SUBJECT TEACHING GUIDE

G1117 - Steam and Gas Turbines I

Degree in Maritime Engineering

Academic year 2020-2021

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	G1117 - 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	ANTONIO VEGA OMAÑA

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

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.

6. COURSE ORGANIZATION

	CONTENTS
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. Cycle Rankine. 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	Gas turbines. Basic cycles: General ideas. Introduction. Turbine classification. The turbine constant pressure combustion. Ideal Brayton cycle and real. Low pressure air thermodynamic tables.
3	Flow in fixed nozzles and crowns. Introduction. Continuity equation. Subsonic, transonic flow and supersonic in any conduit. Average speed in any section of the nozzle. Critical section of a nozzle. - Practice 1: Presentation, recognition and schematization of a conventional steam installation of a ship. - Practice 2: Fixed organs of steam turbines. Nozzles.
4	Transformation of mechanical and fluid energy in the mobile crowns with mobile blades (impeller). Introduction. Speed triangles. Fundamental equation of turbomachines. Second form of Euler's equation. Third form of Euler's equation. Study of action and reaction blades. - Practice 3: Mobile steam turbine organs. Blades.
5	Single-step thermal turbomachinery. Introduction. Selection of the degree of reaction. Form of fixed and mobile action and reaction blades. Turbine simple pressure and simple speed. Turbine simple reaction.
6	Multi-step thermal turbomachine. Action turbine. Reaction turbines Comparison between Reaction Turbines and action. - Practice 4: Presentation and analysis of the simulator steam turbines.
7	Turbine design. Nozzles and Blades. Process of design. Preliminary design. Requirements and conditions of service. Computational fluid dynamics. Models CFD. - Practice 5: Design of the section of a mobile blade

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

- 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 pass in TE 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.
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 pass in PA is a condition for computing 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.
- 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.