Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: SEE6xxx
2. Course Title: Energy Transition Economics: Market, Policy, and Quantitative Modeling
3. Per Week Lectures: 3 (L)

   Credits (3*L+2*T+P+A): 9 Duration of Course: Full Semester
4. Proposing Department/IDP: Sustainable Energy Engineering

   Other Departments/IDPs which may be interested in the proposed course:

   ECO, DOMS, CE, EE, CHE

   Other faculty members interested in teaching the proposed course:
5. Proposing Instructor(s): Deepika Swami
6. Course Description: This course provides an understanding of the energy systems from an economic perspective, focusing on how resources are allocated, priced, and governed to meet growing energy needs under environmental and sustainability constraints. It explains the drivers of energy demand and supply, evaluates energy investments using standard financial and economic criteria, and assesses the functioning of energy markets. Students will also gain the ability to interpret energy data, apply decomposition and elasticity concepts, and utilize modeling frameworks to analyze future energy scenarios and transition pathways. Overall, the course will equip them with the capacity to critically evaluate alternative energy strategies and support evidence-based decision-making in the context of climate change and low-carbon development.

A) Objectives: The objective of this course is to develop an understanding of the economic principles governing energy systems and their role in shaping energy transitions. The course aims to equip students with the analytical tools required to examine energy demand and supply, evaluate investments, assess market behaviour, and analyze policy instruments designed to address market failures and climate change. By integrating concepts of efficiency, economic decision-making, and quantitative modeling, the course enables students to critically evaluate conventional and low-carbon energy pathways. These tools enable students to evaluate long-term energy pathways, technology choices, and policy impacts under uncertain market scenarios.

B). Contents

S. No	Broad Title	Topics	No. of Lectures
1.	Energy Landscape	1.1.Energy transition in historical perspective 1.2.Global and Indian energy scenario 1.3.Energy consumption and energy flow 1.4.Fossil fuels and Renewable Energy 1.5.Energy and Climate Change	4
2.	Energy resource management	2.1. Energy as an economic resource 2.2. Energy measurement 2.3. Energy accounting 2.4. Efficiency and Optimization	5

		2.5. Sustainable supply chain	
3.	Economics of energy demand	3.1.Factors driving energy demand 3.2.Price and income elasticity of energy demand 3.3.Sectoral energy demand 3.4.Decomposition Analysis: IDA, LMDI 3.5.Behavioral economics 3.6.Digitization and AI	10
4.	Energy Supply: Quantitative assessment	4.1.Decision tools for energy based investment 4.2.Economic vs. financial evaluation 4.3.Net present value, Levelized Cost of Energy 4.4.Marginal Utility 4.5.Marginal Abatement Cost Curve 4.6.Sensitivity and Scenario Analysis	8
5.	Market and Policy instruments	5.1.Tax, Subsidy 5.2.Carbon tariff and trading, CCTS, ETS 5.3.Regulatory frameworks 5.4.Command and Control 5.5.Fiscal incentives 5.6.Trade and International Policy, CBAM	7
6.	Energy models	6.1.LEAP 6.2.TIMES-MARKAL 6.3.SimaPro 6.4.GREET	6

B) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): None

C) Short summary for including in the Courses of Study Booklet

This course offers a systems-level perspective on the economic drivers shaping the global and Indian energy transition, linking resource constraints, market structures, technological change, and climate imperatives. It prepares students to interpret real-world energy challenges using data-driven insights and analytical reasoning relevant for policy, industry, and research.

7. Recommended books:

Textbooks

- Bhattacharyya, S. C. (2019). *Energy economics: concepts, issues, markets and governance*. Springer Nature.
- Nersesian, R. L. (2016). *Energy economics: markets, history and policy*. Routledge.
- Vanek, F., Albright, L. D., & Angenent, L. (2008). *Energy systems engineering*. McGraw-Hill Professional Publishing.
- Zweifel, P., Praktiknjo, A., & Erdmann, G. (2017). *Energy economics: theory and applications*. Springer.

Reference books

- Bala, B. K. (2022). *Energy Systems Modeling and Policy Analysis*. CRC Press.
- Giannakidis, G., Labriet, M., Gallachóir, B., & Tosato, G. (2015). Informing energy and climate policies using energy systems models. *Springer International Publishing, Switzerland. Doi*, *10*(1007), 973–978.
- Halkos, G. (2023). *Modeling Energy-Environment-Economy Interrelations*. MDPI-Multidisciplinary Digital Publishing Institute.

8. Any other remarks:

Dated: 14/03/2026 Proposer: Deepika Swami

Dated:_____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____