FMEC 526 Modern Power Cycles

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Office Hours: Mondays and Wednesdays 12:00 – 02:00 pm
General Information's: check blackboard

Course Description

Modern Power Cycle. Credit 3: First and second law design and analysis of modern cycles including Rankine Steam Cycles, Bryton Gas Turbine cycles, Combined Cycles, Cogeneration, Central Heat and Power Generation (CHP). Tri-generation and current advances in thermal power systems design and analysis. Cycles efficiency and factors effecting performance and plant efficiency. Thermodynamic analysis of proposed as well as existing thermal energy systems.

Course Prerequisites: Mass and Heat Transfer
Fluid Mechanics
Thermodynamics

Textbook

Kam W. Li and A. Paul Priddy Publisher: Wiley

References

1. Thermodynamics: An Engineering Approach by Yunus A. Cengel, 6rd Ed., McGraw-Hill
2. Powerplant Technology, M. M. Ei-Wakil, McGraw Hill,
3. Fundamentals of Engineering Thermodynamics by Michael J. Moran and Howard N. Shapiro, 5th Edition, John Wiley

Class schedule

Lectures: Thursdays at 07:00 pm – 09:50 pm; Frey Hall Room 201

Grader: Arzu Kurt

Grading and Class Policies

Final grade is determined based on your performance on the following areas:
Homework: 20%
Midterm 1: 30%
Midterm 2: 30%
Quizzes: 20%

Course Topics

Lecture 1:
course introduction

Lecture 2:
Review of Mollier diagram and steam table, First and second laws of thermodynamics, thermodynamic efficiency, Carnot and Ideal Rankine cycles

Lecture 3:
Non ideal Rankine cycle, steam quality, turbine efficiency, factors affecting Rankine efficiency and work output,
Quiz 1

Lecture 4:
Ideal Rankine cycle with reheat and regeneration, presentation of temperature versus entropy diagram, and enthalpy versus entropy diagram, closed and open feedwater heaters, ideal Rankine cycle using two independent closed heaters, ideal Rankine cycle using two cascaded closed heaters , super critical pressure cycle, efficiency and heat rate

Lecture 5:
Ideal Rankine cycle with reheat and regeneration continued, Rankin Cycle with two closed feedwater heaters drained back to condenser, Rankin Cycle with two closed feedwater heaters pumped forward
Quiz 2

Lecture 6:
Rankine Review
Quiz 3

Lecture 7:
Midterm 1

Lecture 8:
Brayton cycle (gas turbines), idealized brayton cycle, development of gas turbines, brayton cycle with regeneration.

Lecture 9:
Brayton cycle continued, types of recuperators, gas turbine intercooling, gas turbine reheat, other brayton cycle variation, gas turbine inlet air cooling, gas turbine inlet air fogging
Quiz 4

Lecture 10:
Combined cycle and cogeneration

Lecture 11:
combined cycle cogeneration continued, otto and diesel cycles, air standard cycle, combined heat and power, conventional electric power and heating, reciprocating engines, gas turbines, microturbines, steam turbines, fuel cells, US climate zones,

Lecture 12:
Modern power cycles, air standard cycle, otto cycle, diesel cycle, additional power cycle concept: solar thermal, geothermal, pumped storage
Quiz 5

Lecture 13:
Overview of nuclear reactor, power reactor types; pressurized water reactor, boiling water reactor, gas reactors, natural uranium reactor, etc. reactor core design, evolution of nuclear power

Lecture 14
Midterm 2

Course Policies:

1. Lecture notes will be posted on the blackboard prior to class**.**
2. Blackboard will be used for posting lectures, making course announcements, grading, and communicating with the class.
3. Lectures are held on Thursdays from 7:00PM to 9:50PM
4. No late homework (HW) is accepted and zero grade will be assigned. Each homework will consist of three to five problems. Homework must be submitted in class immediately after lectures on the due dates. All procedures must be shown in homework's, projects, and tests.
4. The first homework page has to have heading; your name, identification number, course & HW number (MEC 526, HW-2, for example)
5. Submitted homework for grading has to be your own work. You have to **show all work or give related references**. No makeup tests will be given. If you do homework with someone else, you have to understand and stand behind the submitted work on your own. If it is determined that you are not familiar with the homework you may be responsible for plagiarism and cheating, and therefore loose all credits for that homework and all other homeworks to follow.
6. There are five Quizzes and each quiz will be based directly on homework and exams will be based directly on quizzes so the best way to excel in this class is to DO THE HOMEWORK!

Special Needs/Disabilities

If you have a physical, psychological, medical or learning disability that may impact on your ability to carry out assigned course work, I would urge that you contact the staff in the Disabled Student Services office (DSS), ECC (Educational Communications Center) Building, Room 128,(631)632- 6748. DSS will review your concerns and determine with you what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

Statement on Academic Dishonesty

"Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, design, computer programs, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted to the fullest via the CEAS CASA committee. For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn."

Calculator Policy

"Effective Spring, 2008 only the following calculators will be permitted to be used on all midterm and final exams in the department of Mechanical Engineering. There will be no exceptions! This list of calculators is identical to that allowed for the National Council for Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) Exam that many of you will take in your senior year, as well as the professional Engineering (PE) exam that you may take several years now. The sooner you become comfortable on one of these calculators, the better.

NCEES Allowed calculators as of spring, 2008:

► Casio: All **fx-115** models. Any Casio calculator must contain fx-115 in its model name

► Hewlett Packard: The **HP 33s** and **HP 35s** models, but no others.

► Texas Instruments: All **TI-30X** and **TI-36X** models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

The NCEES policy on calculators can be found here:
http://www.ncees.org/exams/calculators/."