AERO 305 – AERODYNAMICS I

Course Code		Course Name	Semester	
AERO 305		Aerodynamics I	Fall ☒ Spring ☐ Summer ☐	
Hours			**Credit**	**ECTS**
Theory	**Practice**	**Lab**	3	5
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	The objective of the course is to inform the student with the fundamentals of lift formation. Mathematical basis of lift formation is given through the potential flow theory around a rotating cylinder. Then this concept is carried to Joukovsky airfoil through the use of conformal mapping and the Kutta condition is explained. Thin airfoil theory is given for both symmetrical and cambered airfoils. The concept of flapped airfoil and increase in lift is explained. Then finite-wing, lifting line theory is given and the differences between an airfoil and a finite wing are specified. Formation of induced drag is explained. Elliptic wing loading and minimum induced drag concepts are analysed. General wing loading is treated and the aerodynamic coeffficients are calculated. Final chapter is devoted to slender bodies and wings to show the effect of small aspect ratios in the calculation of lift.
Course Content	Potential flow theory, flow around a cylinder, formation of lift, Kutta-Joukovsky theorem, Joukovsky airfoil, definition of aerodynamic coefficients, Panel Method. Thin airfoil theory, Kutta condition, Kelvin 's circulation theorem, symetrical and cambered airfoils, lift curve slope and zero lift angle of attack, flapped airfoil. Finite wing , lifting line theory, elliptic and general wing loading. Slender wing theory, pressure distribution, aerodynamic coeffi cients.
Course Method/ Techniques	Lecture ☒ Question & Answer ☐ Presentation ☒ Discussion ☒
Prerequisites/ Corequisites	AERO 206
Work Placement(s)	

Textbook/References/Materials

- John D. Anderson, "Fundamentals of Aerodynamics", 5th Edition, McGraw-Hill.
- B. W. McCormick, "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley and Sons, ISBN 0-471-03032-5.

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

Weekly Schedule

No	Topics	Materials/Notes
1	Introduction and definitions.	
2	Introduction and definitions.	
3	Introduction and definitions.	
4	Fundamental Principles and Equations of Aerodynamics.	
5	Fundamental Principles and Equations of Aerodynamics.	
6	Fundamental Principles and Equations of Aerodynamics.	
7	Inviscid and Incompressible Flows.	
8	**Midterm Exam**	
9	Inviscid and Incompressible Flows.	
10	Incompressible Flows over Airfoils.	
11	Incompressible Flows over Airfoils.	
12	Incompressible Flows over Finite Wings.	
13	Incompressible Flows over Finite Wings.	
14	3-D Incompressible Flow.	
15	3-D Incompressible Flow.	
16	**Final Exam**	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize		
Homework	4	20%
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam		30%
Final Exam		50%
	Total	**100%**
Contribution of Midterm Studies to Success Grade		50%
Contribution of End of Semester Studies to Success Grade		50%
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	2	28
Quiz/Studio/Criticize			
Homework	4	8	32
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	12	12
Final Exam and Preparation for Final Exam	1	12	12
Total Workload			**126**
Total Workload / 25			**126/25**
ECTS Credit			**5**

Course Learning Outcomes	
No	**Outcome**
L1	Learn the basic aerodynamic principles, terms and relations.
L2	Understand the basic flows.
L3	Calculate the aerodynamic force coefficients.
L4	Understand the difference between 2D and 3D flows.

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
L1	5	5	4	5	0	3	3	5	2	0	1
L2	5	5	4	5	0	3	3	5	2	0	1
L3	5	5	4	5	0	3	3	5	2	0	1
L4	5	5	4	5	0	3	3	5	2	0	1