

King Fahd University of Petroleum & Minerals
MECHANICAL ENGINEERING DEPARTMENT
ME 311: Fluid Mechanics

Catalogue Description: (3-0-3)

Definition and properties of fluids. Fluid statics with applications. Basic of fluid dynamic equations of continuity, energy and momentum, with applications to different flow situations and flow measurement. Viscous effects, boundary layer concepts, laminar and turbulent flow in pipes, open channel flow, fluid dynamics, forces on immersed bodies. Modeling and dimensional similarity. Introduction to turbomachinery.

Status in Curriculum (Required or Elective): Required (offered Fall & Spring)

Prerequisites: ME 201, ME 203, MATH 201

Co-requisites: None

Prerequisites by Topics:

- Fluid kinematics and pressure variation in flowing fluids, momentum principle(ME201)
- Energy principle (ME203)
- Control Volume approach, continuity and Euler's equation, boundary layer concept (MATH 201)

Textbook:Engineering Fluid Mechanics, Elger, Williams, Crowe and Roberson, John Wiley & Sons, 10th Ed., 2014.

References:

- 1 F. M. White, **Fluid Mechanics**, McGraw-Hill Company, 1999.
- 2 Fox, and McDonald, **Introduction to Fluid Mechanics**, John Wiley & Sons, 1998.

Coordinator:Dr. Abdelsalam Mohammad Al-Sarkhi, Professor of Mechanical Engineering

Goals: (general objectives)

The purpose of this course is to, to provide students with the basic principles required for understanding the main concepts in both areas of fluid statics and fluid dynamics and to develop the ability to apply the main concepts of fluid statics and fluid dynamics in solving a wide range of problems that are normally encountered in engineering practice.

Course Outline (Lecture Topics):

1. Fluid properties.
2. Fluid statics.
3. Fluid kinematics and pressure variation in flowing fluids.
4. Momentum principle with applications.
5. Energy principle.
6. Dimensional analysis and similitude; model studies for different flows and at different conditions.
7. Surface friction and boundary layer concept.
8. Laminar and turbulent flow in conduits.
9. Introduction to turbomachinery.

Design Activities/Projects:

Small design project by the end of semester including design of piping system using any computer language or any other design problems is assigned.

Computer Usage:

Students are encouraged to solve some assigned homework problems using the available engineering equation solver EES.

Laboratory: None

Assessment Tools:

- i- First Major Exam
- ii- Second Major Exam
- iii- Homework Assignments
- iv- Quizzes

- v- Small Project (5% of the grade)
- vi- Final Exam

Course Learning Outcomes:

- I- Understand the definitions of fluid properties and the differences between ideal fluids, real fluids and Newtonian and Non-Newtonian fluids.
- II- Apply the main concepts of fluid statics for solving engineering problems involving compressible and incompressible fluids.
- III- Determine the pressure variation in a given flow process and also pressure variation in rotating fluids in addition to solving related problems in engineering practice.
- IV- Understand the three conservation principles of mass, momentum and energy and using these principles in solving related engineering problems.
- V- Understand the main concepts of dimensional analysis and similitude and using these concepts for obtain the dimensionless parameters for a given problem and also solve various problems related to modeling and experimentation in the area of fluids engineering.
- VI- Understand the main concepts of surface resistance and boundary-layer flows.
- VII- Apply the basic concepts of laminar and turbulent flow in conduits for solving problems related to fluid transportation in heating and ventilating systems and oil and water piping systems.
- VIII- Develop the ability to think as an engineer for solving problems in the areas of fluid statics and fluid dynamics

Course Learning Outcomes mapped to Student Outcomes:

Student Outcomes	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
Course-to-Student outcome mapping	III, VI	I, II, V			IV				IV		
Emphasis*	S	S			S				M		

* L:: Little/None M: Moderate S: Strong

Status of Continuous Improvement review of this Course:

Date reviewed:

Reviewed by: Dr. Abdelsalam Al-Sarkhi

Prepared by: Dr. Saad Bin Mansoor

Date prepared: March 08, 2015