COURSE SYLLABUS: 2019-20

Basic information on the course			
Course:	Fluid Mechanics Engineering		
Course code:	44102201	Plan:	Degree in Industrial Chemical Engineering Degree in Mechanical Engineering Degree in Industrial Electronics Engineering
Academic Year:	2017-18	Undergraduate/Graduate:	Bachelor Degree
Degree Year:	2	Type:	Compulsory
Duration:	2º Semester		

TIME DISTRIBUTION ACCORDING TO REGULATIONS	
Credits:	6
Total time:	150
USE OF LEARNING PLATFORM:	B-Learning

TEACHERS			
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OTHER IMPORTANT INFORMATION

Content justification

The general objective of the course is to learn the basic principles of the fluid mechanics and its application to the problem solving in the field of the engineering practice: design of pipeline, channels and fluid transport systems.

The contents of the subject are organized in the following units:

I. Fluid Mechanics Fundamentals.

1. Definition and properties of the fluids.
2. Static of fluids.
3. Dimensional analysis and similitude.
4. Fluid kinematics
5. Fluid dynamics.

II. Fluids Transport Systems.

6. Steady flow in closed conduits.
7. Fluid distribution networks.
8. Steady flow in open conduits.
9. Flow measurement
10. Pumping systems

Courses related in Study Plan

Among others, some courses related with this subject in Study Plan are:

1. Physics Fundamentals for Engineers
2. Mathematics Fundamentals for Engineers
3. Mechanic Technology
4. Industrial Installations
5. Industrial Pneumatic
6. Machine maintenance and safety

On the other hand, the course on Hydraulic Machines is a complementary course to Fluid Mechanics Engineering.

Pre-required knowledge

It is recommended that the students have studied the courses on Physics Fundamentals for Engineers and Mathematics Fundamentals for Engineers.
It is also desirable that the students have skills on Programming and Languages.

COMPETENCES

Basic and general competences

Application of knowledge

Key competences University of Almeria

- Basic knowledge for the proffesion
- Teamwork
- Ability to learn in an autonomous way

Specific competences

E-CT3 - Knowledge in basic and technological subjects, which empowers them to learn new methods and theories, and empowers them to adapt to new situations.

E-CT4 - Ability to solve problems with initiative, decision-making, creativity, critical reasoning and communicating and transmitting knowledge, skills and skills in the field of Industrial Engineering.

E-CRI2 - Knowledge of the basic principles of fluid mechanics and their application to problem solving in the field of engineering. Calculation of pipes, channels and fluid systems.

In addition to these specific competencies, at the realization of the subject will contribute to the development of the following basic competencies of the degree:

CB1 - The student should have demonstrated to acquire and understand wide range of knowledge in an area of study from the secondary level to the cutting-edge.

CB2 - The student should know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study

CB4 - The students should convey information, ideas, problems and solutions to both a specialized and non-specialized audience.

CB5 - The students should have developed those learning skills necessary to undertake later studies with a high degree of autonomy

LEARNING OUTCOMES

1. The overall objective of the subject “Fluid Mechanical Engineering” is to convey to the students the basic knowledge of the laws governing fluid behavior, so that they can understand and address real engineering problems.

PLANNING
Contents

PRESENTATION OF THE COURSE (BIG GROUP)

THEORY (TECHING GROUP)

Block I. Fundamentals of Fluid Mechanics.

Unit 1. Fluid properties. Lubrication. (2 h)

- Introduction
- Density. Specific weight
- Viscosity. Lubrication
- Pressure. Compressibility
- Surface energy. Capillarity
- Vapour pressure. Solubility

Unit 2. Fluid static

- Fundamental equation of hydrostatics
- Pressure measurement
- Pascal's Theorem
- Forces on submerged bodies
- Buoyancy and equilibrium of submerged bodies

