



University of Puerto Rico
 Mayagüez Campus
 College of Engineering
 Department of Mechanical Engineering
 M.S./Ph.D. in Mechanical Engineering



Course Syllabus

1. General Information:	
Alpha-numeric codification: INME 6025 Course Title: Gas Dynamics Number of credits: 3 Contact Period: Three hours of lecture per week	
2. Course Description:	
English: Fluid properties, equations of mass, momentum and energy, one-dimensional gas dynamics, normal and oblique shocks, expansion fans, flows in ducts and nozzles, flow with friction and heat transfer, small perturbation theory, introduction to characteristic method.	
Spanish: Propiedades de fluidos, ecuaciones de masa, momento y energía, dinámica de gases en una dimension, ondas de choque normales y oblicuas, expansión del ventilador, flujo en tuberías y toberas, flujo con fricción y transferencia de calor, teoría de pequeñas perturbaciones, introducción al método de características.	
3. Pre/Co-requisites and other requirements:	
Pre-requisite: Authorization of the Director of the Department	
4. Course Objectives:	
<ul style="list-style-type: none"> • Applying and analyzing preliminary models of problems involving compressible flows in ducts, nozzles, wind tunnels, flows past airfoils, turbine and compressors cascades in subsonic and supersonics flows. 	
5. Instructional Strategies:	
<input checked="" type="checkbox"/> conference <input type="checkbox"/> discussion <input type="checkbox"/> computation <input type="checkbox"/> laboratory <input type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop <input type="checkbox"/> art workshop <input type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input checked="" type="checkbox"/> special problems <input type="checkbox"/> tutoring <input type="checkbox"/> research <input type="checkbox"/> other, please specify:	
6. Minimum or Required Resources Available:	
Classroom, projector	
7. Course time frame and thematic outline	
General Topics	Contact Hours
Review of fluid properties, dimensional analysis, kinematics of fluid motion.	5
Equations of mass, momentum and energy conservation, integral and differential formulation, relation between vorticity and entropy generation, wave propagation in compressible flows	6

One-dimensional gas dynamics, area-velocity relation, isentropic flows, choking, normal shock, nozzles and diffusers.	8
Piston problems and shock, nozzles and diffusers. Piston problems and shock tubes, converging-diverging nozzles	
Oblique shock waves and Prandtl-Meyer expansions, over and under expanded flows. Supersonic nozzles and diffusers, nozzles for propulsion and wind tunnels, supersonic airfoils, wave drag.	8
Flows with friction and heat transfer, Fanno and Rayleigh lines	5
Small perturbation theory, application to jet flows, internal and external flows	5
Method of characteristic, computation procedure, applications	5
Test	3
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (S/NS) Not Quantifiable

9. Evaluation Strategies

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	2	40
<input checked="" type="checkbox"/> Final Exam	1	20
<input type="checkbox"/> Short Quizzes		
<input checked="" type="checkbox"/> Oral Reports	1	20
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	1	20
<input type="checkbox"/> Journals		
<input type="checkbox"/> Other, specify:		
TOTAL:		100%

10. Bibliography:

Textbook:

Rathakrishnan E. 2010. *Applied Gas Dynamics*. New York: John Wiley & Sons. [Available at the Circulation Collection (QC168. R38 2010), UPRM General Library]

Other resources:

1. Benedict, Robert P. 1982. *Fundamentals of Gas Dynamics*. New York: John Wiley & Sons. [Available at the Circulation Collection (QC 168. B448 1983), UPRM General Library] (**)
2. Zucker R.D., O. Biblarz. 2002. *Fundamentals of Gas Dynamics*. New York: John Wiley & Sons. (**)
3. Liepmann H.W. and Roshko A. 2002. *Elements of Gas Dynamics*, New York: Dover Publications.
4. Kreith, Frank. 1999. *CRC Handbook of Thermal Engineering*. Florida: CRC Press. <http://dx.doi.org/10.1201/9781420050424>. [Available via MechanicalENGINEERING netBASE, UPRM General Library Databases] (*)
5. Electronic resources available through the Library's website:
<http://www.uprm.edu/library/cre/listdbsp.php?l=1&st=0&topic=77>.

* These are classical handbooks

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

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