RYERSON UNIVERSITY

Faculty of Engineering, Architecture and Science

Department of Mechanical and Industrial Engineering

Course Outline (W2012)

MEC810: Thermal Power Generation

Instructor

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Prerequisites

MEC514, MEC616, MEC701, PCS213, CMN432, ECN801, MEC411, MEC430, MEC431, MTH510

Compulsory Text

Powerplant Technology; M.M. El-Wakil; McGraw-Hill, 2002.
ISBN-13: 978-0-07-287102-9
ISBN-10: 0-07-287102-4

Reference Texts

1. *Steam. Its Generation and Use, 40th ed.*; Babcock and Wilcox, 1992.
2. *Thermodynamics and Heat Power*, 7th ed., I. Granet and M. Bluestein, Prentice Hall, 2003.
3. *Power Plant System Design*, K. W. Li and A. P. Priddy, John Wiley and Sons, 1985.

Calendar Description

Electrical systems loads, peaks, reliability. Types of power plants and interconnectivity. Boilers and nuclear reactors. Steam turbine and gas turbine calculations. Auxiliary equipment: heat exchangers, fuel preparation, water treatment, cooling equipment. Combined-cycle power plants. Co-generation. Environmental impact of energy production. Pollution abatement devices. Economics.

Learning Objectives

At the end of this course, the successful student will be able to:

1. (1c) Interconnect concepts of various engineering knowledge to design and solve real world engineering problems pertaining to systems and processes.
2. (1d) Use specialized core engineering knowledge to understand and design a specific component, system, or process.
3. (4b) Define design parameter uncertainties and their impacts.
4. (4d) Generate solutions for more complex design engineering problems/systems.
5. (4g) Apply selection/decision-making techniques to more complex design engineering problems/systems.

6. (5c) Design and develop simple tools (software, hardware) to perform given tasks as required by the project.
7. (6a) Effectively contribute to multidisciplinary team and achieve project goals.
8. (7a) Demonstrate accurate use of technical vocabulary.
9. (7d) Use graphics to explain, interpret, and assess information.
10. (8a) Contribute to teamwork in an equitable and timely manner.
11. (9a) Consider economic, social, and environmental factors in decisions.
12. (11b) Display awareness of environmental, safety, economic, social, and other risks associated with the project and ability to respond proactively to minimize these risks.

Note: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board. For more information, see: http://www.feas.ryerson.ca/quality_assurance/accreditation.pdf

Course Organization

3 hours of lecture per week for 13 weeks, in 1 sections

Course Evaluation

Assignments	10%
Midterm exam	25%
Group design project	25%
Final exam	40%
Total	100%

Examinations

Midterm exam in week 7, two hours (covers weeks 1-6).
Final exam, during exam period, three hours (covers weeks 1-13).

Course Content

Topic	Description
1	**Introduction:** World, Canada, and Ontario energy snapshot. Electricity demand evaluation, loads (annual, daily, based, peak loads), etc. Types of power plants and their characteristics
2	**Review of thermal power plant thermodynamic cycles:** Rankine cycle, Brayton cycle, combined cycle, co-generation
3	**Optimization of the Rankine cycle:** Detailed calculations and component selection.
4	**Steam generation:** Boilers (types, components, auxiliaries, etc.). Fuel preparation systems (coal, oil, and natural gas systems). Design consideration and calculations, environmental considerations
5	**Steam turbines:** Basics of steam turbine design (action and reaction and velocity diagrams). Blades and nozzles.
6	**Renewable power generation:** Wind power. Solar power. Geothermal energy.