

COURSE CODE: 1152EE106		COURSE TITLE: SMART GRID						L	T	P	C	
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COURSE CATEGORY: Program Elective												
PREAMBLE : To enable the students acquire knowledge on smart grid, different options of architectural design and sensors, measurement technology for various aspects of smart grid, renewable energy sources and storage integration with smart grid.												
PREREQUISITE COURSES: Power System Analysis												
COURSE EDUCATIONAL OBJECTIVES : The objectives of the course are to make the students, <ul style="list-style-type: none"> • To understand the basic concepts, components and architecture of smart grid • To understand the various measurement technologies in smart grid • To educate the importance of renewable energy in smart • To know about battery technology and energy storage • To brief about role of Electric Vehicles in smart grid 												
COURSE OUTCOMES : <i>Upon the successful completion of the course, students will be able to:</i>												
CO Nos.	Course Outcomes						Knowledge Level (Based on revised Bloom's Taxonomy)					
CO1	Explain the smart grids components and architecture						K2					
CO2	Describe different measuring methods and sensors used in smart grid						K2					
CO3	summarize various renewable energy technologies						K2					
CO4	Interpret the role of batteries and energy storages						K2					
CO5	Summarize the importance of Electric Vehicles in smart grid						K2					
CORRELATION OF COs AND POs												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M	M	L			M	M	L		
CO2	L	H	L	M	H			M	M	L		
CO3	H		H	H	H			M	M	L		
CO4	H	H	M		H			M	M	L		
CO5	H		H	M	H	M		H	M	L		
COURSE CONTENT:												
UNIT I	INTRODUCTION						9					
Today's Grid Versus Smart Grid, Rationale for Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, Shareholders Roles and Function, Architecture, Functions of Components												
UNIT II	SENSORS AND MEASUREMENT						9					

Sensors for Smart Grid, Monitoring and Measurement Technologies, PMU, Smart meters, Smart Appliances, Multi Agent Systems (MAS) Technology, Micro grid and Smart grid comparison, Wide Area Measurement		
UNIT III	DISTRIBUTED GENERATION	9
Solar Energy, PV Systems, Wind turbine Systems, Biomass, Small and Micro Hydro Power, Fuel Cell, Geothermal heat pumps.		
UNIT IV	ENERGY STORAGE	9
Batteries, Flow Batteries, Fuel Cell and hydrogen electrolytes, Flywheel, Super conduction magnetic energy storage systems, super capacitors, Simulation and case studies		
UNIT V	ELECTRIC VEHICLES	9
Plugin Electric Vehicles and hybrid, Vehicle classes, Vehicle Architecture, Grid to Vehicle (G2V) Charging, Grid Impacts, Vehicle to Grid (V2G)		
TOTAL: 45 PERIODS		
TEXT BOOKS:		
<ol style="list-style-type: none"> 1. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE press 2012. 2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko 3. Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons Inc, 2012. 4. Lars.T.Berger, K.Iniewski, "Smart Grid: Applications, Communications & Security" Wiley India Pvt. Ltd, Reprint 2015. 		
REFERENCE BOOKS:		
<ol style="list-style-type: none"> 1. Fereidoon P. Sioshansi, "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Academic Press, 2012. 2. Clark W.Gellings, "The smart grid: Enabling energy efficiency and demand response", Fairmont Press Inc,2009. 3. Qi Huang, Shi Jing "Innovative Testing and Measurement Solutions for Smart Grid", John Wiley & Sons Inc, 2015. 		
ONLINE RESOURCES		
<ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc18_ee42/preview 		