جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Fluid Mechanics - ME 200B

Division	Physical Science and Engineering Division
Course Number	ME 200B
Course Title	Fluid Mechanics
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	09:00 AM - 10:30 AM | Mon Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
William Lafayette Roberts	William.Roberts@kaust.edu.sa	+966128084909		Tuesdays and Thursdays from 8:30 to 9:30, or by appointment

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	This course will extend and deepen the students fundamental understanding of fluid mechanics. Topics to be covered include boundary layers, low Reynolds number flows, hydrodynamic stability, one-dimensional compressible flow, and turbulence. Emphasis will be given to analytical solutions to classical problems as well as modern topics.
Course Description from Program Guide	Fundamentals of fluid mechanics. Microscopic and macroscopic properties of liquids and gases; the continuum hypothesis; review of thermodynamics; general equations of motion; kinematics; stresses; constitutive relations; vorticity, circulation; Bernoullis equation; potential flow; thin-airfoil theory; surface gravity waves; buoyancy- driven flows; rotating flows; viscous creeping flow; viscous boundary layers; introduction to stability and turbulence; quasi onedimensional compressible flow; shock waves; unsteady compressible flow; acoustics.
Goals and Objectives	The student will have an understanding of the derivation of the equations governing fluid flow behavior in both low and high Reynolds number regimes. They will be able to predict the stability of fluid flow, and apply boundary layer theory and concepts to solve many practical flow problems. The student will have an understanding of acoustic and finite wave propagation and shock waves.
Required Knowledge	The student should have a strong fundamental understanding of invisid, incompressible fluid mechanics and classical thermodynamics. The student should also have sufficient mathematical sophistication to solve PDEs numerically and analytically.
Reference Texts	The primary text will be 'Fluid Mechanics' 5th edition by Kundu, Cohen, and Dowling. Supplementary material will be provided as necessary.
Method of evaluation	**40.00**% - Final exam **10.00**% - Homework /Assignments **25.00**% - Exam 2 **25.00**% - Exam 1
Nature of the assignments	Assignments will consist of six written homework problem sets

Course Policies	Students are expected to work independently and attend all lectures. In general, late homework will not be accepted and make-up exams will not be given.
Additional Information	In accordance with Unversity policy and professional standards, the highest levels of academic integrity are expected in this class. The code of student conduct is strictly enforced. Academic dishonesty will result in reductions in grades and/or expulsions from this class and/or the University.

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/29/2018	introduction and review
1	Wed 01/31/2018	development of BL equations, application to flat plate
2	Mon 02/05/2018	Blassius solution
2	Wed 02/07/2018	Falkner-Skan Similarity Solutions
3	Mon 02/12/2018	von Karman Momentum Integral method
3	Wed 02/14/2018	Thwaite's method
4	Mon 02/19/2018	transition, pressure gradients, separation
4	Wed 02/21/2018	flow over a cylinder
5	Mon 02/26/2018	flow at low Reynolds number
5	Wed 02/28/2018	lubrication theory
6	Mon 03/05/2018	taylor-Couette flow
6	Wed 03/07/2018	Thermodyanics revisited
7	Mon 03/12/2018	Exam 1
7	Wed 03/14/2018	General concepts of hydrodynamic stability
8	Mon 03/19/2018	Kelvin-Helmholtz instability
8	Wed 03/21/2018	Taylor-Couette Instability
9	Mon 03/26/2018	Rayleigh-Taylor Instability
9	Wed 03/28/2018	capilary instability of jets and cylinders
10	Mon 04/02/2018	derivation of the jet stability equation
10	Wed 04/04/2018	stability of a periodic array of point vorticies
11	Mon 04/09/2018	vorticity
11	Wed 04/11/2018	stability of boundary layers
12	Mon 04/16/2018	exam 2
12	Wed 04/18/2018	stastical description of turbulence
13	Mon 04/23/2018	scales in turbulent flows
13	Wed 04/25/2018	probability density funcstions
14	Mon 04/30/2018	turbulent boundary-free shear flows
14	Wed 05/02/2018	turbulent scalar fields
15	Mon 05/07/2018	turbulent boundary layers
15	Wed 05/09/2018	turbulence modeling
16	Mon 05/14/2018	introduction to compressible flows
16	Wed 05/16/2018	basic equations for 1-D compressible flows
17	Mon 05/21/2018	propagation of acoustic and finite waves
17	Wed 05/23/2018	normal shock waves

Note

The instructor reserves the right to make changes to this syllabus as necessary.