COURSE INFORMATION

Course Code	AAM 533	Course Name	Advanced Orbital Mechanics					
Type of Course	**Level of Course**	**Semester**	**Language**	**Theory**	**Application (Practice)**	**Laboratory**	**Local Credits**	**ECTS**
Elective	Graduate	-	English	3	0	0	3	6

Department	: Aerospace Engineering
Prerequisites/Requirements for Admission	: -
Mode of Delivery	: Face to Face
Course Coordinator	: Prof. Dr. Tahsin Çağrı ŞİŞMAN
Course Lecturer(s)	: Prof. Dr. Çetin ŞENTÜRK
Course Assistant(s)	: -
Course Description/Aim	: The topics that are not included in the content of the undergraduate compulsory course AST 301 Orbital Mechanics are detailed in this course. Furthermore, the understanding of the student on the content of the course is planned to be enhanced via a project-based learning involving software development in the MATLAB environment, and also involving orbital analysis in GMAT open-source software of NASA.
Course Contents	: Lagrange coefficients, restricted three-body problem, universal variables, Lambert's problem, Gauss method of preliminary orbit determination, orbital maneuvers, relative motion and rendezvous, interplanetary trajectories, lunar trajectories.
Recommended Optional Program Components	: -
Compulsory Attendance	: %70

Course Learning Outcomes

#	Learning outcome	Teaching Methods/Techniques	Assessment method(s)
At the end of this course; students will be able to:			
1	Use Lagrange coefficients and universal variables in orbital analysis.	Theoretical Lecture, Solving Exercises	Exams/Homeworks/Project
2	Determine orbit by using Lambert problem and Gauss method.	Theoretical Lecture, Solving Exercises	Exams/Homeworks/Project
3	Understand basics of orbital maneuvers, relative motion and rendezvous, interplanetary trajectories.	Theoretical Lecture, Solving Exercises	Exams/Homeworks/Project
4	Develop or modify orbital analysis codes to solve specific orbital mechanics problems.	Theoretical Lecture, Solving Exercises	Exams/Homeworks/Project

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Weekly Detailed Course Content

Week	Content	Recommended Resource(s)	Time (Hours)
1	Review of numerical integration	Textbook/ Lecture Notes	3
2	Review of two-body problem; Lagrange coefficients	Textbook/ Lecture Notes	3
3	Restricted three-body problem: Equations of motion	Textbook/ Lecture Notes	3
4	Restricted three-body problem: Lagrange points; Jacobi constant	Textbook/ Lecture Notes	3
5	Universal variables: Review of Kepler's equation	Textbook/ Lecture Notes	3
6	Universal variables: Lagrange coefficients	Textbook/ Lecture Notes	3
7	Lambert's problem	Textbook/ Lecture Notes	3
8	Lambert's problem / Midterm Exam	Textbook/ Lecture Notes	3
9	Gauss method of preliminary orbit determination	Textbook/ Lecture Notes	3
10	Orbital maneuvers: Review of Hohmann transfer	Textbook/ Lecture Notes	3
11	Orbital maneuvers: Non-Hohmann transfers; apse line rotation; plane changes	Textbook/ Lecture Notes	3
12	Basics of relative motion and rendezvous	Textbook/ Lecture Notes	3
13	Basics of interplanetary trajectories	Textbook/ Lecture Notes	3
14	Basics of Lunar Trajectories	Textbook/ Lecture Notes	3
15	Final Exam		
16	Final Exam		

Sources

Course Notes / Textbooks	H. D. Curtis, Orbital Mechanic for Engineering Student, 3rd Edition, Butterworth-Heinemann, 2010.
Supplemental Readings	

Evaluation System

Work Placement	Number	Percentage of Grade (%)
Attendance		
Quizzes		
Homework	6	15
Presentation		
Laboratory/Practice		
Report(s)		
Graduate Thesis/Project		
Seminar		
Projects		
Midterm exam(s)	1	35
Others		
Final exam	1	50
	Total	100
	Percentage of semester work	50
	Percentage of final exam	50
	Total	100

COURSE INFORMATION

Workload Calculation

Activity	Number	Time (hours)	Total Work Load (hours)
Course Hours	14	3	42
On-line Activity Hours			
Individual study	16	5	80
Midterm exam(s)	1	2	2
Final exam	1	10	10
Homework	6	8	48
Presentation			
Project			
		Total	182
		ECTS Credit *(Total/30)*	6

Contribution of Learning Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
LO1	5	5	2	5	4	2	3	4	2
LO2	5	5	2	5	4	2	3	4	2
LO3	5	5	2	5	4	2	3	4	2
LO4	5	5	2	5	4	2	3	4	2
LO5	5	5	2	5	4	2	3	4	2
LO6	5	5	2	5	4	2	3	4	2

Contribution Level : 1: “Very low”, 2: “Low”, 3: “Medium”, 4: “High”, 5: “Very High”
LO: Learning Outcome of the Course
PO: Program Outcome