

<p>Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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Advanced Fluid Mechanics

College: *Engineering*

Department: *Mechanical Engineering*

First: Course Definition

1- Course Code: *ME 673*

2- Units: *3 credit hrs*

3- Semester:

4- Prerequisite:

5- Co-requisite:

6- Location (if not on main Campus):

Second: Course Objectives

- To provide students with basic analysis methods for fluid mechanics theory and applications at a more fundamental level than commonly pursued in undergraduate classes.
- To help students improve physical and mathematical understanding of fluid flows.
- To help students understand and use advanced analysis and simulation techniques for solving fluid problems.
- To help students understand advanced fluid topics such as vortex dynamics, boundary layer theory, transition, and turbulence.

Third: Course Specifications

1- Topics to be covered:		
Subject	No of Weeks	Units
<i>Conservation Laws: conservation of mass, momentum and energy. Strain and stress in fluid flow and their</i>	<i>3</i>	<i>9</i>

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<i>relationships.</i>		
Laminar flow of viscous incompressible fluids: flow between parallel flat plates, Couette flow, Poiseuille flow, flow between two co axial cylinders. Flow of two concentric rotating cylinders, unsteady motion of flat plates.	3	9
Boundary layer Theory: Blasius solution, shear stress and boundary layer thickness, boundary layer on a surface with pressure gradient. Momentum integral theorem for boundary layer, separation and its prevention.	3	9
Turbulence: Concepts of linearized stability of parallel viscous flow, transition to turbulent flow, Reynolds equation for turbulent flow. Prandtl mixing length theory, velocity profile. Turbulent flow in pipes and turbulent boundary layer on a flat plate.	3	9
Inviscid flow: Elementary plane flow solutions, uniform tream, source or sink and vortex. Superposition of lane flow solutions. Flow over wedge, cicular and Rankine oval.	3	9
	<i>Total</i>	45 hours

2- Course components (Total hrs in the Semester)

Lecture	Exercise or lab	total
45 hours		45 hours

3- Intended Learning Outcomes of the Course (ILO's) :

a. Knowledge:

i) Description of the knowledge to be acquired:

- To understand Laws of conservation, namely conservation of mass, conservation of momentum and conservation of energy and their applications in engineering fields.

-To understand laminar flows in steady state and transient conditions

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-To understand the theory of Boundary layer with applications and control of separation.

- To understand Turbulence, Reynolds equation and models of turbulence with their applications.

ii) Teaching strategies to be used to develop that knowledge:

- Lectures with applications
- Group discussion to assess communication abilities
- Seminars
- Projects presented by students

iii) Methods of assessment of knowledge acquired:

- Quizzes to assess basic understanding
- Projects on related topics
- Homework assignments
- Mid term exam
- Final term exam

b- Cognitive (Intellectual) Skills:

i) Cognitive skills to be developed:

- To acquire ability to analyze and solve mathematically problems with boundary Conditions.*
- to understand modelisation and its implementation.*

ii) Teaching strategies to be used to develop these cognitive skills:

- Lectures and tutorials.
- Discussion in class .
- Homework assignments

iii) Methods of assessment of students' cognitive skills:

- Their written Reports.
- examinations (quizzes, mid term and final exams).
- Case study reports

c. Interpersonal Skills and Responsibility:

i) Description of the interpersonal skills and capacity to carry responsibility to be developed:

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- Team work.
- Ideas development and shearing with others (communication skills)

ii) Teaching strategies to be used to develop these skills:

- Lectures.
- Mini projects.
- Case study analysis.
- Homework assignment

iii) Methods of assessment of students' interpersonal skills and capacity to carry responsibility:

- Mini projects.
- Written reports.
- Students' seminars and presentations.

d. Communication, Information Technology and Numerical Skills:

i) Description of the skills to be developed in this domain:

- Modelisation and simulation of problems.
- Use of commercial codes for modeling.
- Writing of good technical reports.

ii) Teaching strategies to be used to develop these skills:

- Lectures.
- Case study analysis.
- Mini projects.

