8Course Title	Ship machinery and systems				
Course Code	MAEN502				
Course Type	Required				
Level	Master's Level				
Year / Semester	1 / 1				
Teacher's Name	Dr. Charalambos Chasos, C/Eng. Rod Beams, Dr. Antonios Lontos, Dr. Marios Mastrokalos				
ECTS	8	Lectures / week	3	Laboratories / week	0
Course Purpose and Objectives	The aim of this course is to provide special engineering knowledge of common traditional and alternative fuels systems and machinery, focused on their structural analysis, categorization, relation and discrimination.				
Learning Outcomes	By the end of the course students will be able to: • Categorize and compare ship engines and marine auxiliary machines, analyzing their construction, use and maintenance procedures. • Design and construct procedures plan, analyzing the ship machinery and systems maintenance demands (traditional and alternative), based on International Maritime Regulations.				
Prerequisites	MAEN500 pass, only for those not holding a degree in marine related fields (no background in shipping).	Required			
Course Content	• Ship engines. Safe preparation and shutdown of main propulsion and auxiliary engines. Starting, stopping and control of main propulsion and auxiliary engines. Procedures for emergency situations activities required to maintain operation of main propulsion and auxiliary machinery and associated systems. • Mechanical Power Transmission. Transmission system clutches and main reduction gearboxes. Transmission, types and applications. Control of temperatures, pressures, viscosity associated with main propulsion and auxiliary machinery. • Noise and vibration analysis, noise & vibration sources, low-noise design, global and local vibration prediction and measurements, problems including: singing propeller, propeller vibration problems, noise control in engine rooms, accommodation sound insulation and others • LNG fueled ships and dual fuel technology, special considerations regarding marine engines, safety, storage, fueling, regulatory framework (IMO pollution prevention treaty) • Fuel cell technology use for marine propulsions- towards zero emissions shipping industry. Review of Fuel cell types (PEM, SO, MC, PA), their efficiency and assessment for marine use. Use, Maintenance, Fueling, decommissioning, Hydrogen storage onboard ship, LH2 CGH2. Hybridization with LNG (dual fuel systems) • Renewable sources for ship propulsion, solar and wind energy,				

	current and future concepts on board ship.
Teaching Methodology	The course will be delivered through lectures, discussions, and presentations augmented by consultations with staff during office hours, home and library study.
Educational activities encourage the active participation of students in the learning process	During the course attending, the students will be encouraged to construct and present written semester assignments concerning aspects like: • analysis, design and comparison of real ship machinery and systems for different ship types, assessing their affecting technical parameters • design and construct procedures plan, analyzing the ship machinery and systems maintenance demands (traditional and alternative), based on International Maritime Regulations
Recommended software packages	The educational activities and the laboratory exercises could be conducted using the software: • AutoCAD and Solidworks for mechanical component and systems designs • Labview and Matlab for gathering and assessing the affecting technical parameters of the ship's machinery and systems performance, during related experiments
Recommended laboratory exercises/tests that students could attend in FU laboratories and/or in collaborating ship companies	Parallel with the course attending, the students will be recommended to attend seminars, educational visits to the ship's engine room and experiments conducted in the FU Mechanical Engineering Department laboratories, co-organized by the FU and the collaborating ship company, concerning aspects like: • technical parameters affecting the ship's engine performance • technical parameters affecting the ship's power transmission and steering systems performance • technical parameters affecting the ship's auxiliary machinery systems performance
Recommended synergies between teaching and research that could provide the students engagement in research activities	The students will be encouraged to create and present papers in marine focused conferences, based on their semester assignments, in order to produce the base of their MSc Dissertation, concerning aspects like: • comparing the factors affecting the ship's machinery and systems performance • evaluating ship's maintenance procedures plans, concerning traditional and alternative ship machinery and systems.
Bibliography	**Textbooks:** • Prof. Detlef Stolten, Dr. Remzi C. Samsun, Dr. Nancy Garland, (2016) Fuel Cells : Data, Facts and Figures, Wiley • Bent Sørensen, Giuseppe Spazzafumo, (2018), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Academic press • Marco Giuffrida, (2016), Electrical Plants and Electric Propulsion on Ships • Calder, N., (2006). Marine Diesel Engines: Maintenance, Troubleshooting, and Repair. International Marine/Ragged Mountain Press. • Diesel Engines for Ship Propulsion and Power Plants (2012), Volume I & Ii. K. Kuiken, Target Global Energy.

	• Veritek (1985), Vibration Control in Ships, Veritek **Other Reading:** • Molland, A.F., (2008). The Maritime Engineering Reference Book: A Guide to Ship Design, Construction and Operation. Elsevier Ltd. • Pounder's Marine Diesel Engines and Gas Turbines, (2009). Elsevier Ltd. • Mc George H. D., (1999). Marine Auxiliary Machinery. Elsevier Ltd. • Hasheinrich, M-P., Bernhardt, F., (2009). Compendium Marine Engineering. DWMedia Group. • Totten, G., Westbrook, S., Shah, S., (2003). Fuels and lubricants handbook. ASTM Int **Journals:** • IMechE Journal of Engineering for the Maritime Environment (JEME) • IMarEST Journal of Marine Engineering and Technology (JMET) • Journal of Marine Science and Technology • Ocean Engineering • SNAME and RINA journals • Marine Structures, Elsevier • Canadian Shipping and Marine Engineering, ProQuest • International Journal of Marine Science; Richmond • Journal of Marine Research; New Haven • Marine Technology Society Journal; Washington • Maritime Studies; Canberra • Naval Engineers Journal. Wiley
Assessment	Final Exam: 60% Course Work/Assignment: 40%
Language	English