

**SMART ELECTRIC GRID  
(PROFESSIONAL ELECTIVE IV)**

**Prerequisite:** Power Systems - II & Electrical Distribution Systems

**Course Objectives:**

- To group various aspects of the smart grid
- To defend smart grid design to meet the needs of a utility
- To select issues and challenges that remain to be solved
- To analyze basics of electricity, electricity generation, economics of supply and demand, and the various aspects of electricity market operations in both regulated and deregulated environment.

**Course Outcomes:** Upon the completion of the subject, the student will be able to

- Recite the structure of an electricity market in either regulated or deregulated market conditions.
- Understand the advantages of DC distribution and developing technologies in distribution
- Discriminate the trade-off between economics and reliability of an electric power system, differentiate various investment options (e.g. generation capacities, transmission, renewable, demand-side resources, etc) in electricity markets
- Analyze the development of smart and intelligent domestic systems.

**UNIT - I ( ~8 Lecture Hours)**

**Introduction:** Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

**Smart Grid to Evolve a Perfect Power System:** Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

(13) *Jeledy*  
(14) *Raj*

(15) *MKGA*

**UNIT - II ( ~8 Lecture Hours)**

**DC Distribution and Smart Grid:** AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and

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appliances with DC-Data centers and information technology loads-  
Future neighbourhood-Potential future work and research.

**Intelligrid Architecture for the Smart grid:** Introduction- Launching intelligrid- Intelligrid today- Smart grid vision based on the intelligrid architecture- Barriers and enabling technologies. SCADA, synchro phasors (WAMS)

**UNIT - III ( ~10 Lecture Hours)**

**Dynamic Energy Systems Concept:** Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems- Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

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**UNIT - IV ( ~8 Lecture Hours)**

**Energy Port As Part Of The Smart Grid:** Concept of energy -Port, generic features of the energy port. **Policies and Programs to Encourage End - Use Energy Efficiency:** Policies and programs in action -multinational - national-state-city and corporate levels.

**Market Implementation:** Framework-factors influencing customer acceptance and response  
- program planning-monitoring and evaluation.

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(15) *M. S. G. A.*

**UNIT - V ( ~10 Lecture Hours)**

**Efficient Electric End - Use Technology Alternatives:** Existing technologies - lighting - Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency- LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs - Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

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### Text Books:

1. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
2. Jean Claude Sabonnadiere, Nouredine Hadjsaid, "Smart Grids", Wiley-ISTE, IEEE Press, May 2012

### Reference Books:

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong. Wu, Akihiko Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.
2. James Momoh, "Smart Grid: Fundamentals of Design and Analysis"-Wiley, IEEE Press, 2012.

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