a. Course Code ESE-832

b. Title Energy and Climate Change

c. Credit Hours 3

d. Objectives

The objectives of this course are:

a. To elaborate the fundamental concepts of climate change: Science history,
b. To explain the Energy causes of Climate Change (natural and anthropogenic): Greenhouse Effect, Sources of Greenhouse Gases (transport, power generation, industry).
c. To discuss in detail the Effects of Climate Change: agriculture, water, food security, ecology, human health
d. To enlighten the Impacts of Climate Change: floods, droughts, extreme heat and cold waves, shifting weather patterns, hurricanes.
e. To discuss the Pakistan's Policy Options and Strategy: Adaptation or Mitigation strategies. Role of renewable energy resources.
f. To equip students with Pakistan's Stance in Global Negotiations

Outcomes

9. The course should enable the student to:

a. Understand the fundamentals of climate change science for an interdisciplinary approach to solving sustainability challenges
b. The ability to communicate their instance to professionals, policymakers and the general public.
c. The breadth of vision to recognize the social, economic, and environmental concerns with Primary and secondary energy resources.
d. The critical thinking skills to approach sustainability.

10. **Contents with suggested contact hours:**

No.	Topics	Semester Weeks	Contact Hours
	Science of Climate Change	2 Weeks	6

1.	1. Introduction to Climate change: History, Scientific basis 2. Introduction to Earth Science: Structure, historical changes		
	3. Climate change Energy Causes , Effects, Scientific consequences i. The Science of global warming: natural and human forcing factors ii. Greenhouse gasses and Biogeochemical Cycles	3 Weeks	9
2.	**Impacts of Climate Change** 4. Impacts of climate change on human, societies and on natural ecosystems (Agriculture, Water, Food security & Economics). 5. Monitoring of global warming and changing environmental conditions 6. Vulnerability of Pakistan due to Climate Change	3 Weeks	9
3.	**Addressing Climate Change (Mitigation and Adaptation)** 7. Global, Regional and National Climate Change mitigation & Adaptation 8. Role of Renewable energy resources 9. Energy and transport for the future: energy efficiency; alternatives available for residential, industrial, or transportation sectors; or explorations of the decarbonization.	3 Weeks	9
4.	**Climate Change Governance (Global Efforts)** i. International dimensions of climate change (UNFCC, IPCC) ii. Role of National and International Bodies iii. Pakistan National Climate Change Policy iv. Pakistan's Stance in Global Negotiations	3 Weeks	9
	Invited speaker Talk/Case study		3
	Total	15 Weeks	45

11. Details of lab work, workshops practice (if applicable).

No lab is required.

12. Recommended Reading (including Textbooks and Reference books).

No.	Title	Author	Type
1.	Comprehensive Guide to Climate Change-5th Edition (2015)	John Houghton	Text Book
2.	Energy and Climate Change: Creating a Sustainable Future (2008)	David Coley	Ref Book
3.	Renewable Energy and Climate change (2013)	Volker Quaschning	Ref Book
4.	Climate Change Profile of Pakistan (2017)	Asian Development Bank	Ref Book
5.	IPCC Assessment Reports (2017)	IPCC	Report
6.	UN Climate Change Annual Report (2017)	IPCC	Report
6.	Working Group I Report "Climate Change 2013: The Physical Science Basis" Working Group II Report "Climate Change 2014: Impacts, Adaptation, and Vulnerability Working Group III Report "Climate Change 2014: Mitigation of Climate Change"	IPCC	Report