



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



## Course Syllabus

<b>1. General Information:</b> Alpha-numeric codification: INME 4003 Course Title: Design of Thermal and Fluid Systems Number of credits: 3 Contact Period: Three hours of lecture per week
<b>2. Course Description:</b> English: Analysis and design of piping systems and heat exchangers. Selection of pumps and fans. Systems simulation and modeling. Spanish: Análisis y diseño de sistemas de tuberías e intercambiadores de calor. Selección de bombas y ventiladores. Simulación y modelado de sistemas.
<b>3. Pre/Co-requisites and other requirements:</b> Pre-requisites: INME 4001 and INME 4015
<b>4. Course Objectives:</b> Upon successful completion, students will be able to: <ul style="list-style-type: none"><li>• Use engineering knowledge to generate an engineering design involving piping, heat exchangers and pumps that meet specified needs.</li><li>• Plan a thermo-fluid mathematical modelling of a problem and solve the problem using numerical simulation by choosing the design variables which affects the problem.</li><li>• Integrate a broad range of requirements such as economic analysis for adapting a new technology.</li><li>• Generate optimal solutions to a problem for single variable and multivariable using the optimization techniques.</li><li>• Make clear and effective technical presentations, both in terms of form as well as content, of his/her work and write clear technical reports describing his/her work. (3)</li><li>• Use of proper engineering judgment in the area of thermo-fluid design guided by ethical, environmental, and professional considerations. (4)</li><li>• Use project management tools such as Gantt charts, Pareto charts, critical path analysis, and action items for planning, prioritizing, and scheduling tasks in a design project work effectively. Work on project teams in both member and leader roles, with team members who may have different backgrounds and technical skill levels. (5)</li><li>• Describe how thermofluid engineering design fits into the larger framework of professional engineering. (7)</li></ul>
<b>5. Instructional Strategies:</b> <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 type="checkbox"/> special problems <input type="checkbox"/> tutoring

research other, please specify:

**6. Minimum or Required Resources Available:**

Computer resources for simulation and modeling.

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

<b>General Topics</b>	<b>Contact Hours</b>
Piping systems, duct design	18
Heat Exchangers	12
Prime movers-pumps, fans	8
Simulation and optimization	4
Tests	3
<b>Total hours: (equivalent to contact period)</b>	<b>45</b>

**8. Grading System**

Quantifiable (letters)  Not Quantifiable

**9. Evaluation Strategies**

	<b>Quantity</b>	<b>Percent *</b>
<input checked="" type="checkbox"/> <b>Exams</b>	<b>2-3</b>	<b>50-75</b>
<input checked="" type="checkbox"/> <b>Final Exam **</b>	<b>1</b>	<b>0-25</b>
<input checked="" type="checkbox"/> <b>Short Quizzes</b>	<b>0-3</b>	<b>0-10</b>
<input checked="" type="checkbox"/> <b>Oral Reports</b>	<b>0-4</b>	<b>0-25</b>
<input type="checkbox"/> <b>Monographies</b>		
<input type="checkbox"/> <b>Portfolio</b>		
<input checked="" type="checkbox"/> <b>Projects</b>	<b>0-1</b>	<b>0-50</b>
<input type="checkbox"/> <b>Journals</b>		
<input checked="" type="checkbox"/> <b>Other, specify: Homework</b>	<b>0-5</b>	<b>0-25</b>
<b>TOTAL:</b>		<b>100%</b>

\* All evaluation strategies will add to 100%

\*\* In design courses a capstone project may replace the final exam.

**10. Bibliography:**

**Textbook:**

Hodge, B. K., & Taylor, R. P. (1999). *Analysis and design of energy systems*. Upper Saddle River, NJ: Prentice Hall. (\*\*)

**Other references:**

- Cengel, Y.A. and Ghajar, A.J., (2015) *Heat and Mass Transfer: Fundamentals and Applications*, 5<sup>th</sup> ed., McGraw-Hill Education, New York, NY.
- Cengel, Y.A and Cimbala, J.M., (2017) *Fluid Mechanics: Fundamentals and Applications*, 4<sup>th</sup> ed., McGraw Hill Education, New York, NY.
- Janna, W.S., (2014) *Design of Fluid Thermal Systems*, 4<sup>th</sup> ed., Cengage Learning, Boston, MA.
- ASHRAE, (2005) *Handbook of Fundamentals*, Atlanta, GA. (\*)

\*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*