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|-------------------------------|---|-----------------|---|---------------------|---|
| Course Title                  | Ship electrical systems and components  |                 |   |                     |   |
| Course Code                   | MAEN503   |                 |   |                     |   |
| Course Type                   | Required  |                 |   |                     |   |
| Level                         | Master's Level  |                 |   |                     |   |
| Year / Semester               | 1 / 1   |                 |   |                     |   |
| Teacher's Name                | Dr. Photis Vrionides, Dr. Marios Lestas   |                 |   |                     |   |
| 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 marine electrical and electronic systems, focused on their structural analysis, categorization, relation and discrimination.   |                 |   |                     |   |
| Learning Outcomes             | <p>By the end of the course students will be able to:</p> <ul style="list-style-type: none"> <li>• Categorize and compare ship electrical systems and components, analyzing their construction, use, control and maintenance procedures.</li> <li>• Design and construct procedures plan, analyzing the ship electrical systems and components maintenance demands (traditional and alternative), based on International Maritime Regulations.</li> </ul>   |                 |   |                     |   |
| Prerequisites                 | MAEN500 pass, only for those not holding a degree in marine related fields (no background in shipping).   | Required        |   |                     |   |
| Course Content                | <ul style="list-style-type: none"> <li>• Overview of generation and distribution systems.</li> <li>• Electrical power for marine propulsion.</li> <li>• Operation and control of AC and DC electric machines.</li> <li>• Battery technologies.</li> <li>• Power system analysis.</li> <li>• Marine emergency power systems.</li> <li>• Shore connections in port.</li> <li>• Power electronic converter circuits.</li> <li>• Propulsion control and operation.</li> <li>• Hybrid systems.</li> <li>• Diesel/DF electric propulsion.</li> <li>• Comparison of Electrical power to fuel cells for marine propulsion. Power density, fueling requirements, safety aspects, regulatory framework.</li> <li>• Converters.</li> <li>• Fault current.</li> </ul> |                 |   |                     |   |
| Teaching Methodology          | The course will be delivered through lectures, discussions, and presentations augmented by consultations with staff during office hours, home and library study.  |                 |   |                     |   |

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| <p>Educational activities encourage the active participation of students in the learning process</p>                               | <p>During the course attending, the students will be encouraged to construct and present written semester assignments concerning aspects like:</p> <ul style="list-style-type: none"> <li>• analysis, design and comparison of real ship electrical systems and components for different ship types, assessing their affecting technical parameters</li> <li>• design and construct procedures plan, analyzing the ship electrical systems and components maintenance demands (traditional and alternative), based on International Maritime Regulations</li> </ul>  |
| <p>Recommended software packages</p>   | <p>The educational activities and the laboratory exercises could be conducted using the software:</p> <ul style="list-style-type: none"> <li>• AutoCAD and Solidworks for ship electrical systems and components designs</li> <li>• Labview and Matlab for gathering and assessing the affecting technical parameters of the ship's electrical systems and components performance, during related experiments</li> </ul>   |
| <p>Recommended laboratory exercises/tests that students could attend in FU laboratories and/or in collaborating ship companies</p> | <p>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 Electrical Engineering Department laboratories, co-organized by the FU and the collaborating ship company, concerning aspects like:</p> <ul style="list-style-type: none"> <li>• technical parameters affecting the ship's electrical systems performance</li> <li>• technical parameters affecting the ship's electrical components performance</li> </ul>   |
| <p>Recommended synergies between teaching and research that could provide the students engagement in research activities</p>       | <p>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:</p> <ul style="list-style-type: none"> <li>• comparing the factors affecting the ship's electrical systems and components performance</li> <li>• evaluating ship's maintenance procedures plans, concerning traditional and alternative ship electrical systems and components.</li> </ul>  |
| <p>Bibliography</p>  | <p><b>Textbooks:</b></p> <ul style="list-style-type: none"> <li>• Giuffrida, M., (2016). Electrical Plants and Electric Propulsion on Ships</li> <li>• Patel, M.R., (2011). Shipboard Electrical Power</li> <li>• Borstlap, R., (2011). Ships Electrical Systems</li> <li>• Islam, M.M., (2011). Handbook to IEEE Standard 45: A Guide to Electrical Installations on Shipboard.</li> <li>• Payne, J.C., (2007). The Marine Electrical and Electronics Bible.</li> <li>• Sherman, E.R., (2012). Advanced Marine Electrics and Electronics Troubleshooting: A Manual for Boatowners and Marine Technicians.</li> <li>• Gupta, M., (2014). Installation, maintenance and repair of electrical machines and equipments. S.K. Kataria &amp; Sons.</li> </ul> <p><b>Other Reading:</b></p> <ul style="list-style-type: none"> <li>• Watson, O.G., (1990). Marine electrical practice. Elsevier Ltd, Butterworth-Heinemann.</li> </ul> |

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|            | <ul style="list-style-type: none"> <li>• Lindley, R., Higgins, R., Mobley, K., Wikoff, D., (2008). Maintenance engineering handbook. Mc Graw Hill.</li> <li>• Hubert, C.I., Triebel, W.A., (2002). Operation, testing and preventive maintenance of electric power apparatus. Prentice Hall.</li> <li>• Brotherton, M.K. and Sherman, E.R., (2002). The 12-Volt Bible for Boats.</li> <li>• Payne, J.C., (2010). Understanding Boat DC Electrical Equipment.</li> <li>• Bottrill, G., Cheyne, D., (2005). Practical Electrical Equipment and Installations in Hazardous Areas.</li> </ul> <p><b>Journals:</b></p> <ul style="list-style-type: none"> <li>• IMechE Journal of Engineering for the Maritime Environment (JEME)</li> <li>• IMarEST Journal of Marine Engineering and Technology (JMET)</li> <li>• Journal of Marine Science and Technology</li> <li>• Ocean Engineering</li> <li>• SNAME and RINA journals</li> <li>• Marine Structures, Elsevier</li> <li>• Canadian Shipping and Marine Engineering, ProQuest</li> <li>• International Journal of Marine Science; Richmond</li> <li>• Journal of Marine Research; New Haven</li> <li>• Marine Technology Society Journal; Washington</li> <li>• Maritime Studies; Canberra</li> <li>• Naval Engineers Journal. Wiley</li> </ul> |
| Assessment | <p>Final Exam: 60%</p> <p>Course Work/Assignment: 40%</p>  |
| Language   | English  |