Course unit English denomination	Discrete choice models. Theory and applications
SSD	CEAR 03/B (ex ICAR/05)
Teacher in charge	Dr. Riccardo Ceccato
Teaching Hours	24
Number of ECTS credits allocated	3
Course period	January and February
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (at least 60%, corresponding to 15 hours) ☐ No
Course unit contents	The course is divided into three sections. In the first one, theoretical basis and practical applications of the main discrete choice models are provided. In the second one, practical issues useful to properly apply these models are shown. The third one is focused on a description of the functionalities and main operational steps to use an opensource software package (based on Python), widely adopted to implement these models. The specific contents of the course are the following: 1. Theoretical basis (6 hours): a. Definition of discrete choice models and practical examples b. Fundamentals of Random Utility Models c. Main types of discrete choice models d. Input data 2. Model implementation (6 hours): a. Model specification, estimation and validation b. Forecasting techniques 3. Practical case studies (12 hours): a. Fundamentals of Python programming language b. Introduction to the software package Biogeme c. Workshops on modelling and forecasting individual choices: i. transportation systems (e.g. travel mode choice, route choice) ii. environmental engineering (e.g. car engine type choice, preferences for renewable energy/nuclear) iii. urban planning (e.g. residential location choice, urban greening planning) iv. economics (e.g. choice of the electricity distribution company, choice of the heating/cooling system)
Learning goals	The course aims to provide students with: • Basic knowledge of discrete choice models • Practical tools to apply discrete choice models to forecast individual behaviors and design new services/goods • Expertise to implement the acquired knowledge to a variety of contexts and problems, to analyze and quantify choice propensities and market shares
Teaching methods	The course is delivered through frontal lessons, presentations of real case studies, and workshops. In addition, active learning techniques are implemented.

Course on transversal, interdisciplinary, transdisciplinary skills	☒ Yes ☐ No
Available for PhD students from other courses	☒ Yes The course is available for all PhD students from UNIPD. ☐ No
Prerequisites	Basic knowledge of statistical methods (in particular, probability theory and linear regression models)
Examination methods	Report on a case study assigned by the teacher or proposed by the student.
Suggested readings	• Train, K. E. (2009). Discrete choice methods with simulation. Cambridge university press (https://galileodiscovery.unipd.it/permalink/39UPD_INST/prmo4k/alma990013257450206046). • Hensher, D. A., Rose, J. M., & Greene, W. H. (2015). Applied choice analysis. Cambridge university press (https://galileodiscovery.unipd.it/permalink/39UPD_INST/prmo4k/alma990017151070206046). • Teacher's slides
Additional information	The analysis and forecast of demand and individual choice behaviors is of paramount importance for several applications. Examples include: the quantification of the number of persons that will use a mobility service, the analysis of the impacts of a new service/technology, the market share of a new product with alternative characteristics and under alternative pricing strategies. Discrete choice models are flexible and effective methods to in-depth model individual choices, analyze factors affecting these decisions and forecast the effects of different future scenarios. In line with this perspective, the course is implemented following an interdisciplinary approach, aiming at providing theoretical and practical elements to develop and implement discrete choice models, considering a variety of contexts and issues. In particular, students will gain expertise on formulating, testing and applying these models on real cases, also using a specific software package based on Python.