



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: INME 4707 Course Title: Gas Turbine Thermodynamics and Propulsion Number of credits: 3 Contact Period: Three 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:
Prerequisites: INME 4002 or INQU 4012 or INME 4045 and INGE 4010 and (INGE 4015 and INGE 4016) and INGE 3016 and MATE 4009 or MATE 4145 Co-requisite: INME 4002
4. Course Objectives:
Upon successful completion, students will be able to: <ul style="list-style-type: none">• Describe and use basic concepts of thermodynamics, fluid mechanics and aerodynamics to the analysis of jet engines;• Explain how fluid flow propulsion and compressible fluid theory are used in the overall conceptual design of jet engines;• Identify and evaluate the basic measurement parameters of pressure, temperature and flows and relate them to fuel consumption and thrust output.
5. Instructional Strategies:
<input checked="" type="checkbox"/> conference <input checked="" type="checkbox"/> discussion <input checked="" type="checkbox"/> computation <input type="checkbox"/> laboratory
<input checked="" type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop
<input type="checkbox"/> art workshop <input checked="" type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input checked="" type="checkbox"/> special problems <input type="checkbox"/> tutoring
<input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> other, please specify: Course Project (Report and Presentation)

6. Minimum or Required Resources Available:

Computers, Internet

7. Course time frame and thematic outline

General Topics	Contact Hours
Introduction to Gas Turbines	3
History and Classification of Turbine Aircraft Propulsion	3
Fundamentals Review (e.g. Thermodynamics, Fluid Dynamics)	2
Engine Performance Parameters	6
Engine Performance Parameters	3
Exam 1	1
Turbojet Engines: Thermodynamic Analysis	5
Turbofan Engines: Thermodynamic Analysis	5
Exam 2	1
Turbofan Engines: Thermodynamic Analysis (cont)	5
Overview of Jet Engine Components	4
Project (Oral Presentation and Written Report)	1
Overview of Jet Engine Components	3
Future Trends in Aviation	3
Total hours: (equivalent to contact period)	45

8. Grading System Quantifiable (letters) Not Quantifiable**9. Evaluation Strategies**

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	2	25
<input checked="" type="checkbox"/> Final Exam	1	25
<input type="checkbox"/> Short Quizzes		
<input type="checkbox"/> Oral Reports		
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	1	20
<input type="checkbox"/> Journals		
<input checked="" type="checkbox"/> Other, specify: Attendance	1	5
TOTAL:		100%

10. Bibliography:**Textbook:**

Ahmed F. El-Sayed, 2008. *Aircraft Propulsion and Gas Turbine Engines*. 1 Edition. CRC Press. ISBN: 978-0-8493-9196-5.

Other references:

- Hünecke, Klaus, 1997. *Jet Engines: Fundamentals of Theory, Design and Operation*. Airlife. ISBN: 978-1853108341
- Kerrebrock, Jack L., 1992. *Aircraft Engines and Gas Turbines*. MIT Press. ISBN: 978-0262111621.
- Hill, Philip and Peterson, Carl, 1992. *Mechanics and Thermodynamics of Propulsion*. 2nd Edition. Addison-Wesley. ISBN: 978-0201146592.

- Mattingly, H.D., Heiser, W. H. and Pratt, D. T., 2002. *Aircraft Engine Design*. 2nd Edition. AIAA Educational Series. ISBN: 978-1563475382.
- Cumpsty, N.A., 2003. *Jet Propulsion: A Simple Guide to the Aerodynamic and Thermodynamic Design and Performance of Jet Engines*. 2nd Edition. Cambridge University Press. ISBN: 978-0521541442.
- Dole, C. E. and Lewis, J. E., 2000. *Flight Theory and Aerodynamics*. John Wiley & Sons. ISBN: 978-0471370062

11. Law 51: The Comprehensive Educational Services Act for People with Disabilities:

States that after identifying with the instructor and the institution, the student with disabilities will receive reasonable accommodation in their courses and evaluations. For more information, contact the Department of Counseling and Psychological services at the Office of the Dean of Students (Office DE 21) or call 787-265-3864 or 787-832-4040 x 3772, 2040 and 3864.

12. Academic Integrity

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws.—

13. Certification 06-43 of the Academic Senate

"The academic guidelines for offering online courses," defines: Traditional face-to-face courses are those that have less than 25% of the course's regular contact hours via the Internet. Therefore, a three-credit course will be considered "face to face" if, of the 45 hours of regular contact, 11 or less are taught via the Internet. According to certification 06-43 of the Academic Senate, a course may include up to 25% of its total contact hours via the Internet. The objective of this is so that all professors have this alternative in the case of any unscheduled eventuality.

14. Sexual Harassment: Certification 130-2014-2015 states:

Sexual harassment in the workplace and in the study environment is an illegal and discriminatory act and is against the best interests of the University of Puerto Rico. All persons who understand they have been subject to acts of sexual harassment at the University of Puerto Rico may file a complaint and request that the institution investigate, where necessary, and assume the corresponding action by the university authorities. If the complainant is a student, he or she must refer his or her complaint to the Office of the Student Ombudsperson or that of the Dean of Students.

Revised: February, 2019