

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

**c. Professional and Practical Skills: :**

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

**d.General and Transferable Skills: :**

1 -	Collaborate effectively within team.
2 -	Work in stressful environment and within constraints.
3 -	Communicate effectively
4 -	Effectively manage tasks, time, and resources.
5 -	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
Quizzes	10.00		
Assignment	5.00		
Final Written exam	40.00		
Lab Experiment	10.00		
Lab project	5.00		
Mid-Term Exams	30.00		

**Recommended books :**

J. D. Glover, M. S. Sarma and T. J. Overbye, "Power System Analysis and Design", Cengage Learning, 6th Edition, 2017.