3
PO7	1	1	2	2	2	2
PO8	1	1	2	2	2	2
PO9	1	1	1	2	2	2
PO10	1	2	2	3	3	3
PO11	1	1	2	2	2	3
PO12	1	1	2	2	2	3

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1	Lecture, Problem-solving sessions	Midterm exam, Quizzes
CLO2	Lecture, Tutorial exercises, Example demonstrations	Midterm exam, Homework assignments
CLO3	Lecture, Analytical exercises, In-class practices	Midterm exam, Final exam
CLO4	Lecture, Case studies, Simulation-based learning	Final exam, Project/Report
CLO5	Lecture, Engineering applications, Design/problem tasks	Project, Practical evaluation
CLO6	Lecture, Case studies, Group work, Applied problem-solving	Project report, Presentation, 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	**1**	**20**	**20**
Group Work	-	-	-
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	-	-	-
Assignment(s)/Homework/Class Works	**1**	**15**	**15**
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	-	-
Special Course Internship (Work Placement)	-	-
Homework/Assignments	1	10
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	1	10
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	50
Total	**4**	**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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Machine Component Design							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MEC303	III	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	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	The **Machine Component Design** course provides a comprehensive understanding of the fundamental principles and analytical techniques used in the design of machine elements and mechanical systems. The course introduces the mechanical behavior of engineering materials, including their properties, selection criteria, and manufacturing considerations relevant to machine design. Students learn to analyze stresses in machine components under various loading conditions—axial, shear, torsional, and bending—through graphical and analytical methods such as **Mohr's Circle**. Emphasis is placed on the application of safety factors, failure theories, and design criteria to ensure the reliability and durability of mechanical systems. The course also covers the design and analysis of essential machine elements such as **riveted joints, welded and screwed connections, shafts, clutches, bearings, and springs**, examining their functions, failure modes, and design optimization principles. Practical applications are reinforced through problem-solving exercises, quizzes, and case studies reflecting real-world engineering challenges. Through this course, students gain the ability to apply engineering knowledge, material science, and mechanical design principles to the creation of safe, efficient, and cost-effective machine components that meet performance and operational requirements.
Course Aims and Objectives	The primary aim of this course is to equip students with the theoretical knowledge and practical skills necessary for designing, analyzing, and evaluating machine components that operate safely and efficiently under various loading and environmental conditions. The course bridges the gap between fundamental mechanics and real-world engineering design by integrating concepts from material science, stress analysis, and manufacturing processes. • **To introduce the principles of mechanical design** and the systematic approach used in developing machine components that meet functional, economic, and safety requirements. • **To develop students' ability to analyze stresses and deformations** in mechanical members subjected to axial, torsional, bending, and combined loads using analytical and graphical methods. • **To provide a thorough understanding of material selection** and the influence of material properties and manufacturing processes on design performance and reliability. • **To enable students to apply failure theories and design criteria** for static and dynamic loading conditions, incorporating factors of safety and service conditions. • **To teach the design and operational characteristics of common machine elements**, including riveted joints, welded and screwed connections, shafts, clutches, bearings, and springs.

	• **To enhance problem-solving and decision-making skills** in the context of mechanical design, considering constraints such as cost, efficiency, and sustainability. • **To prepare students for professional engineering practice** by emphasizing the importance of design documentation, engineering ethics, and compliance with standards and design codes.
Course Learning Outcomes	**CLO1 – Fundamental Principles of Machine Design** Explain the fundamental principles of machine design, including the relationships among loads, stresses, strains, material properties, and mechanical behavior of components. **CLO2 – Stress, Strain & Failure Analysis** Analyze stress and strain distributions in machine elements under axial, torsional, bending, and combined loading using analytical, graphical, and computational methods; apply failure theories and safety factors for static and dynamic load conditions. **CLO3 – Material & Component Selection** Select appropriate engineering materials and mechanical components (shafts, bearings, springs, clutches, joints) based on mechanical properties, design standards, manufacturing constraints, operational requirements, and cost considerations. **CLO4 – Design of Machine Elements** Design and evaluate mechanical joints (riveted, welded, screwed), shafts, bearings, clutches, and springs; perform related calculations and ensure the required reliability, functionality, and safety margins. **CLO5 – Advanced Stress Analysis & Analytical Tools** Interpret and apply advanced analytical tools—including Mohr's Circle, principal stresses, and strain transformation—to assess complex loading conditions and ensure optimal design performance. **CLO6 – Integration, CAD Application & Professional Practice** Integrate material, design, and manufacturing principles; utilize CAD tools and design standards for modeling and validating machine components; prepare professional engineering reports while adhering to ethical and safety practices.

