MECH 4430 – Turbomachinery (Gas Turbines)

Course Information and Policy - Winter 2004

http://www.dal.ca/~koksalm/mech4430/mech4430.html

Brief Information

In this course, thermal and fluid dynamics aspects of gas turbines are covered. The topics include shaft power cycles, cycle losses, combined power cycles, compressible flow basics, aircraft cycles, radial turbomachinery, axial turbomachinery, combustion systems, performance prediction and off-design conditions.

Course Objectives

At the end of the course, the students will:

a) have a thorough understanding of gas turbine cycles and respective losses,
b) have basic skills to analyze gas turbine turbomachinery,
c) acquire a limited design experience.

Prerequisites

MECH 3800 (Engineering Thermodynamics II), MECH 3300 (Fluid Dynamics).

Schedule

Lectures: Tuesday: 13:05 – 14:25 (B227), Thursday: 14:05-15:25 (D410)
Tutorial: Monday: 12:35 – 14:25 (D414)

Instructor

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TA

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Textbook

Gas Turbine Theory, Saravanamuttoo, HIH., Rogers GFC., Cohen, H., 5th edition, Prentice-Hall, 2001.

Additional Reading

- The Design of High-Efficiency Turbomachinery and Gas Turbines, Wilson, D.G., Korakianitis, T., 2nd Edition, Prentice-Hall, 1998.
- Elements of Gas Turbine Propulsion, Mattingly, J.D., McGraw-Hill, 1996.
- Introduction to Gas Turbine, Shepherd, D.G., 2nd Edition, Constable & Company, 1960 (Available at the Sexton library).

Grading

The final grading for the course is based on the following scheme:

Midterm:	**35%**
Assignments:	**15%**
Mini Project (Literature review or design)	**10%**
Final Exam	**40%**

The midterm examination is scheduled for **March 1, 2004.**

All examinations will have two parts. There will be a 20-25 minutes "closed books and notes" conceptual question part followed by an "open books and notes" numerical problem part.

Supplementary exam will be given to those who fail marginally (40-50%). It will replace the final exam mark.

Assignments

You will be a given a weekly set of assignment problems. The assignments will be posted on the course web site. Solutions to all of the assignment problems will also be posted. Late assignments will not be accepted unless you have prior permission from the instructor.

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Course Syllabus - Winter 2004

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Overview of gas turbines

Shaft Power Cycles

Ideal cycles, component losses, design point performance calculations, combined cycles, steam injection gas turbine cycles, evaporative gas turbine cycles.

Gas Turbine Cycles for Aircraft Propulsion

Intake and propelling nozzle efficiencies, turbojet cycle, turboprop, turbofan, turboshaft engines, thrust augmentation.

Centrifugal Compressors

Operation principles, compressibility effects, non-dimensional quantitities, compressor characteristics.

Axial Flow Compressors

Basic operation principles, degree of reaction, performance calculations.

Axial and Radial Flow Turbines

Basic theory, choice of blade profile, estimation of stage performance.

Combustion Systems

Operational requirements, types of combustion systems, important factors in combustor design, combustion chamber performance, gas turbine emissions.

Performance Prediction of Gas Turbines (If time permits)

Off-design operation characteristics, transient behavior, control systems.