The Hashemite University
College of Engineering
Department of Electrical Engineering
EE 563 Smart Grid Technology (3 Credit Hours/Dept. Elective)

Instructor

Dr. Feras Alasali	
Email:	Ferasasali@hu.edu.jo
Office:	
Online support hours: (Office Hour)	Sun/Tues/Thurs: 10:00-11:00 Mon/Wed: 12:30-13:30

Grading info

Class Info

Days	Mon/ Wed
Time	11:00-12:30
Location	Online (Microsoft Teams)

Course

Course Number:	110409563
Prerequisite:	Power Systems (110409461), covering the following topics: - Fundamentals of power systems generation, transmission, and distribution. - Transformers & Synchronous generators. - Series impedance of transmission lines. - Capacitance of transmission lines and underground cables.
Textbook:	No specific textbook is required for the course. The presentations and notes include material from a wide range of sources that cover the different aspects of the smart grid. However, the main references of this course are listed in the References section.
Course Aims and Description:	A Smart Grid is the integration of telecommunication and information technologies with the power system network to modernise and fully automate the electricity and improve how electricity travels from power plants to consumers. The driving force behind Smart Grids include environmental awareness of people and governments; the need for further automation and energy efficiency; the large capital investments for the renewal of the ageing infrastructure; adoption of competitive energy prices; security of supply along with renewable energy sources. This course provides the students with a working knowledge of fundamentals, design, analysis, and development of smart grid and modernising the electric power network by using different communication technologies. The energy storage systems and renewable energy sources in smart grid will be covered. It also familiarizes the students with how the smart grid can help to improve the electrical grid efficiency, reliability, resiliency, energy security and independency.
Specific Outcomes of Instruction (Course Learning Outcomes):	1- Understand the fundamental structure of the power grid. 2- Identify the key elements of smart grids and how the smart grid can improve the electrical grid efficiency. 3- Evaluate technology options such as renewable energy sources, energy storage systems, and information and communications technologies for smart grids. 4- Be able to analysis and solve problems related to smart grid architectures and economical choices.
Important material	- Lecture notes - References and Internet resources

References:

- **"Smart Grid Technology and applications",** Author: J. Ekanayake, et. al, Wiley, 2012.
- **"Smart Grid Fundamentals of Design and Analysis",** Author: J. Momoh, IEEE press, 2012.
- **"Smart Grids Opportunities, Developments, and Trends",** Author: Ali Shawkat , Springer, 2013.
- **"Energy Storage for Sustainable Microgrid",** Author: David Wenzhong Gao, Elsevier, 2015.

Major Topics Covered and Schedule in Weeks:

Topic	# Weeks	# Contact hours*
Introduction to Power Network Structure	1	3
Introduction to Smart Grids, Modernizing Electric Power Network and Intelligent Distribution Networks.	2	6
Renewable Energy and Energy Storage Systems Integration in Smart Grids.	3	9
Elements of measurement, communication and networking technologies.	2	6
Energy Independence, Security, Improving Electrical Grid Efficiency, Reliability and Resiliency.	2	6
Demand side management of Smart Grid, Demand response analysis of Smart Grid, SCADA, Energy Management and Critical Loads Protection.	2	6
Smart Grids and new types of electrical demands such as (Electric Vehicles)	1	3
Introduction into Demand Forecasting in Smart Grid.	1	3
Total	**14**	**42**

NOTE: at the end of each lecture, we will discuss in summary the main content of next lecture.

Course Policy

- If you miss class, there will not be a makeup test, quiz, etc. and you will get a zero unless you have a valid excuse.
- Cheating and plagiarism are completely prohibited.
- If you miss more than 15% of classes you will automatically fail the class.

Grading info:

1) ***Project Work:*** *(Marks = **25%**)*

Instructions to students: A goal of the student projects is to give you a chance to work creatively with the ideas presented in the class and contribute to everyone else's learning. Based on these goals, I want to give you the freedom to define the project as it suits your background, ambitions and interests. Basic information for this task as follow:

I. The project work is done in teams (maximum four students.)
II. The project must include simulation work (such as Matlab)
III. Each project team chooses a theme within one of the following general project areas:
   - Renewable energy systems for a small town.
   - Load forecasting.
   - Energy storage systems.
IV. Minimum number of pages: 15 (Times new roman, font size is 12, space between lines is 1.5)
V. The projects are due by **15:00 on Monday, 3/5/ 2021** delivered by Microsoft teams.
VI. Each group is expected to present the project and have One on One discussion.
VII. Cheating and **plagiarism** are completely prohibited.

2) *Online exam: (Marks = **30%**)*

I. Date: 5/4/2021 (11:00-12:00) delivered by Microsoft teams.
II. Duration: 1 hour.
III. Each student is expected to have One on One discussion as part of this exam.
IV. Cheating and **plagiarism** are completely prohibited.

*3) Final Exam (Marks = **45%**)*

Student Outcomes (SO) Addressed by the Course:

#	*Outcome Description*	*Contribution*
	General Engineering Student Outcomes	
(a)	An ability to apply knowledge of mathematics, science, and engineering	***H***
(b)	An ability to design and conduct experiments, as well as to analyze and interpret data	
(c)	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	***H***
(d)	An ability to function on multidisciplinary teams	
(e)	An ability to identify, formulate, and solve engineering problems	***H***
(f)	An understanding of professional and ethical responsibility	
(g)	An ability to communicate effectively	
(h)	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	***H***
(i)	a recognition of the need for, and an ability to engage in life-long learning	
(j)	A knowledge of contemporary issues	
(k)	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	***H***

H=High, **M**= Medium, **L**=Low