

MEC 526 Modern Power Cycles

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Office Hours: Tuesdays 02:00-04:00 pm or by appointment

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: Tuesdays at 06:30 pm – 09:20 pm; Frey Hall 216

Teaching Assistant: None

Grading and Class Policies

Final grade is determined based on your performance on the following areas:

Homework: 30%

Midterm 1: 35%

Final: 35%

Course Topics

Lecture 1: (8/27/2024)
course introduction

Lecture 2: (9/03/2024)
Review of Mollier diagram and steam table, First and second laws of thermodynamics, thermodynamic efficiency, Carnot and Ideal Rankine cycles

Lecture 3: (09/10/2024)
Non-ideal Rankine cycle, steam quality, turbine efficiency, factors affecting Rankine efficiency and work output,

Lecture 4: (9/17/2024)
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: (9/24/2024)
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

Lecture 6: (10/01/2024)
Continuation on Rankine cycle

Lecture 7: (10/08/2024)
Brayton cycle (gas turbines), idealized brayton cycle, development of gas turbines, brayton cycle with regeneration.

Lecture : (10/15/2024)
Fall break, no class

Lecture 8: (10/22/2024)
Midterm 1

Lecture 9: (10/29/2024)
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

Lecture 10: (11/05/2024)
Combined cycle and cogeneration

Lecture 11: (11/12/2024)
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: (11/19/2024)

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

Lecture 13: (11/26/2024)

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: (12/03/2024)

Midterm 2

Course Policies:

1. Lecture notes will be posted on the Brightspace prior to class.
2. Brightspace will be used for posting lectures, making course announcements, grading, and communicating with the class.
3. Lectures are held on Tuesdays from 6:30PM to 9:20PM
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 before lectures on the due dates. All procedures must be shown in homework's, projects, and tests.
5. The first homework page has to have heading; your name, course & HW number (MEC 526, HW-2, for example)
6. 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 lose all credits for that homework and all other homeworks to follow.

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/>”Student Accessibility Support center Statement

Student Accessibility Support Center Statement

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website:<http://www.stonybrook.edu/ehs/fire/disabilities>.

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.