iii) Methods of assessment of students numerical and communication skills:

- Mini projects.
- Homework assignments.
- Students' seminars and presentations.

e. Psychomotor (if applicable) & Other Non-cognitive Skills :

i) Description of the psychomotor or other skills to be developed and the level of performance required:

- No

ii) Teaching strategies to be used to develop these skills :-

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- No

iii) Methods of assessment of student's psychomotor skills:

- No

4- Student Assessment Schedule:

Serial	Assessment tool (test, group project, examination etc.)	Week due	Weight
1	First Project – case study	Week 3	10 %
2	Mid Term Exam	Week 8-9	20 %
3	Second Term Project – case study	Week 10	10 %
4	Third Term Project – case study	Week 13	10 %
5	Final Exam	Week 16	50 %

5- Student Support:

- Providing electronic library of textbooks and scientific periodicals.
- Providing computer applications for the course.

6- Learning Resources:

i) Essential Books (References):

- B. Munson, D. Young, T. Okiishi, "Fundamentals of Fluid Mechanics", John Wiley, 6th edition, 2010.

ii) Course Notes:

- Dispatched during lectures

iii) Recommended Books

- F. M. White, Fluid Mechanics, McGraw- Hill Company, 4th edition, 1994.
- H. Schlichting, Boundary Layer Theory, 7th Ed., McGraw-Hill Company, 1979.

iv) Electronic Books & Web Sites:

- [Fluid Mechanics Textbook Free Content Book](http://www.potto.org/release-notesFM.php)
www.potto.org/release-notesFM.php
- [Fluid Mechanics - Wikibooks, open books for an open world](http://en.wikibooks.org/wiki/Fluid_Mechanics)
en.wikibooks.org/wiki/Fluid_Mechanics
- [Fluid Mechanics Books - Free Computer books Download](#)

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www.freebookcentre.net/Physics/Fluid-Mechanics-Books.html

-Fluid Mechanics Textbook

www.cramster.com/course/fluid-mechanics-solutions-34

-Fluid Mechanics - Free E-Books

www.e-booksdirectory.com/listing.php?category=228

v) Periodicals:

-Trove - Search results for 'subject:"Fluid mechanics - Periodicals."'

trove.nla.gov.au/result?...subject%3A%22Fluid+mechanics+-+Periodicals...

- "Fluid mechanics Periodicals." | Brown University ...

library.brown.edu/.../Results?...%22%20Fluid%20mechanics%20Periodicals...

-Fluid dynamics - IEEE Conferences, Publications, and Resources

technav.ieee.org/tag/6060/fluid-dynamics

-Amazon.ca: Periodicals - Fluid Mechanics / Mechanical: Books

www.amazon.ca/periodicals-Fluid-Mechanics-

-The Journal of Fluid Mechanics

www.jfm.damtp.cam.ac.uk/

-Engineering Library Resources | Engineering Library at ...

engineering.test1.library.cornell.edu/cullrseek/.../*%20?...

-Fluid mechanics -- Periodicals - Universiti Tun Hussein Onn ...

[ent.uthm.edu.my/.../q\\$003dFluid\\$002bmechanics\\$0026qf\\$003dPUBDATE\\$002509Pu](http://ent.uthm.edu.my/.../q$003dFluid$002bmechanics$0026qf$003dPUBDATE$002509Pu)

-Amazon.co.uk: Periodicals Fluid Mechanics

www.amazon.co.uk/periodicals-Fluid_

7- Course Evaluation and Improvement Processes:

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching:

-Student`s assessment of course and instructor

-Questioners to be filled by instructor and students

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department:

-External assessment

-Seminars on topics related to the course

-Through course file

iii) Processes for Improvement of Teaching:

-Inviting professors to give seminars on related topics

-External assessments on course and students` results

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iv) Processes for verifying standards of student achievement:

- Through assessment of course file
- External instructor
- Through samples of students` results (exams)

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.:

- Through a committee of evaluation in checking the outcomes.
- Through the students` assessment for continuous improvement process.