

Faculty of Engineering & Technology

Power System Analysis 1

Information :

Course Code : EPR 411

Level : Undergraduate

Course Hours : 3.00- Hours

Department : Specialization of Electrical Power Engineering

Instructor Information :

Title	Name	Office hours
Professor	Said Fouad Mohamed Mekhemar	7
Assistant Lecturer	Ahmed Moreab Hussien Mohamed	5

Area Of Study :

- Develop the students' knowledge about the power system operation under both normal and abnormal conditions.
- Prepare students to analyze power systems under normal operation and fault conditions.
- Train students to use commercial software packages to study the normal operation of power systems.
- Train students to perform basic experiments on power system simulator.

Description :

Symmetrical components: Synthesis of unsymmetrical phasor diagrams from their symmetrical components, Symmetrical components of unsymmetrical systems, Power in terms of symmetrical components, Positive, negative and zero phase sequence networks, Unsymmetrical faults: Shunt faults, Series faults, Network matrices: Network topology, System admittance and system impedance matrices, Load flow solutions and control: Load flow equations, The Gauss-Seidel method, Newton-Raphson method and approximations, De-coupled methods, Regulating transformers.

Course outcomes :

a. Knowledge and Understanding: :

- 1 - Describe power flow equations in both rectangular and polar forms.
- 2 - Explain the transformation from phase domain to symmetrical components domain and vice versa.

b. Intellectual Skills: :

- 1 - b1. Convert power system parameters from normal units to per unit and vice versa.
- 2 - b2. Solve power flow equations using Gauss-Seidel, Newton-Raphson and Fast-Decoupled methods.
- 3 - b3. Apply symmetrical components' method to analyze unsymmetrical three-phase circuits.
- 4 - b4. Analyze power systems under symmetrical and unsymmetrical faults.

c. Professional and Practical Skills: :

- 1 - c1. Use measuring instruments, and laboratory equipment to practice power system simulator experiments, collect, analyze and interpret results.
- 2 - c2. Use of techniques, equipment, and software packages pertaining to power system analysis.
- 3 - c3. Apply modern techniques, skills and numerical modeling methods to power system analysis.

d.General and Transferable Skills: :

1 -	d1. Collaborate effectively within team.
2 -	d2. Work in stressful environment and within constraints.
3 -	d3. Communicate effectively
4 -	d4. Effectively manage tasks, time, and resources.
5 -	d5. Demonstrate efficient IT capabilities.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Bus admittance and bus impedance matrices	5	3	2
Power flow problem	5	3	2
Solving power flow equations using Gauss-Seidel method	5	3	2
Power System Modeling and per unit system	5	3	2
Solving power flow equations using Newton-Raphson method	5	3	2
Application of Fast decoupled method	5	3	2
Use of PowerWorld Simulator in solving power flow problems	5	3	2
System modeling under fault conditions	5	3	2
System representation, Symmetrical fault	5	3	2
Symmetrical faults solution using bus impedance matrix	5	3	2
Definition of symmetrical components, Sequence networks of loads and series impedances	5	3	2
Sequence networks of machines and transformers	5	3	2
Single-Line to Ground fault	5	3	2
Line-Line and Line-Line to Ground faults	5	3	2
Experiment on Power System Simulator	5	3	2

Teaching And Learning Methodologies :

Interactive Lecturing
Problem Solving
Experiential Learning

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Computer project	10.00		
Final Written exam	40.00		
In Class Quizzes	5.00		
Lab Experiment	5.00		
Mid-Term Exams	40.00		

Recommended books :

- 1- Hadi Saadat, Power System Analysis, McGraw-Hill, 2nd edition, 2004
- 2- J. D. Glover, M. S. Sarma and T. J. Overbye, "Power System analysis and Design", Cengage Learning, USA, 5th Edition, 2012.
- 3- J. J. Grainger and W. D. Stevenson, Jr., power system analysis, McGraw-Hill, Int. editions 1994.