

Indian Institute of Technology Kanpur

Course Title: Smart Grid Technology

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. With the increase in penetration of SGT in power systems, there has been a growing demand of real time visualization, monitoring, and control of the power system network using fast responding intelligent devices, such as Intelligent Electronics Devices (IEDs), Phasor Measurement Units (PMUs), and Advanced Metering Infrastructure (AMI). Therefore, there is a need to add a course on SGT to help students understand about the new tools and technologies being developed for the better monitoring and control of the power system network. This course proposes to familiarize students about those technologies.

B. Contents:

S.No	BroadTitle	Topics	Estimated no. of Lectures (Each of 50 min)
1.	Smart Grid Overview	History of Smart Grid, Conventional Grid Vs. Smart Grid, Features of Smart Grid, Key Characteristics of Smart Grid, Smart Grid Elements, Forces behind Smart Grid Evolution, Smart Grid Stake Holders, Smart Grid Building Blocks, Smart Grid Resources	6
2.	Smart Grid Architecture & Design	Conventional Power System Architecture, IT Layer, Communication Layer, distributed architecture design	5
3.	Smart Grid Measurement Technology	Synchrophasor Technology, Smart Meters and Advanced Metering Infrastructure, Wireless Sensor Network (WSN), GIS/Google mapping	9
4.	Smart Grid Communication Technology	Wired Communication (e.g. PLCC, Ethernet, Optical Fibre), Wireless Communication (e.g. WiFi, Zigbee, GSM/GPRS, WAN), Machine to Machine Communication	6
5.	Smart Grid Standards and Protocols	Overview of Protocols such as IEC 61850, IEC 60870, IEEE C37.118, IEC 62351, IEEE 1588, DNP 3.0, IEC 61970/ 61968, IEC 62056	9
6.	Interoperability and associated standard	Interoperability issues in Smart Grid and its solutions, Common Information Model, Multispeak, Green Button, SunSpec, SEP 2.0	5

C. Recommended books:

Textbooks:

- James Momoh, “Smart Grid: Fundamentals of Design and Analysis,” (I E E Power Engineering Series)– Wiley-Blackwell, Apr 2012.
- Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, and Nick Jenkins, “Smart Grid: Technology And Applications,” Wiley, New Delhi, Aug 2015.

Reference Books:

- 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.
- Buchholz, Bernd M., Styczynski, Zbigniew, “Smart Grids – Fundamentals and Technologies in Electricity Networks”, Springer, 2014
- Lars T. Berger and Krzysztof Iniewski, “Smart Grid Applications, Communications, And Security,” Wiley, New Delhi, Aug 2015
- Chen-Ching Liu, Stephen McArthur, Seung-Jae Lee, “Smart Grid Handbook”, 3 Volume Set, Wiley, USA, 2016