Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: Applied Thermodynamic			
ACADEMIC YEAR: 2018-2019			
TYPE OF EDUCATIONAL ACTIVITY: Basic			
TEACHER: Enrico Nino			
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phone: 0971205144		mobile (optional):	
Language: Italian			
ECTS: 9	n. of hours: 90	Campus: Potenza School of Engineering Program:	Semester: First

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course of Applied Thermodynamic is aimed at students of the mechanical course with the aim of providing the main concepts of classical thermodynamics by guiding them in understanding the phenomena of energy interaction between systems and the surrounding environment. In particular, the study starting from the thermodynamic balance of fluid systems (gases and vapors) will evolve in the study of thermodynamic transformations for the realization of direct and inverse thermodynamic cycles. The exchange of energy will be dealt with both from the point of view of the mechanical exchange and from the point of view of thermal energy exchange.

At the end of the course the student will be able to understand the interaction between system and environment and their evolution between different states of thermodynamic equilibrium;

The student will be able to draw direct and inverse thermodynamic cycles by quantizing energy exchanges and efficiency gains;

The student will be able to propose autonomous variations in the processes involved in the exchange of both mechanical and thermal energy.

PRE-REQUIREMENTS

Students must have acquired elements of math and physics analysis. In practice, it is suggested that students have taken the tests of Analysis 1 and Physics 1 or have studied the contents in order to acquire, with greater ease and profit, the contents of the course of Applied Thermodynamic.

SYLLABUS

Applied Thermodynamics:

Fundamental definitions. Balance and thermodynamic state. Heat exchange and workouts. Transformations almost static, reversible and irreversible. Volume shift work for reversible transformations and for irreversible quasi-static transformations. 1st Thermodynamics Principle. 1st Thermodynamics principle for open systems. 2 th Thermodynamics Principle: entropy of a closed or open system, Clausius statement, Kelvin-Plank statement, direct and inverse Carnot cycle. Mechanical energy equation for open systems. Diagram p, v (by Clapeyron). Diagram T, s of (Gibbs). Real pure substances. Phase rule. State Diagram T, p. Ideal gases: state equation, internal and enthalpy energy, specific heat, entropy, polypropic, adiabatic, isothermal, isobaric, isocorous transformations. Liquids and vapors: properties, state diagrams p-v; T-s; h-s; p-h. Direct cycles and gas thermal motors: alternative ignition internal combustion engines (Otto cycle) and spontaneous ignition (Diesel cycle), gas turbo-engines (Joule-Brayton cycle), regenerative gas turbo-engines (Joule-Brayton regenerative cycle). Direct Cycles and Steam Thermal Systems: Carnot cycle, Rankine steam cycle saturated, overheated and regenerated, regenerative steam. Steam reverse cycles: refrigerators, heat pumps.

Psychrometry:

Moisture properties (title, relative humidity, dew temperature, enthalpy), Mollier diagram.
Heat transfer:
Heat conduction. Fourier Law. General equation of conduction in Cartesian coordinates and for an indefinite cylinder. Driven in a single-layer flat wall. Conduction in a multilayer plane wall with known temperature of the boundary surfaces, with known fluid limit temperature. Driving in a multilayer cylindrical wall. Systems in non-stationary conditions with concentrated thermal capacity. Irradiation. Black body reading. Mutual exchange between black bodies. Thermal convection. Motorcycle and viscosity regime. Limit layer on a plate and in a circular duct. Dimensional analysis for forced and natural convection. Heat exchange applications: heat exchangers.

TEACHING METHODS

The course includes 90 hours of instructional lessons and exercises. In particular, there are about 54 hours of classroom lessons and about 36 hours of numerical classroom exercises.

EVALUATION METHODS

The objective of the exam is to check the level of achievement of the above-mentioned training objectives.
The exam is divided into a written test, consisting of two exercises to be performed in one hour's time, and an oral exam. The oral test provides for discussion of any problems encountered in carrying out written tests and in-depth studies on the main issues of applied thermodynamics and heat transfer

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- V. Betta, G. Alfano; Fisica Tecnica, Liguori Editore.
- Cavallini, L. Mattarolo; Termodinamica applicata, Cleup.
- Principi di trasmissione del calore. F. Kreith. LIGUORI.
- Elementi di trasmissione del calore. G. Guglielmini, C. Pisoni. MASSON.
- Trasmissione del calore. C. Bonacina, A. Cavallini, L. Mattarolo. CLEUP
- Notes from lessons

INTERACTION WITH STUDENTS

At the beginning of the course the objectives, the program and the verification method will be described. The e-mail address and how to contact the teacher will be provided.
Reception hours: Wednesdays from 4:00 pm to 6:00 pm at the teacher's office.
In addition to the weekly reception time, the teacher is available for clarification at the end of each lesson.

EXAMINATION SESSIONS (FORECAST)[1]

19/10/2018; 16/11/2018; 18/01/2019; 22/02/2019; 22/03/2019; 12/04/2019; 17/05/2019; 21/06/2019; 19/07/2019

SEMINARS BY EXTERNAL EXPERTS YES □ NO X

FURTHER INFORMATION

[1]