Course Syllabus - Rocket Propulsion

Viggo Hansen

January 30, 2025

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

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 Notes:

- **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 prefered 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 (Python/MATLAB/Jupyter Notebook): Course Repository
- Course NotebookLM (Provide gmail account 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.