The University of Jordan
School of Engineering
Electrical Engineering Department
2nd Semester – A.Y. 2020/2021

Course:	**Power System Analysis (I) – 0933481 (3 Cr. – Required Course)**
Instructor:	Prof. Daifallah Dalabeih Office: E306, Telephone: 06/5355000 ext 22857, Email: dalabeih@ju.edu.jo Office Hours: Will be posted soon
Course website:	http://elearning.ju.edu.jo/
Catalog description:	Introduction to sources of electrical energy and power system components. Basic concepts. Per unit quantities. Per unit calculations applied to power systems. The one-line diagram. Representation of transmission lines: current, voltage and power relations at both ends, reactive compensation. Symmetrical 3-phase fault calculations. Symmetrical components. Unsymmetrical faults calculations. Load flow: problem definition, Gauss-Seidel, Newton-Raphson (N-R), decoupled N-R methods.
Prerequisites by course:	**EE** **0903371** Electrical Machines (I) (pre-requisite)
Prerequisites by topic:	Students are assumed to have a background in the following topics: • Basic electrical circuit analysis techniques. • Transformers and synchronous machines.
Textbook:	**Power Systems Analysis by John J. Grainger, William D. Stevenson and Gary W. Chang, McGraw-Hill Education, 2nd edition, 2015.**

References:

1. Power Systems Analysis by Hadi Saadat, PSA Publishing LLC, 3rd edition, 2011.
2. Power System Analysis and Design by J. Duncan Glover, Thomas J. Overbye and Mulukutla S. Sarma, Cengage Learning, 6th edition, 2016.
3. Power Systems Analysis by Arthur R. Bergen and Vijay Vittal, Pearson, 2nd edition, 1999.
4. Modern Power System Analysis by D P Kothari and I J Nagrath, Tata McGraw Hill Education Private Limited, 4th edition, 2011.
5. Fundamentals of Electric Power Engineering by Isaak D Mayergoyz and Patrick McAvoy, WSPC, 1st edition, 2014.
6. Transients in Electrical Systems: Analysis, Recognition, and Mitigation by J.C. Das, McGraw-Hill Education, 1st edition, 2010.

7. Power System Transient Analysis: Theory and Practice using Simulation Programs (ATP-EMTP) by Eiichi Haginomori, Tadashi Koshiduka, Junichi Arai and Hisatochi Ikeda, Wiley, 1st edition, 2016.

Schedule: 16 Weeks, 42 lectures (50 minutes each) plus exams.

Course goals: The overall objective is to provide the student with basic knowledge and proficiency in the principles of electrical power systems and its representation, and to calculate voltages, currents, and complex powers at normal and abnormal conditions for balanced and ubalanced conditions.

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student will:		[SO]
1.	Understand the basic principles of power systems and the method of representation of all components in one line diagram.	[1]
2.	Be able to perform voltage, current and complex power calculations using per unit system.	[1]
3.	Be familiar with the factors that influence the power flow through a transmission line and how it is affected by reactive compensation.	[1]
4.	Be able to calculate voltages and currents during balanced 3-phase fault conditions.	[1]
5.	Be able to calculate voltages and currents during unbalanced fault conditions.	[1]
6.	Be able to write load flow programs and solve nonlinear equations to calculate different variables in the transmission system.	[1]

Course topics:

		Hrs
1.	Basic concepts: General review of power system components in the generation, transmission, and distribution systems. Node equations. Direction of power flow, per unit quantities, one line diagram, impedance/reactance diagrams.	6
2.	Representation of transformers, and synchronous machines: Review of equivalent circuits under normal and abnormal conditions, per unit, calculations.	4
3.	Current and voltage relations on a Transmission Line (TL): Representation of short, medium, and long transmission lines as 2-port networks. The equivalent circuit of a long line. Power flow through a transmission line. Circle diagram. Reactive compensation of a transmission line.	7
4.	Symmetrical Faults: Transients in RL circuits. Internal voltages of loaded machines under fault conditions. Fault calculations using Z_bus. The selection of circuit breaker.	4
5.	Symmetrical Components: The symmetrical components of unsymmetrical phasors. Symmetrical wye and delta circuits. Power in terms of symmetrical components. Sequences circuit of wye and delta impedances, transmission lines and synchronous machines. Sequence circuits of wye-delta transformers. Unsymmetrical series impedances. Sequence networks.	9
6.	Unsymmetrical Fault Calculations: Unsymmetrical faults on power system single line to ground, line-line, and double line to ground faults. Demonstration problems.	6
7.	Power Flow Analysis: Power flow equations. The power flow problem. Solution by Gauss/Gauss-Seidel. Newton Raphson iterations and its application to power flow equations. Decoupled power flow.	6

Ground rules:

Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessment & grading policy:

Assignments	0%	Quizzes	0%
First Exam	30%	Projects	0%
Midterm Exam	30%	Lab Reports	0%
Final Exam	40%	Presentation	0%
		Total	**100%**

Last Revised: March 2021