

**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
Professor	Hanafi Mahmoud Ismail	2
Teaching Assistant	Toaa Abdelsalam Elsayed Mohamed	1

**Area Of Study :**

- Develop the students' knowledge about the economics of power generation and operation.
- Prepare students to select most economical power supply for a given load.
- Train students to apply mathematical methods and computer packages to obtain optimal scheduling of generation at minimum operating cost.

**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.

**Course outcomes :**

**a.Knowledge and Understanding: :**

1 -	Describe characteristics of load curve including: load, demand, diversity, coincidence, and capacity factors.
2 -	Illustrate fixed cost, running costs, interest and depreciation
3 -	Derive the mathematical formula for the most economical power factor as function of the applied tariff and the cost of capacitor bank.
4 -	Describe the optimal economic dispatch problem formulation with and without losses.

**b.Intellectual Skills: :**

1 -	Select the most economical power supply for a given load.
2 -	Choose of size and number of generating units based on cost analysis.
3 -	Determine the most economical power factor for a given tariff.
4 -	Solve the optimal dispatch problem neglecting losses with and without generation limits.
5 -	Solve the optimal dispatch problem with losses.

**c. Professional and Practical Skills: :**

- 1 - Apply PowerWorld Simulator to solve the optimal economic dispatch problem.

**d. General and Transferable Skills: :**

- 1 - Demonstrate efficient IT capabilities.

**Course Topic And Contents :**

Topic	No. of hours	Lecture	Tutorial / Practical
Fundamentals of power generation and different types of power plants: Thermal, Hydro, Nuclear, Wind, Photovoltaic.	5	3	2
Classification of costs: fixed and running. Cost analysis of power plants. Interest and Depreciation	10	6	4
Economics of power systems. Choice of size and number of generating units.	5	3	2
Load curves of different areas (industrial, residential, commercial,..). Load duration curve. Characteristics of load curves: Demand factor, Load factor, Diversity factor, Coincidence factor.	10	6	4
Types of tariffs, Types of consumers and their tariffs.	5	3	2
Impact of power factor improvement on system performance.	5	3	2
Methods of power factor improvement. Economics of power factor improvement and sizing of capacitor.	5	3	2
Optimization problem with equality and inequality constraints	5	3	2
Operating cost of a thermal power plant	5	3	2
Economic dispatch neglecting losses and no generation limits	5	3	2

**Teaching And Learning Methodologies :**

Interactive Lecturing

Problem Solving

Experiential Learning

Discussion / Debate

**Course Assessment :**

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

**Course Notes :**

No course notes are required

**Recommended books :**

- 1- B.R. Gupta, "Generation of Electrical Energy", 7th edition, S. Chand, 2017.
- 2- Hadi Saadat, "Power System Analysis", PSA Publishing, Third Edition, 2010.