Content of the Course

Week	*Subject*
1	Introduction, course overview
2	Engineering Materials and Their Properties Manufacturing Consideration of Machine Design
3	Quiz I
4	Stress • Shear Stress • Tortional Shear Stress • Bending Stress • Mohr Cycle
5	Stress • Shear Stress • Tortional Shear Stress • Bending Stress • Mohr Cycle
6	Quiz II
7	Factors of Safety, Plain and rolling bearings,
8	Mid-term Exam
9	Riveted Joints
10	Quiz III
11	Welding
12	Screwing
13	Shafts and clutches / Quiz IV
14	Springs
15	Final Exams

Methods and Techniques Used in the Course

Lectures and Theoretical Explanations:

Core concepts of mechanical design, material behavior, and stress analysis are introduced through instructor-led lectures supported by visual materials, design standards, and real-world examples.

Problem-Solving Sessions:

Students engage in analytical exercises and numerical problem-solving related to stress, strain, and component design to strengthen their ability to apply theoretical knowledge to engineering scenarios.

Case Studies and Design Applications:

Real-life engineering problems, such as the design of shafts, bearings, and joints, are analyzed to illustrate the integration of mechanical design principles with practical constraints.

Laboratory and Computational Activities:

Practical applications are supported through hands-on activities, including CAD-based component modeling and computational analysis using engineering software where applicable.

Group Projects and Design Assignments:

Students collaborate in small teams to design, evaluate, and present machine components, fostering teamwork, communication, and project management skills.

Quizzes and Midterm/Final Examinations:

Regular quizzes and exams assess comprehension, analytical skills, and the ability to apply mechanical design principles under given constraints.

Interactive Discussions and Feedback:

Classroom discussions encourage critical thinking, problem interpretation, and peer learning, supported by instructor feedback on design solutions and analytical methods.

Use of Standards and Design Codes:

Students are guided in applying relevant engineering standards (e.g., ISO, ASME, DIN) in mechanical design to ensure accuracy, safety, and compliance with industrial practices.

Sample Questions

Stress Analysis and Mohr's Circle

- Determine the normal and shear stresses acting on an inclined plane of a shaft subjected to combined bending and torsion.
- Draw Mohr's circle for a given state of stress and determine principal stresses and maximum shear stress.

Factor of Safety and Material Selection

- Calculate the factor of safety for a shaft subjected to fluctuating loads, considering both static and fatigue conditions.
- Recommend suitable materials for a high-speed rotating shaft, considering mechanical properties and manufacturing constraints.

Design of Bearings

- Design a plain journal bearing for a given load, speed, and lubrication condition.
- Calculate the required dimensions of a rolling bearing for a shaft under radial and axial loads.

Riveted and Welded Joints

- Determine the stresses in a riveted lap joint subjected to tensile load and suggest design improvements.
- Design a welded joint for a structural component, specifying the type and size of weld required to resist the applied load.

Shafts and Couplings

- Design a shaft to transmit a specified power at a given speed, considering torsion, bending, and combined loading.
- Select and design a coupling to connect two shafts, ensuring alignment and torque transmission.

Springs and Energy Storage Components

- Calculate the dimensions and stiffness of a helical compression spring subjected to an axial load.
- Determine the deflection and stress in a leaf spring used in a mechanical assembly.

