Course Syllabus - Rocket Propulsion

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Contents

1 Course Information

- **Course No.**: 2145473
- **Credits**: 3 credits (3-0-6)
- **Program**: Aerospace Engineering (International Program)
- **Level**: Undergraduate
- **Prerequisites**: 2183-221 Thermodynamics, 2183-222 Fluid Mechanics

2 Course Description

Fundamentals of rocket propulsion, covering classical chemical rocket propulsion for launch, orbital, and interplanetary flight. Topics include:

- Flight mission and performance
- Rocket equations
- Nozzle theory and design
- Future trends in rocket propulsion
- Preliminary design of engine components

3 Course Objectives

Upon completing this course, students will:

- Classify rocket engine types and identify the roles of main components
- Analyze flight mission regimes and determine flight performance
- Perform conceptual and preliminary design of rocket engines

4 Course Outline

Week	Topic	Sutton Chapter
1-2	Introduction to Rocket Engines	Ch. 2
3	Nozzle Theory and Thermodynamic Relations	Ch. 3
4	Flight Mission and Performance	Ch. 4
5	Chemical Rocket Propellant Performance Analysis	Ch. 5
6-10	Liquid Propellant Rocket Propulsion	Ch. 6-10
	Individual Project or Exam	
11-13	Solid Propellant Rocket Propulsion	Ch. 12-15
14-15	Hybrid Propellant Rocket Propulsion Design (Group Project)	Ch. 16

5 Evaluation

- Weekly Quizzes (Paper-Based, 1 Note Page Allowed) Topics to match Sutton chapters in Course Outline: 30%
- Homework Assigned Weekly via MCV (Submit as source code or pdf, to GitHub Repo, Via Email, MCV or hardcopy in class): 30%
- Final Design Group Project: 40%

5.1 Homework VCS Systems:

The software codes cooperatively developed in this course are designed to equip students with the essential skills of modular and composable systems engineering—a critical and highly sought-after competency in the aerospace industry, particularly among space startups and leading organizations. By engaging with these codes, students will learn to construct complex systems by integrating modular components, fostering adaptability and efficiency in design. This hands-on approach not only deepens their understanding of rocket propulsion concepts but also prepares them to meet the dynamic demands of modern aerospace engineering, where the ability to rapidly assemble and reconfigure systems is paramount.

- **Contributions**: Homework can be submitted as improvements to existing code in the course repository, including:
  - Additional vectorized Python functions relevant to the coursework (optimizations are greatly encouraged)
  - Jupyter Lab notebooks solving specific textbook problems or problems created by students or the instructor
  - Corrections to any existing software or content

  Note: There is no requirement to use software tools; assignments can be submitted as PDF, MS Word, or hardcopy documents.

- **Submission**: Ideally submit homework code and the final project via the Course GitHub repository in MATLAB, Python, or other relevant code formats. If preferred, students may send written homework notes via MVC, email or hard-copy in class.

- **GitHub Access**: Email your GitHub username to vkhansen@eng.chula.ac.th to be added to the repository.
- **Google Groups Mailing List:** Google Groups for discussions, updates, and Q&A:
  - Admin Panel: rocket-propulsion-2145473
  - Email: rocket-propulsion-2145473@googlegroups.com

6 Online Resources

- Course GitHub Repository (Provide Github username for contributor access): Course Repository
- Course NotebookLM (Provide gmail account email address for access): Google NotebookLM
- Jeerasak Pitakarnnop Materials (pdf password "aeroise"): Web

7 Reading List

Required Textbook:

Sutton, G. P., and Biblarz, O., *Rocket Propulsion Elements*, 9th ed., Wiley, 2017.

References

[1] Gerald Hagemann, Hans Immich, Thong Van Nguyen, and Gennady E. Dumnov. *Advanced Rocket Nozzles*. Journal of Propulsion and Power, 14(5):620-629, 1998.

[2] Philip G. Hill and Carl R. Peterson. *Mechanics and Thermodynamics of Propulsion*. 2nd edition, Prentice Hall, 1992. ISBN: 978-81-317-2951-9

[3] Dieter K. Huzel and David H. Huang. *Design of Liquid Propellant Rocket Engines*. National Aeronautics and Space Administration, Washington, D.C., 1967. (NASA SP-125)

8 Document History

- Version 1.0 - 01/21/2024 - Initial draft by Viggo Hansen
- Version 1.1 - January 30, 2025 - Revised to include detailed submission methods for homework and projects via GitHub, aligning with Code-First Learning principles.