ENG 3165 THERMODYNAMICS AND FLUID MECHANICS

COURSE OUTLINE

LECTURER – ELIJAH CHIBWE

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COURSE OUTLINE

- This course will cover the basics of thermal and fluid-based systems.
- It includes conservation of mass, energy and entropy balance, as applied in modern engineering.
- The course coverage is a mixture of two broad engineering concepts, namely:
    1. Thermodynamic, and
    2. Fluid mechanic.
- The following topics will be covered as part of this course.

Introduction to Energy Systems

- Introduction to energy systems, basic principles of energy conversion and control volume.

Introduction to Fluid Mechanics

- Definition and properties of fluids, units and dimensions. Pressure, manometric, forces on submerged planes, buoyancy, flotation.

General Fluid Motion:

- The continuum and control volume concepts. Ideal flow concepts of fluids in conduits and open channels..

Conservation of mass and energy:

- Continuity and mass flow. Impulse-momentum principles, applications, losses in pipe bends nozzles. Bernoulli's equation and its applications.

Fluid Work, Energy and Power:

- Application of continuity, energy, and momentum principles to flow of real fluids through pipes, losses in pipes.

Thermodynamic Concepts:

- The thermodynamic fluid and its properties, the equilibrium state, Definition of work and heat, processes and the concept of systems. Energy conversion and the first law of thermodynamics. The second law of thermodynamics, reversibility and enthalpy.

Systems and Cycles:

- Closed systems, steady flow in open systems. Ideal and real gases, properties of steam, the Mollier diagram. The Carnot cycle, vapour power cycles, the Rankine cycle. Heat engines, steam engines, steam turbine. Introduction to heat transfer; cooling of equipment, heat exchangers.

General application of fluid-based and thermodynamics systems in power generation

- Fluid-based (hydro power plant, wind turbines), thermodynamics (thermal power plant – coal-fired, petroleum-fired, gas-fired, Nuclear-powered)

Upon successful completion of this course, students will be able to:

1. Demonstrate an understanding of the thermodynamic properties and equations of state.
2. Demonstrate knowledge of the first law of thermodynamics.
3. Demonstrate an ability to apply the first law of thermodynamics to engineering processes.
4. Demonstrate an understanding of entropy and the second law of thermodynamics.
5. Demonstrate an ability to apply the second law of thermodynamics to real systems.
6. Demonstrate an ability to analyze reversible and irreversible systems.
7. Demonstrate an ability to apply the laws of thermodynamics to steady state open systems.
8. Demonstrate an ability to analyze one or more applications such as vapor power systems, gas power systems, refrigeration, heat pumps, etc.
9. Fundamentals of fluid mechanics
10. Demonstrate an understanding of the interrelation between fluid flow and thermal energy transfer

Course Assessment

COMPONENT OF ASSESSMENT	NUMBER	CONTRIBUTION OVERALL GRADING (%)
LABS	6	15
ASSIGNMENTS / MINI PROJECTS	10	5
TESTS	1	20
SUB-TOTAL OF CONTINUOUS ASSESSMENT		40
FINAL EXAMINATION	1	60

Prescribed Text Books

1. Rayner Joel (1996), ***Basic Engineering Thermodynamics***, Fifth Edition, ISBN 0-582-25629-1, Addison Wesley Longman Limited, United Kingdom
2. R. K. Rajput (2011), ***A Textbook of Fluid Mechanics and Hydraulic Machines***, Revised Edition, S. Chand and Co. Ltd, New Delhi India
3. 1. Yunus A. Qengel, John M. Cimbala (2018) **Fluid Mechanics Fundamental and Application**, 4th Ed, ark:/13960/t3232m198.