MEC 1203: Engineering Thermodynamics

Hours per semester				Weighted total mark	Weighted exam mark	Weighted continuous assessment mark	Credit unit
LH	PH	TH	CH				CU
45	30	75	60	100	60	40	4

Course Description

This course introduces students to the principles and laws of thermodynamics. It covers the basic concepts such as definitions, properties of state and laws as well as thermodynamic processes.

Course Objectives

At the end of this course, the student should be able to:

- Exhibit working knowledge of the basic thermodynamics principles especially those applied in energy conversion technologies
- Understand the laws of thermodynamics and appreciate their importance in the Engineering Application
- Read and understand the use the tables of thermodynamic properties, e.g steam tables
- Solve problems related to changes in state related to thermodynamic processes

Course Outline

Basic definitions and Introduction: (4 Hours)

- Thermodynamic system and control volume
- Thermodynamic property and process
- Homogeneous and heterogeneous systems, and pure substance
- Equilibrium and quasi-static process
- Units and dimensions

Temperature: (4 Hours)

- Definition of temperature
- The zeroth law of thermodynamics and measurement of temperature
- Relationship between various temperature scales
- Equation of state and ideal gases
- Specific heat capacities and perfect gases

- Ideal gas temperature

Work and Heat Transfer (2 Hours)

Working fluids: (8 Hours)

- Pure substances, phase change and phase diagrams and
- Interpretation of steam tables

First law of thermodynamics: (6 Hours)

- As applied to closed systems
- As applied to open systems
- Internal energy and enthalpy
- Steady flow
- Applications of the steady flow energy equation

Second law of thermodynamics: (6 Hours)

- Heat engines and refrigerators
- Thermal energy reservoirs
- Statement of the second law of thermodynamics
- The Carnot cycle and absolute thermodynamic temperature scale
- Entropy

Thermodynamic Cycles: (8 Hours)

- Performance Criteria for Thermodynamic Cycles
- Gas Power Cycles (The Carnot cycle for a perfect gas; Stirling and Ericsson Cycles; The Constant Pressure (Joule-Brayton) Cycle)
- Air Standard Cycles (Otto and diesel cycles; The Dual Combustion (Mixed) Cycle)
- Vapour Power Cycles (The Carnot Cycle and Steam Plant; The Rankine Cycle; The Reheat Cycle; The Regenerative Cycle)

Introduction Combustion: (7 Hours)

- Fuels and combustion
- Theoretical and actual combustion processes
- Enthalpy of formation and enthalpy of combustion

- First law analysis of reacting systems
- Adiabatic flame temperature

Practicals (30 Hours)

Mode of Delivery

The course will be taught by using lectures, tutorials, assignments and practical thermodynamics laboratory sessions.

Mode of Assessment

This shall be by practicals, assignments, tests and examination. The relative contribution to the final grade will be as shown below:

Assessment Contribution

Tests / Assignments/ Practicals 40% Final Examinations 60% Total 100% **Reference Materials**

Cengel A. Yunis, Boles, A. Michael: Thermodynamics: An Engineering Approach, , 2008. ISBN-B0010QUF4U

Eastop T.D., MacConkey: Applied Thermodynamics for Engineering Technologists, 1996 ISBN 10 058 209 1934