



**Code: ICAR/05**

**Credits: 9**

**Course: Planning of Transportation Systems**

**Main language of instruction: Italian**

**Other language of instruction: English**

## **Teaching Staff**

### **Head instructor**

**Prof. Paolo DELLE SITE - [paolo.dellesite@unicusano.it](mailto:paolo.dellesite@unicusano.it)**

## **Introduction**

### *1. Objective of the course :*

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 the planning and functional design activities. Goods transport and modelling of logistics are included. For each topic, the analysis of the phenomenon, the modelling and the application of computational tools to elementary cases are included.

## **Objectives**

### *2. 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**

### *3. Programme of the course:*

#### **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**

#### *4. Materials to consult*

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

#### *5. 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.