Syllabus

Program: MEC-BAC – Bachelors in Mechanical Engineering		
Department: CCT-DEM – DEPARTMENT OF MECHANICAL ENGINEERING – CCT		
Course: FLUID MECHANICS I		
Code: MFL1001	**Class hours:** 72 hours	**Academic year:** 2023/1
Professor: MARCUS VINICIUS CANHOTO ALVES	**Contact:** marcus.alves@udesc.br	

Topics

Hydrostatics and buoyancy; Mass, momentum and energy conservation laws; Reynolds Transport Theorem; Integral Analysis; Differential Analysis; Viscous flows; Dimensional Analysis; Introduction to Computational Fluid Dynamics – CFD.

General Objective

Develop the theoretical framework articulated with the applications of mechanics whose object of study are fluids.

Specific Objectives

1	Discuss the categories of fluid mechanics and their methods;
2	Understand the properties of fluids;
3	Derive the governing equations of fluid mechanics, and use the equations to reason about fluid flows;
4	Explain the concept of control volume and apply it to solve fluid mechanics problems in inertial frames;
5	Identify key non-dimensional parameters for given systems and use such numbers to characterize the systems;
6	Explain the role of fluids in real life situations;
7	Study a real life engineering fluid dynamics problem using CFD.

Program

Course program presentation and preliminary discussions;
Preliminary concepts and fluid properties;
Interactions and fluid behavior;
Pressure distribution in fluids and hydrostatics;
Integral relations for a control volume;
Mid-term written test;
Differential relations for fluid flow;
Viscous flow – Navier-Stokes equations;
Inviscid flow – Euler equations;
Dimensional analysis and similarity;
Final-term written test;
Introduction to Computational Fluid Dynamics – CFD (Class project)

Methodology

The presential lectures focus on the delivery of fundamental material and provide an environment to discuss the salient concepts of fluid mechanics with the help of partially prepared slides and notes. Solution of limited exercises and in-depth examples during lectures. Homework problems every week (Thursday).

Grading system

Homework – H;
Mid-term exam – ME;
End-term exam – EE;
Class project – CP;

Semester grade – SG;
SG = 0.1H+0.3ME+0.4EE+0.2CP

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If the semester grade (SG) is greater or equal 7.0 the student is considered approved. If the semester grade (SG) less than 7.0, the student is considered to be under Final Examination (FE) and can take a final test that will be graded according to the following weighting (articles n°144 a n°148 of UDESC's general regiment and Resolution 044/2007 CONSUNI) and generate the Final Score (FS):

FS=0.6SG+0.4FE;

If the student's FS is greater or equal to 5.0, the student is considered approved; if not, the student reproved in the discipline and will not be granted the scholar credits of Fluid Mechanics I.

Frequency is mandatory to a minimum of 75% of the classes, otherwise the student will be automatically fail by frequency. All tests and exams will be graded from 0.0 to 10.0 and will be evaluated in the following criteria:
1- Interpretation;
2- Organization;
3- Notation and unities;
4- Solution detailing and justification;
5- Final answers;

Basic bibliography

1- WHITE, Frank M. Fluid mechanics. 6th ed. New York, NY: McGraw-Hill, c2008. 864 p. (McGraw-Hill series in mechanical engineering). ISBN 9780072938449 (enc.).
2- YAMAGUCHI, H. Engineering Fluid Mechanics. Dordrecht: Springer Netherlands, 2008. (Fluid Mechanics and Its Applications, 0926-5112 ; 85). ISBN 9781402067426. Disponível em: http://dx.doi.org/10.1007/978-1-4020-6742-6
3- CROWE, C. T; ELGER, D. F; ROBERSON, John A. Engineering fluid mechanics. 9th ed. New Jersey: Wiley, 2009. 553 p. ISBN 9780470259771 (enc.).

Supplementary bibliography

1-SPURK, Joseph H. Fluid mechanics: problems and solutions. 1 ed. Berlin: Springer, 1997. 601 p. ISBN 3540616527.
2-WHITE, Frank M. Viscous fluid flow. 2. ed. New York, NY: McGraw-Hill, 1991. 614 p. ISBN 0071009957(broch.).
3- MOTT, Robert L. Applied fluid mechanics. 5th ed. New Jersey: Prentice-Hall, 2000. xvii, 597 p. ISBN 0130231207.
4-SPURK, H.Joseph.; AKSEL, Nuri. Fluid Mechanics. 2. Berlin, Heidelberg: Springer Berlin Heidelberg, 2008. ISBN 9783540735373. Disponível em: http://dx.doi.org/10.1007/978-3-540-73537-3
5-LESIEUR, Marcel. Turbulence in Fluids : Fourth Revised and Enlarged Edition. Dordrecht: Springer Netherlands, 2008. (Fluid Mechanics and its Applications, 0926-5112 ; 84). ISBN 9781402064357. Disponível em: <http://dx.doi.org/10.1007/978-1-4020-6435-7>