The University of Jordan
School of Engineering
Department of Electrical Engineering
1st Semester – A.Y. 2017/2018

Course code:	**0923785**
Course title:	**Advanced Power System Protection**
Credit hours:	3

Catalog Data:

Power system protection review. Distance protection schemes: permissive Under-reach transfer tripping, permissive overreach transfer tripping, directional comparison blocking, and direct transfer tripping. Rotating machines protection: stator and field faults and protection, loss of excitation, and abnormal voltages. Differential protection principles: line differential, transformer differential, and bus-bar differential: low and high impedance bus-bar protection. Numerical relaying: introduction, protection philosophy, basic hardware and protection schemes, protection algorithms, microprocessor application to protective relays, Matlab simulation of numerical relays. Communication schemes for power systems protection: power line carriers, optical fiber, and microwave. Protection schemes for the distribution network with distributed generators: protection philosophies and challenges, fault characteristics of renewables including PVs and wind generators. Adaptive relaying.

Prerequisites by Course: None

Prerequisites By Topic:

Students should have a background of:

- Power system protection components.
- Symmetrical and unsymmetrical fault analysis.
- Basic relaying schemes.

Textbook: -

References:

- Protective Relaying: Principles and Applications, by J.L. Blackburn, 3rd edition, CRC Press.
- Protection of Electricity Distribution networks 2nd edition, J.M. Gers and D.J. Holmes, IET power and energy series 47.
- Protective Relays: Their Theory & Practice" by A.R. Van C. Warrington.
- Protective relays principle 2009 by Anthony F.Selva.

Schedule & Duration: 16 Weeks, 42 contact hours (50 minutes each) including exams.

Minimum Student requirements: class handouts and from above references, scientific calculator and an access to personal computer.

Course Objectives:

The overall objective is provide master students with the knowledge and proficiency of protection relaying system as applied to all components of power system. In addition, students will be able to apply concepts of fault analysis on settings or realys. The protection of systems with renewable energy is also studied.

Course Learning Outcomes and Relation to Program Learning Outcomes:

Upon successful completion of this course, a student should:

1. To master the basic components of power system protection systems. [i.ii]
2. Identify the effects of transient response of current transformers. [i,ii,iii]
3. Be familiar with pilot distance schemes: PUTT,POTT, Directional. [i,iii]
4. Master the principles of rotating machinery schemes. [i.ii,iiii]
5. Master the differential protection principle, and busbar protection. [i.ii]

6. State the differences between the numerical, solid state, and electromechanical relays. [i.ii,iii,iv]
7. Identify the protection problems raise form the interconnection of renewables to the electric system. [i,ii,iii,iv]

Program learning outcomes

i Demonstate a sound, in-depth and up-to-date technical knowledge in the field of specialization.

ii Ability to identify and solve engineering problems in their chosen field of study.

iii Acquir the skills for continued professional development and independent self-study.

iv Demonstrate the ability to communicate technical informatiom effectively and professionally both orally and in writing..

Course Topics:

	Topic Description	Hrs
1.	Power system protection review: Relaying principles, Transducers, Overcurrent, Differential, and Distance protection.	**6**
2.	Distance protection schemes: permissive Under-reach transfer tripping, permissive overreach transfer tripping, directional comparison blocking, direct transfer tripping	**6**
3.	Rotating machines protection: stator and field faults and protection, loss of excitation, and abnormal voltages.	**9**
4.	Differential protection principles: line differential, transformer differential, and bus-bar differential: low and high impedance bus-bar protection.	**6**
5.	Numerical relaying: introduction, protection philosophy, basic hardware and protection schemes, protection algorithms, microprocessor application to protective relays, Matlab simulation of numerical relays, control and protection integrated devices (Intelligent Electronic Devices (IED)).	**6**
6.	Communication schemes for power systems protection: power line carriers, optical fiber, and microwave.	**3**
7.	Protection schemes for the distribution network with distributed generators: protection philosophies and challenges, fault characteristics of renewables including PVs and wind generators. Adaptive relaying.	**6**

Ground Rules:

Attendance is mandatory and highly encouraged. To that end, attendance will be taken every lecture. 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.

Assessments:

Exams, projects, and term papers.

Grading policy:

Project and term paper		**30 %**
Midterm Exam		**30 %**
Final Exam		**40 %**
	Total	**100%**

Last Updated:

Mar 27, 2017