Last update: 25-04-2017

820013 - MF - Fluid Mechanics

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2017
Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
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BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: CARLOS RUIZ MOYA - JOSEP XERCAVINS VALLS

Others: VICENTE BITRIAN - ALBERT CARBÓ - ALFRED FONTANALS - CARLOS RUÍZ - JOSEP XERCAVINS

Requirements

Co-requirements: Mathematics II, Physics II

Degree competences to which the subject contributes

Specific:
2. Understand the basic principles of fluid mechanics and its application to problems in the field of engineering. Calculate the parameters of ducts, channels and fluid systems.

Transversal:
1. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Teaching methodology

The subject will be developed using master classes to present the contents to the students. The students will have to do individual work for problem solving and test preparing, and also team work for lab experiences and complex problem solving.

Learning objectives of the subject

Giving the students the knowledge and basic skills on this subject in order to prepare him for professional tasks related to the contents of it, and at the same time encouraging the training and learning processes in the field of fluid mechanics engineering.

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Study load

Total learning time: 150h	Hours large group:	45h	30.00%
	Hours medium group:	0h	0.00%
	Hours small group:	15h	10.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

Content

1. Fundamentals concepts. Fluid Properties.

Learning time: 21h 30m

Theory classes: 7h 30m
Laboratory classes: 1h
Self study : 13h

Description:
Definition of fluid.Fluid as a continuous media.Fundamental properties.Viscosity.

Specific objectives:
Understanding the basic concepts of fluid mechanics. Identifying different kinds of problems in fluid mechanics. Applied knowledge of basic fluid properties and the influence of viscosity on friction in fluid flow.

2. Hydrostatics.

Learning time: 18h 30m

Theory classes: 6h 30m
Laboratory classes: 1h
Self study : 11h

Description:
Pressure. Pascal's law. Pressure measurement. Hydrostatic forces over submerged surfaces. Flotation and stability. Fluids in motion as a rigid solid.

Specific objectives:
Achieving the capacity to determine the pressure distribution in a still fluid, to calculate hydrostatic forces over flat and curved submerged surfaces and to determine the pressure distribution in fluids in motion as rigid solids.

3. Basic concepts for flow analysis.

Learning time: 10h 30m

Theory classes: 3h 30m
Laboratory classes: 1h
Self study : 6h

Description:
Systems and control volumes. Eulerian and Lagrangian approaches. Material derivative. Flow classification. Visualization of a velocity field. Reynolds' transport theorem. Basic analysis techniques.

Specific objectives:
Understanding the use of the material derivative for connecting the Eulerian and the Lagrangian approach, identifying different flow visualization techniques, understanding the use of Reynolds' transport theorem and knowing the differential, integral, experimental and computational techniques used for flow analysis.

4. Basic integral equations in fluid mechanics (I).	Learning time: 40h 30m Theory classes: 14h 30m Laboratory classes: 1h Self study : 25h

Description:
Continuity equation: massic and volumetric flow. Energy equation. Bernoulli equation. Scope and limitations. Velocity and flow rate meters.

Specific objectives:
Correctly applying the concepts of compressibility and steadiness in flow determination. Identifying and correctly estimating the different forms of mechanical energy together with the efficiency in their transformations. Correctly using Bernoulli's equation in solving basic hydraulic problems and in velocity and flow rate meters.

5. Basic integral equations in fluid mechanics (II).	Learning time: 25h Theory classes: 9h Laboratory classes: 1h Self study : 15h

Description:
Newton's laws and momentum conservation. Forces over a control volume. Angular momentum equation. Application to turbomachines: characteristic curves.

Specific objectives:
Identifying forces and torques over a control volume. Determine resulting forces due to flow streams. Estimating torques generated by flow streams.

6. Pipe flow	Learning time: 17h 30m Theory classes: 6h Laboratory classes: 1h 30m Self study : 10h

Description:
Developed flows. Laminar and turbulent flow. Main and secondary losses. Flow in non-circular ducts. Hydraulic radius and equivalent diameter. Pipe systems: serial-parallel arranges. Steady state basic hydraulics, installation resistant curve. Operation point of a pumping installation.

Specific objectives:
Solving basic steady state hydraulic problems. Developig basic design tasks for fluid distribution instalations and determining the operating point in pumps.

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7. Free surface flows	Learning time: 16h 30m Theory classes: 5h 30m Laboratory classes: 1h Self study : 10h

Description:
Flow classification. Uniform flow in canals. Specific energy, critical depth. Flow under a gate. Gradually variated flow. Flow rate control and measurement with pouring systems.

Specific objectives:
Solving slow problems in steady state open canals.Using pouring systems for flow control and measurement.

Qualification system

Evaluation will be done by means of written tests both for mid-terms and final exams. Exercises and problems will be evaluated from the material submitted by the student. Lab experiences will be evaluated based on previous test, assistance, developed tasks in the lab and lab reports.
Mid-terms: 40 %
Exercises/Problems: 5 %
Lab experiences: 15 %
Team work: 5 %
Final exam: 35 %

This course will re-evaluation test as established by the rules of the school.

Regulations for carrying out activities

Lab experiences are mandatory.

Bibliography

Basic:

White, Frank M. Mecànica de fluidos. 6ª ed. Madrid: McGraw-Hill, 2008. ISBN 978-84-4816-603-8.

Gerhart, Philip M.; Gross, Richard J.; Hochstein, John I. Fundamentos de mecánica de fluidos. 2ª ed. Argentina: Addison-Wesley Iberoamericana, 1995. ISBN 0-2016-0105-2.

Çengel, Yunus A.; Cimbala, John M.. Mecánica de fluidos : fundamentos y aplicaciones. México, D.F.: McGraw-Hill, cop. 2006. ISBN 9701056124.

Complementary:

Franzini, Joseph B.; Finnemore, E. John. Mecánica de fluidos con aplicaciones en ingeniería. 9ª ed. Madrid: McGraw-Hill, 1999. ISBN 84-4812-474-X.