

## COURSE SYLLABUS

### 1. General Information:

Alpha-numeric codification: INGE 4015 (GEEG 4015)  
Course Title: Fluid Mechanics  
Number of credits: 3  
Contact Period: 3 contact hours of Conference a week

### 2. Course Description:

**English:** Elements of mechanics of fluids and fluid statics. Development of the fundamental equations of fluid mechanics and its applications. Introduction to dimensional analysis and similitude. Motion of ideal and real fluids including internal and external viscous flows. Introduction to the use of hydraulic machinery.

**Spanish:** Elementos de la mecánica de los fluidos y los fluidos en reposo. Desarrollo de las ecuaciones fundamentales de mecánica de los fluidos y sus usos. Introducción al análisis dimensional y de similitud. Movimiento de fluidos reales e ideales incluyendo flujos viscosos externos e internos. Introducción al uso de maquinaria hidráulica.

### 3. Pre/Co-requisites and other requirements:

INGE 3032 and MATE 3063 or MATE 3185

### 4. Course Objectives:

After completing the Fluid Mechanics course the students will be able to:

- Define and describe fluid properties relevant to fluid statics and dynamics.
- Describe the principles of fluid statics and apply them to solve engineering problems involving pressure measurement devices, hydrostatic forces, and buoyancy.
- Recognize the importance, uses, and applications of the Reynolds Transport Theorem.
- Apply conservation laws to a control volume in order to solve fluid dynamics problems.
- Interpret and solve the Navier-Stokes equations for simple fluid flow problems.
- Perform a dimensional analysis and solve modeling problems using the principles of dynamic similarity.
- Compute head losses and select appropriate pump devices in pipe flow problems.
- Understand and describe the fundamentals of drag and lift, and solve external flow problems.
- Understand and solve open channel flow problems.

**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:**

Textbook. For online lectures a laptop with camera and access to High Speed Internet are needed.

**7. Course time frame and thematic outline:**

<b>Outline</b>	<b>Contact Hours</b>
• Basic Definitions and Fluid Properties	3
• Fluid Statics	3
• Hydrostatic Forces on Submerged Surfaces	3
• Fluids in Motion: Kinematics and Dynamics of Fluid Particles	2
• Fundamental Equations: System and Control Volume Definitions <ul style="list-style-type: none"> <li>○ Reynolds Transport Theorem</li> <li>○ Mass Conservation</li> <li>○ Linear and Angular Momentum Equations</li> <li>○ Bernoulli's Equation</li> <li>○ Energy Equation</li> <li>○ Navier-Stokes Equations</li> </ul>	15
• Dimensional Analysis and Similitude	3
• Internal Flows	6
• External Flows	4
• Introduction to Turbo machinery/ Open Channel/ Compressible flow	3
• Partial Exams	3
<b>Total hours: (equivalent to contact period)</b>	<b>45</b>

**8. Grading System:**

- Quantifiable (letters)       Not Quantifiable

## 9. Evaluation Strategies:

	Quantity	Percent
<input type="checkbox"/> Exams	2 to 4	40 to 80
<input type="checkbox"/> Final Exam	1	20 to 30
<input type="checkbox"/> Short Quizzes	Variable	0 to 10
<input type="checkbox"/> Oral Reports	Variable	0 to 10
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input type="checkbox"/> Projects		
<input type="checkbox"/> Journals		
<input type="checkbox"/> Other, specify:		
<b>TOTAL:</b>		<b>100%</b>

## 10. Bibliography:

### Textbook:

- Fluid Mechanics, Fundamentals and Applications, Cengel Y.A. and Cimbala J.M., McGraw Hill, 4<sup>th</sup> ed., 2013.

### Additional References

- Fluid Mechanics, White, F.M., McGraw Hill, 8<sup>th</sup> ed., 2015.
- Fundamentals of Fluid Mechanics, Munson B.R., Rothmayer A.P., Okiishi T.H., and Huesbsch, 7<sup>th</sup> ed, John Wiley & Sons, 2012.
- Introduction to Fluid Mechanics, Fox R. W., Pritchard, P. J. and McDonald, A. T. 8<sup>th</sup> Ed, John Wiley & Sons Inc, 2011.

## 11. Reasonable Accommodation (Law 51):

The University of Puerto Rico at Mayagüez (RUM) recognizes that each student has an inherited right to request reasonable accommodation according to Law 51: Law for Integral Educational Services for People with Disabilities. Every student has the right to receive reasonable accommodation if he/she presents the necessary evidence to be evaluated by the Office of Services to Students with Disabilities (OSEI-RUM), and the related information can be found at the following link: <https://www.uprm.edu/cms/index.php/page/85>. If your case is approved by OSEI-RUM, you will receive reasonable accommodation in your courses and evaluation, and you must contact each professor for course registered. For additional information contact OSEI-RUM at Sánchez Hidalgo 410 or via telephone 787-832-4040 extension 3107.

## 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. Policy Against Discrimination Based on Sex, Sexual Orientation, and Gender Identity:**

The University of Puerto Rico prohibits discrimination based on sex, sexual orientation, and gender identity in any of its forms, including that of sexual harassment. According to the Institutional Policy Against Sexual Harassment at the University of Puerto Rico, Certification Num. 130, 2014-2015 from the Board of Governors, any student subjected to acts constituting sexual harassment, may turn to the Office of the Student Ombudsperson, the Office of the Dean of Students, and/or the Coordinator of the Office of Compliance with Title IX for an orientation and/or formal complaint.

**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.

**15. Certification 06-43 of the Academic Senate states, "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 16-43 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.

Revised by:

Approved by:

Sylvia Rodríguez Abudo, PhD  
Coordinator  
Fluid Mechanics Committee

Aidsa I. Santiago Román, PhD  
Department Chair

Revised: June 2020