



FIRST/ SECOND SEMESTER 2022-2023

Course Handout Part II

Date: 29-08-2022

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : ECE/EEE/INSTR F424
Course Title : *Smart Grid for Sustainable Energy*
Instructor-in-Charge : Dr. Ankur Bhattacharjee
Instructors : Dr. Ankur Bhattacharjee, Dr Pratyush Chakraborty

Scope and Objective of the Course:

Concern over carbon emission, climate change, and energy sustainability is motivating a large global effort to integrate renewable energy into the power grid in large scale. Handling variability of renewable generation is a key challenge for the system. We need to optimize the resources and processes at both economic and engineering sides of the power system. Installation and integration of renewable energy sources, operation control and communication are highly required to design and implement a smart grid. Considering all these in mind, the course aims to introduce different techno-commercial challenges and opportunities of the modern power system, also known as smart grid. The students will be able to analyze the problems of future power grid and learn some recent developments in this multi-disciplinary field.

Textbooks:

1. Smart Grid Fundamentals and Applications: I S Jha, Subir Sen, Rajesh Kumar, D.P. Kothari, New Age International Publishers
2. Smart Grid: Communication- Enabled Intelligence for the Electric Power Grid: Stephen F Bush, Wiley-IEEE Press

Reference books

1. Power Generation, Operation, and Control: Wood and Wollenberg, Wiley and Sons
2. Power System Stability and Control: Kundur, Tata McGraw-Hill Edition
3. Integration of Distributed Generation in the Power Systems, M. H. Bollen, Fainan Hassan, Wiley, IEEE pub.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Textbook/Reference Book
1-3	Introduction to Smart Grid	Definition, Structure, and Importance	Chapter 1 of TB1, TB2
4-5	Introduction to Smart Grid	Global Standards, Policies, Control Layers, and Elements	Chapter 1 of TB1, TB2



6	Renewable Power Generation	Need for Renewable Power Generation, Broad Classification	Chapter 8 of TB2
7-8	Renewable Power Generation	Technology for various Renewable Power Generation (Solar, Wind, Biomass etc.)	Chapter 8 of TB2 and Class Notes
9	Renewable Power Generation	Maximum power extraction and efficiency enhancement of renewable energy systems	Class Notes
10	Energy Storage	Need for Energy Storage, Broad Classification	Chapter 5 of TB1
11-12	Energy Storage	Various Storage Technologies (Electrochemical, Electrical, Mechanical etc.)	Chapter 5 of TB1
13	Energy Storage	Suitable battery storage for portable and stationary energy applications	Chapter 5 of TB1
14	Energy Storage	Controller design and Management for battery storage systems	Class Notes
15-16	Grid Integration of Renewable Energy and Energy Storage	Different technologies and challenges of grid integration	Class Notes
17	Demand Response	Definition and Need, Types	Chapter 7 of TB2
18	Demand Response	Controllable Load Models	Chapter 7 of TB2
19	Demand Response	Price based DR	Class Notes
20	Demand Response	Incentive-based DR	Class Notes
21-22	Hybrid Electric Vehicle/E-mobility	Need, Types, Vehicle to Grid Technology	Chapter 6 of TB1
23-24	Microgrid	Detailed architecture and operation of a Microgrid	Chapter 2.5 of TB1
25-26	Microgrid	Operations and Control of AC - DC Microgrid	Chapter 2.5 of TB1
27	Microgrid	Case Studies on Microgrid performance	Class Notes
28-29	Smart Grid	Analysis of components, its operation	Chapter 2 of TB1
30	Smart Grid	Clustering of smart-microgrids, energy scheduling	Class Notes
31-33	Smart Grid Economics	Unit Commitment, Economic Dispatch, Automatic Generation and Control	Chapter 3,5 of RB1
34-35	Electricity Markets	Deregulation of Economics, Energy and Reserve Markets	Class Notes

36-37	New Sensing, Control and Communication Technologies	Smart Grid Communication, Advanced Smart Metering infrastructure	Chapter 3 of TB1
38	Application of Data Science in Smart Grid	Availability of Big Data in Power Systems	Chapter 7 of TB1, Class Notes
39-40	Application of Data Science in Smart Grid	Applications, Importance and Limitations	Chapter 7 of TB1, Class Notes

Evaluation Scheme:

Component	Duration	Weightage (%)	Marks	Date & Time	Nature of Component
Quiz (Best out of two)	-	15%	30	To be announced	Closed Book
Mid Semester Examination	90 Minutes	30%	60	03/11 1.30 - 3.00PM	Closed Book
Group Project	-	20%	40	To be announced	Open Book
Comprehensive Exam	180 Minutes	35%	70	26/12 AN	Closed Book
Total		100%	200		

Chamber Consultation Hour: To be announced in the class

Notices: All the official notices related to this course will be uploaded on CMS.

Make-up Policy: There will be make-up for the Mid-Semester and End-Semester examination subject to prior approval taken from the IC. No make-up will be allowed for Quiz.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Dr. Ankur Bhattacharjee
INSTRUCTOR-IN-CHARGE

