SUBJECT TEACHING GUIDE

G1090 - Steam and Gas Turbines II

Degree in Marine Engineering

Academic year 2021-2022

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	G1090 - 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
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Other lecturers	ANTONIO VEGA OMAÑA

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
- 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 of the 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.
- 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.
- Operation, monitoring, performance evaluation and maintenance of the propulsion system security and auxiliary machinery.
- Manage the operation of electrical and electronic control equipment.

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.

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 on the following aspects :
- 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.
- Practical knowledge: Start and stop the main propulsion machine and the auxiliary machinery, including the corresponding systems.
- Practical knowledge: Operation, monitoring, evaluation of performance and effective maintenance of the propulsion system security and auxiliary machinery.
- Theoretical knowledge: Project characteristics and system configurations of automatic control equipment and safety devices for the main engine.

6. COURSE ORGANIZATION	
CONTENTS	
1	Analysis of internal losses in steam turbines: Losses nozzles. Losses on fixed and mobile pallets. Losses output speed. Frictional losses disc and ventilation. Interstitial internal losses. External losses in a steam turbine: Losses mechanical. Losses by radiation and heat conduction To the exterior. Interstitial external losses. losses operation outside the design point Loses shock. Methods to reduce losses. powers and Returns. thermal balance.
2	Power control in steam turbines. Methods of power regulation. Regulation qualitative or throttling of steam. Regulation quantitative or varying the degree of admission. Mixed regulation. Regulation by direct steam passage I live to an intermediate staging. Regulating Condensing turbine. Turbine regulation backpressure. Willans straight.
3	Construction of steam turbines. materials used in the construction of steam turbines. Vanes. Discs and drums. Axes. Stator. diaphragms nozzle holder. Rotor. Types. Balanced static and dynamic. Manufacturing processes. Axis. Bearings. Shutters.
4	Condenser steam turbines. Calculation heat exchange surface. Growth control biological fouling film (Biofouling). Removal of biofouling
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 expansion. Closed cycles and combined.
6	Gas turbines. Compressors. Fundamental theory of Euler's equation. Compression ratio of a staggering. Moving vanes: Influence of the angle of blade outlet. Diffuser. Losses. Turbillion speed. Yields. Characteristic curves.
7	Combined Cycles. Introduction. Thermodynamic principles. Components. Cycle efficiency combined. Design of a combined cycle. COGAS / COGES naval systems.
8	Operation and Maintenance of Thermal Turbo Machines. Operation. Preventive Maintenance. Maintenance predictive. Corrective maintenance. Dilation and thermal stresses. Thrust balancing. Analysis of vibrations. - Practice 3. Operation of turbines. KONGSBERG turbine simulator.

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

- JUNE CALL:
1. Theory and problems (60%)
1st partial exams of problems and theory (15% + 15%): topics and date to be agreed.
2nd partial exams of problems and theory (15% + 15%): 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 set in the exam calendar approved by the Center Board.
The pass in theory / problems is a condition to compute the rest of the parts of the subject in the final grade.
2. Classroom Practices (20%)
Resolution and delivery of proposed problems (face-to-face at the beginning of the class / any exception will be justified and agreed with the teacher): 20%
Classroom practices are recoverable in the final exam by performing some extra exercises.
Final exam: for those students who do not pass it per course, on a date set in the exam schedule approved by the School Board.
The pass 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 to all students enrolled in the course. The contents of the works will be considered part of the subject, and may be asked in the theory exam.
3.2) Oral presentation according to the exhibition calendar. Presentation (30 min) of the work in its final form and assessment and questions by the teacher and classmates (15 min). To be qualified, it is a condition to participate in the act of exposition and defense of work. Not recoverable in the final exam.
4. Laboratory practices (10%)
Minimum compulsory attendance at 80% of the practical hours. Positive assessment of the memory of practices carried out. Not recoverable in the final exam.
- JULY CALL: Exam of the entire syllabus of the subject on a date set in the exam calendar approved by the School Board.

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. Editorial Dossat. Madrid. 1988.
- Pérez del Rio J. Tratado General de Máquinas Marinas. Máquinas de Vapor. Editorial Planeta. Volumen VII. Madrid. 1972.
- 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 Torralba 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.