SUBJECT TEACHING GUIDE

G595 - Thermodynamics and Thermal Machines

Degree in Energy Resources Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Energy Resources Engineering			Type and Year	Compulsory. Year 3
Faculty	School of Mines and Energy Engineering				
Discipline	Subject Area: Mining Pre-Technology Module: Training in Common with the Mining Branch				
Course unit title and code	G595 - Thermodynamics and Thermal Machines				
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. INGENIERIA ELECTRICA Y ENERGETICA
Name of lecturer	PABLO BERNARDO CASTRO ALONSO
E-mail	pablo.castro@unican.es
Office	E.P. de Ingeniería de Minas y Energía. Planta: + 0. DESPACHO SUBDIRECCION 059 (059)
Other lecturers	RAMON LECUNA TOLOSA CARMELA ORIA ALONSO

3.1 LEARNING OUTCOMES
- APPLICATION OF THERMODYNAMIC'S CONCEPTS TO ENGINEERING PRACTICE.
- KNOWLEDGE OF THE CYCLES OF THE MAIN HEAT ENGINES USED IN POWER GENERATION
- KNOWLEDGE OF THE BASIS OF HEAT TRANSFER

4. OBJECTIVES

KNOWLEDGE OF THE BASIC CONCEPTS OF THERMODYNAMICS AND HEAT TRANSFER.
APPLICATION OF THE THEORETICAL BASIS OF THERMODYNAMICS AND HEAT TRANSFER TO THE DESIGN OF THERMAL FACILITIES.

6. COURSE ORGANIZATION

CONTENTS	
1	THERMODYNAMICS
1.1	Fundamental concepts (thermodynamic system, system's properties, processes and state changes, equations of state)
1.2	The First Law of Thermodynamics (internal energy and heat, work, expression of the First Law, work done in closed systems, the First Law in open systems, mechanical irreversibility. sign convection for heat and work, Joule's Law, specific heat)
1.3	The Second Law of Thermodynamics (Second Law in cyclical processes, Second Law in non-cyclical processes, irreversibility calculation, efficiency in energetic processes)
1.4	State functions (perfect gases with variable heat capacities, steam, T-s diagram, h - s diagram)
2	CYCLES OF HEAT ENGINES
2.1	Power cycles (steam cycles, air cycles, Otto cycle, Diesel cycle, heat engines)
2.2	Refrigeration cycles (compression refrigeration, absorption refrigeration, heat pumps)
3	THERMOTECHNICS
3.1	Combustion (combustion properties, fuels, thermodynamics of combustion)
3.2	Psychrometry (psychrometric diagram, psychrometric transformations)
3.3	Heat transfer (conduction, convection, finned heat exchangers, radiation, overall heat transfer coefficient, Introduction to heat exchangers)

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
PERIODIC ASSESSMENTS	Written exam	No	Yes	30,00
FINAL EXAM	Written exam	Yes	Yes	30,00
LABORATORY PRACTICES	Laboratory evaluation	No	Yes	20,00
CLASSWORK	Work	No	No	20,00
TOTAL				100,00

Observations

TO ACCESS TO CONTINUOUS ASSESSMENT IS NECESSARY TO ATTEND A MINIMUM OF 75% OF THE CLASSES.
TO PASS THE SUBJECT AT LEAST 5 POINTS ARE NEEDED IS OBTAINED FROM THE SCORES OF THE PERIODIC ASSESSMENTS AND THE FINAL EXAM.
IF VIRTUAL TEACHING IS REQUIRED ALL THE ASSESSEMENTS COULD BE DONE VIA MOODLE

Observations for part-time students

PART-TIME STUDENTS MUST TAKE AN EXAM OF ALL THE CONTENTS OF THE SUBJECT, INCLUDED PRACTICAL ACTIVITIES, WITH THE 100% OF THE TOTAL SCORE IN THE ORDINARY OR EXTRAORDINARY CALL.
TO PASS THE COURSE IT IS NECESSARY TO OBTAIN A SCORE OF 50% OR MORE OF THE MAXIMUM SCORE.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

- TERMODINÁMICA LÓGICA Y MOTORES TÉRMICOS; AGÜERA SORIANO, J.; ED CIENCIA 3, S.A.
- PROBLEMAS RESUELTOS. TERMODINÁMICA LÓGICA Y MOTORES TÉRMICOS; AGÜERA SORIANO, J; ED
- FUNDAMENTOS DE TERMODINÁMICA TÉCNICA; MORAN, M., SHAPIRO, H.; ED REVERTE, S.A.
- THERMODYNAMICS: AN ENGINEERING APPROACH, CENGEL YUNUS A., BOLES MICHAEL A., ED. McGraw-HILL SERIES IN MECHANICAL ENGINEERING, 2007, 6th ed.
- THERMODYNAMICS: AN INTEGRATED LEARNING SYSTEM, PHILIP SCHMIDT. ET AL. HOBOKEN, NEW JERSEY: JOHN WILLEY & SONS, COP. 2006.