

III CHE363 Fuels and Energy

Course Outlines

- **Title:** Fuels and Energy
- **Code Number:** CHE 363
- **Semester:** 6th
- **Credit Hours:** 3
- **Pre-requisites course requirements/ skills:** CHE 122, CHE 231
- **Learning Outcomes:**

Upon successful completion of the course, the students will be able to

1. Explain the types, sources and resources of energy
2. Discuss different conversion technologies and their environmental impacts
3. Solve problems related to fuels and energy

- **Contents**

Unit I: Introduction

- 1.1 Energy sources and resources
- 1.2 Classification of fossils and hydrocarbon fuels
- 1.3 Fuel Properties and characterization

Unit II: Principles of Combustion

- 2.1 Combustion of solid, liquid and gaseous fuels
- 2.2 Mechanism and kinetics of combustion
- 2.3 Combustion calculations

Unit III: Fuel Upgradation

- 3.1 Carbonization, liquefaction and gasification of coal
- 3.2 Fisher-tropsch process and clean coal technology
- 3.3 Petroleum refining
- 3.4 Natural gas processing and syngas production
- 3.4 Synthetic fuels

Unit IV: Combustion Technologies

- 4.1 Fluidized bed combustion boilers
- 4.2 Furnaces
- 4.3 Waste heat recovery
- 4.4 Synthetic liquid fuels
- 4.5 Internal Combustion Engines

Unit V: Energy Conversion

5.1 Overview of energy conversion technologies

5.2 Engineering thermodynamics for process utility boilers, heat pumps, steam turbine Combined heat and power (CHP) and gas turbine CHP

5.2 Energy conversion performance for process parameters and process head load

Unit VI: Emission Control

6.1 Greenhouse gas emission consequences of energy efficiency measures in industry

6.2 Greenhouse gas emissions from industrial energy systems

6.3 Optimization of industrial energy systems

6.4 Potential for greenhouse gas emissions reduction in industry

6.5 Overview of energy policy instruments and their impacts

Unit VII: Alternative Resources of Energy (ARE)

7.1 Introduction to ARE sources

7.2 Methods of production of fuel from biomass

7.3 Biomass volatilization

7.4 Kinetics of gasification

7.5 Solar, hydel, wind and geothermal energy

7.6 Gasification and liquefaction of forest products

7.7 Energy conversion methodologies of selected systems

- **Teaching-learning Strategies**

The teaching and learning strategy have been designed on the understanding of concepts and the ability to critically analyze and apply the learned content through lectures, discussion, activities, case studies using computer, multi-media and writing board instructional aids.

Lectures: 3 hours per week

- **Assignments- Types and Number with calendar**

A minimum of two assignments to be submitted before the written exam of final term

- **Assessment and Examinations**

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written examination at the mid-point of the semester.

2.	Formative Assessment	25%	It includes: classroom participation, attendance and assignments.
3.	Final Assessment	40%	Written examination at the end of semester.

- **Textbooks and reference readings**

- 1 Turns, S.R. (2011) An introduction to combustion: Concepts and Applications. 3rd ed. McGraw-Hill.
- 2 Griffiths, J.F. and Barnard, J.A. (1995) Flame and combustion. 3rd ed. Blackie Academic and Professional.
- 3 Harker, J.H. and Buckhurst, J.R. (1981) Fuel and energy. Academic Press.
- 4 Smith, M.L. and Stinson, K.W. (1952) Fuels and combustion. McGraw-Hill.