Mechanical Engineering Dept. Department

Syllabus
ME 447: Intelligent Energy Systems (3-0-3)

Course Catalog Description:

Overview of systems engineering concepts; fundamentals of energy systems; energy and the environment; instrumentation and control of energy systems; energy systems control fundamentals; energy systems control design. Development of intelligent control for energy systems, automation network protocols, distributed control systems, and smart grids. Application of multi-agent methods for energy monitoring and management, Internet of Things (IoT) to energy systems, big data analytics for energy systems, power over Ethernet (PoE) for energy systems.

Course Objectives:

1. Introduce students to systems engineering concepts as well as to environmental and energy systems/technologies and their inputs, processes, and outputs
2. Enable the student to optimize the energy costs and performance of automation energy systems while meeting the functional needs and expectations of end-users
3. Make students able to develop and design intelligent, reliable and efficient energy management systems that suit the ever-changing needs of the environment and technology in the energy industry
4. Make students able to develop and design intelligent, reliable and efficient energy management systems that suit the ever-changing needs of the environment and technology in the energy industry

Course Learning Outcomes:

CLO1. Be able to explain the concepts of energy management systems.

CLO2. Be able to describe sustainable techniques that achieve energy efficiency goals.

CLO3. Be able to independently identify and solve problems using critical thinking

CLO4. Be able to use modern software tools, processes, devices, and diagnostic tools for energy systems engineering design and development

CLO5. Be able to appreciate societal, environmental and economics impact of energy savings

CLO6. Be able to appreciate ethical issues while designing and developing intelligent energy management systems

Learning Resources:

- • Systems Engineering Principles and Practice, by A. Kossiakoff, S. M. Biemer, S. J. Seymour, D. A. Flanigan (ISBN-10: 1119516668) • Analysis and Design of Energy Systems, by B.K. Hodge and

Robert Taylor (ISBN-10: 0135259738) • Energy and the Environment, by R. Ristinen (ISBN-10: 111935529X) • Fundamentals of Energy Regulation, by J. A. Lesser, L. R. Giacchino (ISBN-10: 0910325200) • Modeling, Assessment, and Optimization of Energy Systems by Hoseyn Sayyaadi (ISBN: 9780128166574)

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Assignments	None	20.0%
Quizzes	None	10.0%
Major Exams	None	20.0%
Term Project and case studies	None	20.0%
Final Exam	None	30.0%

Lecture Weekly Schedule:

Week#	Topics
1	Systems Engineering Overview and Stakeholder Analysis
2	Fundamentals of Energy Systems
3	Energy and the Environment
4	Instrumentation and Control of Energy Systems
5	Instrumentation and Control of Energy Systems (Continue)
6	Energy Systems Control Fundamentals
7	Energy Systems Control Design
8	Intelligent Control for Energy Systems
9	Intelligent Control for Energy Systems (Continue)
10	Automation Network Protocols
11	Distributed Control Systems and Smart Grids
12	Multi-Agent Systems for Energy Monitoring and Management
13	Internet of Things (IoT): Applications to Energy Systems
14	Big Data Analytics for Energy Systems
15	Power over Ethernet (PoE) for Energy Systems