Course title	Code No.
Ship energy efficiency and optimization	

Semester	Course status (mandatory or optional)
1st semester	**Mandatory**

Lecturer(s)	E-Mail
Josip Orović	**jorovic@unizd.hr**

Contact hours per week	Credit Points	Workload		
2+1	**5**	**Presence**		**Self-study**
		Lecture	**30**	**50**
		Seminar		**30**
		Practice		
		Laboratory		
		Simulator	**15**	

Media	Teaching aids
Overhead projector, white and smart board, engine room and nautical simulators	**Presentations, check lists, work groups, manuals, videos**

Enrolment requirements and entry competences required for the course
None

Conditions for permission to take the exam
Completed simulator exercises and successfully presented seminar paper

Assessment methods and criteria
Assessment is carried out by means of evaluation of: **Seminar paper and presentation (35%)** **Written exam (35%)** **Oral exam (30%)**

Learning outcomes at the programme level to which the course contributes
Students should be: **- able to understand the ship energy systems and to optimize the ship propulsion operations;** **- able to make informed and responsible decisions regarding environmental protection;**

- able to understand and apply state of the art ship technology which can influence the development of a shipping company;
- able to evaluate and use the maritime transport data as a fundament for decision making;
- able to communicate effectively in a multi-cultural environment.

Learning Outcomes

Professional competence	Key skills
The students should be able: 1. To analyze different propulsion plants regarding the energy efficiency; 2. To identify parameters that influence ship energy efficiency; 3. To evaluate efficiency of different propulsion plants 4. To recommend the options for ship propulsion plant optimization 5. To select an appropriate maintenance model and to justify selection 6. To critically assess the various ship inspections 7. To determine and assess the effect of various faults on ship propulsion plants	- communication in foreign languages; - mathematical competence and basic competences in science and technology; - digital competence; - learning to learn; - social and civic competences; - sense of initiative and entrepreneurship; - cultural awareness and expression.

Applicability in other courses/programs

This module is suitable for study programs in technical universities dealing with efficiency and optimization of marine propulsion plants.

Content

- Energy balance of ship propulsion plants: efficiency at different loads, different propulsion plants: slow speed diesel engine propulsion plant, RoPax vessel with four stroke diesel engines, steam turbine propulsion plant, diesel electric propulsion plant, combined propulsion plants - COGES or similar - hybrid, alternative fuels and GHG emission.
- Influence analysis of certain parameters at efficiency and total costs of ship plant. Engine data and weather condition: speed, power, weather, fuel oil consumption, exhaust emission. Weather routing, slow steaming, usage of different fuels, load distribution, hull and propeller fouling and similar.
- Simulation of different conditions at ship engine room simulators. Influence of different weather conditions (wind, wave, current, temperature, pressure, and humidity), maneuvering, port and open sea conditions, loading and discharging cargo, shallow water and etc.
- Ship propulsion plant and engine room process optimization: theory and practical application. Assessing potential savings in Main and Auxiliary Engines and Machinery Operation and Maintenance.

- Ship energy efficiency Management plant (SEEMP).
- Ship inspection and classification. Managing technical systems: Planned maintenance Systems and Purchasing, Inspections: Vetting, PSCV Flag state, USCG.
- Advanced diagnostics: simulation and analysis of different conditions in the engine rooms of different propulsion plants (fuel oil Injection, quality, type, timing and etc.).

Literature

- IMO Training Course on Energy Efficient Operation of Ships
- ABS: Ship Energy Efficiency Measures
- S.S. Rao: Engineering Optimization: Theory and Practice; John Wiley & Sons, Inc., 1996
- A. Ravindran; K.M. Ragsdell; G.V. Reklaitis: Engineering optimization, Methods and Application; ; John Wiley & Sons, Inc., 2006
- Chapra, S.S.; Canale, R.P.: Numerical methods for engineers
- Matlab: Optimization toolbox, User's Guide
- International Maritime Organisation, Marine Environment Protection Committee, 2012 Guidelines for the Development of a Ship Energy Efficiency Management Plan (SEEMP), MEPC.213(63)
- Lloyd's Register: Implementing a Ship Energy Efficiency Management Plan (SEEMP) Guidance for shipowners and operators
- Instruction manuals
- Simulator manuals

Amendment Log

Version No.:	Date:	Changes:	Name:
1.	30.01.2020.		Josip Orović