



Introductory Course in Fluid Mechanics

Subject Code: AMEE 202
Number of periods per week: 3
Number of total weeks: 14

Lecturer: Marios M. Fyrillas, Ph.D.
E: m.fyrillas@fit.ac.cy;
T: 22345159 Ext. 131
URL: <http://staff.fit.ac.cy/eng.fm/>

Objectives

To gain an understanding of the integral form of the conservation laws for mass, momentum and energy, and the basic principles underlying the statics and dynamics of a fluid.

Course Outline

- Fundamental concepts: Definition of a fluid, control volume and differential analysis, kinematics of fluid motion, stress and strain rate, viscosity, Newtonian fluid.
- Fluid in equilibrium: Fluid statics, variation of pressure with depth, forces on immersed surfaces.
- Conservation laws in control volume form: continuity, momentum equation for steady flow, first law of thermodynamics (relation to Bernoulli's equation), applications.
- Dimensional analysis and similitude: Nature of dimensional analysis, Buckingham's Π theorem, arrangement of dimensionless group.
- Viscous flow: Laminar internal flows, Poiseuille and Couette flow, turbulent internal flow, internal flow with losses: major and minor losses, friction factor, boundary layer thickness.

Assessment

- Final exam 50%
- Coursework
 - Midterms: 20 %
 - Laboratories: 20 % (Participation 5%, Lab Report 10%, Lab Assessment 5%)
 - Quizzes / Assignments: 10 %

Textbook

- Fundamentals of Fluid Mechanics. Donald F. Young, Theodore H. Okiishi, Bruce Roy Munson, John Wiley & Sons, 4th edition, 2002.

References

- Introduction to Fluid Mechanics. Fox and McDonald, 5th Edition, Wiley, 1998.
- Rheology: Principles, Measurements and Applications. C.H. Macosko, VCH, New York, 1994.
- Mechanics of Fluids. Merle C. Potter, Prentice Hall, 1997.
- Fluid Mechanics. J.F. Douglas. 3rd Edition, Longman 1998.
- Fluid Mechanics. Pijush K. Kundu, Ira M. Cohen, 2nd Edition, Academic Press, 2001.
- Engineering Fluid Mechanics. C. T. Crowe, D.F. Elger, John A. Roberson, 7th edition, John Wiley & Sons, 2000.
- Applied Fluid Mechanics. Robert L. Mott, Prentice Hall, 5th edition, 1999.
- Fluid Mechanics with applications. Anthony Esposito, Prentice Hall, 1998.

Laboratory

Laboratory Regulations

- Students should be well prepared prior to performing a lab
- Students should perform the lab carefully
- Do not play with any other equipment in the lab
- Smoking is not allowed in the lab
- Leaving the group and wandering is not allowed
- Students are responsible for any loss or damage of equipment
- Damage to equipment must be reported immediately
- Students should come in the lab on time. Late students will not be admitted to the lab without an acceptable reason, and they will get a zero grade for the missing lab.

The grade of a student will be based on his/her performance during the laboratory exercise and on his/her lab report. The lab-report should be carefully prepared, explain the student's work, include all the measurements, calculations and the appropriate error analysis, and give answers to the questions asked during the lab.

The grading of a laboratory exercise will be as follows:

- Preparation / Performance during the lab period: 25 %
- Presentation of the lab report: 20 %
- Calculations / Error Analysis: 25 %
- Comments / Answers on questions: 30 %

Laboratory Report

- The lab report should include:
 - A short introduction explaining the objective, apparatus, theory and procedure of the laboratory exercise
 - Presentation of the main equations that are to be used for the exercise
 - Presentation of the measurements and the necessary calculations
 - Comments on the graphs that the student has to draw
 - Explanations of the experiment's results
 - Answers of the questions of the laboratory booklet
- The lab report for a performed experiment should be submitted within a week. Reports delivered after that day would not be accepted.
- The lab report could be prepared in a computer or by hand. In both cases, the report has to be well-structured, clear and to cover all issues discussed in the lab booklet.

The suggested scheme is as follows:

- Title
- 1. Objective
- 2. Theory
- 3. Method
 - 3.1. Apparatus with diagram
 - 3.2. Procedure
- 4. Measurements
- 5. Graph and Calculations
- 6. Conclusions

Diagram: Label all parts of the experiment

Method: Give full detail of how you obtained the measurements, the order in which they were carried out and precautions you took to obtain accurate measurements

Measurements: List all the measurements taken. Enter the measurements in a ruled table giving the units in which each is measured.

Calculation: Convert measured values to SI units and substitute them in the formulas

Graph: Choose scales to use as much as possible of the paper, label the two axis and give the units. Mark the points clearly.

Conclusion: The results should be given to a sensible order of accuracy, and should include a discussion of any errors and uncertainties in the measurements. Also, conclusions should include answers to any questions posed during the lab.