

NIRMA UNIVERSITY
Institute of Technology
B. Tech in Electrical Engineering
Semester - VI

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Course Code	2EEDE07
Course Title	Smart Grid

Course Outcomes (COs):

At the end of the course, students will be able to-

- 1 recognize the concept of smart grid and its advantages over conventional grid
- 2 assess the role of automation in smart grid
- 3 learn various sensing technologies, networking and communication technologies involved with the smart grid
- 4 evaluate the power quality problems associated with the integration of renewable energy sources in smart grid

Syllabus:

Teaching Hours: 45

Unit-1: Introduction

05

Evolution of Electric Grid, conventional electrical networks, motives behind developing the Smart Grid Network, Definitions, Characteristics and Benefits of the Smart Grid, Present Grid versus Smart Grid, Functions of Smart Grid Components, Key challenges for Smart Grid, Present development and International practices in Smart Grid.

Unit-2: Smart Grid Measurement and Automation

10

Wide Area Monitoring Systems (WAMS), Phasor Measurement Units (PMU), Smart Meters – Key Components of Smart Metering, Smart Appliances, Advanced Metering Infrastructure (AMI), GIS and Google Mapping Tools. Intelligent Grid Automation, Substation automation equipment, Home and Building Automation.

Unit-3: Smart Grid Communication Technologies

10

Classification of Power System Communication according to their functional requirements, Communications Infrastructure and Protocols for Smart Metering, Smart Grid Communication Technologies – Wireless and Wired. Basics of Cloud Computing, Cyber Attacks and Power System Security, Smart Grid Cyber Security.

Unit-4 Power Quality Management in Smart Grid

08

Power Quality & Electromagnetic Compatibility (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.

Unit-5: Smart Grid Systems

12

Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Issues Associated with Sustainable Energy Technology, Electric Vehicles and Plug-in Hybrids, Impact of PHEV on the Grid, Environmental Implications – Climate Change, Implications of Climate Change. Storage Technologies, Benefits of Energy Storage Systems (ESS)

Self-Study Component:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents. A visit to smart grid / GIFT city may be an advantage.

Suggested Readings:

1. Salman K. Salman, Introduction to the Smart Grid: Concepts, Technologies and Evolution, The Institution of Engineering and Technology (IET).
2. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Smart Grid: Technology and Applications, John Wiley & Sons.
3. James Momoh, Smart Grid: Fundamentals of Design and Analysis, John Wiley & Sons, IEEE Press
4. Clark W. Gellings, The Smart Grid, Enabling Energy Efficiency and Demand Response, CRC Press.
5. Ali Keyhani, Design of smart power grid renewable energy systems, Wiley IEEE
6. Relevant recent literature, journal articles, standards and codes

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2020-21 and onwards