DEPARTMENT OF AERONAUTICAL ENGINEERING
COURSE SYLLABUS

AE 311: Incompressible Flow

COURSE TITLE	ENGLISH CODE/NO	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	Total
Incompressible Flow	AE 311	هـ ط ٣١١	3	1		3

Pre-requisites:	AE 303, EE 300, MATH 205
Course Role in Curriculum *(Required/Elective):*	Required Course

Catalogue Description:
Two-Dimensional Inviscid Fluid Flow, Stream Function and Velocity Potential, Superposition of Elementary Flows, Source Panel Methods, Thin airfoil theory, Vortex Panel Methods, Finite Wings. Vortex Lattice Method, Incompressible Boundary Layer, Aerodynamic Design.

***Textbooks*:** *(Author, Title, Pub., year)* Anderson, John D., Fundamentals of Aerodynamics, 5th Edition, McGraw-Hill, 2010.
Supplemental Materials: Course Notes

Course Learning Outcomes:
By the completion of the course the students should be able to:

1. Derive flow equations for incompressible potential flow from fundamental principles.
2. Define potential flow and state the general approach for the solution of incompressible potential flow.
3. Analyze (i.e., calculate velocities, pressures, stream function, potential function, stagnation points, streamlines, equipotential lines, circulation around bodies, etc.)
4. Implement the source panel method to compute pressure and velocity on non-lifting surfaces.
5. State the fundamental concepts in Airfoil Theory (i.e. Kutta-Joukowski Theorem, Kutta Condition, and Kelvin's theorem)
6. Use thin airfoil theory to compute aerodynamic characteristics of airfoils
7. Implement the vortex panel method to compute aerodynamic characteristics for thick airfoils.
8. Analyze the effects of airfoil geometrical characteristics and the angle of attack on aerodynamic characteristics and their impact on airfoil design
9. Describe the flow field around wings of finite span and Explain the generation of induced drag and Apply Prandtl's lifting-line theory to calculate the aerodynamic characteristics of airplane wings
10. Identify wing aerodynamic parameters and recognize their impact on wing design.
11. Identify possible solutions, as well as any limitations of these solutions, to several regional, national, and/or global contemporary problems related to aerodynamics and explain what makes these issues particularly relevant to the present time.
12. Investigate recent developments in aerodynamics with application to aeronautical systems.

Topics to be Covered:		***Duration in Weeks***
1.	Basic laws	2
2.	Potential Flow Theory	5
3.	Airfoil Theory	3
4.	Finite Wing Theory	3
5.	Global/Social/Contemporary Problems Related to Aerodynamics+ Life-long learning exercise	1

Student Outcomes addressed by the course: (Put a ✓ sign)

(a)	an ability to apply knowledge of mathematics, science, and engineering	✓
(b)	an ability to design and conduct experiments, as well as to analyze and interpret data	
(c)	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	✓
(d)	an ability to function on multidisciplinary teams	
(e)	an ability to identify, formulate, and solve engineering problems	✓
(f)	an understanding of professional and ethical responsibility	
(g)	an ability to communicate effectively	
(h)	the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i)	a recognition of the need for, and an ability to engage in life-long learning	✓
(j)	a knowledge of contemporary issues	✓
(k)	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	✓

Key Student Outcomes assessed in the course: (c), (e) and (j)

Instructor or course coordinator: Dr. Ibraheem AlQadi
Last updated: May 2015