

IV Year II Semester

L T P C

Code: 17EE841

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**SMART GRID TECHNOLOGY
(Open Elective-II)**

Preamble:

This course facilitates the students to learning the basics of smart grid concepts in power network. This theory is extended to Architecture of Smart Grid and components. Students are able to learn the different computational tools and optimizing algorithms. Students gain knowledge on concepts of renewable energy integrated technologies. Also this course gives knowledge on the communication technologies and smart grid control related concepts.

Learning objectives:

1. The main objective of the course is to present concepts and topics that are relevant to smart grid technologies to facilitate exploring research opportunities.
2. Understand the challenging issues and architecture of smart grid
3. Understand the communication and wide area monitoring in smart grid
4. Rudimentary energy management issues in smart grid
5. Acquire the knowledge in computational intelligence and security issues in smart grid
6. Know the role of Power electronics and energy storage in smart grid

Unit – I

Introduction to Smart Grid:

What is Smart Grid? Working definitions of Smart Grid and Associated Concepts– Smart Grid Functions– Traditional Power Grid and Smart Grid– New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid.

Unit – II

Smart Grid Architecture:

Components and Architecture of Smart Grid Design – Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid – Demand Response, Dispersed Loads, Smart meters.

Unit – III

Tools and Techniques for Smart Grid:

Computational Techniques– Static and Dynamic Optimization Techniques– Computational Intelligence Techniques – Evolutionary Algorithms– Artificial Intelligence techniques.

Unit – IV

Distribution Generation Technologies:

Introduction to Renewable Energy Technologies– Micro grids – Storage Technologies– Electric Vehicles and plug – in hybrids as ESS– Environmental impact and Climate Change– Economic Issues.

Unit – V

Communication Technologies and Smart Grid:

Introduction to Communication Technology– Synchro Phasor Measurement Units (PMUs) – Wide Area Measurement Systems (WAMS).

Unit – VI

Control of Smart Power Grid System:

Decentralized Secondary Control for frequency and voltage, Virtual inertia, Virtual impedance, Load Frequency Control (LFC) in Micro Grid System – Voltage Control in Micro Grid System– Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

Course Outcomes:

- Understand the smart grid concept.
- Know the communication technologies, standards and protocols for smart grid applications.
- Be able to model, analyze and develop appropriate constrained optimization problems for demand response management, dynamic pricing and renewable integration in smart grid.
- Know power electronics and energy storage issues in smart grid.

Text books:

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

Reference books:

1. Control and Optimization Methods for Electric Smart Grids, Aranya Chakraborty, Marija D Ilic Editor, Springer Publications.