



## DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

### LESSON PLAN

Course Code	Course Title	Year/Sem	Branch	Contact Hrs/Week	Section
<b>R20</b>	CONCEPTS OF SMART GRID TECHNOLOGIES	<b>IV/I</b>	<b>ECE</b>	<b>5</b>	<b>ECE</b>

#### COURSE OUTCOMES:

At the end of the course students are able to

**CO1:** Know the concept of smart grid and analyse the smart grid policies and developments in smart grids.

**CO2:** Develop concepts of smart grid technologies in hybrid electrical vehicles etc.

**CO3:** Know the concepts of smart substations - feeder automation - Battery Energy storage systems etc.

**CO4:** Analyse micro grids and distributed generation systems.

**CO5:** Analyse the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.

Unit No.	Out Comes	TOPIC(S)		BOOK Reference	Total periods	Delivery Method	GATE/ IES
		<b>UNIT I - Introduction to Smart Grid</b>					
1	CO1: To understand concept of smart grid and their basic developments.	1.1	Evolution of Electric Grid	T1	15	Chalk & Talk, PPT, Active Learning, Smart board & Tutorial	
		1.2	Concept of Smart Grid	T1			
		1.3	Definitions - Need of Smart Grid	T1			
		1.4	Functions of Smart Grid	T1			
		1.5	Opportunities & Barriers of Smart Grid	T1			
		1.6	Difference between conventional & smart grid	T1			
		1.7	Concept of Resilient & Self-Healing Grid	T1			
		1.8	Present development & International policies on Smart Grid.	T1			
		1.9	Case study of Smart Grid.	T1			

<b>UNIT II - Smart Grid Technologies: Part 1</b>							
2	CO2: To understand smart grid technologies and its usage in applications of introduction to smart grid technologies for electric vehicles.	2.1	Introduction to Smart Meters	T1, T2	10	Chalk & Talk, PPT Tutorial, Active Learning Smart board&C ase Study	
		2.2	Real Time Pricing	T1, T2			
		2.3	Smart Appliances	T1, T2			
		2.4	Automatic Meter Reading(AMR)	T1			
		2.5	Outage Management System(OMS)	T1			
		2.6	Plug in Hybrid Electric Vehicles(PHEV)	T1			
		2.7	Vehicle to Grid				
		2.8	Smart Sensors				
		2.9	Home & Building Automation				
		2.10	Phase Shifting Transformers				
		2.11	Net Metering.				
<b>UNIT III – Smart Grid Technologies: Part 2</b>							
3	CO3: To have knowledge on smart substations, feeder automation and application for monitoring and protection.	3.1	Smart Substation	T1, T2	15	Chalk & Talk, PPT, Smart board‘La b, Tutorial	
		3.2	Substation Automation	T1, T2			
		3.3	Feeder Automation. Geographic Information System (GIS)	T2			
		3.4	Intelligent Electronic Devices (IED) & their application for monitoring & protection.	T1, T2			
		3.5	Smart storage like Battery Energy Storage Systems (BESS)	T2			
		3.6	- Super Conducting Magnetic Energy Storage Systems (SMES)	T2			
		3.7	Pumped Hydro	T1			
		3.8	Compressed Air Energy Storage (CAES)	T2			
<b>UNIT IV- Micro grids and Distributed Energy Resources</b>							
	CO4: To have knowledge on micro grids and distributed energy resources.	4.1	Concept of micro grid	T1, T2	10	Chalk & Talk, PPT, Smart board‘La b, Tutorial	
		4.2	need & applications of microgrid	T1			
		4.3	formation of microgrid	T1, T2			
		4.4	Issues of interconnection	T1, T2			
		4.5	protection & control of	T1, T2			

			microgrid				
		4.6	Integration of renewable energy sources	T1, T2			
		4.7	Demand Response.	T1, T2			
<b>UNIT V - Information and Communication Technology for Smart Grid</b>							
5	CO5: To deal power quality aspects in smart grid with information and communication technology.	5.1	Advanced Metering Infrastructure (AMI)	T1, T2	<b>11</b>	Chalk & Talk, PPT Tutorial, Active Learning & Seminars	
		5.2	Home Area Network (HAN)	T1, T2			
		5.3	Neighborhood Area Network (NAN)	T2			
		5.4	Wide Area Network (WAN)	T2			
		<b>TOTAL</b>				<b>61</b>	

CO1	Know the concept of smart grid and analyse the smart grid policies and developments in smart grids.	APPLY, ANALYZE,	K3,K4
CO2	Develop concepts of smart grid technologies in hybrid electrical vehicles etc.	APPLY	K3
CO3	Know the concepts of smart substations - feeder automation - Battery Energy storage systems etc.	APPLY, ANALYZE	K3,K4
CO4	Analyse micro grids and distributed generation systems.	APPLY	K3
CO5	Analyse the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.	APPLY, ANALYZE	K3,K4

**CO-PO MAPPING:** (1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]); ‘-’: No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1-K3	3	3	3	3	3	3	3	3	3	3	-	3
CO2-K3	3	3	3	2	3	2	3	3	3	2	-	3
CO3-K3	2	3	2	2	3	3	3	3	-	2	3	-
CO4-K4	3	3	3	3	3	3	3	2	-	-	-	-
CO5-K3	2	3	3	3	3	3	3	3	-	3	-	-

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S.NO	GRADUATE ATTRIBUTION	ACTION VERBS	LEVEL
1	ENGINEERING KNOWLEDGE	APPLY	K3
2	PROBLEM ANALYSIS	ANALYZE	K4
3	DESIGN DEVELOPMENT OF SOLUTIONS	UNDERSTANDING	K2
4	INVESTIGATION OF COMPLEX PROBLEMS	APPLY, ANALYZE,	K3,K4
5	MODERN TOOL USAGE	APPLY	K3
6	ENGINEER AND SOCIETY		
7	ENVIRONMENT AND SUSTAINABILITY		
8	ETHICS	ANALYZE	K4

9	INDIVIDUALS AND TEAM WORK	APPLY, ANALYZE	K3,K4
10	COMMUNICATION	APPLY, ANALYZE,	K3,K4
11	PROJECT MANAGEMENT AND FINANCE	APPLY	K3
12	LIFE LONG LEARNING		

**Text Books:**

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
1.	Integration of Green and Renewable Energy in Electric Power Systems - by Ali Keyhani - Mohammad N. Marwali - Min Dai Wiley - 2009.
2.	Smart Grids by Jean-Claude Sabonnadière - Nouredine Hadjsaid - Wiley publishers - 2013.

**Reference Books:**

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
1.	The Advanced Smart Grid: Edge Power Driving Sustainability:1 by Andres Carvallo - John Cooper - Artech House Publishers July 2011
2.	Control and Automation of Electric Power Distribution Systems (Power Engineering) by James Northcote - Green - Robert G. Wilson - CRC Press - 2017.
3.	Substation Automation (Power Electronics and Power Systems) by Mladen Kezunovic - Mark G. Adamiak - Alexander P. Apostolov - Jeffrey George Gilbert - Springer - 2010.
4.	Electrical Power System Quality by R. C. Dugan - Mark F. McGranhan - Surya Santoso - H. Wayne Beaty - McGraw Hill Publication - 2nd Edition.

		Name	Signature with Date
i.	Faculty	B.Ganesh	
ii.	Course Coordinator		

**HOD**

**PRINCIPAL**