COURSE SYLLABUS
2017-2018

SUBJECT DATASHEET

Course information	
Name	Sustainable Transportation
Code	DIM-OPT-622
Degree	Master on Industrial Engineering
Year	Second
Semester	Second (Spring)
ECTS credits	3
Type	Elective
Department	Mechanical Engineering
Area	Energy
Coordinator	José Ignacio Linares Hurtado

Instructor information	
Instructor	
Name	Juan de Norverto Moriñigo
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Area	Energy
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Office hours	To be defined at term beginning

SPECIFIC SUBJECT DATASHEET

Subject contextualization

Contribution to the professional profile of the Title

This subject has been designed to complete the student knowledge about the issues about transportation, focusing on sustainability point of view, inside the Industrial engineer profile, going deep with the concepts already studied in other subjects in previous terms belonging to Energy Engineering.

At the end of the season, the students will be able apply sustainability indicators to transportation systems, impact of transportation on environment and feasibility of transportation projects for cities. Also power train technologies and passengers and goods transportation alternatives.

This subject will explore both theory and praxis, so numerical models will be used to solve the basic equations of the engineering transportation.

Pre requirements

There are not any pre requirement needed to study the subject. However basic Energy Engineering knowledge will be a good asset.

THEME SEGMENT AND CONTENTS

Contents – Theme segments
THEME 1: Sustainability
Unit 1: INTRODUCTION TO SUSTAINABILITY TRANSPORTATION
1.1 Definitions. Functions and Factors. Social Impact. **1.2** Transportation models and classification: Road, train, vessels, airplanes. **1.3** History. **1.4** Transportation Engineering.
Unit 2: SUSTAINABLE DEVELOPMENT
2.1 What is sustainability?. Processes and indicators. **2.2** Lyfe cycle analysis: from well to wheel.
Unit 3: THE CO_2 PROBLEM
3.1 The greenhouse effect. **3.2** Engine combustion with conventional fuels. **3.3** Basic equations.
Unit 4: SUSTAINABLE DRIVING
4.1 Driver's role. **4.2** Technology role.
THEME 2: Technology
Unit 5: NON-CONVENTIONAL FUELS AS AN ALTERNATIVE
5.1 Bio-fuels. **5.2** LPG. **5.3** CNG. **5.4** Hydrogen.
Unit 6: NON-CONVENTIONAL VEHICLES
6.1 Hybrid. **6.2** Electric.
THEME 3: Policies
Unit 7: SPECIFIC TRANSPORTATION PROGRAMS
7.1 PMUS (In City). **7.2** PPT (To working place) **7.3** Car Pooling. **7.4** Car Sharing.

Competences – Learning Outcomes
Competences
General Competences
CG1. To have appropriate knowledge about the scientific and technological aspects of: mathematical, analytical and numerical methods in engineering, electrical engineering, power engineering, chemical engineering, mechanical engineering, continuum mechanics, industrial electronics, automation, manufacturing, materials, quantitative methods management, industrial computing, planning, infrastructure, and so on.

General and Basic Competences
CB2. Knowing how to apply and integrate their knowledge, understanding these, its scientific basis and troubleshooting capabilities in new and imprecisely defined environments, including multidisciplinary contexts both researchers and highly skilled professionals.
Learning outcomes
At the end of the course students should be able to: LO1. To know about sustainability. How to measure and improve projects. LO2. To know about impact of transportation on environment. LO3. To know about powertrain technologies. LO4. To know about passenger and goods transportation alternatives. LO5. To know about sustainable transportation projects for cities.

TRAINING METHODOLOGY

Subject methodological aspects

In-class methodology: Activities	Competencias
1. **Lectures.** The teacher will explain basic concepts for every theme showing the more important aspects. Special attention to be paid with equations and how to use. Examples will be presented, discussed and solved to complete the understanding. **(20 hours)**.	**CG1**
2. **In-class case discussion and problem solving.** Students will discuss the cases and problems proposed by the teacher. Cases will be open challenges that can be analyzed and solved by the use of the concepts already presented in class. **(6 hours)**.	**CB2**
3. **Team Work presentations**. The teacher will ask for team works of any proposed matter. Students will have to look for additional documentation to what was shown in class. Students must justify their conclusions and add value with their engineering mind. These works will be public presented in class. **(2 hours).**	**CB2**
4. **Assessment.** A written and individual exam will be done in the last session of the course. **(2 hours).**	**CB2**
Distance Methodology: Activities	**Competencias**

Main target of the distance Works is to be able to understand theoretical concepts and to be able to apply them. 1. **Self-learning on the concepts presented in class**. Material to be used are slides, multimedia files, personal and teacher notes, recommended books and magazines. **(20 hours).** 2. **Cases study.** To be revised and updated with the rest of information given in the subject. **(12 hours).** 3. **Team Works.** Preparation and presentation of team Works. Students must find the information sources to create outstanding works. **(14 hours).** 4. **Exam preparation.** Students will prepare the final exam based on the provided material and the adquired knowledge. **(14 hours).**	**CG1** **CB2** **CB2** **CB2**

