POLYTECHNIC UNIVERSITY OF PUERTO RICO
College of Engineering and Applied Sciences
COURSE SYLLABUS

Course code	Course Title	Classification	Credit Hours
ENGI 3520	THERMAL SYSTEMS ENGINEERING	Required	4

Prerequisites	Co- requisites	Schedule
MATH 1370, SCIE 1210, SCIE 1440	N/A	Two two-and-a-half-hour lecture periods per week

Course Description:

This course covers the three main components of thermal fluid sciences: thermodynamics, fluid mechanics, and heat transfer. It provides an integrated introduction to the fundamental tools needed to solve engineering problems in these areas. By the end of the course, students will be able to analyze and solve problems related to thermodynamics, fluid mechanics, and heat transfer.

Textbook:

Moran, M. J., Shapiro, H. N., Munson, B. R., and DeWitt, D. P. (2002) **Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer**, John Wiley and Sons, ISBN-13: 978-0471204909, ISBN-10: 0471204900

References:

1. Kaminski, D. A. and Jensen, M. K. (2017) **Introduction to Thermal and Fluids Engineering**, 1st Ed., John Wiley and Sons, ISBN 10: 9781119289685, ISBN-13: 978-1119289685
2. Cengel Dr., Yunus A., Turner, Robert H., and Cimbala, John M. (2016) **Fundamentals of Thermal-Fluid Sciences**, 5th Ed., McGraw Hill Education, ISBN-13: 978-0078027680, ISBN-10: 0078027683
3. Incropera, F. P., DeWitt, D. P., Bergman, T. L., and Lavine, A. S. (2011) **Introduction to Heat Transfer**, 6th Ed., John Wiley and Sons, ISBN-13: 978-0470501962, ISBN-10: 0470501960
4. McCabe, W., Smith, J., and Harriott, P. (2005) **Unit Operations of Chemical Engineering**, 7th Ed., McGraw-Hill, ISBN-13: 978-0072848236, ISBN-10: 0072848235

Contribution to Professional Component:

Engineering Science: 4 credits

Relationship with Program Learning Outcomes:

(O1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(O5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

(O4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Course Objectives:

1. To develop the student's ability to apply knowledge in solving problems regarding thermodynamic properties of materials.
   1.1 Identify and define different thermodynamic properties.
   1.2 Apply knowledge of Science and Engineering to solve problems where thermodynamic properties are involved.

2. To develop the student ability to apply knowledge in solving problems regarding first and second laws of Thermodynamics.
   2.1 Define the mass and energy conservation laws.
   2.2 Apply knowledge of Science and Engineering to solve fundamental problems regarding mass and energy conservation laws.

3. To develop the student ability to apply knowledge in solving problems regarding the basic principles of Fluid Mechanics
   3.1 Identify problems and scenarios of Fluid Statics and Fluid Dynamics.
   3.2 Solve problems regarding Fluid Statics using the hydrostatic equation.
   3.3 Solve problems regarding Fluid Mechanics using the Bernoulli equation and the Momentum equation.

4. To develop the student ability to apply knowledge in solving problems regarding the basic principles of Heat Transfer
   4.1 Define and identify the three modes of heat transfer (conduction, convection and radiation) in real life scenarios.
   4.2 Solve problems regarding one mode or a combination of modes of heat transfer.

5. To develop the student ability to acquire knowledge of contemporary issues.
   5.1 Identify contemporary issues on Thermal Systems related to Industrial Engineering and communicate them through a project.

6. To develop the student ability to function on multidisciplinary teams
   6.1 The students participate in team efforts contributing with a particular disciplinary expertise.

		TOPICS COVERED	
Meeting	Chapter	Topic	Modules (OL)
1	1	Introduction	1
2	2	Getting Started in Thermodynamics: Introductory Concepts and Definitions	2
3-4	3	Using Energy and the First Law of Thermodynamics	3
5-6	4	Evaluating Properties	4
7		**First Exam**	First Evaluation Activity
8-9	5	Control Volume Analysis Using Energy	5
10	6	The Second Law of Thermodynamics	6
10	7	Using Entropy	7
11	8	Vapor Power and Refrigeration Systems	8
12		**Second Exam**	Second Evaluation Activity
13	11	Getting Started in Fluid Mechanics: Fluid Statics	9
14-15	12	The Momentum and Mechanical Energy Equations	9
16-17	14	Internal and External Flow	9
18		**Third Exam**	
19-20	15	Getting Started in Heat Transfer: Modes, Rate Equations and Energy Balances	10
21	16	Heat Transfer by Conduction	11
22	17.1-17.4	Heat Transfer by Convection	11
23	17.5	Heat Exchangers	11
24		**Fourth Exam**	Final Evaluation Activity

Minimum Criteria for Evaluation: Four Partial Exams 70% (Activities for modules-OL) Assignments 20% (Evaluation Activities-OL) Project 10% (Final Activity-OL) Total 100 %	Grading will be as follows: 100% to 90% A 89% to 80% B 79% to 70% C 69% to 60% D Less than 60% F
Prepared by: Pablo Traverso Avilés Revised by: OAC	Date of Last Revision: February 2025