General Design and Problem Solving

- Evaluate a failed machine component using given load conditions, material properties, and failure modes.
- Compare two design alternatives for a mechanical assembly and justify the selection based on strength, manufacturability, and safety.

Materials Used in the Course

Textbooks and Reference Books

- Shigley, J.E., Mischke, C.R., & Budynas, R.G., *Mechanical Engineering Design*, 11th Edition, McGraw-Hill, 2019.
- Spotts, M.F., Shoup, T.E., & Hornberger, K.E., *Design of Machine Elements*, 9th Edition, Pearson, 2014.
- Juvinall, R.C., & Marshek, K.M., *Fundamentals of Machine Component Design*, 5th Edition, Wiley, 2012.

Lecture Notes and Course Handouts

- Detailed notes on stress analysis, Mohr's circle, shaft and bearing design, riveted and welded joints, springs, and couplings.
- Sample design problems and solutions for mechanical components.

Software Tools

- **CAD Software:** SolidWorks / AutoCAD for modeling and visualization of machine components.
- **FEA Software:** ANSYS / SolidWorks Simulation for stress analysis and deformation studies.
- **Spreadsheet Tools:** Microsoft Excel for calculations, data organization, and iterative design checks.

Laboratory and Workshop Materials

- Material samples for tensile, shear, and torsion testing (steel, aluminum, and non-ferrous alloys).
- Riveted and welded joint samples for strength and failure study.
- Bearing and coupling prototypes for practical understanding and measurement exercises.
- Helical, leaf, and torsion spring samples for stress and deflection experiments.

Online Resources

- Access to academic journals (e.g., *Journal of Mechanical Design*, *International Journal of Mechanical Sciences*) for recent research and case studies.
- Standards and codes: ISO, ASME, and ASTM standards relevant to machine design and material selection.

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	2	2
PO2	2	3	3	3	3	2
PO3	2	3	3	3	3	2
PO4	1	2	3	3	3	2
PO5	1	2	2	3	2	2
PO6	1	2	2	2	3	2
PO7	1	1	2	2	2	2
PO8	1	1	2	2	2	3
PO9	1	1	1	1	2	3
PO10	2	2	2	3	3	2
PO11	1	2	2	2	2	3
PO12	1	2	2	2	2	3

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1	Lectures, Conceptual Explanation, Problem-Solving Sessions	Midterm Exam, Quizzes
CLO2	Lectures, Analytical Exercises, Example Problems	Midterm Exam, Problem Sets
CLO3	Case Studies, Design-Oriented Problem Solving, Tutorials	Midterm Exam, Final Exam
CLO4	Material Selection Workshops, Interactive Lectures	Assignments, Design Reports
CLO5	Lab Demonstrations, Technical Applications, Design Practice	Lab Reports, Project Evaluation
CLO6	CAD-Based Sessions, Design Simulations, Group Projects	Project Report, Presentation, Final Exam

