



Course guide

250ST013 - 250ST013 - Transport Systems Operations and Logistics

Last modified: 16/05/2023

Unit in charge:	Barcelona School of Industrial Engineering	
Teaching unit:	751 - DECA - Department of Civil and Environmental Engineering.	
Degree:	MASTER'S DEGREE IN SUPPLY CHAIN, TRANSPORT AND MOBILITY MANAGEMENT (Syllabus 2014). (Compulsory subject).	
Academic year: 2023	ECTS Credits: 5.0	Languages: English

LECTURER

Coordinating lecturer: Prof. Francesc Soriguera Martí

Others: Prof. Francesc Soriguera Martí

PRIOR SKILLS

Ch. 4 of the course (Observation and Measurement) is grounded on fundamental probability tools and estimation methods. These concepts are acquired on the complementary course of "Data Analysis in Transportation and Logistics". The development of the course will take this background for granted, as it is acquired in another required course of the masters? degree.

REQUIREMENTS

Pre-requisit/Co-requisit => to have completed or to be enrolled in the course on "Data Analysis in Transportation and Logistics" compulsory subject in Q1.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CESCTM4. Know and apply the modeling techniques and simulation optimization to solve the problems of design, operation and management of transportation systems.

CESC4. Know and apply the techniques of modeling, simulation and optimization to solve the problems involved the design and management of supply chains.

CETM1. Knowledge of the design, planning of transport infrastructure and modal terminals, such as highways, railways, ports, airports, railway stations and transport logistics centers exchange.

CETM3. Knowledge for planning, management and operation of transportation systems and mobility, ability to analyze service levels to users, operating costs and environmental and social such as mass transit, and private vehicle traffic impacts, air transport, sea transport, intermodal transport and urban mobility.

CESC1. Analyze and optimize the operations associated with the supply chains of companies and organizations in general, both globally and in each of its parts: supply, distribution, production, transportation, storage and retrieval.

TEACHING METHODOLOGY

Two hours of lecture per week plus two hours of discussion at odd weeks. Discussion sessions will be devoted to reinforce the concepts presented in the lectures with examples and practical application in problems. The semester lasts a maximum of 15 weeks. No textbook is assigned to this course. However the recommended text (Daganzo, 1997) follows closely the concepts presented in the course, with a deeper analysis in many chapters.

The students will be assigned practical exercises to be solved during the course. These will include 3 individual homework assignments and 1 group mini-project.

-Homework 1 - Basic assessment tools, using space-time diagrams, cumulative count curves, and optimization methods.

-Homework 2 - Flow theory and control.

-Homework 3 - Scheduled transportation.

-Mini-Project - Observation and measurement. Student will be asked to gather data over time regarding some activity of interest; analyze the data, assess the performance of the system and propose improvements.

LEARNING OBJECTIVES OF THE SUBJECT

General Objectives

The course will present concepts of transport operations that should be understood by every student of transportation engineering or planning, regardless of his or her background or specific professional interests, and to prepare the student for further study in this field.

Specific objectives

The course focuses on logic, ways of thinking and basic assessment tools (predominantly graphical) suitable in order to obtain solutions to problems that commonly arise in transportation operations. To a large extent, the concepts described in this course are not specific to any one mode (e.g. typically the term "traffic streams" does not refer only to highway vehicles). Rather, we seek to introduce logical ideas relevant to virtually any and all types of transport. The course does not cover all aspects of transport operations. The kinds of recipes found in handbooks, for example, are de-emphasized. The ideas covered in the course are those that, by virtue of their grounding in physical reality, are most likely to stand the test of time, and should be considered fundamentals. We will strive always to distinguish those concepts that are true "by definition" from those involving theory or conjecture.

STUDY LOAD

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

Total learning time: 125 h

CONTENTS

1-Basic Assessment Tools

Description:

We will present the tools, predominantly graphical, useful for understanding details of transport operations. We will briefly discuss optimization techniques.

