

EE6509 RENEWABLE ENERGY SYSTEMS IN SMART GRIDS

Academic Unit: 3.0
Pre-requisite: Nil
Effective: Academic Year 2014-2015
Last update: July 2013

LEARNING OBJECTIVE

The objectives of this course are to learn about the issues in renewable energy systems and distributed generation. It covers the understanding and design of distributed generation systems based on solar photovoltaics, wind turbines, fuel cells, micro-turbines and micro-hydro generation. These systems can be connected to the utility grid or to a microgrid. The course will cover various types of energy storage devices. The course will also introduce various smart grid technologies, including advanced metering infrastructure, demand side management, demand response management and electric vehicles. These technologies are focused on providing efficient and environmentally friendly electric energy solutions that can help in improving energy efficiency and reducing energy consumption.

CONTENT

Introduction to Power Systems with Distributed Generation. Distributed Generation. Energy Storage. Smart Grids.

COURSE OUTLINE

This course is aimed for graduate students or engineers already working in related fields and is designed to provide key concepts of power systems, distributed generation, energy storage and smart grids. The first topic introduces the basic knowledge of power systems with distributed generation and the concepts of microgrids and smart grids. The second topic enables students to grasp basic principles and applications of different distributed generation systems. The third topic introduces the knowledge on energy storage devices which are used in power systems. The fourth topic provides students with an understanding of various smart grid technologies. Prior knowledge of power systems, power electronics, electrical machines and control theories at the undergraduate level will be helpful.

LEARNING OUTCOME

The students can easily appreciate that engineering for sustainability is an emerging theme and that the need for more environmentally friendly electrical energy systems is an important part of the global trend. The students will learn that distributed generation systems in microgrids can offer increased reliability and reduced network losses. The students will also understand that renewable energy systems based on energy sources such as solar and wind do

not diminish over time and are independent of fluctuations in fuel price. The students will also gain insight into different energy storage devices and their applications. The course will equip students with the concepts and technologies of the smart grid. The students will also be able to acquire the knowledge of current research, and the critical issues in the development and deployment of the smart grid.

ASSESSMENT SCHEME

Continuous Assessment	20 %
Final Examination	80 %

TEXTBOOK

1. S. Chowdhury, S. P. Chowdhury, and P. Crossley, Microgrids and Active Distribution Networks, Institution of Engineering and Technology, 2009. (NTU eBook Collection)

REFERENCES

1. J. Momoh, Smart Grids: Fundamentals of Design and Analysis, IEEE Press, John Wiley and Sons, Inc., 2012. (NTU eBook Collection)
2. M. H. J. Bollen, The Smart Grid: Adapting the Power System to New Challenges, Morgan and Claypool Publishers, 2011. (NTU eBook Collection)
3. N. Hadjsaid and J. Sabonnadiere, SmartGrids, John Wiley and Sons, 2012. (TK3105.S636sm)