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Preparation for lectures	**15**	**1**	**15**
Lectures	**15**	**4**	**60**
Midterm Exam	**1**	**1**	**1**
Preparation for Midterm Exam	**1**	**4**	**4**
Final Exam	**1**	**1**	**1**
Preparation for Final Exam	**1**	**4**	**4**
Presentation(s)	-	-	-
Preparation for Presentation(s)	-	-	-
Case Studies / Critical Thinking	-	-	-
Project Writing	**1**	**4**	**4**
Group Work	**1**	**4**	**4**
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			**117**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	2	20
Field Work	1	5
Special Course Internship (Work Placement)	-	-
Homework/Assignments	4	10
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	1	5
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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Fluid Mechanics							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MEC305	III	Fall	3	4	3	0	0
Course type: Compulsory Elective				**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. 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 ***Fluid Mechanics*** course provides students with a comprehensive understanding of the fundamental principles governing fluid behavior and their applications in engineering systems. The course begins with an introduction to the basic concepts and properties of fluids, followed by an in-depth study of pressure, fluid statics, and hydrostatic forces. Students will learn to analyze fluid motion through kinematics, flow visualization, and flow patterns, and will apply fundamental equations such as the Bernoulli and general energy equations to practical problems. The course also emphasizes energy and momentum analysis of steady flow systems, including applications of linear and angular momentum equations. Internal flows are studied with a focus on pipe networks and minor losses, while external flow topics introduce concepts of drag and lift that are critical in marine and mechanical engineering applications. By the end of the course, students will develop the ability to model, analyze, and solve real-world engineering problems related to fluid mechanics, preparing them for advanced courses and professional applications in fields such as ship design, propulsion systems, and energy systems.
Course Aims and Objectives	**Course Aims and Objectives** The primary aim of this course is to provide students with a solid foundation in the principles of fluid mechanics and their applications in engineering systems, particularly within maritime and mechanical engineering contexts. The course seeks to equip students with both theoretical understanding and analytical skills required to model, analyze, and interpret fluid flow phenomena. • Understand the fundamental properties of fluids and the basic principles of fluid statics and dynamics. • Analyze hydrostatic forces on submerged surfaces and evaluate fluid pressure distributions. • Apply the Bernoulli and general energy equations to practical engineering systems. • Perform energy and momentum analysis of steady-state flow systems. • Examine internal flows with emphasis on pipe networks, head losses, and flow distribution. • Understand the principles of external flows, including drag and lift forces, and their relevance in engineering applications. • Develop problem-solving skills by applying theoretical concepts to real-world scenarios in marine and mechanical systems. • Foster critical thinking and analytical reasoning for advanced studies and professional practice in fluid-related engineering fields.

Course Learning Outcomes	**CLO1 – Understand Fundamental Fluid Mechanics Concepts** Define and explain the essential properties of fluids and core principles of fluid mechanics, including fluid statics, kinematics, and dynamics, using appropriate engineering terminology. **CLO2 – Analyze Hydrostatic Pressure and Forces** Analyze pressure distributions in static fluids and calculate hydrostatic forces acting on submerged and floating bodies, applying these principles to marine and engineering structures. **CLO3 – Apply Fluid Flow and Energy Principles** Apply Bernoulli's equation, the general energy equation, and momentum analysis to solve engineering problems involving fluid motion, steady flow systems, pipelines, and channels. **CLO4 – Evaluate Flow Losses and System Behavior** Evaluate frictional and minor head losses in internal flows and design simple piping networks, interpreting flow behavior through fluid kinematics and flow visualization patterns. **CLO5 – Analyze External Flows and Engineering Applications** Explain and calculate drag and lift forces in external flows and relate these phenomena to practical engineering applications such as ships, turbines, aerodynamic surfaces, and propulsion systems. **CLO6 – Demonstrate Engineering Problem-Solving and Communication Skills** Integrate theoretical principles with practical engineering applications to solve fluid-related problems, effectively communicate technical results using diagrams and engineering reasoning, and demonstrate readiness for advanced hydraulics, hydrodynamics, and marine engineering courses.

Content of the Course

Week	*Subject*
1	Introduction Basic Concepts
2	Properties of fluids
3	Pressure and fluid statics
4	Hydrostatic forces
5	Fluid kinematics
6	Flow patterns and flow visualization
7	Bernoulli equation
8	General energy equation
9	Energy analysis of steady flows
10	Momentum analysis of flow systems
11	Linear and angular momentum equations
12	Internal flow
13	Minor losses piping networks
14	Introduction to external flow
15	Drag and lift

Methods and Techniques Used in the Course

Lectures and Theoretical Explanations – Delivery of fundamental fluid mechanics concepts supported by visual aids, diagrams, and real-world engineering examples.

Problem-Solving Sessions – Step-by-step analysis of sample problems to reinforce theoretical knowledge through quantitative applications.

Classroom Discussions and Q&A – Interactive discussions to encourage critical thinking and conceptual understanding.

Case Studies – Examination of real engineering problems related to hydraulics, marine hydrodynamics, and aerodynamics.

Group Work – Collaborative problem-solving and discussions to enhance teamwork and communication skills.