Related activities:

Homework 1

Full-or-part-time: 43h 45m

Practical classes: 10h 30m

Laboratory classes: 5h 15m

Self study : 28h

2-Traffic flow theory

Description:

Common properties of traffic streams (including flow, density and speed), relations between these properties and models describing how these properties change over time and space.

Related activities:

Homework 2

Full-or-part-time: 37h 30m

Practical classes: 9h

Laboratory classes: 4h 30m

Self study : 24h

3-Flow Control

Description:

Schemes to affect traffic stream properties in some desirable way(s); e.g. coordinating green times at neighboring highway traffic signals to reduce driver delay or implementing take-off and landing rules at an airport runway to maintain safe spacings between aircraft. Preliminary discussion of transport networks (e.g. paradoxes) is provided here with an eye toward preparing students for more detailed study in other courses and to highlight the complications that can arise network-wide when deploying control schemes.

Related activities:

Homework 2

Full-or-part-time: 18h 45m

Practical classes: 4h 30m

Laboratory classes: 2h 15m

Self study : 12h

4-Observation and Measurement

Description:

Collection and interpretation of transportation data in order to estimate relevant properties of traffic streams (e.g. capacity, average speed, O/D matrix?) accounting for the inherent uncertainty in transport systems.

Related activities:

Mini-Project

Full-or-part-time: 6h 15m

Theory classes: 1h 30m

Practical classes: 0h 45m

Self study : 4h



5-Scheduled Transportation

Description:

Basic principles in operating fleets with schedules. This includes dispatching of vehicles, schedule adherence and control, passenger delays and transfer coordination.

Related activities:

Homework 3

Full-or-part-time: 18h 45m

Practical classes: 4h 30m

Laboratory classes: 2h 15m

Self study : 12h

GRADING SYSTEM

The final course grade (F) will be derived from the performance on the homework assignments and mini-project (H) obtained as the arithmetic average of the grades in all activities) and on the final exam (E). Geometric weighted average will be applied in order to obtain the final grade from both parts, so that: $F = H^{0.4} \cdot E^{0.6}$

Those who do not pass the course (i.e. F

Reevaluation: A reevaluation exam will be proposed. This exam will substitute 100% of the final course grade, provided that the grade obtained is higher than the previous. The reevaluation exam will never reduce previous course grades.

EXAMINATION RULES.

Homework assignments: Individual

Mini-project: In groups of 4 students

Final exam & reevaluation: In the final exam & reevaluation, students will be allowed to bring one sheet of hand-written notes. No other written or electronic materials will be allowed.

BIBLIOGRAPHY

Basic:

- Daganzo, C.. Fundamentals of Transportation and Traffic Operations. New york: Elsevier, 1997. ISBN 0080427855.

Complementary:

- Homburger, W.S. et al. Fundamentals of traffic engineering. 16th ed. Berkeley, CA: Institute of Transportation Studies, 2007.

- TRB. Highway capacity manual. Washington D.C: Transportation Research Board, 2010. ISBN 9780309160773.

- Vuchic, V.R. Urban Public Transportation: Systems & Technology. Englewood Cliffs, N.J: Prentice Hall, 1981. ISBN 0139394966.

- Edie, Leslie C. "Discussion of traffic stream measurements and definitions". Proceedings The 2nd International Symposium. Paris: OECD, 1965. pp 139-154.

- Greenshields, B.D.; Bibbins, J.R.; Channing, W.S.; Miller, H.H. "A study of traffic capacity". Highway Research Board Proceedings [on line]. Washington: National Research Council (U.S.A.), Highway Research Board, 1935. Vol. 14, pp. 448-477 [Consultation: 03/04/2023]. Available on: <https://onlinepubs.trb.org/Onlinepubs/hrbproceedings/14/14P1-023.pdf>.- Makigami, Y. ; G.F. Newell ; R. Rothery.. "Three-dimensional representation of traffic flow". Transportation Science [on line]. Vol 5 (1971) num. 3 pp 302-313 [Consultation: 23/09/2022]. Available on: <http://search.proquest.com/publication/37963>.

RESOURCES

Hyperlink:

- Atenea - Digital Campus. <https://atenea.upc.edu/moodle/login/index>