

University of Puerto Rico
Mayagüez Campus
College of Engineering
Department of Mechanical Engineering
Bachelor of Science in Mechanical Engineering

Course Syllabus

1. General Information:

Alpha-numeric codification: INME4707
Course Title: Gas Turbine Thermodynamics and Propulsion
Number of credits: 3
Contact Period: 3 hours of lecture per week

2. Course Description:

English: Study of how concepts of thermodynamics, fluid mechanics, aerodynamics, and compressible flow theory are applied to the analysis and design of aircraft jet engines. Analysis of gas turbine using jet engine familiarization, cycle analysis, propulsion and turbomachinery theories. Study of jet engine performance using energy budgets and its optimization in the jet engine cycle. Discussion of actual industry testing applications.

Spanish: Estudio de cómo los conceptos de la termodinámica, mecánica de fluidos, aerodinámica y teoría de flujo compresible se aplican al análisis y diseño de motores de propulsión de aeronaves. Análisis de las turbinas de gas mediante la familiarización de la turbina de propulsión, análisis de ciclo y teorías de propulsión y turbomaquinaria. Estudio del rendimiento de la turbina de propulsión usando la utilización de balances de energía y su optimización en el ciclo de la turbina de propulsión. Discusión de la aplicación de los experimentos en la industria.

3. Pre/Co-requisites and other requirements:

PRE-REQUISITES:
INME 4001 OR INME 4045 OR INQU 4011, INGE 4015 OR DIR. PERM

CO-REQUISITES:
INME4002 or INQU 4012 OR INME4045

4. Course Objectives:

Through this course students should be able to: (i) fully describe and apply basic concepts of thermodynamics, fluid mechanics and aerodynamics to the analysis of jet engines; (ii) explain how fluid flow propulsion and compressible fluid theory are used in the overall conceptual design of jet engines; (iii) identify and evaluate the basic measurement parameters of pressure, temperature and flows and relate them to fuel consumption and thrust output.

5. Instructional Strategies:

conference discussion computation laboratory

seminar with formal presentation seminar without formal presentation workshop

art workshop practice trip thesis special problems tutoring

research other, please specify:

6. Minimum or Required Resources Available:

General Library, Mechanical Engineering Department Library.

7. Course time frame and thematic outline

Outline	Contact Hours
Introduction Fluid Flow Propulsion	3
Conservation Law; Laws of Thermodynamics and Perfect Gas Relation	3
One Dimensional Compressible Flow	3
Applications to Gas Turbine Engines	3
Special Topics Relating to Gas Turbines	6
Thermodynamic Cycle Analysis	6
Propulsion Analysis	6
Combined Thermodynamic and Propulsion Analysis	6
Summary Review and Future Trends	3
Introduction to Off-Design Performance	3
TEST	3
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (letters) Not Quantifiable

89.500 → 100 A
 77.500 → 89.499 B
 67.500 → 77.499 C
 50.500 → 67.499 D
 0 → 50.499 F

9. Evaluation Strategies

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	1	30
<input checked="" type="checkbox"/> Final Exam	1	40
<input checked="" type="checkbox"/> Short Quizzes	2	30
<input type="checkbox"/> Oral Reports		0%
<input type="checkbox"/> Monographies		0%
<input type="checkbox"/> Portfolio		0%
<input type="checkbox"/> Projects		0%
<input type="checkbox"/> Journals		0%
Other, specify:		0
TOTAL:		100%

10. Bibliography:

Course website: <http://www.me.uprm.edu/sleonardi>

Lewis, John H., Fundament Engineering Principles as Applied to Gas Turbine Performance Analysis, 2005, Pratt & Whitney

Manttingly, H.D., Heiser, W. H. and Pratt, D. T., Aircraft Engine Design, Second Edition, 2002. AIAA Educational Series.

Cumpsty, N.,Cumpsty, N.A. Jet Propulsion: A Simple Guide to the Aerodynamic and Thermodynamic Design and Performance of Jet Engines, Second Edition, Cambridge University Press, 2003

Hughes, William F., and Brighton, John A., Schaum's Outlines of Theory and Problems of Fluid Dynamics, Third Edition, 1999, McGraw-Hill*

Dole, C. E. and Lewis, J. E., Flight Theory and Aerodynamics, 2000, John Wiley & Sons, New York, NY*

* These books remain as the top books for the subjects covered in the course and there are no up-to-date textbook to substitute these books.

11. According to Law 51

Students will identify themselves with the Institution and the instructor of the course for purposes of assessment (exams) accommodations. For more information please call the Student with Disabilities Office which is part of the Dean of Students office (Chemistry Building, room 019) at (787)265-3862 or (787)832-4040 extensions 3250 or 3258.