	IN-CLASS ACTIVITIES				DISTANCE ACTIVITIES				Learning Outcomes	
Week	h/s	Lectures and problem solving	Presentations	Assessment	h/s	Self-learning of concepts presented in class	Cases study	Team works	Learning Outcomes	Description
1	2	Theory of Unit 1 (2 hours)			2	Unit 1 (2 hours)			LO1	To know about sustainability. How to measure and improve projects.
2	2	Theory of Unit 1 (2 hours)			2	Unit 1 (2 hours)			LO1	To know about sustainability. How to measure and improve projects.
3	2	Theory of Unit 2 (2 hours)			2	Unit 2 (2 hours)		Work description and topic delivery to the students. Students can propose alternative works which should be approved by instructor	LO1	To know about sustainability. How to measure and improve projects.
4	2	Theory of Unit 3 (2 hours)			3	Unit 3 (2 hours)		Working on descriptive report (1 hours)	LO2	To know about impact of transportation on environment.
5	2	Theory of Unit 3 (1 hour). Problems of Unit 3 (1 hour)			4	Unit 3 (1 hours)	Case study of Unit 3 (2 hours)	Working on descriptive report (1 hours)	LO2	To know about impact of transportation on environment.
6	2	Problems of Unit 3 (1 hour). Theory of Unit 4 (1 hour)			5	Unit 4 (1 hour)	Case study of Unit 3 (2 hours)	Working on descriptive report (2 hours)	LO2	To know about impact of transportation on environment.
7	2	Theory of Unit 4 (1 hour). Problems of Unit 4 (1 hour)			3	Unit 4 (1 hour)	Case study of Unit 4 (2 hours)	Milestone 1: Descriptive report delivery	LO3	To know about powertrain technologies.
8	2	Problems of Unit 4 (1 hour). Theory of Unit 5 (1 hour)			5	Unit 5 (1 hour)	Case study of Unit 4 (2 hours)	Working of Final Report (2 hours)	LO3 LO4	To know about powertrain technologies. To know about passenger and goods transportation alternetives.
9	2	Theory of Unit 5 (1 hour). Theory of Unit 6 (1 hour)			4	Unit 5 (1 hour) Unit 6 (1 hour)		Working of Final Report (2 hours)	LO3 LO4	To know about powertrain technologies. To know about passenger and goods transportation alternetives.
10	2	Theory of Unit 6 (2 hours)			5	Unit 6 (2 hours)		Working of Final Report (3 hours)	LO3 LO4	To know about powertrain technologies. To know about passenger and goods transportation alternetives.
11	2	Theory of Unit 6 (2 hours)			2	Unit 6 (2 hours)		Milestone 2: Final report delivery	LO3 LO4	To know about powertrain technologies. To know about passenger and goods transportation alternetives.
12	2	Theory of Unit 7 (2 hours)			5	Unit 7 (2 hours)		Working on presentation (3 hours)	LO5	To know about sustainable transportation projects for cities.
13	2	Problems of Unit 7 (2 hours)			9	Exam preparation (5 hours)	Case study of Unit 7 (4 hours)		LO5	To know about sustainable transportation projects for cities.
14	2		Team works presentations (2 hours)		5	Exam preparation (5 hours)				
15	2			End term exam (2 hours)	4	Exam preparation (4 hours)				

ASSESSMENT AND SCORING CRITERIA

Assessment activities	Criteria	Weight
Realización de exámenes: • End of term exam	- Concepts understanding. - Use of concepts to solve real cases. - Problem solving solution analysis and results interpretation. - Presentation and written communication.	**50%**
Contonuous assessment: • Homeworks and case solving	- Concepts understanding. - Use of concepts to solve real cases.	**20%**
• Team works	- Technical writing. - Oral presentations	**30%**

Scoring
The score for the **ordinary summon** will be obtained by: • 50% comes from the end of term exam. • 50% comes from continuous evaluation. **Extraordinary summon** • 20% from the score obtained in continuous evaluation. • 80% from the extraordinary summon exam. Attendance: The absence of more than 15% of the total amount of classes can entail to fail the ordinary summon.

WORKING SCHEDULE

In-class and distance activities	Do date	Delivery date
• Self-learning of concepts presented in class	After lesson	
• Problem solving	After lesson	
• End of term exam	Last session (week 15)	

• End of term exam preparation	Weeks 13, 14 and 15	
• Team work preparation	Weeks 4 to 12	• M1: week 7 • M2: week 11 • M3: week 14
• Team work presentation	Week 14	

STUDENT SCHEDULE SUMMARY (HOURS)			
LIVE			
Lectures	**Case discussion**	**Presentations**	**Assessment**
20	6	2	2
DISTANCE			
Self-study on theory	**Self-work on cases**	**Team work preparation**	**Exam preparation**
20	12	14	14
		ECTS:	**3 (90 hours)**

BIBLIOGRAPHY AND RESOURCES

Basic bibliography
Notes and Slides
• Available slides at Moodle.
Aditional Bibliography
Reports
• Collections of articles on the subjects: sustainable transportation and sustainability indexes • White Book of 2015 transportation (EU) • Green Book 2012 transportation (EPA)