DEGREE CURRICULUM

FLUID MECHANICS

Coordination: Josep Illa

Academic year 2015-16

FLUID MECHANICS 2015-16

Subject's general information

Subject name	Fluid Mechanics
Code	102112
Semester	2n Q Avaluació Continuada
Typology	Obligatòria
ECTS credits	6
Theoretical credits	0
Practical credits	0
Coordination	Josep Illa
Office and hour of attention	Desk 2.08 EPS,
Department	INFORMÀTICA I ENGINYERIA INDUSTRIAL
Modality	Presencial
Important information on data processing	Consult this link for more information.
Language	Catalan
Degree	Degree in Automation and Industrial Electronic Engineering; Degree in Mechanical Engineering
Office and hour of attention	Desk 2.08 EPS,
E-mail addresses	jilla@macs.udl.cat estanislau.fons@udl.cat

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Josep Illa
Estanislau Fons

Subject's extra information

In order to successfully follow the course it is strongly recommended to refresh the basic concepts of physics and calculus. Some of the problems proposed during the course will require the use of numerical computational techniques, and for that reason it is greatly valuable the ability to use a programmable pocket calculator or having the knowledge of some programming language (Basic, Fortran, C, Matlab,...). The default language used in the course will be Matlab, available at the computers from the EPS.

A fluid is a state of matter aggregation characterized by the property of adopting the form of the vessel which contains it, and mainly refers to liquids and gases. The Fluid Mechanics is the wide branch of physics concerned with the phenomena related to fluid movement. In the present course, based on physics and on differential and integral calculus, the basic principles of the mechanics of incompressible fluids will be explained using a deductive conceptual approach.

The course is planned for the second semester and is structured in 3cr theory, 2cr problem solving, and 1cr practicum. The practicum will be in reduced groups at the laboratory by the end of the semester.

Learning objectives

see competences

Competences

Degree-specific competences

- Knowledge of applied thermodynamics and heat transmission, and of the basic principles and their application to the solution of engineering problems.

  Goals

  - Ability to apply the basic concepts of Thermodynamics to solve problems.

- Knowledge of the basic principles of fluid mechanics and their application to the solution of problems in the field of engineering. Calculation of pipelines, channels and systems of fluids

  Goals

  - Acquisition of the basic knowledge of fluid mechanics to be able to use it in the solution of practical problems and in the reliability analysis of the proposed results.

Degree-transversal competences

- Ability to gather and interpret relevant data in their field of study, and to emit judgements that include a reflection on relevant themes of a social, scientific or ethical nature.
- Goal: To be able to judge aspects of the social impact of a technical proposal.
- Ability to resolve problems and elaborate and defend arguments inside their field of study.

  Goal: To be able to propose problems and to discuss the strategy to solve them.

- Ability to work under pressure and/or in situations where there is a lack of information.

  Goal: To be able to formulate restrictive hypothesis when there is a lack of reliable information.

Subject contents

Lesson 1 HYDROSTATICS

1. Properties of fluids
2. Pressure. Definition and properties. Absolute and relative pressure
3. General equation of hydrostatics
4. Pressure force on submerged surfaces
5. Instruments for measuring the pressure

Lesson 2 HYDRODYNAMICS

1. Basic concepts. The continuity equation
2. The energy or Bernouilli equation
3. Applications of the Bernouilli equation
   - -Tubs of Pitot, Prandtl and Venturi
   - -Diaphragm and nozzle
   - -Fluid flow through a thin wall hole
4. Coefficient for correction of kinetic energy
5. The momentum equation. Force in an elbow pipe
6. Coefficient for correction of momentum

Lesson 3 HEAD LOOSES

1. Laminar and turbulent flow
2. General head losses: equation of Darcy-Weisbach
3. Head looses in laminar flow: Poiseuille's law
4. Head looses in turbulent flow. Experiences of Nikuradse.
5. Local head looses
6. Optimal diameter for a pipeline

Lesson 4 CENTRIFUGAL PUMPS

1. Classification of pumps
2. Centrifugal pumps. Euler equation

3. Head looses, power and yield of a pump

4. Characteristic performance. Working point

5. Cavitations. The NPSH concept

6. Examples of application

Lesson 5 OLEOHYDRAULICS

1. Classification of positive displacement machines

2. Theoretical, real and instantaneous flow

3. Energy yield

4. Basic schemas of hydrostatic transmission

5. Valves and servomechanisms

6. Examples of application

Evaluation

By mid semester there is a test (E1) including all subjects taught during that period. By the end of the semester there is another test (EJ) including all subjects discussed during the semester. There will be a mark on the laboratory work (P) and a mark reflecting the global appraisal of the professor (A). The first mark will be calculated as:

$$NJ1=0.75*\max\{(E1+EJ)/2, EJ\} + 0.2*P + 0.05*A$$

If anyone does not succeed in this first attempt there will be a second opportunity to pass the course through a final examination (EF) which includes all stuff of the course. Then the final mark is:

$$NJ2=0.75*EF + 0.2*P + 0.05*A$$

All tests will be done in the dates established by the Direction of the EPS. Practicum at the laboratory will be carried out during the last weeks of the semester in a timetable agreed with the students. Practicum is subject of the exams too.

The presence of a serious error in a test or exam disqualifies it.

Bibliography

Recommended bibliography

Basic references

-J.Agüera Soriano, “Mecánica de fluidos incompresibles y turbomáquinas hidráulicas”, 5ª ed., Editorial Ciencia3 S.A., 2002 (ISBN: 84-95391-01-05)

- Claudio Mataix, “Mecánica de fluidos y máquinas hidraulicas” , 2ª ed.,Ediciones del Castillo S.A., Madrid 1986 (ISBN: 84-219-0175-3).

-Merle c. Potter, David C. Wiggert, “Mecánica de fluidos”. Ed. Paraninfo Thomson Learning, 3ªed. 2002. (ISBN: 970-686-205-6)

-J.B.Franzini, E.J.Finnemore, "Mecànica de fluidos con aplicaciones en Ingenieria", 9ªed., McGraw-Hill, 1999, (ISBN: 84-481-2474-X)

-Irving H. Shames, “Mecánica de fluidos”, Ed. McGraw-Hill, 1995.

Additional references

-V.L. Streeter, E.Benjamin, K.W. Bedford, “Mecánica de los fluidos”, Ed. McGraw-Hill, 9ª ed., 2000 (ISBN: 968-600-987-4).

-Frank M.White, “Fluid Mechanics”, Ed. McGraw-Hill, 1986

-Robert L.Mott, "Mecánica de fluidos Aplicada" 4ªed. 1996. Ed. Prentice Hall. ISBN: 968-880-542-4

-B.R.Munson, "Fundamentos de Mecánica de Fluidos", 1999, Ed. Limusa, ISBN: 968-18-5042-4.

-Jordi Bosser, “Vademecum de mecánica de fluidos y máquinas hidráulicas”, 1990, CPDA, ETSEIB, Publicacions UPC.

-“Màquines hidràuliques i de fluids. Màquines volumètriques”, 1993, CPDA,ETSEIB, Publicacions UPC.

-M.V. Zubicaray, J.A. Fernández, “Bombas, teoria, diseño y aplicaciones” 3ª ed., Ed. Limusa, 2003. ISBN: 968-18-6443-3.