GAU, Faculty of Engineering

Course Unit Title	Power System Analysis & Protection
Course Unit Code	EEN486
Type of Course Unit	Technical Elective, EE engineering students
Level of Course Unit	4th Year BSc
National Credits	3
Number of ECTS Credits Allocated	6 ECTS
Theoretical (hour/week)	3
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	4
Semester when the course unit is delivered	7
Course Coordinator	Prof. Dr. Adalet Abiyev
Name of Lecturer (s)	Prof. Dr. Adalet Abiyev
Name of Assistant (s)	-
Mode of Delivery	Face to Face, E-learning activities
Language of Instruction	English
Prerequisities and co-requisities	-
Recommended Optional Programme Components	Basic bacground Circuit Theory

Objectives of the Course:

- Analyze unbalanced power systems using symmetrical components
- Power flow determination using the Gauss-Seidel and the Newton-Raphson methods
- Perform fault analysis using symmetrical components and determine fault currents and voltages at various locations in the network
- Understand the philosophy and the principles of power system protection, and know how to set primary protection and back-up protection for inverse time overcurrent relays.

Learning Outcomes

When this course has been completed the student should be able to		Assesment.
1	***derive*** the basic concepts and methods used for power system analysis.	1
2	***construct*** mathematical models for computing the steady state performance, and basic unbalanced performance of power systems.	1
3	To ***derive***, ***describe*** and ***compare*** different models of the most common equipment used in power network models.	1
4	Using different methods, to ***compute***, ***analyze***, and ***reflect*** on the performance of a power system under steady state and unbalanced operation	1
5	Conduct experiments and interpret obtained data	3

Assesment Methods: 1. Written Exam, 2. Assignment 3. Project/Report, 4.Presentation, 5 Lab. Work

Course's Contribution to Program

		CL
1	Ability to understand and apply knowledge of mathematics, science, and engineering	4
2	Ability to design and conduct experiments as well as to analyze and interpret data	5
3	Ability to work in multidisciplinary teams while exhibiting professional responsibility and ethical conduct	2
4	Ability to apply systems thinking in problem solving and system design	4
5	Knowledge of contemporary issues while continuing to engage in lifelong learning	2
6	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice	3
7	Ability to express their ideas and findings, in written and oral form	4
8	Ability to design and integrate systems, components or processes to meet desired needs within realistic constraints	2
9	Ability to approach engineering problems and effects of their possible solutions within a well structured, ethically responsible and professional manner	3
11	Strong foundation on the fundamentals of Electrical and Electronics Engineering such as Circuit Theory, Signals, Systems, Control and Communications, which are necessary for successful practice in the field	5
12	Awareness on the contemporary requirements, methods and applications of the Electrical and Electronics Engineering	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate 4: High, 5:Very High)

Course Contents

Week			Exams
1		Introduction	
2	Chapter 3	Per-unit system.	
3	Chapter 4	Transmission line characteristics. Line inductance, line transposition .	
4	Chapter 5	Capacitance of the transmission lines. Earth effect.	
5	Chapter 6	Analysis of power systems networks and methods of solution	Quiz 1
6		Load flow and short circuit analysis.	
7	Chapter 10	Symmetrical three-phase faults.	
8			Midterm
9		Symmetrical components.	
10	Chapter 11	Power system stability analysis	
11	Chapter 12	Economic operation of power systems.	Quiz 2
12	Chapter 7[1]	Current and voltage transformers. Overcurrent protection.	
13		Differential protection and its application to generators.	
14		Transformer and bus bar protections.	
15			Final Exam

Recommended Sources

Textbook: Hadi Saadat, *Power System Analysis*, 3rd Ed., PSA Publishing, June 2010. (Other editions are also useful).
Supplementary Material (s):
1. Electrical Energy Systems. Mohamed E. El-Hawary. 2000 by CRC Press LLC.
2. Power System Analysis and Design, 4rd ed., Glover, Sarma, and Overbye, Thompson, 2008.

Assessment

Attendance& E-learning	5%	
Quiz-1	10%	
Midterm Exam	30%	
Quiz-2	10%	
Final Exam	45%	
Total	100%	

ECTS Allocated Based on the Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class (including the Exam week)	15	3	45
Labs and Tutorials	-	-	-
Assignments	2	6	12
Project/Presentation/Report Writing	-	-	-
E-learning Activities	10	3	30
Quizzes	2	6	12
Midterm Examination	1	12	12
Final Examination	1	14	14
Self Study	14	3	42
Total Workload			167
Total Workload/30 (h)			5.67
ECTS Credit of the Course			6