UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Energetic Sustainability

2122-1-F1701Q142

Aims

Analysis of energetic aspects connected with the use of energetic resources and with the energetic sustainability referred to global and local contests.

Contents

Thermodinamics

Thermal machines

Refrigeration machines

Energy Saving

Global energy system

Environmental effects of energy consuption

Detailed program

Thermodinamics

- Concept of temperature and of thermodinamic system
- First law of thermodinamics: the conservation of energy
- Hentalpy and its application to thermal reactions
- Second law of thermodinamics: reversibility and irreversibility
- Entropy function and its evolution
- Thermodinamic efficiency

Thermal machines

- Internal combustion engines
- Otto cycle (gasoline engine)
- Diesel cycle
- Brayton cycle (turbine engine)
- Fuels for internal combustion engines
- External combustion engines
- Rankine cycle
- Cogeneration systems
- Optimization of the thermal machines

Refrigeration Machine

- Cooling performance coefficient
- Cooling cycles
- Refrigerant gasses
- Heat pumps
- Geothermal application of heat pumps
- Trigeneration systems

Energy Saving

- Energy saving strategies
- Determination of energy efficiencies in various technological applications
- Dispersion of heat
- Methods for efficient use of energy
- Comparison between differet technologies for energy saving

Global energy system

- Global energy balance
- Distribution of energy consuption
- Evolution of energy consuption
- Energy requests by their possibile applications
- Peculiar aspects of global energy consuption
- Peculiar aspects of energy consuption in Italy

Environmental effects of energy consuption

- Earth's radiation balance
- Temperature on Earth
- Earth atmosphere and greenhouse effect
- Possible reasons of the global warming

- Radiative forcing
- Global effect on Earth climate changes
- Strategies to mitigate the global warming

Prerequisites

Basic knowledge of the three-year degree in physics

Teaching form

Lectures.
Some seminars on specific arguments will be organized as parts of the course program.

Textbook and teaching resource

Egbert Boeker and Rienk Van Grondelle - Environmental Physics: Sustainable Energy and Climate Change (3rd edition)

David JC MacKay - Sustainable Energy — without the hot air (2008) - https://www.withouthotair.com

Y. A. Çengel – Introduction to thermodynamics and heat transfer – McGraw-Hill

During the course some bibliographic references will be indicated and some lecture notes will be available

Semester

Second semester

Assessment method

Oral examination - No intermediate evaluation will be organized

- Discussion on argument presented during the course
- Analysis on some aspects related to production and use of energy
- Description of possible approaches connected with energy sustainability

Office hours

Monday - Friday by appointment