

Faculty of Engineering & Technology
Economics of Generation and Operation

Information :

Course Code : EPR 412 **Level :** Undergraduate **Course Hours :** 3.00- Hours
Department : Specialization of Electrical Power Engineering

Instructor Information :

Title	Name	Office hours
Lecturer	MARIAM AHMED SAMEH MOHAMAD AHMED ABBADI	3
Teaching Assistant	Toaa Abdelsalam Elsayed Mohamed	4

Area Of Study :

1. Enhance the student's knowledge about over-voltages and traveling waves in electrical power systems with the associated suitable protection devices and schemes.
2. Enhance the student's understanding for performing system insulation design with adequate reliability at a minimum cost.
3. Enrich the student's knowledge about the protection of different power system components.
4. Train students to design protective devices against over-voltages and surges.

Description :

Load curves, Variation in demand, Load diversity. Power plant layout: thermal power plants, Hydroelectric plants, Diesel and gas turbine plants, Main equipment, Auxiliaries, Bus-bar arrangements. Power plant economics: Capital cost, Operating cost, Fixed charge rate, Selection of plant and size and unit size, Operation and economics of spinning reserve. Tariffs, Effect of low power factor, Power factor improvement, Most economic power factor. Optimal operation of power systems: Modeling of fuel cost for thermal generation, Optimal operation of thermal system, Accounting for system losses, Optimal operation of hydro-thermal system. New energy sources: Solar energy, Wind energy, Other energy sources: Tidal, Geothermal.

Course outcomes :

a. Knowledge and Understanding: :

1 -	a1. Describe, with the help of neat sketches, the substation equipment and the functions of each equipment, the different bus-bar arrangements and the advantages and disadvantages of each.
2 -	a2. Describe the terms and applications related to the protection of over-voltages, traveling waves, lightning surges, and earthing systems.
3 -	a3. Explain the mechanism of lightning stroke generation.
4 -	a4. Describe, with the help of neat sketches, the concepts of generator, line carrier and transformer protection.

b. Intellectual Skills: :

1 -	b1. Calculate the voltage rating of a surge arrester.
2 -	b2. Determine the size of the neutral earthing resistance.

3 -	b3. Calculate the transmitted and reflected voltage/current waveforms.
4 -	b4. Deduce the response of protective relays for a given condition.
c. Professional and Practical Skills: :	
1 -	c1. Practice basic experiments on simulators of substation including SCADA systems.
d. General and Transferable Skills: :	
1 -	d1. Collaborate effectively within multidisciplinary team.
2 -	d2. Work in stressful environment and within constraints.
3 -	d3. Communicate effectively

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Over-voltage transients (general); Importance, characteristics, types, its control.			
Travelling waves, Surge velocity, Surge impedance, Surge power and energy stored.			
Incident reflected and transmitted waves (coefficients), Different termination cases.			
Bewley lattice diagram, application to simple cases.			
Applications: Over-voltage protection, Surge diverters and Insulation Coordination,			
Item Protection: Protection of generators.			
Protection of transformers.			
Substation busbar arrangements & Protection of bus-bars.			
Protection of transmission lines, (carrier protection).			

Teaching And Learning Methodologies :

Interactive Lecturing
Problem Solving
Experiential Learning

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Final exam	40.00		
In Class Quizzes	10.00		
Lab Experiments	10.00		
Mid-term exams	30.00		
Participations	10.00		

Course Notes :

No course notes are required

Recommended books :

- 1- Sunil S. Rao, "Switchgear, Protection and Power Systems", Khanna Publishers, Thirteenth Edition, 2008.
- 2- Horwitz, S. H. and Phadke, A. G., "Power System Relaying", John Wiley, 1992.