AGU Graduate School of Engineering and Science Electric and Computer Engineering Program

COURSE RECORD

Code	**ECE 654**
Name	**Power System Operations and Controls**
Hour per week	3 (3 + 0)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall-Spring
Type	Elective
Location	In Class
Prerequisites	ECE 652
Special Conditions	
Coordinator(s)	Assoc. Prof. Dr. Ahmet Onen
Webpage	
Content	• Introduction to power system stability, • Synchronous Machine Modelling, • Excitation System Modeling, • Turbine governor modelling, • Transient Stability Analysis, • Small angle stability analysis, • Voltage Stability Analysis, • Frequency Stability Analysis.
Objectives	To teach the student fundamentals power system stability, transient stability analysis, voltage and frequency stability and usage of a programming language during the course of these analysis.
Learning Outcomes	LO-1. learn the principles of power system stability LO-2. learn the Synchronous machine modelling LO-3. learn the how to model excitation system LO-4. learn how to design turbine governor LO-5. learn to calculation of small angle stability analysis LO-6. learn how to apply control in power system LO-7. learn how to design controller for voltage stability LO-8. learn how to design controller for frequency stability
Requirements	Expected requirements of the course.
Reading List	Recommended readings, text books, etc.
Ethical Rules and Course Policy	Will be announced during the class.

LEARNING ACTIVITIES

Activities	**Number**	**Weight (%)**
Lecture	3	25%
Group Works	8	25%
Presentations	7	25%
Site Visits	1	25%
	Total	100

ASSESSMENT

Evaluation Criteria	**Weight** (%)
Quizzes	15%
Weekly Assignments	20%
Group Project Assignments & Presentations	10%
Attendance/Participation	05%
Final Exam/Submission	50%

Total	100%

For a detailed description of grading policy and scale, please refer to the website https://goo.gl/HbPM2y section 28.

COURSE LOAD *Please, use this one as a reference for your course*

Activity	**Duration** (hour)	**Quantity**	**Work Load** (hour)
In class activities	2	14	28
Lab	1	7	7
Group work	2	12	24
Research (web, library)	2	12	24
Required Readings	2	10	20
Pre-work for Presentation	2	7	14
Lab reports	1	7	7
		General Sum	**124**

ECTS: 7,5 (Work Load/25-30)

CONTRIBUTION TO PROGRAMME OUTCOMES*

	PO1	PO2	PO3	PO4	PO5	PO6
LO1	1	3	4	5	4	3
LO2	5	5	4	5	4	3
LO3	3	4	2	2	4	1
LO4	1	3	4	5	4	3
LO5	5	5	4	5	4	3
LO6	3	4	2	2	4	1
LO7	5	5	4	5	4	3
LO8	3	4	2	2	4	1

* Contribution Level: 0: None, 1: Very Low, 2: Low, 3: Medium, 4: High, 5: Very High

WEEKLY SCHEDULE

W	**Topic**	**Outcomes**
1	Power system overview: Review of basic power equations	LO1, LO2
	Power generation characteristic Steam generation units, and gas turbine	
2	Economic dispatch of thermal units: Economic calculation and lamda iteration method	LO1, LO2, LO3
	Economic dispatch of thermal units first and second order gradient method and economic calculations	
3	Tranmission Losses: Load flow calculation on transmission lines	LO1, LO3
	Tranmission Losses: Loss calculation by using B matrix and penalty factor	
4	MIDTERM EXAM-1	
	Restructure of electric system: ISO, RTO and power exchange	
5	Restructure of electric system: LMP calculation and Fixed transmission Right	LO1, LO2, LO3
	Power system overview: Review of basic power equations	
6	Power generation characteristic Steam generation units, and gas turbine	LO4, LO5
	Economic dispatch of thermal units: Economic calculation and lamda iteration method	

7	Economic dispatch of thermal units first and second order gradient method and economic calculations	LO5, LO6
	Tranmission Losses: Load flow calculation on transmission lines	
8	Tranmission Losses: Loss calculation by using B matrix and penalty factor	LO4, LO5
	MIDTERM EXAM-1	
9	Restructure of electric system: ISO, RTO and power exchange	LO6, LO7
	Restructure of electric system: LMP calculation and Fixed transmission Right	
10	Unit Commintment: calculation of optimum order for thermal units	LO7, LO8
	Load Forecasting: Load Calculation for different weather condition	
11	MIDTERM EXAM-2 or presentation of review	
	Optimum Load Flow: Optimum load flow calculation with existing of constraints	
12	State Estimation and Bad Data Analysis: Voltage and phase angle calculation when measurements are not avaliable	LO4, LO5
13	Automatic Generation Control: Generator model, tie-line and load model and control of all.	LO1, LO2
	Unit Commintment: calculation of optimum order for thermal units	
14	Load Forecasting: Load Calculation for different weather condition	LO1, LO2
	MIDTERM EXAM-2 or presentation of review	
15	Optimum Load Flow: Optimum load flow calculation with existing of constraints	LO1, LO2
	State Estimation and Bad Data Analysis: Voltage and phase angle calculation when measurements are not avaliable	

Prepared by
Assoc. Prof. Ahmet ONEN
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