SUBJECT TEACHING GUIDE

G1118 - Steam and Gas Turbines II

Degree in Maritime Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Maritime Engineering			Type and Year	Compulsory. Year 3
Faculty	School of Maritime Engineering				
Discipline	Topic Module: Specific Technology Propulsion and Ship Services				
Course unit title and code	G1118 - Steam and Gas Turbines II				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. CIENCIAS Y TECNICAS DE LA NAVEGACION Y DE LA CONSTRUCCION NAVAL
Name of lecturer	SERGIO GARCIA GOMEZ
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Other lecturers	JAVIER GARCIA GUTIERREZ

3.1 LEARNING OUTCOMES
- To calculate the internal and external of the TV losses.
- Calculate powers and peripherals and internal performance, effective power and mechanical performance on TV.
- To acquire knowledge about the regulation of power steam turbines
- Calculate the thermal balance of an installation of a ship turbines.
- Optimize the constructive elements of the steam turbine.
- Knowing how to perform the operation start-up, shutdown and operation of steam turbines aboard a ship.
- Knowing how to calculate the power and efficiency of the steam turbine installation
- Knowing how to apply the techniques of maintenance and inspection in a steam turbine.
- Knowing how to calculate the surface heat exchange in a condenser of a steam turbine installation. Analysis, control and minimize the problem caused by biofouling (biofouling) of the exchange surface condenser.
- Knowing the possible techniques for optimizing the basic cycles of gas turbines.
- Knowing the operation of the compressor gas turbines.
- Knowing the bodies of gas turbines: combustion chambers, nozzles and heat exchangers.
- Ability to start operation and regulation of gas turbines.

4. OBJECTIVES
Knowing how to power steam turbines is regulated, what internal and external losses of these turbines are and know how to calculate the power and performance. Knowing the construction and materials of different parts of steam turbines and gas . Knowing techniques maintenance and driving steam turbines in ships. Study capacitors turbine installations steam and compressors in gas turbines. Knowing how you can optimize the basic cycles of turbines organic gas and make the study of them.

6. COURSE ORGANIZATION	
CONTENTS	
1	Analysis of losses in thermal turbomachines. Introduction. Internal losses. External losses. Yields and Powers of multiple TMTs.
2	Architecture of Thermal Turbo Machines. Introduction. Materials employed. Vanes. Rotors. Diaphragms. Bodies. Bearings. Watertightness. Labyrinth-gasket seals. Combustion chambers. Injectors Marine turbines. - Practice 1. Components of the turbines.
3	Auxiliary organs of thermal turbomachines. Cutting and regulation bodies. Start and regulation of Gas turbines. Turbine lubrication systems.
4	Condenser for steam turbines. Calculation of heat exchange surface. Growth control of biological fouling film (biofouling). Elimination of biofouling. - Practice 2. Design of capacitors and biofouling mitigation systems.
5	Gas turbines. Optimization of basic cycles. Heat recovery. Ideal and real cycle. Regenerative open cycle with intermediate cooling in compression. Regenerative open cycle with intermediate heating in the expansion. Closed and combined cycles.
6	Gas turbines. Compressors. Euler's Equation Fundamental Theory. Compression ratio of a step. Moving vanes: Influence of the angle of blade outlet. Diffuser. Losses. Turbillion speed. Performance. Characteristic curves
7	Combined Cycles. Introduction. Thermodynamic principles. Components. Efficiency of a combined cycle. Design of a combined cycle. COGAS / COGES naval systems.
8	Operation and Maintenance of Thermal Turbo Machines. Operation. Preventive Maintenance. Predictive Maintenance. Corrective maintenance. Expansions and thermal stresses. Thrust balancing. Vibration analysis. - Practice 3. Design of the operating characteristics of a turbine. KONGSBERG turbine simulator.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Description Theory and problems exam	Written exam	No	Yes	30,00
Description Theory and problems exam	Written exam	No	Yes	30,00
Description Classroom Practices	Others	No	Yes	20,00
Minimum compulsory attendance at 80% of the hours of practices. Positive evaluation of the memory of practices carried out. Recoverable in the final exam. Final exam: for those students who do not pass it by course, on a date fixed in the exam calendar ap	Laboratory evaluation	Yes	No	10,00
3.1) Prepare the assigned work. The work in its final form will be sent as an attachment to sergio.garcia@unican.es 48 hours before the date set in the exhibition calendar, as well as all students enrolled in the course. The contents of the works will be	Work	Yes	No	10,00
TOTAL				100,00

Observations

Continuous assessment through Partial Exams requires a minimum attendance of 80% of contact hours for each part of the subject (theory, classroom practice and laboratory practice). Attendance must have a positive attitude (exclusive attention throughout the class; the use of mobile phones during classes is expressly prohibited).
Students who do NOT opt for the continuous assessment modality, or who have not reached the minimum attendance requirement required for continuous assessment, will have their knowledge acquired throughout the subject assessed in the regular exam.
- JUNE CALL:
1. Theory and exercises (60%)
1st partial exam (30%): topics and date to be agreed.
2nd partial exam (30%): topics and date to be agreed. Recoverable in the final exam. Final exam: of the subject not passed in the partial exams, on a date fixed in the examination calendar approved in the Board of the Center.
2. Practices in Classroom (20%)
3. Group work (10%)
3.1) Prepare the assigned work. The work in its final form will be sent as an attachment to sergio.garcia@unican.es 48 hours before the date set in the exhibition calendar, as well as all students enrolled in the course. The contents of the works will be considered part of the subject, being able to be asked in the theory exam.
3.2) Oral exhibition according to exhibition calendar. Exhibition (30 min) of the work in its final form and assessment and questions by the teacher and the classmates (15 min). To qualify, it is a condition to participate in the act of exhibition and defense of work. Not recoverable in the final exam.
4. Laboratory practices (10%)
Minimum compulsory attendance at 80% of the hours of practices. Positive evaluation of the memory of practices carried out. Not recoverable in the final exam.
- CALL FOR JULY: Examination of the entire syllabus of the subject on a date fixed in the examination calendar approved by the Board of the Center.

Observations for part-time students

Students who are enrolled part-time will not be able to perform the continuous assessment and will present the final exam, enough to obtain a maximum grade of 8.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
- Kostyuk A. &Frolov V. Steam and Gas Turbines. MIR, Moscú. 1988.
- Mataix C. Turbomáquinas Térmicas: Turbinas de Vapor, Turbinas de Gas y Turbocompresores. Editorial Dossat 2000. 3ª Edición. Madrid. 2000.
- Schegliaev A.V. Turbinas de Vapor. Editorial Mir. Moscú. 1985.
- Troyanovsky B.M., Filippov G.A., Bulkin A.E. Turbinas de Vapor y de Gas de las Centrales Nucleoeléctricas . MIR, Moscú. 1987.
- Pérez del Rio J. Tratado General de Máquinas Marinas. Máquinas de Vapor. Editorial Planeta. Volumen VII. Madrid. 1972.
- Muñoz Torralbo M. et al. Turbomáquinas Térmicas. Editorial Sección de Publicaciones de la E.T.S. de Ingenieros Industriales. Madrid. 2001.
- Mattingly J.D. Elements of propulsión. Gas turbines and Rockets. American Institute of Aeronautic and Astronautics. 2006.