AERO 310 – Flight Mechanics

Course Code	Course Name		Semester	
AERO 310	Flight Mechanics		Fall ☐ Spring ☒ Summer ☐	
Hours			**Credit**	**ECTS**
Theory	**Practice**	**Lab**	3	6
3	0	0		

Course Details	
Department	Aerospace Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Course Objectives	Aircraft geometry from stabilty and control point of view. Control surfaces. Governing equations related to longitudinal and lateral static stability and control of an aircraft. Aircraft trim analysis. Importances of the neutral point, maneuver point etc. Differences of stick fixed and stick free stability. Governing equations of motion for 6 degree of freedom dynamic motion of aircraft. Effects of the aerodynamic design, center of gravity location and moments of inertia on static and dynamic stability and control of an aircraft. Calculation of the stability derivatives of an aircraft. Dynamic modes of an aircraft. Solution of related problems.
Course Content	Aircraft Forces and Subsystems: The atmosphere, aerodynamic forces, propulsion subsystem. Turbojets-Level Flight in the Vertical Plane: Governing equations, level flight, ceiling, cruise flight and range, maximum endurance. Other Flights in the Vertical Plane: Take-off and landing, climbing flight, unpowered flight. Turning Flight in the Horizontal Plane: Governing equations, maximum load factor, bank angle, turning rate, and turning radius. Piston-Props-Level

	Flight in the Vertical Plane: Governing equations, level flight and ceiling conditions, best range, maximum endurance. Other Flight: Take-off and landing, climbing flight, turning fight, turboprops, turbofans, and others-turboprops and turbofans, Mach number representation, flight and maneuvering envelops, the effect of wind on performance.
Course Method/ Techniques	Lecture ☒ Question & Answer ☐ Presentation ☒ Discussion ☐
Prerequisites/ Corequisites	
Work Placement(s)	

Textbook/References/Materials

- Airplane Flight Dynamics and Automatic Flight Controls, Jan Roskam
- Aircraft Dynamics: From Modeling to Simulation, M. R. Napolitano, Wiley
- ETKIN, B., DUFF REID, L., "Dynamics of Flight - Stability and Control", Third Eddition, John Wiley and Sons, 1996, ISBN: 0-471-03418-5. (TL570.E75 1995)
- The following books are the excellent sources of reference.
- McCORMICK, B. W., "Aerodynamics, Aeronautics and Flight Mechanics", Second Edition, John Wiley and Sons, 1995, ISBN: 0-471-57506-2. (TL570.M38 1995)
- ANDERSON, J. D., "Introduction to Flight", Third Edition, McGraw-Hill, 1989, ISBN: 0-07-100496-3. (TL570.A68 1989)

Course Category				
Mathematics and Basic Sciences	☐		Education	☐
Engineering	☒		Science	☐
Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule

No	Topics	Materials/Notes
1	Introduction to Aircraft Geometry and Control Surfaces	
2	Equations of Motion and Reference Frames	
3	Review of Fundamentals of Aerodynamics	
4	Review of Fundamentals of Aerodynamics	
5	Aerodynamic and Propulsive Forces and Equations	
6	Stability and Control in Steady Flight. Trim Problem.	
7	Stability and Control in Steady Flight. Trim Problem.	
8	Midterm Exam	
9	Stability and Control in Disturbed Flight Conditions	
10	Stability and Control in Disturbed Flight Conditions	
11	Longitudinal Dynamic Stability and Response to Inputs	
12	Longitudinal Dynamic Stability and Response to Inputs	

13	Lateral Dynamic Stability and Response to Inputs	
14	Lateral Dynamic Stability and Response to Inputs	
15	Lateral Dynamic Stability and Response to Inputs	
16	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize		
Homework		
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam		
Final Exam		
	Total	**100%**
Contribution of Midterm Studies to Success Grade		
Contribution of End of Semester Studies to Success Grade		
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	48
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	4	56
Quiz/Studio/Criticize			
Homework	3	15	45
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	2	2
Final Exam and Preparation for Final Exam	1	2	2
Total Workload			**147**
Total Workload / 25			
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	Explains the fundamental principles of flight mechanics and aerodynamic forces.
L2	Calculates aircraft performance parameters (range, climb, turn, etc.).
L3	Analyzes aircraft stability and control characteristics.
L4	Derives and simulates flight dynamics equations.
L5	Evaluates flight safety and certification processes.

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**Total**
L1	5	4	3	3	2	2	2	3	3	2	2	31/55 = %56.36
L2	5	5	4	4	3	2	2	3	3	2	3	36/55 = %65.45
L3	4	5	5	4	4	3	3	3	3	3	3	40/55 = %72.73
L4	4	4	4	5	5	3	3	3	3	3	3	40/55 = %72.73
L5	3	3	3	3	3	4	4	4	5	4	4	40/55 = %72.73
											Total	187/275= 68%