Assignments and Homework – Regularly assigned exercises to improve analytical and practical skills.

Visual and Simulation Tools – Use of flow visualization, diagrams, and, where applicable, basic computational tools to support understanding of abstract fluid phenomena.

Exams and Quizzes – Midterm and final exams, along with short quizzes, to assess comprehension, problem-solving ability, and application of concepts.

Sample Questions

Conceptual Questions

- Define the basic properties of fluids and explain the difference between compressible and incompressible fluids.
- Discuss the physical significance of Bernoulli's equation and provide two practical engineering applications.
- Explain the difference between laminar and turbulent flow.

Problem-Solving Questions

- A tank is filled with water to a depth of 4 m. Calculate the hydrostatic force on a vertical rectangular plate of 2 m width and 3 m height, fully submerged in water.
- Water flows through a horizontal pipe that narrows from a cross-sectional area of 0.05 m^2 to 0.01 m^2. If the velocity in the wider section is 2 m/s, calculate the velocity in the narrower section using the continuity equation.
- Using Bernoulli's equation, determine the pressure difference between two points in a horizontal pipeline if the velocity changes from 3 m/s to 6 m/s. Assume water density = 1000 kg/m^3.

Applied/Advanced Questions

- A pump delivers 0.2 m^3/s of water to a reservoir 15 m above the pump inlet with a total head loss of 3 m. Calculate the required pump power if the pump efficiency is 70%.
- A pipe system has three parallel branches with different diameters and lengths. Discuss how you would approach calculating the flow distribution in the network.
- An airfoil with a chord length of 2 m experiences a lift force of 5000 N when exposed to an airflow velocity of 30 m/s at sea-level conditions. Calculate the lift coefficient.

Materials Used in the Course

Textbooks and References

- *Fluid Mechanics* by Frank M. White, McGraw-Hill.
- *Fundamentals of Fluid Mechanics* by Munson, Young, Okiishi, and Huebsch.
- *Mechanics of Fluids* by Merle C. Potter and David C. Wiggert.
- Additional academic papers and case studies related to fluid dynamics applications.

Lecture Materials

- Instructor-prepared lecture notes and slides.
- Problem sets and sample solutions.
- Supplementary reading materials provided via the learning management system.

Software and Computational Tools

- MATLAB for solving fluid mechanics problems numerically.
- ANSYS Fluent or OpenFOAM for Computational Fluid Dynamics (CFD) simulations.
- Microsoft Excel for data analysis and graphing.

Visual and Demonstrative Materials

- Flow visualization videos (laminar vs. turbulent flow, drag/lift demonstrations).
- Laboratory demonstrations (if available) such as manometers, Venturi meters, and flow channels.
- Virtual labs and online simulation tools for fluid flow experiments.

Assessment Tools

- Homework assignments and practice problem sets.
- Mid-term and final exams (theoretical and problem-solving).
- Optional project or report on a selected fluid mechanics topic.

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 – Define and explain the basic properties of fluids and fundamental concepts of fluid mechanics.	Lectures, Interactive Discussion, Concept Demonstrations	Quizzes, Midterm Exam
CLO2 – Analyze pressure distributions in static fluids and calculate hydrostatic forces on submerged and floating bodies.	Lectures, Problem-Solving Sessions	Assignments, Midterm Exam
CLO3 – Apply Bernoulli and energy equations to solve problems involving fluid motion and energy transfer.	Lectures, Worked Examples, Simulation-Based Demonstrations	Quizzes, Midterm Exam, Final Exam
CLO4 – Perform energy and momentum analyses of steady flow systems.	Lectures, Problem-Solving Workshops, Case Studies	Assignments, Midterm Exam, Final Exam
CLO5 – Evaluate head losses and design simple piping networks.	Lectures, Practical Examples, Group Work	Assignments, Project, Final Exam
CLO6 – Communicate technical findings effectively and demonstrate readiness for advanced courses.	Group Projects, Presentations, Report Writing	Project Report, Presentation, 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	**1**	**20**	**20**
Group Work	-	-	-
In-class Discussion(s)	-	-	-
Quiz(es)	-	-	-
Preparation for Quiz(es)	-	-	-
Laboratory / Practical Applications	-	-	-
Assignment(s)/Homework/Class Works	**1**	**20**	**20**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**101**
ECTS Credit			**4**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Homework/Assignments	1	10
Providing reliability and motivation of the individual homework completion and Submission	-	-
Presentation/Jury	-	-
Project	1	10
Quiz	-	-
Midterms/Oral Exams	1	30
Final/Oral Exams	1	50
Total	**4**	**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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Marine Electrotechnology I							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED301	III	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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Marine Engines Simulator							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED303	III	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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Marine Diesel Engines II							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED305	III	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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Hydraulic, Pneumatic and Automatic Control							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
MED307	III	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

