SUBJECT TEACHING GUIDE

G1089 - Steam and Gas Turbines I

Degree in Marine Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Marine Engineering			Type and Year	Compulsory. Year 3
Faculty	School of Maritime Engineering				
Discipline	Topic				
Course unit title and code	G1089 - Steam and Gas Turbines I				
Number of ECTS credits allocated	6	Term		Semester based (1)	
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
- Knowing solve the main, auxiliary and propulsion systems and ship refrigeration and air conditioning Legislation
- Knowing solve problems fluidomecánicas systems and machines. in internal combustion engines, in steam turbines. in gas turbines. in steam generators, heat transfer, regulation and control machinery and marine systems. in electric propulsion systems. power electronics. in the calculation, selection, installation and maintenance of marine propellers and knowledge of classification societies and know how to solve problems inspection
- Operate the main and auxiliary machinery and the corresponding control systems.
- Management of the operation of the machinery of the Propulsion installation.
- Plan and schedule operations.

4. OBJECTIVES
Knowing the Rankine cycle changes to improve thermal performance. Knowing and applying the equations fundamental movement of the compressed fluid and thermal turbomachinery (steam turbines and gas). Know and identify the various parts, uses more employees and types of motor thermal turbomachinery (axial and radial) both thermal, conventional and nuclear, land and sea plants. mechanical and thermodynamic study the constituent parts of a steam turbine, energy transformations in fixed and mobile elements. powers and yields. Gas turbines. Study the ideal and real cycles of gas turbines, Brayton cycle, yields and modifications.
Train the student in relation to the steam and gas turbines at the operational level , in accordance with the provisions of Table A-III / 1 of the Code of training, certification and guard for seafarers, as amended (STCW -78/2010). The student will achieve knowledge, understanding and sufficiency about: - Basic construction and operating principles of the systems of marine steam turbine machines. - Basic construction and operating principles of marine gas turbine machine systems. - Basic construction and operating principles of the machine systems, including: fluid flow and characteristics of the lubricating oil, fuel and cooling systems. - Preparation, operation, fault detection and necessary measures to prevent breakdowns in the following control systems and machines: main machine and related auxiliary machines. - Preparation, operation, fault detection and necessary measures to prevent breakdowns in control systems and machines for auxiliary propulsion machinery and related systems. - Preparation, operation, fault detection and necessary measures to prevent breakdowns in the following control systems and machines: steam boilers, steam turbines, associated auxiliary and steam systems.
Train the student in relation to steam and gas turbines at the management level , in accordance with the provisions of table A-III / 2 of the Code of training, certification and guard for seafarers, as amended (STCW-78/2010). The student will achieve knowledge, understanding and sufficiency about: - Project characteristics and operating mechanisms of the main machines and related auxiliary machinery: marine steam turbines. - Project characteristics and operating mechanisms of the main machines and related auxiliary machinery: marine gas turbines. - Theoretical knowledge: Propulsion characteristics of diesel engines, steam and gas turbines, including speed, power and fuel consumption. - Theoretical knowledge: Thermal cycle, thermal performance and thermal balance of steam turbines and marine gas turbines.

6. SUBJECT PROGRAM	
CONTENTS	
1	1.Steam Turbines. Cycles: Machines fluid. Turbomachines. Definition of steam turbine. Historical evolution of the Steam Turbine. Description of the steam turbine. Classification of the Turbines of steam. Steam Turbine Cycles. Rankine cycle. Rankine cycle trends and modifications: performance improvements. Rankine cycle with intermediate overheating. Increase performance internal of the turbine by reducing the degree of humidity. Regenerative Cycle. Regenerative cycle with intermediate overheating. Rankine Royal Cycle. Performance.
2	2. Gas turbines. Basic cycles: General ideas. Introduction. Turbine classification. The constant pressure combustion turbine. Ideal and real Brayton cycle. Low pressure air thermodynamic tables.
3	3. Flow in fixed nozzles and crowns. Introduction. Continuity equation. Subsonic, transonic and supersonic flow in any conduit. Average speed in any section of the nozzle. Critical section of a nozzle. - Practice 1: Presentation, recognition and diagramming of a conventional steam installation of a ship. - Practice 2: Fixed organs of steam turbines. Nozzles.
4	4. Transformation of mechanical energy and fluid in the mobile crowns of mobile vanes (Impeller). Introduction. Speed triangles. Fundamental equation of turbomachines. Second form of Euler's equation. Third form of Euler's equation. Study of the action and reaction blades. - Practice 3: Mobile steam turbine components. Blades.
5	5. Single-step thermal turbo-machine. Introduction. Selection of the degree of reaction. Shape of the fixed and mobile blades of action and reaction. Simple pressure and simple speed turbine. Simple reaction turbine.
6	6. Multi-step thermal turbomachine. Action turbine. Reaction turbines Comparison between Reaction and Action Turbines. - Practice 4: Presentation and analysis of the steam turbine simulator.
7	7. Diseño de turbinas. Toberas y Álabes. Proceso de diseño. Diseño preliminar. Requisitos y condiciones de servicio. Dinámica de fluidos computacional. Modelos CFD.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Description Theory and exercises exam	Written exam	No	Yes	30,00
Description Theory and exercises exam	Written exam	No	Yes	30,00
Description Classroom Practices	Others	No	Yes	20,00
Description Group work	Work	Yes	No	10,00
Laboratory practices	Laboratory evaluation	Yes	No	10,00
TOTAL				100,00

Observations

- FEBRUARY CALL:
1. Theory (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. The approved in theory is a condition to compute the rest of the parts of the subject in the final grade.
2. Practices in Classroom (20%)
Resolution and delivery of the problems proposed during classroom (will be resolved in class by a student with support of the teacher).
Classroom practices are recoverable in the final exam.
Final exam: for those students who do not pass it by course, on a date set in the exam calendar approved by the Board of the Center.
The approved in classroom practices is a condition to compute the rest of the parts of the subject in the final grade.
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 SEPTEMBER: 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.
- Mattingly J.D. Elements of propulsión. Gas turbines and Rockets. American Institute of Aeronautic and Astronautics. 2006.