



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

SMART GRID TECHNOLOGIES								
I Semester: EPS								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BPSE04	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisite: -								

I. COURSE OVERVIEW:

This course introduces concept of Smart Grid, the rationale for smart grid technology and its characteristics. This course focuses on monitoring, analysis, control and communication capabilities to the national electrical delivery system to maximize the throughput of the system while reducing the energy consumption. It also elaborates the integration of renewable energy resources and storage devices to achieve a more efficient and reliable grid, enable active participation of consumers with more environmental constraints.

II. COURSE OBJECTIVES:

The students will try to learn:

- I. The challenging issues, architecture and policies in smart grid.
- II. The role of renewable energy resources and Microgrid for smart generation
- III. The concept of smart transmission with wide area measurement systems, phasor measurement units.
- IV. The power quality issues and monitoring in smart grid.

III COURSE OUTCOMES:

After successful completion of the course, students will be able to:

- CO1 Explain the features smart grid to increase grid efficiency, selfhealing, accessibility and reliability.
- CO2 Analyze the different energy storage solutions available for improving grid stability and security.
- CO3 Analyze the dynamic behaviour of Microgrid and its grid integration issues to meet the load requirement effectively.
- CO4 Outline the role of different renewable resources like PV, Wind, etc for improving the system dynamics performance.
- CO5 Identify the efficient management of power quality for compatibility between all the equipments connected to the grid.
- CO6 Make use of sensors, transducers, intelligent electronic devices and meter to improve the distribution system overall performance.

IV. COURSE CONTENT:

MODULE -I: –INTRODUCTION TO SMART GRID (9)

Introduction to smart grid, evolution of electric grid, concept of smart grid, definitions, need of smart grid, concept of robust, self-healing grid present development & international policies in smart grid.

MODULE -II: AUTOMATION IN GRID MANAGEMENT (9)

Introduction to smart meters, real time pricing, smart appliances, automatic meter reading (AMR), outage management system (OMS), plug in hybrid electric vehicles (PHEV), vehicle to grid, smart sensors, home, building automation, smart substations, substation automation, feeder automation.

MODULE -III: GEOGRAPHIC INFORMATION SYSTEM(GIS) (9)

Intelligent Electronic Devices (IED), their application for monitoring, protection, smart storage like battery.

SMES, pumped hydro, compressed air energy storage, wide area measurement system (WAMS), phase measurement unit (PMU).

MODULE – IV: CONCEPT OF MICRO-GRID (9)

Need and applications of micro grid, formation of micro grid, issues of interconnection, protection, control of micro grid, plastic, organic solar cells, thin film solar cells, variable speed wind generators, fuel cells, micro turbines, captive power plants, integration of renewable energy sources.

MODULE -V: POWER QUALITY IN SMART GRID (9)

Power Quality, EMC in smart grid, power quality issues of grid connected renewable energy sources, power quality conditioners for smart grid, web-based power quality monitoring, power quality audit, advanced metering infrastructure (AMI) and various communication means and IP based protocols.

V. TEXTBOOKS:

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE, 2nd edition, 2011.
2. Clark W Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press, 2nd edition, 2009.

VI. REFERENCE BOOKS:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, “Smart Grid: Technology and Applications”, Wiley, 1st edition, 2012.
2. Stuart Borlase, “Smart Grid: Infrastructure, Technology and solutions “CRC Press, 2nd edition, 2011.
3. A GPhadke, “Synchronized Phasor Measurement and their Applications”, Springer, 2nd edition, 2012.

VII. ELECTRONICS RESOURCES:

1. <https://www.researchgate.net>
2. <https://www.aar.faculty.asu.edu/classes>

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech-talk topics
4. Assignments
5. Model question paper-I
6. Model question paper-II
7. Lecture notes
8. Early learning readiness videos (ELRV)