Unit 3. Dimensional analysis and similitude

- Magnitude, dimension and units
- Dimensional equation
- General hydraulic equation
- Physical Meaning of Dimensional Numbers: Reynolds, Euler, Froude, Mach
- BUCKINGHAM theorem: flow through orifices, friction in uniform pipes, flow on open structures, Minor losses.
- Similarity. Hydraulic models

Unit 4. Fluid kinematics

- Description of fluid flow. Euler and Lagrange methods.
- Velocity and acceleration
- Flow regimes
- Discharge expressions
- Continuity equation

Unit 5. Hydrodynamics

- Fluid Dynamics Equations: Navier-Stokes and Euler Equations.
- Bernoulli's theorem. Energy conservation equation
- Hydraulic grade and energy lines

- One-dimensional fluid flow analysis
- Conservation of momentum. EULER equation.
- Laminar and turbulent boundary layer
- Drag and Sustainability Forces

Block II. Fluid flow systems.

Unit 6. Permanent flow in closed conduits

- Head Loss in pipes. DARCY-WEISBACH equation.
- Friction equations in pipes. MOODY diagram.
- Experimental formulas.
- Minor Losses
- Hydraulic calculation of pipes.

Unit 7. Pipe networks

- Introduction
- Complex systems. Serial and parallel pipe connection
- Types of networks: branched and looped
- Network calculation methods
- Calculation tools: EPANET and others

Item 8. Pumping systems

- Pump classification
- Theoretical energy head of a turbomachine
- Performance curves
- Efficiency and Power balance
- Cavitation. NPSH
- Pump affinity laws
- Operating point. Pumping system types: Simple and Complex
- Hydraulic transients and waterhammer
- Pump selection

Item 9. Permanent flow in open channels(2h)

1. Uniform flow. Chezy and Manning equations
2. Capacity function of a channel
3. Free flow on close conduits. Drainage and sanitation pipes
4. Calculation of sections. Hydraulic efficiency
5. Specific energy. Critical flow-

Unit 10. Flow measurement

1. Flow measurement in closed conduits:venturimeter, Orifice, Pitot tube, propeller flowmeters, ultrasonic and electromagnetic flowmeters
2. Capacity in free currents: flow under gates, weirs, flumes, propeller flowmeters ultrasonic flow

meters, tracers, etc.

SUMMARY, DISCUSSION AND EVALUATION OF THE COURSE (GREAT GROUP)

PRACTICES (WORK GROUPS)

EXPERIMENTS

1. Practice 1. Bernoulli's demonstration.
2. Practice 2. Head loss in pipes of load in forced currents.
3. Practice 3. Flow measurement in closed conduits.
4. Practice 4. Flow measurement in open channels.
5. Practice 5. Performance curves of a pump.

R**EXERCISE AND PROBLEMS SOLVING (2 hours per session)**

1. Fluid properties and fluid static exercises.
2. Exercises on dimensional analysis and similitude and kinematics and fluid dynamics.
3. Complex fluid distribution systems (I).
4. Complex fluid distribution systems (II).

COMPETENCY ASSESSMENT

Criteria and assessment tools

The evaluation of the subject will be based on the follow-up of the student's learning process and the completion of a final test or exam. The evaluation tools to be used are as follows

1. Evaluation of the practice reports. The student should perform two activities for each experiment of the subject. The first one involves writing and uploading a report containing the required experimental results. The second one consists of a test that the students must respond. Both activities will be carried out through the tools of the Learning Course. This assessment will make up 5% of the final grade
2. Test on theoretical concepts. At the end of the course a test will be carried out on the theoretical concepts developed throughout the subject. This test will be carried out in person (computer classroom) using the "Evaluation" tool of the Learning Platform. This test will take 25% of the final grade
3. Examen final. Se realizará un examen final que consistirá en resolver una serie de ejercicios o problemas en el que el alumnado deberá aplicar los conocimientos teóricos y prácticos impartidos en la asignatura. El examen final supondrá un 70% de la nota final.
4. Final exam. The students must do a final problem-solving exam in which the students must apply the theoretical and practical knowledge and skills acquired in the subject. The final exam will take 70% of the final grade

