



Italian code: ICAR/05 (old) – CEAR-03/B (new)

Credits: 9

Course: Planning of Transportation Systems

Main language of instruction: Italian

Other language of instruction: English

Head instructor

Professor Paolo DELLE SITE - paolo.dellesite@unicusano.it

Objectives

The course provides the main theoretical and methodological tools related to the mathematical and statistical modelling of transportation systems. The tools, which deal with the simulation of demand , supply, and demand-supply interaction, and with the assessment of interventions, are used for planning and functional design activities. Goods transport and modelling of logistics are part of the teaching programme. For each topic, the analysis of the phenomenon, the modelling and the application of computational tools to elementary cases are included.

Pre-requisites

- Calculus (mandatory)
- Statistics (recommended)

Course structure

- Introduction
- Supply models
- Statistics and econometrics
- Demand models
- Assignment models
- Assessment models
- Goods transport
- Modelling of logistics

Competencies

A. Knowledge and understanding:

The aims of the transportation planning activities and the normative framework will be defined. The modelling aspects of the techniques most frequently used for the simulation of supply, demand and supply-demand interaction of land transportation systems will be investigated. The main techniques for the assessment of interventions will be presented, and noteworthy design problems will be tackled, including the regulation of controlled intersections. Topics of interest to both firms and governments include the organisation of goods transport and models from operations research related to key logistics design problems.

B. Applying knowledge and understanding:

The course, through the study of the functioning of transportation systems and of their mathematical and statistical representation, aims to develop the capacity to simulate and assess sustainable solutions for the land mobility needs of a territory. Additionally, the course will develop the capacity to tackle key problems in the area of logistics.

C. Making judgements:

At the end of the course, the student will be able to simulate and assess interventions on transportation systems, as well as to tackle design problems in the area of logistics.

D. Communication skills:

The technical and scientific language, needed to interact with other experts in the discipline and with decision makers inside public administrations and companies in the sector, will be gained.

E. Learning skills:

The knowledge and the key methodological tools that will be useful in subsequent advanced professional training in the areas of transportation systems planning and functional design and of logistics, will be provided.

Syllabus

Subject 1 – Introduction

Lesson 1. Transportation and activity systems.

Lesson 2. Planning according to time horizon: strategic, tactical and operational planning.

Lesson 3. Planning according to law provision.

Lesson 4. Modelling transportation systems: the four-step models.

Lesson 5. Study area zoning. The origin-destination matrix.

Subject 2 – Supply models

Lesson 1. Transportation networks and related graphs.

Lesson 2. Design of controlled intersections.

Lesson 3 . Volume-delay functions.

Subject 3 - Statistics and econometrics

Lesson 1. Statistics.

Lesson 2. Linear regression models.

Lesson 3. Random utility discrete choice models.

Subject 4 – Demand models

Lesson 1. Generation and attraction models.

Lesson 2. Distribution models.

Lesson 3. Modal split models.

Subject 5 – Assignment models

Lesson 1. Assignment models of private traffic to road networks.

Lesson 2 . Assignment models to public transport networks.

Subject 6 – Assessment models

Lesson 1. Users' benefits.

Subject 7 – Goods transport

Lesson 1. Transport modes. Vehicles. Loading units. Infrastructures.

Lesson 2. Organisation of services and actors.

Subject 8 – Logistics and goods transport models

Lesson 1. Inventory management.

Lesson 2. Transportation problem.

Lesson 3. Facility location.

Lesson 4. Travelling salesman problem.

Lesson 5. Vehicle routing.

Lesson 6. Arc routing.

Lesson 7. Theoretical framework for the analysis of goods transport demand

Evaluation system and criteria

The examination consists of a written test. This includes:

- 3 open-ended questions (6 marks each for a total of 18 out of 30 marks).

- 3 numerical exercises or multiple-choice questions (2 marks each for a total of 6 out of 30 marks).

In addition, three e-tivities, consisting of numerical problems, are compulsory. These need to be sent to the instructor in advance of the examination. Each e-tivity counts 2 marks for a total of 6 out of 30 marks.

Bibliography and resources

1. Materials to consult

Notes written by the instructor are available in Italian (part of the notes are also available in English).

2. Recommended bibliography

Suggested readings are:

- Cascetta E. (2009) Transportation Systems Analysis. Models and Applications. Second Edition. Springer.
- Ortúzar J. de D., Willumsen L.G. (2011) Modelling Transport. Fourth Edition. Wiley.
- Eiselt H.A., Sandblom C.-L. (2013) Operations Research: A Model-Based Approach. Second Edition. Springer.