Faculty of Maritime Studies

Marine Engineering

Syllabus

Course name: Technical Ship Management I							
Code	**Year**	**Semester**	**Credit**	**ECTS**	**Course application, Hour/Week**		
					Theoretical	**Application**	**Laboratory**
TSM301	III	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**
				-	-	-	100
Course Venue and Time				Tuesday / 10:30 – 13:20			
Instructor information				**Cpt. Caner Özbilgiç** Faculty of Maritime Studies Wednesday / 09:00 - 12:00 +90 (392) 650 26 00 / 4060 mehmetemin.debes@kyrenia.edu.tr www.kyrenia.edu.tr			

Course Description	This course provides an in-depth exploration of the fundamental principles and practices of maritime commercial and technical ship management. It covers the operational, legal, and financial aspects of maritime trade, including liner and tramp markets, chartering practices, freight markets, and key shipping documentation. Students will learn the technical management requirements of ships, including maintenance, classification, surveys, compliance with international regulations, and safety audits. The course also emphasizes safety, environmental protection, and quality management systems in accordance with international conventions such as the ISM Code and MARPOL. In addition, students will develop leadership, decision-making, and teamwork skills essential for effective crew and resource management. A significant focus is placed on maritime English terminology used in commercial and technical documentation, enhancing students' ability to operate in an international maritime environment. Through theoretical lectures, case studies, and practical applications, students gain a comprehensive understanding of how modern shipping companies manage vessels efficiently while meeting safety, environmental, and commercial obligations.
Course Aims and Objectives	**Aim:** The primary aim of this course is to equip students with the theoretical knowledge and practical skills required to effectively manage commercial and technical aspects of maritime operations while ensuring compliance with international safety, environmental, and quality standards. **Objectives:** By the end of the course, students will be able to: 1. **Understand and analyze** the structure and dynamics of maritime markets, including liner and tramp shipping, chartering practices, and freight contracts. 2. **Interpret and apply** international maritime laws, conventions, and regulations related to ship operations, safety management, and environmental protection. 3. **Develop and implement** safety and quality management systems (SMS & QMS) in compliance with ISM Code and other relevant standards. 4. **Manage technical operations** of ships, including maintenance planning, classification surveys, and regulatory inspections. 5. **Apply leadership and decision-making skills** for effective crew management, workload planning, and resource allocation onboard and ashore. 6. **Use professional maritime English terminology** accurately in commercial, technical, and regulatory documentation, including INCOTERMS, charter parties, statements of facts, and time sheets. 7. **Evaluate and improve operational performance** of shipping companies while balancing safety, environmental, and commercial considerations.

