SCHEME OF COURSE WORK

COURSE DETAILS:

Course Title :	**SMART GRID**		
Course Code :	**13EE1137**	**L T P C:**	**4 0 0 3**
Program:	B.Tech.		
Specialization:	Electrical and Electronics Engineering		
Prerequisites :	Basic knowledge in Power Transmission Engineering, Communication engineering		
Courses to which it is a prerequisite:	Distributed Generation.		

COURSE OUTCOMES (COS):

After completion of the course student acquire knowledge in

1	Describe the communication technologies for smart grid.
2	Describe the information security for smart grid.
3	Recognize infrastructure for smart metering and distribution automation
4	Describe the tools of Distribution management systems and describe Energy management systems.
5	Describe application of power electronics in Smart grid.

PROGRAMME OUTCOMES (POs)

The student of Electrical and Electronics Engineering at the end of the program will be able to:

1	Apply the knowledge of basic sciences and electrical and electronics engineering fundamentals to solve the problems of power systems and drives.
2	Analyze power systems that efficiently generate, transmit and distribute electrical power in the context of present Information and Communications Technology.
3	Design and develop electrical machines and associated controls with due considerations to societal and environmental issues.
4	Design and conduct experiments, analyze and interpret experimental data for performance analysis.
5	Apply appropriate simulation tools for modeling and evaluation of electrical systems.
6	Apply the electrical engineering knowledge to assess the health and safety issues and their consequences.
7	Demonstrate electrical engineering principles for creating solutions for sustainable development.
8	Develop a techno ethical personality that help to serve the people in general and Electrical and Electronics Engineering in particular.
9	Develop leadership skills and work effectively in a team to achieve project objectives.
10	Communicate effectively in both verbal and written form.
11	Understand the principles of management and finance to manage project in multi disciplinary environments.
12	Pursue life-long learning as a means of enhancing the knowledge and skills.

Course Outcomes versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	S		M		M			
CO2	M	M				S						
CO3	S		S				M					
CO4	M	S		S		M						
CO5	S	M			M							

S - Strongly correlated, M - Moderately correlated, Blank - No correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

TEACHING LEARNING AND EVALUATION:

Week	**TOPIC / CONTENTS**	**Course Outcomes**	**Sample questions**	**TEACHNG-Assessment STRATEGY**	**LEARNING Method & Schedule**
Week1	Introduction, Early Smart Grid initiatives, Overview of the technologies required for the Smart grid.	CO1	Explain briefly what is Smart grid and the technologies required for Smart grid.	Lecture/ Discussion/ Power Point Presentation	Assignment-1 & quiz-1
Week2	Introduction to data communication, Dedicated and Shared communication channels, Switching techniques	CO1	State and explain different communication channels used for Smart grid	Lecture/ Discussion/ Power Point Presentation	Assignment-1 & quiz-1
Week3	Communication channels, Layered Architecture and Protocols, Communication Technologies for the Smart Grid, Standards for information exchange	CO1	Explain the different layers present in ISO/OSI model of Smart grid.	Lecture/ Discussion/ Power Point Presentation	Assignment-1 & quiz-1
Week4	Introduction to information security for the Smart Grid, Encryption and decryption	CO2	Explain about Symmetric key encryption. Explain about digital signatures in detail.	Lecture/ Discussion/ Power Point Presentation	Assignment-1 & quiz-1
Week5	Authentication, Digital signatures, Cyber Security Standards.	CO2	Write about Authentication and public key Encryption	Lecture/ Discussion/ Power Point Presentation	Assignment-1 & quiz-1
Week6	Introduction to Smart metering and	CO3	Draw the functional	Lecture/	Assignment-1

	Demand-side Integration, Smart Metering, Smart meters: An overview of the hardware used.		block diagram of a smart meter and explain in detail	Discussion/ Power Point Presentation	& quiz-1
Week7	Communication Infrastructure and protocols for smart metering, Demand-side Integration.	CO3	Whtat is Demand side integration? What are its advantages?	Lecture/ Discussion/ Power Point Presentation	Assignment-1 & quiz-1
Week8	Introduction to distribution automation equipment, Substation automation equipment, Faults in the distribution system, Voltage regulation	CO3	Name the equipment involved in the substation automation and briefly explain about Intelligent electronic devices.	Lecture/ Discussion/ Power Point Presentation	Assignment-1 & quiz-1
Week9	Mid 1		CO 1, 2, 3		
Week10	Distribution management systems: Data sources and associated external systems	CO3	Explain Modeling and analysis tools used in Distribution Management Systems (DMS) in detail	Lecture/ Discussion/ Power Point Presentation	Assignment-2 & quiz-2
Week11	Transmission system operation: Data sources, Energy management systems.	CO4	Write short notes on Phasor Measurement Units (PMUs)	Lecture/ Discussion/ Power Point Presentation	Assignment-2 & quiz-2
Week12	Wide area applications, Visualization techniques.	CO4	Explain the Pole-slipping preventive controller	Lecture/ Discussion/ Power Point Presentation	Assignment-2 & quiz-2
Week13	Modelling and analysis tools, Applications	CO4	Describe about Outage Management System (OMS).	Lecture/ Discussion/ Power Point Presentation	Assignment-2 & quiz-2
Week14	Power electronics and energy storage: Power electronics in the Smart Grid	CO5	Explain the operation of Thyristor controlled phase shifting transformer with the help of diagram	Lecture/ Discussion/ Power Point Presentation	Assignment-2 & quiz-2
Week15	Renewable energy generation, Fault current limiting.	CO5	Explain the operation of unified power flow controller with the help of diagram	Lecture/ Discussion/ Power Point Presentation	Assignment-2 & quiz-2
Week16	FACTS, HVDC, Energy storage technologies.	CO5	Describe Energy storage technologies in detail.	Lecture/ Discussion/ Power Point Presentation	Assignment-2 & quiz-2
Week17	Mid2 CO 4, 5				
Week18	END EXAM				