III Year II Semester **L T P C**

Code: 20EE6643 **4 0 0 4**

SMART GRID & MICRO GRID TECHNOLOGIES

Preamble: The aim of this course is to allow the students to understand concepts of smart and micro grid systems along with their control strategies

Course Objectives

1. To understand the basic concepts and components of smart grid
2. To educate the various distributed generation technologies in smart grids
3. To understand the architecture of smart grids
4. To understand the tools for solving ELD and Optimal Power Flow by AI Techniques
5. To understand the basic concepts and components of micro grid

Course Outcomes

1. The student will gain the ability to summarize the smart grids
2. The student will gain the ability to analyse the various DG technologies
3. The student will gain the ability to implement the tools for the basic ELD and OPF problems
4. The student will gain the ability to summarize the micro grids

CO – PO & CO – PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3		2	2	1			2	2	1			1	2	1
CO 2	3		3	3	3			2	2	2			1	2	1
CO 3	1		2		1			2	2				1	2	1
CO 4	3		2	2	1			2	2	1			1	2	1

1 – Weak, 2 – Moderate and 3 - Strong

Unit – I: Basics of Modern Power Systems **10 Hours**

Basics of power systems, definition of smart grid, need for smart grid, smart grid domain, enablers of smart grid, smart grid priority areas, regulatory challenges, smart-grid activities in India.

Unit – II: Distributed Generation Technologies

Penetration of DGs Units in Power Systems - Integration of DGs Units in Distribution Network - Modern Power Electronics for DGs Applications – multiple and single input dc-dc converters - ac-dc and dc-ac converters - Technical restrictions - Protection of DGs - Economics of DGs – Pricing and Financing framework for DG units - Optimal placement of DGs - Case studies

Unit – III: Smart Grid Architecture

Introduction, Factors affecting the growth of SG - The global reality in the field of smart grids and transition into future grids - Smart Agents - Electronics and communications infrastructure

in SG - ICT Technologies - smart meters - metering infrastructures - metering equipment - communication of metering equipment - communication protocols - Metering Data Management Systems (MDMS) - Application of SGs - Interconnections issues between SGs

Unit – IV: Tools and Techniques for Smart Grid

Computational Techniques – Static and Dynamic Optimization Techniques for power applications such as Economic load dispatch – Computational Intelligence Techniques – Evolutionary Algorithms in power system – Artificial Intelligence techniques and applications in power system.

Unit – V: Introduction to Micro-Grid

Introduction to Micro-grids - AC and DC micro-grids - Operational Framework of Micro-grids - anti-islanding schemes - Distribution Management System (DMS) – Micro-grid System Central Controller (MGCC) - Local Controllers (LC) - Economic, environmental and operational benefits of Micro-grids in a distribution network - Demand Response Management in Micro-grids - Business Models and Pricing Mechanism in Micro-grids - Interconnection of Micro-grids

Text Books:

1. S. Borlase, "Smart Grids, Infrastructure, Technology and Solutions", CRC Press, 1st Edition, 2013.
2. G. Masters, "Renewable and Efficient Electric Power System", Wiley–IEEE Press, 2nd Edition, 2013.
3. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE press 2012.

Reference Books:

1. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2nd Edition, 2017.
2. T. Ackermann, "Wind Power in Power Systems", Hoboken, N J, USA, John Wiley, 2nd Edition, 2012.