

**The Hong Kong University of Science and Technology**

**UG Course Syllabus**

**Aerospace Engineering: Principles and Systems**

MECH 2007

3 Credits

**Prerequisite(s):** MATH 1013 OR MATH 1020 OR MATH 1023

**Name:** Zhenyu Gao

**Email:** zhenyugao@ust.hk

**Office Hours:** Monday 15:30-16:30, or by appointment

**Course Description**

This course introduces students to the field of aerospace engineering, including working vocabulary of the field, basic principles in key disciplines of aerospace systems, and interconnections among the various disciplines. This course covers major disciplines in aerospace engineering, such as aerodynamics, propulsion, aircraft performance, space engineering (astronautics), and aerospace systems engineering. In addition, this course aims to introduce aerospace engineering from a modern perspective. It covers recent development trends such as systems design and optimization, data-driven modeling, sustainable aviation, advanced air mobility, and space logistics. The course covers introductory-level materials in each topic; further details appear in later MAE technical courses and research programs.

**Intended Learning Outcomes (ILOs)**

By the end of this course, students should be able to:

1. Understand the vocabulary related to aerospace engineering: components and principles of an aircraft or spacecraft, their purpose and features.
2. Be familiar with general concepts in aerodynamics, aircraft performance, propulsion, space engineering, and preliminaries of aircraft design and systems engineering.
3. Use the basic vocabulary of the field. Connect between the various disciplines of aerospace engineering.
4. Perform basic computations and quantitative evaluations on the main disciplines of aerospace engineering.

## Assessment and Grading

### Homework Assignments (20%)

- Homework 1: Fundamentals, Basic Aerodynamics (5%)
- Homework 2: Flight Vehicle Aerodynamics (5%)
- Homework 3: The Standard Atmosphere, Propulsion (5%)
- Homework 4: Aircraft Performance, Space Engineering (5%)

There will be four homework assignments throughout the semester. Students should submit electronic copies to Canvas before the deadline. Late submissions incur a penalty of 10% of the grade for that homework per day, for at most three days.

### Midterm Exam (35%)

There will be one in-class midterm exam with conceptual and computational questions. Students will have 75 minutes to complete the exam. The range of the midterm exam is the first two homework assignments. One A4 cheatsheet, written on both sides, is allowed.

### Final Exam (35%)

The final exam will cover all materials in the course, with slightly more emphasis on course materials after the midterm. Students will have 150 minutes to complete the exam. Two A4 cheatsheets in the same format are allowed. The date, time, and location are to be announced later.

### Small Essay (7%)

The small essay gives students an opportunity to select an interesting topic in aerospace engineering and investigate its current status and development trends. More details will be released later in the semester.

### Class Participation (3%)

This part consists of class attendance and punctuality, in-class interactions, participation in the online forum, and office hours.

### Summary Table

| Assessment Task     | Contribution to Overall Course grade (%) | Due date                |
|---------------------|------------------------------------------|-------------------------|
| Homework 1          | 5%                                       | 9/25/26 *               |
| Homework 2          | 5%                                       | 10/9/26 *               |
| Homework 3          | 5%                                       | 11/6/26 *               |
| Homework 4          | 5%                                       | 11/20/26 *              |
| Midterm Exam        | 35%                                      | 10/15/26 *              |
| Final Exam          | 35%                                      | TBD *                   |
| Small Essay         | 7%                                       | 11/28/26 *              |
| Class Participation | 3%                                       | Throughout the semester |

\* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

This course will be assessed using criterion-referencing. Grades will not be assigned using a curve.

### Mapping of Course ILOs to Assessment Tasks

| Assessed Task        | Mapped ILOs            | Explanation                                                                                                                                                       |
|----------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Homework Assignments | ILO1, ILO2, ILO3, ILO4 | Homework assignments assess students ability to use aerospace vocabulary, connect major disciplines, and perform basic computations and quantitative evaluations. |
| Midterm Exam         | ILO1, ILO2, ILO4       | The midterm assesses fundamental concepts and computations from the first part of the course.                                                                     |
| Final Exam           | ILO1, ILO2, ILO3, ILO4 | The final exam assesses integrated understanding across aerodynamics, propulsion, aircraft performance, space engineering, and systems engineering.               |
| Small Essay          | ILO1, ILO2, ILO3       | The essay requires students to investigate a topic in aerospace engineering and connect concepts with current development trends.                                 |
| Class Participation  | ILO1, ILO3             | Participation supports active use of aerospace vocabulary through questions, discussion, forum participation, and office-hour engagement.                         |

