BIRZEIT UNIVERSITY

Faculty of Engineering and Technology
ENEE, Electrical Engineering
Second semester 2020/2021

SYLLABUS

Course number and name: ENEE 5306 – Protection and Automation in Electrical Power Systems

Credits and contact hours: Credit: 3 (Lecture: 3, Lab.: 0)

Instructor's or course coordinator's name: Dr. Jaser Sa'ed

- **Office**: Masri221, email: jsaed@birzeit.edu

Textbook:

- J. Duncan Glover, Mulukutla S. Sarma and Thomas J. Overbye, "Power System Analysis and Design," Cengage Learning, Fifth Edition, 2012.
- **Reference:** P. M. Anderson, "Power System Protection," Wiley-Interscience and IEEE Press, 1999.
- **Reference:** Stanley H. Horowitz and Arun G. Phadke, "Power System Relaying," Wiley, Third Edition, 2008.

Specific course information

- **Description**: Transient Stability analysis of power systems, dynamic modeling and the swing equations. The protection system and its elements (current transformers, voltage transformers, circuit breakers, re-closers, fuses, relays), fault analysis (short circuit current calculation, selection of protection components), Relay operating principles, over-current, differential, distance, and pilot protection, digital relays. Protection of generators, motors, transformers, bus-bars and transmission lines. Systems for the automatic regulation of voltage, reactive power and frequency.
- **Prerequisites:** ENEE4403: Power Systems
- Concentration Course for Power and Control Students

Specific goals for the course

Upon the successful completion of this course, a student should be able to:

- Understand the basic principles of power systems protection, identify the protection system components and be familiar with the principle of operation of earth fault, overcurrent directional and non-directional relays, differential and distance relays.
- Be familiar with automatic control of power stations.
- Study the dynamics of the power system during abnormal conditions.

(ABET) Relationship of course to Electrical Engineering Program Student Outcomes:

- (a) Ability to apply mathematics, science and engineering principles.
- (c) Ability to design a system, component, or process to meet desired needs.

Brief list of topics to be covered

- Power System Protection:
  Requirements of a successful protection system, current and voltage transformers, electromechanical and static relays. Directional and non-directional over current protection schemes and relay setting. Voltage and current balance differential protection schemes for feeders, pilot wire protection. Distance protection: principle of operation, distance- time schemes, methods of distance measurement, setting, practical considerations.
- Power System Stability:
  The stability problem, rotor dynamics and the swing equation, the power angle equation, synchronizing power coefficients, equal area criterion of stability. Classical multi machine stability studies. Step-by-step solution of the swing curve. Factors affecting stability.
- Power System Controls
  Generator-Voltage Control, Turbine-Governor Control, and Load-Frequency Control.

Tentative Grading:

- Midterm Exam 20 %
- Final Exam 30 %
- Research Project 20 %
- Assignments 20%
- Participation 10%

Policies:

- No late submissions will be accepted.
- Class attendance is required by the university regulations. Come to All lectures and activities.
- Make-up will be allowed only for students who miss the final exam with an acceptable excuse according to the university regulations.
- All students are expected to comply with University rules and regulations on academic Integrity and honesty.