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

COURSE RECORD

Code	**ECE653**
Name	**Power System Operations and Controls**
Hour per week	3 (3 + 0)
Credit	3
ECTS	10
Level/Year	Graduate
Semester	Fall-Spring
Type	Elective
Location	In Class
Prerequisites	ECE 652
Special Conditions	
Coordinator(s)	Dr. Ahmet Onen
Webpage	
Content	• Power generation characteristic and its importance, • Economic dispatch of thermal units and calculations, • Design transmission system and loss calculation, • Restructure of electric system and how to calculate energy prices • Automatic Generation Control and applications, • Load Forecasting, • State Estimation and Bad Data Analysis, • Optimum load flow, • Online load flow,
Objectives	Power system control application, optimum power flow calculation and economic dispatch and usage of a programming language during the course of these analysis.
Learning Outcomes	LO-1. learn the principles of control system in power systems LO-2. learn the power generation characteristic LO-3. learn the how to economic dispatch of thermal units LO-4. learn how to design transmission system and loss calculation LO-5. learn restructure of electric system and how to calculate energy prices (LMP) LO-6. learn how to apply control in power system LO-7. learn how to forecast load for future years and state estimation LO-8. Computer Application for Power systems
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.

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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: 4 (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 Commitment: 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 Commitment: 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
Dr. Ahmet ONEN
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