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

Course: **Electrical Power Lab – 0903489 (1 Cr. – Required Course)**

Instructor: Dr. Eyad A. Feilat + Eng. Enaam Al-Khatib
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Office Hours: Will be posted soon

Course website: http://engineering.ju.edu.jo/ (Go to Electrical Engineering Department Labs)

Catalog description: Voltage distribution over a string of suspension insulators. i-t fuse characteristics. Measurement of symmetrical components in unbalanced systems. Transmission line parameters. Power flow relations at the ends of transmission lines. Earthing of power system neutral. Power system network analyzer. Comparison of the characteristics of static and electromechanical relays. Characteristics of time lag O/C relays. Differential relays. Directional relays. Power system load flow.

Prerequisites by course: **EE** **0933482** Power System Analysis (II) (pre- or co-requisite)

Prerequisites by topic: Students are assumed to have a background in the following topics:
- Basic electrical circuit analysis techniques.
- Power system analysis.
- Electromagnetic circuits.

Textbook: **Lab Manual which can be obtained from the course Website.**

References:

1. Power Systems Analysis by John J. Grainger, William D. Stevenson and Gary W. Chang, McGraw-Hill Education, 2nd edition, 2015.
2. Power Systems Analysis by Hadi Saadat, PSA Publishing LLC, 3rd edition, 2011.
3. Power System Analysis and Design by J. Duncan Glover, Thomas J. Overbye and Mulukutla S. Sarma, Cengage Learning, 6th edition, 2016.
4. Modern Power System Analysis by D P Kothari and I J Nagrath, Tata McGraw Hill Education Private Limited, 4th edition, 2011.
5. Power Generation, Operation, and Control by Allen J. Wood , Bruce F. Wollenberg and Gerald B. Sheblé, Wiley-Interscience, 3rd edition, 2013.
6. Protective Relaying: Principles and Applications by J. Lewis Blackburn and Thomas J. Domin, CRC Press, 4th edition, 2014.

7. Fundamentals of Power System Protection by Y.G. Paithankar and S.R. Bhide, PHI Learning, 2nd edition, 2013.

Schedule: 16 Weeks, 10 Lab sessions (3 Hours each) plus exams.

Course goals: The overall objective is to allow students to perform a set of experiments to examine basic aspects of power systems, such as: transmission lines, suspension insulators, unbalanced power systems, relays and power system protection and load flow.The student is expected to correlate practical and theoretical results for the abovementioned topics.

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

Upon successful completion of this course, a student will:	[SO]
1. Be able to conduct appropriate experimentation to measure and evaluate fundamental power systems parameters, such as: voltage distribution over a string of suspension insulators, zero, positive and negative sequence currents in 3-phase unbalanced power systems, transmission line parameters, earthing efficacy, response of static and electromechanical relays, etc.	[6]
2. Be able to analyze and interpret measured data, and use engineering judgment to draw conclusions.	[6]
3. Know the basics of measuring instruments usually involved in power system testing (including voltmeters, ammeters, wattmeters, power factor meters, network analyzers) and be able to properly use such instruments.	[6]
4. Understand the requirements and pre-requisites for technical reporting, and be able to properly report experimental results.	[3]
5. Be able to effectively function in a team in a collaborative and inclusive manner, to reach the lab goals and objectives.	[5]

Course topics:	Hrs
1. Voltage distribution over a string of suspension insulators, and how it can be practically equalized. The i-t characteristics of a wire fuse in the overcurrent zone.	3
2. Measurement of the zero, positive and negative sequence currents in a 3-phase unbalance system.	3
3. Determining the A, B, C & D constants of a short and medium transmission line and investigating the voltage, current, and power relations at both ends of the transmission line under no load and full load conditions with and without shunt compensation.	3
4. Merits of different grounding schemes of power system neutral and how the voltages and currents are affected by the method of earthing.	3
5. Operational characteristics of instantaneous overcurrent and overvoltage relays.	3
6. Comparison of the response of static and electromechanical relays from the points of view of operating and resetting values, power consumption and response to DC components.	3
7. The relationship between the plug setting multiplier and time of operation for different time setting multipliers for a definite minimum time-lag overcurrent relay.	3
8. The i-t characteristics of a directional overcurrent relay and the effects of phase angle and voltage variations on its operation.	3
9. Principle of operation of differential protection of power transformers.	3

10. Power system load flow study using a network analyzer. **3**

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	15%
First Exam	0%	Projects	0%
Midterm Exam	30%	Lab Reports	15%
Final Exam	40%	Teamwork	0%
		Total	**100%**

Last Revised: March 2021