Last update: 05-09-2019

820013 - MF - Fluid Mechanics

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: CARLOS RUIZ MOYA - ALFRED FONTANALS GARCIA

Others: Primer quadrimestre:
BOUALEM YOUCEF NASSIM BENABDELOUED - M11, M12, M13, M14, M33, M34
ALBERTO ANTONIO CARBO BECH - M31, M32, M41, M42, M43, M44, M45
JOSE ALEJANDRO CARRILLO CORTES - T11, T12, T13, T14
JOSE IGNACIO ESEBERRI PIEDRA - T21, T22
MARCEL GARCIA COROMINAS - M21, M22
RAUL GARCÍA SANJURJO - M25, M45, T11, T12
ATTILA PETER HUSAR - T21, T22, T23, T24
ALEJANDRO MARTINEZ ALEGRE - M23, M24
ROGER MAYNOU GIL - T23, T24
RAUL OLEGARIO NAVARRETE ROMERO - T14
RICARDO JAVIER PRINCIPE RUBIO - M11, M12, M13, M14
CARLOS RUIZ MOYA - M21, M22, M23, M24, M25, M31, M32, M33, M34, M35, M41, M42

Requirements

Co-requirements: Physics II, Numerical Calculation-Differential Equations.

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.

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.

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

Md-term exam (35%); Homework activities (10%); Final exam (35%); Lab Pràctices (15%); Generic skills (5%). In order to pass the course it is mandatory to attend to all lab practices and deliver the correspondent lab report.
There is a re-avaluaton test for this subject.
The student will be able to access the re-assessment test that meets the requierements set by the EEBE in its Assesment and Permanence Regulations.

Regulations for carrying out activities

The evaluation will be conducted through written test both for the mid-terms and final exam.
There will be 3 homework activities due during the term. These activities will be delivered online through the course intranet.
Practices will be graded based on a pre-test to be presented bedore the lab practice start, attendance (mandatory) and lab activity developed, together with the preparation and delivery of lab reports.

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.