Course Prefix/Number
ELEG 330 – Power System Analysis

Semester:
Spring 2018

Meeting Times:
RU (from 2:00 pm to 3:15 pm) – Section: 01

Location:
B305

Instructor

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Office Hours:

TRU (from 11 am- 1 pm)

Mission Statement

The Department of Electrical and Computer Engineering strives to provide high-quality engineering education centered around the key principles of liberal arts, specifically, lifelong-learning, critical thinking, and effective communication. The department prepares students to become successful engineers, and be able to contribute effectively to their profession and community.

ELEG 330 (Spring 2018) Syllabus

Catalog Description

Examines power system concepts, transmission line, transformer and rotating machine modeling, steady state analysis and power flow, fault analysis, theory of symmetrical components, and power system stability.

- Co- requisite: ELEG 330L.
- Prerequisite: ELEG 310.

About the Course

This course introduces the basic concepts related to operation and analysis of an electric power system, starting from power generation to power transmission and distribution to end users. It requires mathematical background in circuit analysis, phasors and complex numbers, mostly related to the fundamental concepts covered in ELEG 220 and ELEG310. Fundamental power concepts will be reviewed briefly, leading to per unit systems and power network analysis using per unit systems. Basic parameters, modelling and operation of transmission line is covered thoroughly. Power flow studies using various techniques will be discussed. Symmetrical and unsymmetrical fault analysis in various parts of power system will be studied in detail. Power system stability will be studied including steady state and transient stability.

Course Learning Outcomes

By the end of this course, students should be able to:

1. Identify various components of power systems and understand single line diagrams and ratings of various power equipment.
2. Model power transformers and analyze power network, using circuit analysis and per unit computations.
3. Calculate transmission line parameters and model the lines.
4. Perform steady state power flow analysis using various methods.
5. Perform symmetrical fault analysis on power network to study various types of electrical faults (short circuit, earth fault, line to line faults etc.) and their intensity.
6. Perform unsymmetrical fault analysis using symmetric components.
7. Calculate the steady state (static) and transient (dynamic) stability parameters of a power system.
8. Design basic protection systems for transformers, bus bar, transmission lines and electrical machines.
9. Develop power system control functions (voltage and frequency control) for stable operations of power network.
10. Design distributed power generation network and microgrids.

Textbook

- John J. Grainger, William D. Stevenson, Gary W. Chang, “Power System Analysis” *McGraw Hill Education*.

References

- J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye "Power System Analysis & Design" Fifth Edition, *Cengage Learning.*
- B.M. Weedy, G.J. Cory, N. Jenkins, J.B. Ekanayake, G. Strbac, "Electric Power Systems", 5th Edition, *Wiley.*

Course Policies

- Students will be provided brief lecture slides but they are also expected to use the text book for more details.
- Quizzes will be held at the end of every alternative chapter, i.e. each Quiz will cover two chapters. There won't be any quiz from last two chapters.
- There will be two mid-terms exams, as indicated in the weekly breakdown. Each of them will carry 15% of the total assessment.
- Class attendance is essential. Missing more than 15% of the classes, without a documented proof, will result in failure (a grade of "FN"). An attendance sheet will be circulated, starting week two.
- Students are required to have an account on Moodle and to enroll in the course page to receive useful handouts and announcements for the course.
- All disability-related accommodations require registration with Career Services and Wellness (Located in next to the Hangout and Registration) and are not applied retroactively. You should contact Dr. Huda Shaaban, in CSW to arrange an appointment to discuss your needs.
- No make ups for any piece of assessment. In case of an unavoided emergency, the total weight of the remaining assessments might be adjusted. This policy is very strict with no exceptions.

Assessment scheme

Quizzes (5 sets):	20% - (4% each)
Two Midterm Exams:	40% - (20% each)
Final comprehensive exam:	40%

Marking Scheme

A	**94 – 100**	**C**	**74 – 76**
A-	**90 - 93**	**C-**	**70 – 73**
B+	**87 – 89**	**D+**	**67 – 69**
B	**84 – 86**	**D**	**64 – 66**
B-	**80 – 83**	**D-**	**60 – 63**
C+	**77 – 79**	**F**	**0 – 59**

Detailed Course Contents

Topic #	Subject	Ref. from book
1	Introduction and fundamentals of power systems	Chapter 1&2
2	Power transformers, referring over transformers and per unit systems	Chapter 2-3
3	Transmission line parameters and modelling	Chapter 4-5
4	Power flow studies	Chapter 6-7
5	Symmetrical fault analysis	Chapter 8
6	Symmetric components and unsymmetrical faults	Chapter 9-10
7	Power System Stability (Steady state and transient)	Chapter 13
8	Power system protection	Chapter 11
9	Frequency and Voltage Control	W- Chapter 4-5
10	Power distribution and substation equipment	(Lecture Slides)
11	Power Quality and international standards	(Lecture Slides)
12	Distributed Generation and Smart Grids	(Lecture Slides)

Tentative Schedule

Week	Lecture	Date	Subject	Remarks
1	1	1/28/2018	Introduction – Syllabus	Review ELEG310
	2	2/1/2018	Topic # 1	
2	3	2/4/2018	Topic # 2	
	4	2/8/2018	Topic # 2	
3	5	2/11/2018	Topic # 3	
	6	2/15/2018	Topic # 3	
4	7	2/18/2018	Topic # 4	
	8	2/22/2018	Topic # 4	
5	9	3/1/2018	Topic # 4	
6	10	3/4/2018	Review	
	11	3/8/2018	Mid-term Exam #1	Be prepared!
7	12	3/11/2018	Topic # 5	
	13	3/15/2018	Topic # 5	
8	14	3/18/2018	Topic # 6	
	15	3/22/2018	Topic # 6	
9	16	4/1/2018	Topic # 6	
	17	4/5/2018	Topic # 7	
10	18	4/8/2018	Topic # 7	
	19	4/12/2018	Topic # 7	
11	20	4/19/2018	Topic # 8	
12	21	4/22/2018	Topic # 8	
	22	4/26/2018	Topic # 8	
13	23	4/29/2018	Mid-term Exam #2	Be prepared!
	24	5/3/2018	Topic # 9	
14	25	5/6/2018	Topic # 9	
	26	5/10/2018	Topic # 10	
15	27	5/13/2018	Topic # 11	
	28	5/17/2018	Topic # 12	
16	29	5/20/2018	Review	
17	30	5/27/2018	Final Exam	Be prepared!

Mapping to ABET Student Outcomes

	a	b	c	d	e	f	g	h	i	j	k
1	H		H		H						H
2	H		H		H						H
3	H		H		H						H
4	H		H		H						H
5	H		H		H						H
6	H		H		H						H
7	H		H		H						H
8			H		H						H
9	H		H		H						H
10	M		M		M			M			M

Emphasis: H: High, **M**: Medium, and **L**: Low

a. an ability to apply knowledge of mathematics, science, and engineering
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
d. an ability to function on multidisciplinary teams
e. an ability to identify, formulate, and solve engineering problems
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
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