

**COURSE CODE:** ENE-454  
**COURSE NAME:** Energy Resources and Management  
**CREDIT HOURS:** Theory = 3 Practical = 0 Total = 3  
**CONTACT HOURS:** Theory = 48 Practical = 0 Total = 48  
**PREREQUISITE:** None  
**MODE OF TEACHING:** Three hours of lecture per week

**COURSE DESCRIPTION:**

This course is designed to familiarize the students of environmental Engineering with energy, its quantification, its various forms, and sources as well as global energy mix. The course is divided into seven chapters. The first chapter discusses the relationship among force, energy, and work as well various forms of energy. Second, third and fourth chapters of the course will be covering the renewable sources of energy, namely solar, wind and hydel energy. Fifth chapter discusses the energy and environment with a focus on GHG emissions. Sixth chapter discusses Energy management including energy audit. Seventh chapter describes the energy mix over the globe. Besides, students will also have an introduction to the energy management software RETSCREEN.

**COURSE OBJECTIVES:**

The main objective of this course is to provide a comprehensive package of the concepts related to energy, discuss the design aspects of renewable energy technology, and introduce the assessment of the feasibility of the renewable energy projects.

**RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):**

The course is designed so that students will achieve the PLOs:

- |                                    |                          |                                   |                                     |
|------------------------------------|--------------------------|-----------------------------------|-------------------------------------|
| 1 Engineering Knowledge:           | <input type="checkbox"/> | 7 Environment and Sustainability: | <input checked="" type="checkbox"/> |
| 2 Problem Analysis:                | <input type="checkbox"/> | 8 Ethics:                         | <input type="checkbox"/>            |
| 3 Design/Development of Solutions: | <input type="checkbox"/> | 9 Individual and Teamwork:        | <input type="checkbox"/>            |
| 4 Investigation:                   | <input type="checkbox"/> | 10 Communication:                 | <input type="checkbox"/>            |
| 5 Modern Tool Usage:               | <input type="checkbox"/> | 11 Project Management:            | <input type="checkbox"/>            |

6 The Engineer and Society:

12 Lifelong Learning:

### **COURSE LEARNING OUTCOMES:**

Upon successful completion of the course, the student will demonstrate competency by being able to:

| <b>Sr. No.</b> | <b>CLO</b>  | <b>Domain</b> | <b>Taxonomy Level</b> | <b>PLO</b> |
|----------------|---|---------------|-----------------------|------------|
| 1              | <b>APPLY</b> the concepts involved in energy quantification and energy management | Cognitive     | 3                     | 6          |
| 2              | <b>MAKE USE OF</b> the technical aspects of the renewable energy resources        | Cognitive     | 3                     | 7          |

### **Complex Engineering Problem**

|   |  |           |   |   |
|---|--|-----------|---|---|
| 3 | Conduct the energy audit of on-campus buildings and consequently <b>ANALYZE</b> the use of renewable energy resources to power up buildings. | Cognitive | 4 | 7 |
|---|--|-----------|---|---|

### **PRACTICAL APPLICATIONS:**

World in general and Pakistan in specific, are running out of the conventional energy resources with ever increasing energy demand. This course will enable the environmental engineering students to understand the relationship between energy and environment, the potential role of renewable energy resources for the clean energy extraction soon, efficient usage of energy in the institutional buildings as well as industrial units.

### **TOPICS COVERED:**

| <b>Week</b> | <b>Topic Covered</b>  | <b>Reading Assignment/<br/>Homework</b> | <b>CLO #</b> |
|-------------|---|---|--------------|
| 1           | Types of energy   | Chapter 1                               | 1            |
| 2           | Force, Work, energy, Power, Energy Conservation and Energy Efficiency | Chapter 1<br>Quiz 1                     | 1            |
| 3           | Renewable Energy: Solar Energy  | Chapter 2                               | 2            |
| 4           | Renewable Energy: Solar Energy  | Chapter 2                               | 2            |
| 5           | Renewable Energy: Solar Energy  | Chapter 2<br>Quiz 2<br>Assignment 1     | 2            |

|    |  |                                     |   |
|----|--|-------------------------------------|---|
| 6  | Renewable Energy: Wind Energy                                      | Chapter 3                           | 2 |
| 7  | Renewable Energy: Wind Energy                                      | Chapter 3<br>Assignment 2<br>Quiz 3 | 2 |
| 8  | Renewable Energy: Hydel Energy                                     | Chapter 4                           | 2 |
| 9  | <b>Mid Semester Exam</b>   |                                     |   |
| 10 | Renewable Energy: Hydel Energy                                     | Chapter 4<br>Quiz 4<br>Assignment 3 | 2 |
| 11 | Perspectives of World Energy Production and Consumption            | Chapter 6<br>Assignment 4           | 1 |
| 12 | Environmental Impacts of Energy Production, GHG and Kyoto protocol | Chapter 6<br>Quiz 5                 | 1 |
| 13 | Energy Management  | Chapter 7<br>Assignment 5           | 1 |
| 14 | Energy Management  | Chapter 7                           | 1 |
| 15 | Energy Management  | Chapter 7                           | 1 |
| 16 | Energy Management  | Chapter 7                           | 1 |
| 17 | Software Introduction: RETScreen                                   | -                                   | 1 |
| 18 | <b>End Semester Exam</b>   |                                     |   |

**Practical:**

Not Applicable.

**TEXT AND MATERIAL:**

**Textbook (s)**

- 1- Energy and Environment, Willey, 2nd Ed. 2005
- 2- Lecture Notes

**References Material:** (Books available in soft)

- 1- Turner, Wayne C., and Steve Doty. *Energy management handbook*. The Fairmont Press, Inc., 2007.
- 2- Moss, Keith J. *Energy management in Buildings*. Taylor & Francis, 2006.

**ASSESSMENT SYSTEM:**

|                                |             |
|--------------------------------|-------------|
| <b>Theoretical/Instruction</b> | <b>100%</b> |
| <b>Assignments</b>             | <b>10%</b>  |
| <b>Quizzes</b>                 | <b>15%</b>  |
| <b>Mid Semester Exam</b>       | <b>25%</b>  |
| <b>End Semester Exam</b>       | <b>50%</b>  |
| <b>Practical Work</b>          | <b>0%</b>   |
| <b>Lab Attendance</b>          | <b>0%</b>   |
| <b>Lab Report</b>              | <b>0%</b>   |
| <b>Lab Quiz</b>                | <b>0%</b>   |
| <b>Lab Rubrics</b>             | <b>0%</b>   |