Course Learning Outcomes	**CLO1: Explain** the fundamental principles of maritime commercial operations, including liner and tramp shipping, chartering types, and freight markets. *(Knowledge/Understanding)* **CLO2: Interpret and apply** international maritime conventions, safety and environmental regulations, and quality management standards (e.g., ISM Code, classification society requirements). *(Application)* **CLO3: Analyze** various types of charter parties and shipping documentation (e.g., bills of lading, statements of facts, time sheets) and their legal and commercial implications. *(Analysis)* **CLO4: Develop** maintenance, inspection, and technical operation plans for ships in accordance with regulatory requirements and industry best practices. *(Synthesis/Design)* **CLO5: Assess and manage** risks related to maritime safety, environmental protection, and cargo operations, including pollution prevention measures. *(Evaluation)* **CLO6: Communicate effectively** in professional maritime English using correct terminology for technical, operational, and commercial contexts (e.g., INCOTERMS, ship management reports). *(Communication)* **CLO7: Demonstrate** leadership, teamwork, and decision-making skills in managing shipboard personnel, workload planning, and emergency situations. *(Professional/Soft Skills)* **CLO8: Evaluate and propose improvements** to safety, quality, and technical management systems to enhance overall operational efficiency and compliance. *(Evaluation/Problem-Solving)*

Content of the Course

Week	*Subject*
1	**Introduction to Technical Ship Management** • Overview of ship technical management • Tracking regulations and compliance requirements • Ship documentation and inspection procedures
2	**Maintenance and Record Keeping** • Maintenance management and record-keeping systems • Correspondence and reporting in technical management • Planning for repairs and preventive maintenance
3	**Personnel and Training Management** • Crew management principles • Training programs and competency tracking • Safety and supply management related to personnel
4	**Material and Inventory Management** • Materials tracking and record keeping • Planning for equipment and supply needs • Stock management and logistic coordination
5	**Concepts of Safety, Environment, and Quality** • Introduction to safety management • Environmental protection principles • Quality concepts in maritime operations
6	**Marine Environmental Protection and Pollution Prevention** • Measures to prevent marine pollution • Pollution prevention procedures and equipment • Importance of proactive environmental protection
7	**Legal and Commercial Requirements for Safety and Quality Management** • ISM Code overview • International and national quality standards • Regulatory compliance for safety and environmental protection
8	**Safety and Quality Management Systems (Preparation and Implementation)** • Establishing a Safety Management System (SMS) • Implementing a Quality Management System (QMS) • Internal and external audits: techniques and application
9	**Leadership and Teamwork in Maritime Operations** • Crew management and education strategies • Effective team communication and coordination • Motivational and leadership skills development
10	**Maritime Legislation and Regulations** • International conventions and national maritime legislation

	• Compliance and enforcement mechanisms • Legal obligations related to ship operations
11	**Task and Workload Management** • Planning and task allocation • Prioritization under time and resource constraints • Delegation and monitoring of tasks onboard
12	**Resource Management in Maritime Operations** • Allocation and prioritization of resources • Effective ship-to-shore communication • Lessons from team experience and decision-making reflection
13	**Decision-Making Techniques I** • Situation and risk assessment • Evaluating alternatives and selecting actions • Decision-making frameworks and approaches
14	**Decision-Making Techniques II** • Implementing decisions in real operational scenarios • Monitoring and adjusting actions • Evaluating effectiveness of decisions
15	**Integration and Practical Application** • Case studies of technical ship management • Simulation of safety, quality, and operational decision-making • Review and consolidation of leadership, management, and technical skills

Methods and Techniques used in the Course

- **Interactive Lectures** – Instructor-led sessions to explain core concepts of technical management, safety, quality, and environmental regulations.
- **Case Studies** – Analysis of real-world scenarios to illustrate challenges in ship management, maintenance, and compliance.
- **Group Discussions** – Collaborative discussions to develop problem-solving skills and exchange ideas on operational and safety topics.
- **Problem-Solving Exercises** – Practical exercises focusing on planning, decision-making, and prioritization in ship operations.
- **Document Analysis and Simulation** – Reviewing ship documents, audits, and reports to practice regulatory compliance and management procedures.
- **Role-Playing and Scenario-Based Learning** – Simulating onboard situations such as emergencies, resource allocation, and crew management to develop leadership and decision-making skills.

