

Course Contents

1. Give details of the course, on the following lines:
 - a. Course Code ESE- 840
 - b. Title Energy for Sustainable development
 - c. Credit Hours 3
 - d. Objectives

The objectives of this course are:

- To develop an understanding of the principles of development and sustainability in the context of renewable and non-renewable energy sources.
- To explain the social, environmental and financial implications of technologies to de-carbonise emissions and technologies that can offer a future non-carbon energy supply as per country INDC commitments.
- To investigate the appropriateness of a selected energy source or a selected technology for a particular country, region or location.

- To look at the policy impacts on the current and future energy system of the country

- To help the students for establishing business models for sustainable energy

e. **Outcomes**

The course should enable the student to:

- Critique energy systems and sources for their sustainability

- Possess in-depth knowledge and understanding of the inseparable social, technical and environmental dimensions of whole energy systems and energy transitions

- Critically look into existing consumption patterns and technologies for reducing the overall energy intensity
- Analyze the conflicting outcomes arising from the need for increased energy use in most developing countries and the global and local needs for sustainability and minimal environmental impact
- Understand and to be able to analyze the role of different policy and regulatory regimes of the energy sector in infusing sustainable development
- Develop business models for the energy sector aimed at sustainable development
- Identify the policy gaps and recommendations to achieve sustainable development of the energy system
- Be able to communicate with relevant stakeholders on relevant issues of sustainability and energy

f. Contents with suggested contact hours

No.	Topics	Book	Contact Hours
1.	<p>Introduction: Energy and Development</p> <ul style="list-style-type: none"> • Sustainability Concept and indicators • Frame Work of sustainable development • Sustainability indicators • Sustainable Development Goals (SDGs) & Linkage of SDG7 with all UN SDGs • International Protocols Regarding Global Climate Change due to energy usage 	QN	8

	<ul style="list-style-type: none"> • Role of energy in sustainable development 		
2.	Energy Resources – Supply and Demand <ul style="list-style-type: none"> • Energy Consumption and Demand-Global perspectives • Renewable and conventional energy resources for sustainable energy supplies • Waste to energy Techniques • World conflicts and Energy Security, Affordability, Accessibility • Importance of Energy Efficiency & conservation at supply and demand-side • Transmission and distribution system challenges • Energy demand forecasting-Challenges and opportunities 	QN & MH	9
3.	Sustainable energy markets <ul style="list-style-type: none"> • Nature and functioning of markets for sustainable energy resources (global and local trends) • Incorporation of sustainable energy resources in existing and upcoming energy markets • Sustainable & efficient utilization of conventional energy resources for net-zero emissions in developing countries • Sustainable water usage for the power generation systems • Forces of sustainable energy markets (in developed and developing countries) • Circular debt in Power sector: Core Issues, 	MH	9

	<p>Challenges, and Sustainable solution Energy</p> <ul style="list-style-type: none"> • Carbon Capture and storage 		
4.	<p>Energy governance and regulations</p> <ul style="list-style-type: none"> • The suitability and need for change in the existing institutional and governance structure of the energy sector of Pakistan to sustainable development • Review of institutional, policy and regulatory regimes of the energy sector from the lens of sustainable development • Analysis of different policy issues on the sustainability of energy resources, such as oil prices, technology prices, tariffs, indigenization, institutional environment, taxes and subsidies, etc • Visualization and analysis of regulatory governance and substance to invoke sustainable development 	Energy Policy And Regulations of Pakistan AB	9
5.	<p>Key Emerging Technologies for sustainable development</p> <ul style="list-style-type: none"> • Hydrogen economy for sustainable development—opportunities and challenges for developing countries • Repowering of the power plants-Conventional and non-conventional • Sustainable energy access in Rural and Isolated Areas 	AB	6
6.	<ul style="list-style-type: none"> • Seminar by Government or Private sector Expert 		4
Total			45

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

No lab is required.

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

S. No.	Title	Author(s)	Assigned Code	Remarks
1.	Energy and Sustainable Development	Quinta Nwanosike Warren 2020	QN	Reference Book
2.	Greenhouse Solutions with Sustainable Energy, University of New South Wales Press	Diesendorf, M (2007)	DM	Reference Book
3.	Energy for sustainable development; Demand, supply, conversion and management	Dr.Md Hasanuzzaman & Dr. Nasrudin Abd Rahim (2020)	H&N	Reference Book
4.	Exergy: Energy, Environment and Sustainable Development	Ibrahim Dincer, Marc A. Rosen	ID	Reference Book
5	Hydrogen Energy: Background, Significance and Future	Albert O. Backus	AB	Reference Book
6	Energy for Sustainable Development	Md Hasanuzzaman, Nasrudin Abd Rahim	MH	Reference Book