The grades of the practice reports and the theoretical test are kept until the September call of the same academic year

Evaluation of the cross-cutting competencies of the University of Almería:

- Ability to learn to work autonomously. Reports of the experimental practices of the subject will be assessed. This competence will be assessed based on the student's performance in the realization of the experiment reports that must be carried out autonomously by the students and where they develop autonomous their learning skills. The final rating will be PASS or FAIL.
- Basic knowledge of the profession. This competence is related to the overall performance of the student in all aspects of the course, so the evaluation will be based on the general results obtained by the student in all the evaluation instruments of the course. The final rating will be PASS or FAIL
- Trabajo en equipo. Esta competencia se trabajará en las clases dedicadas a la resolución de problemas. Los problemas se plantean al grupo de prácticas y se incentiva la participación de todo el grupo para la resolución de los problemas. Se valorará como Apto y No Apto.
- Teamwork. This competence will be worked on in the classes dedicated to problem solving. Problems arise to the practical group and the participation of the whole group is encouraged to solve the problems. The final rating will be PASS or FAIL

To pass the subject the student must have at least 5 out of 10 in the final grade of the subject and all cross-cutting competencies must have a PASS mark.

Follow-Up Mechanisms

- Attendance to the tutoring sessions.
- Attendance and participation in seminars.
- Logging in the virtual course.
- Use of the virtual communications tools: forums, emails, etc.
- Preparation and submission of virtual activities.

Functional diversity / Functional disability.

- Those students with disabilities or special educational needs can get in contact with the Delegation of the Rector for the Functional Diversity (http://www.ual.es/discapacidad) to receive the appropriate guidance and advice in order to facilitate their instructional, learning and training processes. Likewise, these students may request the implementation of the necessary and suitable adaptations of content, methodology and evaluation that guarantee equal opportunities in their academic development. The processing of any personal data or aggregated information regarding these aforementioned students, in fully compliance with the GDPR, is strictly confidential. Faculties and academic staff lecturing the course referenced by this guide/document will be in charge of applying the recommended adaptations approved by the Delegation of the Rector for the Functional Diversity, this fact will be, therefore, notified to the School or Faculty as well as to the coordinator of the academic course.

BIBLIOGRAPHY

Recommended bibliography

- Mecánica de fluidos incompresibles y turbomáquinas hidráulicas / José Agüera Soriano. *(José Agüera Soriano)* - – Basic Bibliography
- Mecánica de fluidos y máquinas hidraúlicas *(Mataix, Claudio)* - – Basic Bibliography
- Mechanic of fluids and hydraulics *(Giles, Ranald V.)* – Basic Bibliography
- El Riego : fundamentos hidráulicos *(Alberto Losada Villasante)* Complementary Bibliography
- Ingeniería hidráulica : aplicada a los sistemas de distribución de agua *(Editores: Cabrera, E. ...[et al])* - Complementary Bibliography
- Fluid mechanics *(Streeter, Victor L.)* - Complementary Bibliography
- Fluid mechanics *(Robert L. Mott)* – Complementary Bibliography

Bibliography existing in the library of the University of Almeria

http://almirez.ual.es/search/x?SEARCH=70534211

WEB SITES

- http://es.libros.redsauce.net/index.php?folderID=10
  Curso de Mecánica de Fluidos - Pedro Fernández Díez
- http://es.libros.redsauce.net/index.php?folderID=9
  Curso de Turbinas - Pedro Fernández Díez
- http://es.libros.redsauce.net/index.php?folderID=7
  Curso de Bombas - Pedro Fernández Díez
- http://fluing.upv.es
  Página del Grupo FluIng (UPV)
- http://www.epa.gov/nrmrl/wswrd/dw/epanet.html
  EPANET site
- http://www.ehu.es/inwmooqb/fluidos.htm
  Curso de Ingeniería Fluidomecánica - Universidad del País Vasco
- http://www.ehu.es/inwmooqb/maqhidraulicas.htm
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