

COURSE CODE: GIE-455

COURSE NAME: RENEWABLE ENERGY RESOURCES

CREDIT HOURS: Theory = 02
 Practical = 01
 Total = 03

CONTACT HOURS: Theory = 32
 Practical = 48
 Total = 80

PREREQUISITE: NIL

MODE OF TEACHING:

Instruction: Two hours of lecture per week 67%
 Practical: Three hours of Lab work per week 33%

COURSE DESCRIPTION:

The students will learn about the different types of energy, conversion techniques from one energy form to another. Students will be able to perform a better comparative analysis between renewable and conventional energy resources. Students will get familiar about E3 criterion. Students will be given introduction to different software's that are used to analyze and study different renewable energy resources.

COURSE OBJECTIVES:

The students are expected to achieve understand.

- Basic definitions, principles and applications of energy, work, power, energy conservation, energy efficiency, energy pyramid, environment and economics, energy mix of the world in context of climate change
- Apply GIS and Remote Sensing knowledge to combat national and international energy crisis.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

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

- | | | | | | |
|---|----------------------------------|-------------------------------------|----|---|--------------------------|
| 1 | Engineering Knowledge: | <input type="checkbox"/> | 7 | Ethics: | <input type="checkbox"/> |
| 2 | Problem Analysis: | <input type="checkbox"/> | 8 | Individual and Collaborative Team Work: : | <input type="checkbox"/> |
| 3 | Design/Development of Solutions: | <input checked="" type="checkbox"/> | 9 | Communication: | <input type="checkbox"/> |
| 4 | Investigation: | <input checked="" type="checkbox"/> | 10 | Project Management: | <input type="checkbox"/> |
| 5 | Tool Usage: | <input type="checkbox"/> | 11 | Lifelong Learning: | <input type="checkbox"/> |
| 6 | The Engineer and Society: | <input checked="" type="checkbox"/> | | | |

COURSE LEARNING OUTCOMES:

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

No.	CLO	Domain	Taxonomy Level	PLO
1	Develop solutions for various renewable sources under different scenarios using spatial and non-spatial approaches	Cognitive	3	3
2	Distinguish different sources of energy in terms of impacts to economy, society, and climate	Cognitive	4	4
3	Apply concepts of renewable energy for climate change reduction in accordance with Kyoto Protocol for sustainable environment	Cognitive	3	6

TOPICS COVERED:

Theory:

No.	Topic
1	Energy and its Types <ul style="list-style-type: none">• Thermal Energy• Chemical Energy• Electromagnetic Energy• Nuclear Energy• Mechanical Energy
2	Energy conservation, Energy Efficiency and Energy Pyramid
3	Conventional and Renewable Energy Resources
4	Energy Mix of the world (why Renewable energy is the need of time?)
5	Energy Mix of Pakistan and its Details
6	Fossil Energy Resources and Technologies
7	Renewable Energy Resources <ul style="list-style-type: none">• Types of Renewable Energies• Solar Energy (thermal and photovoltaics)• Wind Energy (resources, turbines, and applications)• Hydropower (resources, turbines, small hydro power systems and applications)• Biomass Energy (resources, thermal and non-thermal applications of biomass, and biofuels)• Geothermal Energy (resources, heat, and electricity applications)• Other Renewable Energy Resources (Tidal, Wave and Ocean Thermal Energy Conversion)
8	Renewable Energy and Climate Change
9	Greenhouse Gases and Climate Change <ul style="list-style-type: none">• Energy Use and the Greenhouse Effect, Greenhouse Gases: Types and Sources, Climate Change Impacts

10	International Climate Change Conventions, Protocols and Perspectives <ul style="list-style-type: none"> • Developing vs. Developed Country Perspectives on GHG Mitigation • United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Parties • The Kyoto Protocol and Flexible Mechanisms: Clean Development Mechanism (CDM), Emission Trading.
11	RETSCREEN software for the feasibility analysis of Renewable energy Technologies
12	GIS and Remote Sensing applications for Renewable Energy Resources
13	Spatial Modelling approaches for Renewable Energy Resources
14	Geospatial Case Studies for Renewable Energy Mapping
15	Projects week and advanced technologies

Lab Work:

Focus will be on “GIS Based Application” for the designing and the analysis of Renewable Energy Systems

- Solar water heating system
- Photovoltaic systems
- Energy efficiency and conservation
- Solar Potential Sites
- Wind Potential Sites Following software's will used.
 - ArcGIS / QGIS / Python / Web Application
 - RETSCREEN
 - Solar GIS
 - Manuals are available online at www.retscreen.com

TEXT AND MATERIAL:

S. No.	Title	Author(s)	Remarks
1.	Fundamentals of Renewable Energy Process	Aldo V Da.Rosa	Text
2.	Renewable Energy Conversion, Transmission and Storage	Bent Serensen	Reference
3.	Handbook of Energy Efficiency and Renewable Energy	CRC Press	Reference

ASSESSMENT SYSTEM:

1. CLOs Assessment

Cognitive	Psychomotor	Affective
Spreadsheet	Rubrics	-

2. Relative Grading

Theoretical/Instruction			67%
	<i>Assignments 10-15%</i>		
	<i>Quizzes 10-15%</i>		
	<i>Mid Semester Exam 25-30%</i>		
	<i>End Semester Exam 40-50%</i>		
Practical Work			33%
<i>Laboratory Work</i>		80%	
	<i>Laboratory Report / Rubrics 60%</i>		
	<i>Laboratory Quiz 20%</i>		
<i>Viva/Quiz</i>		20%	
Total			100%