

Course No.:	ENR 135
Course title:	Power systems engineering
Number of credits:	4
Number of lectures-tutorial-lab:	56-0-0
Course coordinator:	Mr. Sheeraz Kirmani

Course outline

Renewable Energy is a multi-disciplinary area and the students of this program are from different backgrounds (Electrical, Mechanical, Chemical, Biotechnology etc.). This course is designed to bring students of different disciplines to a certain level so as to equip them with basic concepts of power systems. Students will learn (1) the methods of power generation, (2) transmission and distribution of electric power and related issues, (3) understanding of electricity markets. To work in a power industry, it is very important to understand the basic concepts of power systems and the related issues. Restructuring of power industry has increased the challenges even more. Hence, it is important for the renewable energy engineer to understand the basic concepts of power system operation, planning and analysis.

Evaluation procedure

- Term Paper / Assignments : 30%
- Two Minor Exams : 20% each
- Major Exam : 30%

Details of course contents and allotted time

	Contents	Lectures	Tutorials
1.	Principles of Electrical Engineering: DC circuits, KCL,KVL, Network Theorems, mesh and nodal analysis, analysis of 1-phase and 3-phase circuits, real and reactive power and power factor, per unit system.	12	4

	Synchronous generators and transformers: construction and characteristics.		
2.	Methods of power generation: Thermal power plants, Hydro-electric power plants, Nuclear Power plant, Diesel power plant, Combined cycle power plant, pumped storage plants, introduction to renewable energy sources.	9	
3.	Transmission & Distribution: Transmission line parameters, modeling of lines and transmission line performance: Voltage regulation and efficiency; loadability of lines, Basic concepts of HVDC. Configuration of distribution systems, feeder size and distribution transformer, power factor correction and capacitor placement.	11	3
4.	Power Plant Engineering: Load and load duration curves, load factor, diversity factor, cost of generation.	3	1
5.	Integrated operation of power systems: Advantages of integrated operation, challenges for integration of renewable energy sources to electric grid, load flow analysis, load-frequency control, reactive power-voltage control and economic load Dispatch.	12	1

Suggested readings

- John J. Grainger and William D. Stevenson, "Power system analysis", Tata McGraw-Hill Publication.
- B.L. Theraja and A.K. Theraja, "A text book of Electrical Technology", S. Chand Publication.
- D.P. Kothari and I.J. Nagrath, "Modern Power system analysis", Tata McGraw-Hill Publication.
- Prabha Kundur, "Power system stability and control", Tata McGraw-Hill Publication.
- Daniel Krischen and Goran Strbac, "Fundamentals of Power System Economics", John Wiley & Sons, Ltd.

William H. Kersting, "Distribution System Modeling and Analysis", CRC Press