Sample Questions

- Explain the key principles of technical ship management and their importance for safe and efficient vessel operation.
- Describe the main components of a Safety Management System (SMS) according to the ISM Code.
- How would you plan preventive maintenance for a ship's machinery and equipment?
- Discuss the steps involved in preparing a ship for dry-docking.
- Explain how crew training and resource management contribute to the effective operation of a ship.
- What are the legal and regulatory requirements for environmental protection on ships?
- Describe the process of conducting internal and external audits for technical management and quality systems.
- How can decision-making and prioritization techniques be applied in case of multiple technical issues on board?
- Identify the main challenges in technical ship management and propose solutions to mitigate them.
- Discuss the role of documentation and record-keeping in ensuring compliance with international maritime standards.

Materials Used in the Course

Textbooks & Reference Books

- IMO **International Safety Management (ISM) Code** documentation
- Manuals on **ship maintenance and machinery operation**
- Books on **maritime technical management and leadership**
- Industry standards on **environmental protection and quality management**

International and National Regulations

- SOLAS (Safety of Life at Sea)
- MARPOL (Marine Pollution)
- Flag state regulations
- Port state control guidelines

Guidelines & Reports

- Shipboard **Safety Management System (SMS)** manuals
- Technical and operational checklists
- Dry-docking and survey reports

Online Resources & Industry Databases

- IMO and ILO websites for updates on maritime regulations
- Industry publications and case studies on **ship management best practices**

Practical Materials

- Sample **maintenance logs, inspection checklists, and vessel records**
- Crew management and training materials
- Templates for **risk assessment, decision-making, 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	
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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
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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	2	3	3	2	2	2	0	0
PO2	2	3	2	3	2	3	2	2	0	0
PO3	3	2	3	2	3	2	3	2	0	0
PO4	2	3	2	3	2	3	2	2	0	0
PO5	3	2	3	2	3	2	3	2	0	0
PO6	2	2	2	3	2	2	2	3	0	0
PO7	2	2	2	2	2	2	2	2	0	0
PO8	1	1	1	2	2	1	1	2	0	0
PO9	1	1	1	1	2	1	1	2	0	0
PO10	1	1	2	1	2	2	2	2	0	0
PO11	1	1	1	2	1	1	2	1	0	0
PO12	1	1	1	2	1	1	2	1	0	0

Course Learning Outcomes/ Evaluation Method		
CLO	**Teaching Method**	**Assessment Method**
CLO1 – Maritime Commercial Principles	Lecture, Case Studies, Group Discussion	Quizzes, Written Assignments, Midterm Exam
CLO2 – International Regulations & Standards	Lecture, Tutorials, Problem-Solving Sessions	Assignments, Case Study Reports, Midterm Exam
CLO3 – Charter Parties & Documentation Analysis	Lecture, Practical Exercises, Document Review	Assignments, Written Case Studies, Project Work
CLO4 – Maintenance & Technical Operations Planning	Workshops, Simulations, Group Projects	Project Reports, Practical Exercises, Presentations
CLO5 – Risk Assessment & Management	Case Studies, Problem-Based Learning, Simulations	Risk Assessment Reports, Quizzes, Practical Exercises
CLO6 – Professional Maritime English	Role-Playing, Communication Exercises, Presentations	Oral Presentations, Written Assignments, Participation
CLO7 – Leadership & Teamwork	Group Exercises, Simulations, Scenario-Based Learning	Peer Evaluation, Practical Exercises, Observation
CLO8 – Safety, Quality & Technical Management Evaluation	Case Studies, Workshops, Problem-Solving Exercises	Project Reports, Assignments, Presentations

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**	**10**	**10**
Final Exam	**1**	**2**	**2**
Preparation for Final Exam	**1**	**10**	**10**
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	**1**	**20**	**20**
Micro-Teaching Sessions	-	-	-
Lesson Planning	-	-	-
Materials Adaptation	-	-	-
Material Development	-	-	-
Draft Preparation	-	-	-
Drawing	-	-	-
Essay Writing	-	-	-
Tutorial(s)	-	-	-
Portfolio Preparation	-	-	-
Portfolio Presentation	-	-	-
Total Workload			**134**
ECTS Credit			**3**

Evaluation System		
Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	15	10
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Homework/Assignments	1	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	50
Total	**4**	**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.		