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 4705	
Course Title: Applied Aerodynamics	
Number of credits: 3	
Contact Period: Three hours of lecture per week	

2. Course Description:

English: Analysis of fluid flow behavior around a rigid body by applying the continuity, momentum and energy equations, two-dimensional potential flow, and the panel method. Analysis of finite wings models using two-and three-dimensional lifting theory and vortex lattice solutions. Study of compressibility effects to analyze fluid flow behavior around transonic wings. Introduction to computational fluid dynamics.

Spanish: Análisis del flujo de un fluido alrededor de un cuerpo rígido al aplicar las ecuaciones de continuidad, momento y energía, el flujo potencial en dos dimensiones y el método de panel. Análisis de los modelos de alas finitas mediante la teoría de elevación en dos y tres dimensiones y las soluciones de malla vorticial. Estudio de los efectos de la compresibilidad para analizar el flujo de un fluido alrededor de alas transónicas. Introducción a la computación de la dinámica de un fluido.

3. Pre/Co-requisites and other requirements:

Prerequisites: INGE3016 and (INGE4010 or (INGE4015 and INGE4016)) and (MATE4009 or MATE4145)

4. Course Objectives:

Upon successful completion, students will be able to:
- Fully describe and integrate all concepts in aerodynamics and potential flow theory to analyze fluid behavior around wings;
- Explain and apply flow superposition, circulation and lift in flow analysis;
- Explain and apply thin-airfoil theory and panel methods;
- Formulate and apply three-dimensional lifting theory and vortex solutions for finite wings;
- Explain the effects of compressibility.

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: Course Project

6. Minimum or Required Resources Available:

General Library, CAD Lab, Mechanical Engineering Department Library.

7. Course time frame and thematic outline

General Topics	Contact Hours
Review of scalar/vector relations	4.0
Derivation of Equations of conservation of mass momentum energy	9
Euler Equation and Bernoulli equation	4.5
Potential Flow theory	4.5
Superposition, circulation and lift	4.5
Types of flow	2.5
Boundary layer theory	2.5
Finite wing, downwash velocity	2.5
Compressibility and transonic wings	2.5
Introduction to CFD	4.0
Test	4.5
Total hours: (equivalent to contact period)	**45**

8. Grading System

☒Quantifiable (letters) ☐ Not Quantifiable

9. Evaluation Strategies

	Quantity	Percent
☒ **Exams**	2	50
☒ **Final Exam**	1	25
☒ **Short Quizzes**	4	5
☒ **Oral Reports**	1	5
☐ **Monographies**		
☐ **Portfolio**		
☒ **Projects**	1	15
☐ **Journals**		
☒ **Other, specify: Homework**	5	0
TOTAL:		**100%**

10. Bibliography:

Textbook:

Anderson, J. D. (2017). *Fundamentals of aerodynamics*. New York, NY: McGraw-Hill Education.

Other references:
- Bertin, John J., Smith Michael L., *Aerodynamics for Engineers*, 2004, Fourth Edition, Prentice Hall, NJ   Copy at the Department's Library
- Anderson, John D, Jr, *Aircraft Performance and Design*, 2002, McGraw-Hill, New York, NY.
  Copy at the University's General Library
- Phillips, W. F., *Mechanics of Flight*, 2004, John Wiley & Sons, New York, NY
- Dole, C. E. and Lewis, J. E., *Flight Theory and Aerodynamics*, 2000, John Wiley & Sons, New York, NY.

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