DEPARTMENT OF AERONAUTICAL ENGINEERING
COURSE SYLLABUS

AE 419: Computational Fluid Dynamics

COURSE TITLE	ENGLISH CODE/NO	ARABIC CODE/NO.	CREDITS			
			Th.	Pr.	Tr.	Total
Computational Fluid Dynamics	AE 419	419 هـ ط	3	1		3
Pre-requisites:	AE 311					
Course Role in Curriculum *(Required/Elective):*	Elective Course					

Catalogue Description:
Introduction to CFD. Navier Stokes Equations. Partial Differential Equations (PDE's). Basics of numerical methods for solving PDE's. Finite Difference Methods. Numerical Solutions of Hyperbolic PDE's. Numerical Solutions of Parabolic PDE's. Numerical Solutions of Elliptic PDE's. Finite Volume Methods. Numerical Grid Generation. Fluent (Commercial CFD package): Preprocessing: problem setup including geometry, grid generation, and solution model selection. Processing: solution process Post processing: results analysis, Performing parametric studies using Fluent.

***Textbooks*:** (Author, Title, Pub., year) Kalus Hoffmann & Steve T. Chiang, Computational Fluid Dynamics for Engineers – Volume I, 4th Edition, EES Publications, 2000.

***Supplemental Materials*:** Course Notes, Ansys Fluent Documentations.

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

1. State the basics steps in a CFD analysis.
2. Derive Navier-Stokes equations from the fundamental principles
3. State the basics steps in a CFD analysis.
4. Classify partial differential equations (PDE's)
5. Formulate Finite Difference approximations f11or different types of PDE's
6. Analyze the stability of finite difference approximation.
7. Assess the accuracy of finite difference approximation using benchmark problems.
8. Solve fluid dynamics and heat transfer problems in one and two dimensions for simple domains.
9. Formulate Finite Volume approximations for different types of PDE's.
10. Use the CFD package FLUENT to study and analyze fluid engineering problems.

Topics to be Covered:	***Duration in Weeks***
1. Introduction	1
2. Navier-Stokes Equations	1
3. Finite Difference Methods	5
4. Finite Volume Methods	1
5. Fluent	6

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: **(e) and (k)**

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