

Faculty of Engineering & Technology

Protection and Switchgear in Electrical Power Systems

Information :

Course Code : EPR 581

Level : Undergraduate

Course Hours : 3.00- Hours

Department : Specialization of Electrical Power Engineering

Instructor Information :

Title	Name	Office hours
Professor	Hossam Eldin Abdallah Talaat	6
Assistant Lecturer	Mohamed Abdallah Mahmoud Shaheen	8

Area Of Study :

This course aims to:

1. Recognize knowledge and understand power system protection relaying philosophy and fundamental considerations.
2. Understand protection of different power system components such as transmission line, rotating machines, and power transformer.
3. Understand and recognize circuit breakers: types, construction, performance and ratings.
4. The student shall attain the above mentioned objectives efficiently under controlled guidance and supervision

The above objectives will be achieved through a series of lectures and tutorial classes.

Description :

Protection relaying philosophy and fundamental considerations, Transmission line protection, Short lines, Medium length lines, Long distance power transmission, Compensating distance relaying. Rotating machinery protection: Relay protection for ac generators, Loss of field relay operation, Power transformer protection, Relay input sources, Switchgear engineering: Circuit breakers, Types, Construction, Performance and ratings, Interruption of fault currents and arcs in circuit breakers, Circuit breaker test oscillograms, Circuit breakers synthetic and direct tests. Switching over-voltages, Resistance.

Course outcomes :

a. Knowledge and Understanding: :

1 -	Describe the high voltage switchgear engineering and insulation characteristics.
2 -	Define the power system phenomena in steady state, and transients.
3 -	Define power system protection equipment.
4 -	Describe the design of protection schemes.

b. Intellectual Skills: :

1 -	Analyzing the engineering problems.
2 -	Illustrating the different solution alternatives for the engineering problems.
3 -	Comparing the solution alternatives and choosing the optimum one.

4 -	Comparing the acceptable solutions of problems based on physical and operational limits of power system components.
5 -	Comparing between a solution based on a given system state to the system behavior at different states
c. Professional and Practical Skills :	
1 -	Constructing suitable switchgear and protection schemes for different components in electric power systems such as: electric machines, transmission and distribution systems, power transformers, control systems, measuring instruments, insulators, etc.
d. General and Transferable Skills :	
1 -	Write technical reports and conduct presentation about power system problems in normal operating conditions.
2 -	working in a team.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Effects of short circuit current on power system, measures of protection systems, protection zones, Primary and back up protection.	8	4	4
Basic elements of trip circuit, classification of relays (electromechanical, static, digital), time characteristics of relays.	5	3	2
Electromechanical relays (attraction type, induction type).	5	3	2
Overcurrent relays, settings of induction type overcurrent relay.	8	4	4
Distance protection (impedance relays, directional impedance relays, settings of distance relays).	6	4	2
Differential protection (circulating current methods, reverse voltage methods), bias beam relay, application of differential protection in power transformers.	8	4	4
Circuit breakers: Types, Construction, Performance and ratings.	12	10	2
Interruption of fault currents and arcs in circuit breakers.	6	4	2
Circuit breaker test oscillograms.	4	2	2
Circuit breakers synthetic and direct tests.	4	2	2
Switching over-voltages.	5	3	2
Resistance switching, Capacitance switching.	4	2	2

Teaching And Learning Methodologies :

Lectures

Tutorials

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Attendance	10.00		assess the performance of the students during the course
Final Exam	40.00	15	to assess the comprehensive understanding of the scientific background of the course, to assess the ability of problem solving with different techniques studied.

First Mid-Term Exam	15.00	7	to assess the skills of problem solving, understanding of related topics.
Quizzes and Assignments (1)	10.00	5	to assess the skills of problem solving, understanding of related topics.
Quizzes and Assignments (2)	10.00	9	to assess the skills of problem solving, understanding of related topics.
Second Mid-Term Exam	15.00	11	to assess the skills of problem solving, understanding of related topics.

Course Notes :

No course notes are required

Recommended books :

Horwitz, S. H. and Phadke, A. G., Power System Relaying, John Wiley, 1992.