### Final Grade Descriptors:

| Grades | Short Description        | Elaboration on subject grading description                                                                                                                           |
|--------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A      | Excellent Performance    | Demonstrates deep understanding of aerospace vocabulary, core concepts, disciplinary links, and quantitative methods. Communicates reasoning clearly and accurately. |
| B      | Good Performance         | Shows solid understanding of aerospace concepts and terminology. Completes most quantitative work correctly and explains reasoning effectively.                      |
| C      | Satisfactory Performance | Shows adequate understanding of introductory aerospace topics and routine computations, with acceptable communication and disciplinary connections.                  |
| D      | Marginal Pass            | Shows limited but sufficient familiarity with basic aerospace vocabulary, selected concepts, and simple calculations.                                                |
| F      | Fail                     | Does not demonstrate sufficient understanding of core aerospace concepts, vocabulary, computations, or communication expectations.                                   |

## Student Rubrics

Use the following rubrics to guide you for the assessment tasks that you submit in this course.

### Homework Assignments Student Rubric

| Criteria                 | Excellent                                                                           | Good                                                   | Satisfactory                                       | Marginal                                     | Fail                                             | Mapping to Course ILOs |
|--------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------|----------------------------------------------|--------------------------------------------------|------------------------|
| Conceptual understanding | Explains concepts accurately and connects them to the correct aerospace discipline. | Explains most concepts correctly with minor omissions. | Shows basic understanding with limited detail.     | Shows partial or inconsistent understanding. | Shows little understanding of required concepts. | ILO 1, ILO 2, ILO 4    |
| Quantitative work        | Calculations are correct, units are handled carefully, and assumptions are clear.   | Calculations are mostly correct with minor errors.     | Completes routine calculations with some mistakes. | Attempts calculations but with major gaps.   | Provides little or no valid quantitative work.   | ILO 1, ILO 2, ILO 4    |

## Small Essay Student Rubric

| Criteria        | Excellent                                                                                         | Good                                                            | Satisfactory                                      | Marginal                                       | Fail                                                      | Mapping to Course ILOs |
|-----------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------|------------------------------------------------|-----------------------------------------------------------|------------------------|
| Topic synthesis | Investigates an aerospace topic with accurate context, relevance, and clear disciplinary framing. | Presents a clear topic discussion with mostly accurate context. | Provides an adequate overview with limited depth. | Discussion is superficial or weakly supported. | Does not present a meaningful aerospace topic discussion. | ILO 1, ILO 2, ILO 3    |

## Exams and Participation Student Rubric

| Criteria         | Excellent                                                                                  | Good                                          | Satisfactory                                 | Marginal                                                       | Fail                                            | Mapping to Course ILOs     |
|------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------|----------------------------------------------------------------|-------------------------------------------------|----------------------------|
| Exam performance | Demonstrates accurate understanding and selects appropriate methods under exam conditions. | Shows strong understanding with minor errors. | Solves standard problems with some mistakes. | Attempts solutions but methods or results are often incorrect. | Cannot complete required problem-solving tasks. | ILO 1, ILO 2, ILO 3, ILO 4 |
| Participation    | Contributes relevant questions, answers, feedback, and aerospace-related discussion.       | Participates regularly and constructively.    | Participates adequately when prompted.       | Participation is limited or inconsistent.                      | Shows little meaningful participation.          | ILO 1, ILO 2, ILO 3, ILO 4 |

## **Communication and Feedback**

Students Talk Time opens the first five minutes of each lecture for feedback, questions, recent aerospace news, or other class-related discussion. Students should preferably post questions about course materials or logistics to the Canvas online forum. Private or sensitive questions may be sent by email to the instructor and TAs or discussed during office hours.

## **Course AI Policy**

Generative AI may be used as a learning helper for background search, brainstorming, checking explanations, and polishing writing. Students remain responsible for the accuracy, originality, and academic integrity of all submitted work. Generative AI must not be used to replace individual learning or obtain unauthorized assistance in exams.

## **Academic Integrity**

All homework are individual assignments. Students may discuss problem-solving ideas with classmates, but must complete their own homework. Put academic integrity above anything else. The course applies strict honor-code enforcement and no tolerance for cheating. See the HKUST Academic Honor Code and Declaration of Academic Integrity.