

Indian Institute of Technology Kanpur

Course Title: Smart Grid Technology: Applications

1. Course Description

A. Objectives: An important goal of Smart Grid Technology (SGT) is to leverage modern Information and Communication Technology (ICT) infrastructure to help monitor and control of the power system more effectively. This transforms conventional power system networks into smart energy grids that will be responsible for intelligent management, operation, and control of energy flow. In addition to the conventional communication between Remote Terminal Units (RTUs) and Supervisory Control and Data Acquisition (SCADA) system, two-way communication between SCADA and fast responding intelligent devices, such as Intelligent Electronics Devices (IEDs), Phasor Measurement Units (PMUs), and Internet of Things (IoT) devices, are also being built to carve the smart grid out of the conventional power grid. This course aims at mainly studying the various applications of smart grid technology for better monitoring and control of power system.

B. Contents:

S.No	BroadTitle	Topics	Estimated no. of Lectures (Each of 50 min)
1.	Smart Grid Technology Overview	Initial Overview of various smart grid measurement and communication technologies, smart grid protocols	4
2.	IT Enablers for Smart Grid Technology	Overview of Multi-agent System, Distributed Intelligence, Big Data Analysis, Cloud Computing, Software-Defined Networks (SDN)	4
3.	Smart Grid Decision Support and operational technology	Concepts of Visualization, Self-Healing, Congestion Management, Dynamic OPF, Security Assessment, Contingency Analysis, Dynamic State estimation, Stability Analysis, Intelligent Fault Management, Feeder Reconfiguration, Short Circuit Analysis, Topology Processing, Power Quality, Voltage VAR Control, advanced control of generators, improved FACTS devices	12
4.	Smart Analytics	Computational Intelligence, Wide Area Monitoring and Control Techniques, Demand Response Management, Predictive Asset Management, Forecasting Techniques	8
5.	New technology Integration	Renewable Integration, Plug-in Electric Vehicle, Smart home and Smart City concepts, Cooperative grids	6
6.	Smart Grid Market and Economics	Energy market overview, Role of System Operators, DSO, and TSO under the smart grid, Transactive Energy	6

C. Pre-requisites, if any: EE330 (for UG)/EE630 (for PG)

2. Recommended books:

Textbooks:

- Lars T. Berger and Krzysztof Iniewski, “Smart Grid Applications, Communications, And Security,” Wiley, New Delhi, Aug 2015
- Buchholz, Bernd M., Styczynski, Zbigniew, “Smart Grids – Fundamentals and Technologies in Electricity Networks”, Springer, 2014
- Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, and Nick Jenkins, “Smart Grid: Technology And Applications,” Wiley, New Delhi, Aug 2015.

Reference Books:

- James Momoh, “Smart Grid: Fundamentals of Design and Analysis,” (I E E Power Engineering Series)– Wiley-Blackwell, Apr 2012
- Takuro Sato, Daniel M. Kammen, Bin Duan, Martin Macuha, Zhenyu Zhou, and Jun Wu, “Smart Grid Standards: Specifications, Requirements, and Technologies,” Wiley-Blackwell, Apr 2015.
- Chen-Ching Liu, Stephen McArthur, Seung-Jae Lee, “Smart Grid Handbook”, 3 Volume Set, Wiley, USA, 2016