Course guides
220263 - 220263 - Fluid Systems Design

Last modified: 08/10/2020

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Optional subject).

Academic year: 2020 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: Robert Castilla

Others: Gustavo Raush

PRIOR SKILLS

Previous knowledge of Fluid Mechanics, Physics, Mathematics and Thermodynamics is required. It is very important to also have knowledge of Computational Fluid Dynamics.

REQUIREMENTS

Have degrees of industrial engineering, or similar.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE03-MEI. Ability to design and test machines.
CE05-MEI. Knowledge and skills for the design and analysis of heat engines and machines, hydraulic machines and installations of heating and cooling industry.
CE16-MEI. Ability to manage research, development and technological innovation.
CG04-MEI. Perform research, development and innovation in products, processes and methods.

Transversal:
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

Theory and problems classes
computer sessions
Lab sessions

LEARNING OBJECTIVES OF THE SUBJECT

1. Knowledge of Fluid Mechanics applied to Turbomachinery
2. Basic knowledge of Turbomachinery design
3. Basic knowledge of Computational Fluid Dynamics applied to Turbomachinery

STUDY LOAD

Type	Hours	Percentage
Self study	80,0	64.00
Hours large group	30,0	24.00
Hours small group	15,0	12.00

Total learning time: 125 h

CONTENTS

Module 1: Introduction to turbomachinery design

Description:
1.1 Introduction
1.2 Radial fans and compressors
1.3 Axial fans and compressors
1.4 Vibration and noise

Related activities:
Exam
Assignment 1

Full-or-part-time: 35h
Theory classes: 15h
Self study : 20h

Module 2: Introduction to Turbomachinery CFD

Description:
2.1 Introduction to CFD
2.2 Computational methods for turbomachinery
2.3 Validation and verification

Related activities:
Assignment 2

Full-or-part-time: 45h
Theory classes: 7h 30m
Laboratory classes: 7h 30m
Self study : 30h

Module 3: Experimental Methods for Turbomachinery

Description:
3.1 Introduction
3.2 Experimental methods for turbomachinery

Related activities:
Assigment 3

Full-or-part-time: 45h
Theory classes: 7h 30m
Laboratory classes: 7h 30m
Self study : 30h

ACTIVITIES

Exam

Description:
Exam done either in class or online on the contents of the first module

Full-or-part-time: 17h 30m
Theory classes: 7h 30m
Self study: 10h

Assignment 1

Description:
Calculation or design project related to a turbomachines, made in groups of 3 students.

Full-or-part-time: 17h 30m
Theory classes: 7h 30m
Self study: 10h

Assignment 2

Description:
Computational Fluid Dynamics related to a Turbomachine, made in group of 3 students

Full-or-part-time: 45h
Theory classes: 7h 30m
Laboratory classes: 7h 30m
Self study: 30h

Assignment 3

Description:
Experimental project realted to a Turbomachines, made in group of 3 students.

Full-or-part-time: 45h
Theory classes: 7h 30m
Laboratory classes: 7h 30m
Self study: 30h

GRADING SYSTEM

The final grade will be calculated from the exam of the first module (40% of weight) and the three deliverables (20% each)
Grade = 0.4*Exame + 0.2*Deliverable 1 + 0.2*Deliverable 2 + 0.2*Deliverable 3

BIBLIOGRAPHY

Basic:

- Schobeiri, Meinhard T. Turbomachinery Flow Physics and Dynamic Performance [Recurs electrònic] . 2nd ed. Berlin, Heidelberg : Springer Berlin Heidelberg, 2012. ISBN 978-3-642-24675-3.
- Dixon, S. L; Hall, C. A. Fluid mechanics and thermodynamics of turbomachinery . 6th ed. Amsterdam [etc.] : Elsevier : Butterworth-Heinemann, cop. 2010. ISBN 9781856177931.
- Turton, Robert Keith. Principles of turbomachinery . 2nd. ed. London, etc. : Chapman & Hall, 1995. ISBN 978-0-412-60210-8.
- Bergadà Granyó, Josep M. Máquinas hidráulicas : problemas resueltos . Barcelona : Pública, 2004. ISBN 8460951901.
- Heras, Salvador de las. Fluidos, bombas e instalaciones hidráulicas . Barcelona : Iniciativa Digital Politècnica, 2011. ISBN 9788476538012.
- Raffel, Markus [et al.]. Particle image velocimetry: a practical guide. 2nd ed. Berlin [etc.]: Springer, 2007. ISBN 9783540723073.
- Adrian, R.J.; Westerweel, J. Particle image velocimetry. Cambridge: Cambridge University Press, 2011. ISBN 9780521440080.
- Westerweel, J. "Fundamentals of digital particle image velocimetry". Measurement science and technology [on line]. Vol. 8, núm. 12 (1997), p. 1379-1392 [Consultation: 01/04/2014]. Available on: http://iopscience.iop.org/0957-0233/8/12/002.
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- Wilcox, David C. Turbulence modelling for CFD. 2nd ed. La Canada, Calif.: DCW Industries, 1998. ISBN 0963605151.
- Dick, Erik. Fundamentals of Turbomachines . Dordrecht : Springer Netherlands : Imprint: Springer, 2015. ISBN 978-94-017-9627-9.
- Lewis, R. I. Turbomachinery performance analysis . London, [etc.] : Arnold, cop. 1996. ISBN 0340631910.

RESOURCES

Other resources:

https://www.cfd-online.com/Wiki/Best_practice_guidelines_for_turbomachinery_CFD
https://link-springer-com.recursos.biblioteca.upc.edu/content/pdf/10.1007/s11831-016-9175-2.pdf