Course number	U-LAS12 10033 LE57		
Course title (and course title in English)	Advanced Dynamics-E2 Advanced Dynamics-E2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,AMAR, Julien Samuel
Group	Natural Sciences	Field(Classification)	Physics(Foundations)
Language of instruction	English	Old group	Group B
Number of credits	2		
Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)
Year/semesters	2026・Second semester		
Days and periods	Tue.4	Target year	Mainly 1st year students
Eligible students	For science students		

[Overview and purpose of the course]

This course aims to introduce advanced concepts of classical mechanics. After learning the content of this course, students will be able to apply Newtonian mechanics to solve advanced problems of classical mechanics, including but not limited to: (a) rotation of rigid bodies, (b) motion under central forces, for example, planetary motion, (c) motion observed from non-inertial frames, etc. Students are also expected to be able to advance their mathematical skills, particularly regarding vector calculus and 2D/ 3D polar coordinate systems by studying the concepts of this course.

[Course objectives]

(1) To build upon the ideas learnt in Fundamental physics A, (2) To be able to understand advanced concepts of dynamics of rigid bodies, (3) To develop the ability to tackle practical problem solving.

[Course schedule and contents)]

1. Brief review of Cartesian coordinate systems, vector analysis, coordinate transformations, Newton's laws, inertial and non-inertial frames, conservation of energy and momentum, collision problems, distributed systems, and center of mass (5 weeks)

2. Lagrangian mechanics and generalized coordinates (2 weeks)

3. Midterm exam and review of previous topics (1 week)

4. Central forces, simple rigid body dynamics (inertia and torques), and orientation in 3D space with Euler angles (3 weeks)

5. General motion of rigid bodies, inertia tensor and principal axes, Euler's equations of rigid body rotation, precession and nutation, free symmetric top, and heavy symmetric top (2 weeks)

6. Introduction to the limits of classical mechanics (chaos theory, special relativity) (1 week)

7. Feedback (1 week)

Continue to Advanced Dynamics-E2(2)↓↓↓

Advanced Dynamics-E2(2)

[Course requirements]

Completion of Fundamental Physics A is required.

[Evaluation methods and policy]

Evaluation will be based on active participation (10%), one Mid-term in-class exam (40%), one Final in-class exam (50%)

[Textbooks]

Instructed during class

[References, etc.]

（References, etc.）

Introduced during class

[Study outside of class (preparation and review)]

Following study materials and working on assignments

[Other information (office hours, etc.)]

Will be discussed in the class.

[Essential courses]