

Renewable Energy Engineering
REE 307 – Internal Fluid Flow (3 credits)
Fall 2018

Course description:

An introduction to viscous flow in internal and external geometry. The course starts by a discussion of laminar and turbulent flows. This is followed by a review of viscous flow in pipes including the losses in valves and connections. This sets the stage for an analysis of pipe networks. This is followed by an introduction to unsteady flow in conduits. The derivation of Navier-Stokes equation and applying it to simple flows will be studied. Finally, the different type of boundary layer and their evolution will be studied. Finally, optimal estimation is considered to cover cases where noise or other reasons necessitate estimating the system states.

Prerequisites:

Fluid mechanics-ENGR 207

Course Coordinator: Dr. Ahmed Elmekawy

Contact Information: Email: aelmekawy@zewailcity.edu.eg

Schedule: -Wednesday 1:30 – 4:30 (F001B-SB)
-Thursday 8:30 – 10:30 (G33B -SB)

Textbook/s

1. Munson, "Fundamental of Fluid Mechanics", 7th Edition
2. White F. M., "Fluid Mechanics", 8th Edition
3. Cengel Y., "Fluid Mechanics Fundamentals and Applications", 3rd Edition
4. Streeter V., "Fluid Mechanics". 3rd Edition
5. Wylie, Streeter, "Fluid Transient", 1978

Grading:

Attendance: 5%

Quizzes: 5%

Matlab Codes: 10%

Midterm Exams: 25%

Term Project: 20%

Final Exam: 35%

Note: 75% attendance is required. No makeup for midterm exams.

Course Learning Objectives:

Having successfully completed this course, the student will be able to:

- Viscous flows in pipes
- Laminar and Turbulent flows, the Reynolds number
- Losses in valves and connections.
- Analysis of pipe networks (Pipes in Series -Pipes in Parallel - Branching Pipes -Networks of Pipes)
- Stream Line and Potential Flow
- The Navier-Stokes equations, Stokes' hypothesis
- The Boundary layer
- The Differential and Integral Equations of the Boundary Layer
- The Displacement and Momentum Thickness
- Approximate Solutions of The Incompressible Laminar and Boundary Layers
- Unsteady Flow in Conduits (Oscillation of Liquid in a U-Tube, Water Hammer Phenomena, Surge tanks
- Compressible Flow.

Sequence of Learning Activities: (subject to 20% variability)

Week#	Weak Starts	Syllabus topic	Notes
1	19/9/2018	Introduction to Pipeline Design	
	20/9/2018	Tutorial	Assignment 1
2	26/9/2017	Flow in Series and parallel pipes and Secondary Losses	
	27/9/2017	Tutorial	Assignment 1
3	3/10/2017	Network of pipelines	
	4/10/2017	Tutorial	Assignment 2
4	10/10/2017	Stream Lines	
	11/10/2017	Tutorial	Assignment 3
5	17/10/2017	Potential Flow	
	18/10/2017	Tutorial	Assignment 3
6	24/10/2017	Navier-Stokes Equations	
	25/10/2017	Midterm 1	Midterm
7	31/10/2017	Applications of Navier-Stokes Equations	Assignment 3
	1/11/2017	Tutorial	Assignment 4
	7/11/2017	Boundary Layer	
	8/11/2017	Tutorial	Assignment 5
9	14/11/2017	Differential and Integral Equations of the Boundary Layer	
	15/11/2017	Tutorial	Assignment 6
10	21/11/2017	Unsteady Flow in Conduits	

	22/11/2017	Tutorial	Assignment 7
11	28/11/2017	Midterm 2	Midterm
	29/11/2017	Tutorial	Assignment 7
12	5/12/2017	Compressible Flow	
	6/12/2017	Tutorial	Assignment 8
13	12/12/2017	Examples of Pipeline network design Projects	
	13/12/2017	Tutorial	
14	19/12/2017	Course project discussion	Project Discussion
15	26/12/2018	Final Exam	Final Exam

Exam Dates:

Exam	Date
First midterm	Week 6
Second midterm	Week 11
Final	Week 15

Assignments/Project:

Assessment	Deadline	Feedback Deadline
Assignment	Due next week	One week
Project	Week 14	Same day of submission

Homework

Eight homework assignments distributed throughout the semester.

Quizzes

Four Quizzes distributed throughout the semester.

Matlab Assignments

- Matlab code for flow between three tanks
- Matlab Code for simple water pipeline network
- Matlab code for Boundary layer growth

Project Description & Evaluation Criteria:

Design only one the following systems

1. Fire Fighting Sprinkler System of a hospital
2. Irrigation System

A report and Oral presentation will be conducted by Wednesday December 12 by 11:00 am



جامعة العلوم والتكنولوجيا
University of Science and Technology

Prepared by Dr. Ahmed Elmekawy, October 2018.