

## Course guide

### 230687 - INE - Internet and Networked Economy

Last modified: 25/05/2023

**Unit in charge:** Barcelona School of Telecommunications Engineering  
**Teaching unit:** 744 - ENTEL - Department of Network Engineering.

**Degree:** MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).  
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

**Academic year:** 2023 **ECTS Credits:** 5.0 **Languages:** English

#### LECTURER

**Coordinating lecturer:** Consultar aquí / See here:  
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura>

**Others:** Consultar aquí / See here:  
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma>

#### TEACHING METHODOLOGY

- Lectures
- Application classes
- Individual work (distance)
- Exercises
- Exams

#### LEARNING OBJECTIVES OF THE SUBJECT

The economics of Internet is crucial since technology and economy interactions are bidirectional. This field is challenging to study because of the lack of publicly available data on ISP's cost structures and the difficulty of collecting well-calibrated consumer data. In this sense, this course studies how companies obtain the appropriate returns that guarantee its economic feasibility. The returns are obtained from ISPs' users that choose among the offered services and the used pricing model.

Undoubtedly the formation and growth of Internet is driven in part by economic considerations that have allowed a fast growing of services that lies on its infrastructure. There are many examples of successful services that today form an important part of our society and our life. All of them have contribute to develop what people name network economy. Thus, this course describes the underlying analytic characteristics that support them. This evaluation allows us to know the basic technical concepts that support them. In this course the analysis of the Distributed Power Control (DPC) algorithm is presented. In cellular networks, this algorithm allows us to manage and to reduce the produced interference when the available resources are shared. Also, other analysis techniques are studied such as the basic tools and mechanisms used to Netflix, Amazon and Wikipedia (three examples of great successful in economy that Internet provide us). Other examples of interest include some basic features of great economic impact and that are used in Google, such us: The Page Rank algorithm and the type of auction, which is included in the ads mechanism of space assignment. All these services are successful examples of interactions between economy and technology that Internet provides.

#### STUDY LOAD

Type	Hours	Percentage
Self study	86,0	68.80
Hours large group	39,0	31.20

**Total learning time:** 125 h



## CONTENTS

---

### 0. Course presentation

**Description:**

- Faculty introduction
- Overview of the contents of the course.
- Description of the grading system and the activities of the course.

**Full-or-part-time:** 3h

Theory classes: 3h

### 1. Recommendation by collaborative filtering: Netflix

**Description:**

- 1.1. Predictors (least squares problem, temporal models, convex optimization)
- 1.2. Neighborhood model (similarity, weighted prediction)
- 1.3. Latent-factor model (matrix factorization, alternating projection)

**Full-or-part-time:** 10h

Theory classes: 3h

Self study : 7h

### 2. Bayesian Ranking: Amazon

**Description:**

- 2.1. Bayesian estimation
- 2.2. Bayesian ranking
- 2.3. Amazon ranking

**Full-or-part-time:** 10h

Theory classes: 3h

Self study : 7h

### 3. Consensus Formation: Wikipedia

**Description:**

- 3.1. Voting Models
  - 3.1.1. Plurality model and Kemeny rule
  - 3.1.2. Positional voting (Borda count)
  - 3.1.3. Condorcet voting
- 3.2. Arrow's impossibility result
- 3.3. Sens impossibility result

**Full-or-part-time:** 10h

Theory classes: 3h

Self study : 7h

### Individual work presentation 1

**Description:**

Presentation of individual work on topics 1-3.

**Full-or-part-time:** 20h

Theory classes: 6h

Self study : 14h

### Exam 1

**Description:**

Exam of the first part of the course (lessons 1-3).

**Full-or-part-time:** 11h

Theory classes: 3h

Self study : 8h

### 4. PageRank Algorithm in Google

**Description:**

4.1. PageRank Basics

4.2. How PageRank works on Google

4.3. Implementation of the PageRank algorithm

4.4. Examples of application and exercises

**Full-or-part-time:** 10h

Theory classes: 3h

Self study : 7h

### 5. Google ad services

**Description:**

5.1. Introduction to auctions

5.2. The process that Google uses to assign space to companies (buyers)

5.3. Other types of space assignation. Differences and similarities

5.4. Examples of application and exercises

**Full-or-part-time:** 10h

Theory classes: 3h

Self study : 7h

### 6. Sharing resources and managing interferences

**Description:**

6.1. Basics on cellular communications and interference

6.2. TPC and DPC algorithms. Differences and similarities

6.3. Application examples and exercises

**Full-or-part-time:** 10h

Theory classes: 3h

Self study : 7h

## 7. Pricing services

### Description:

- 7.1. Pricing in cellular networks
- 7.2. Methods to charge users in cellular networks
- 7.3. Application examples and exercises

### Full-or-part-time: 10h

Theory classes: 3h

Self study : 7h

## Individual work presentation 2

### Description:

Presentation of individual work on topics 4-7.

### Full-or-part-time: 10h

Theory classes: 3h

Self study : 7h

## Exam 2

### Description:

Exam of the second part of the course (lessons 4-7).

### Full-or-part-time: 11h

Theory classes: 3h

Self study : 8h

## GRADING SYSTEM

First Part (Lessons 1, 2 and 3): Exam 30%, Continuous Assessments 20%

Second Part (Lessons 4, 5, 6 and 7): Exam 30%, Continuous Assessments 20%

## BIBLIOGRAPHY

### Basic:

- Krishna, Vijay. Auction theory [on line]. 2nd ed. Boston: Elsevier Academic Press, 2009 [Consultation: 06/09/2022]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9780123745071/auction-theory>. ISBN 9781282285613.
- Hull, John. Options, futures, and other derivatives [on line]. 11th ed. Harlow [etc.]: Pearson, [2021] [Consultation: 06/09/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6661730>. ISBN 9781292410623.
- Courcoubetis, Costas; Weber, Richard. Pricing communication networks : economics, technology and modelling. West Sussex: John Wiley & Sons, cop. 2003. ISBN 9780470851302.
- Chiang, Mung. Networked life : 20 questions and answers [on line]. Cambridge ; New York: Cambridge University Press, 2012 [Consultation: 06/09/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=1025055>. ISBN 9781316089972.

### Complementary:

- Koren, Y and Bell, R.. "Advances in Collaborative Filtering". Ricci, Francesco. Recommender systems handbook [on line]. New York: Springer, cop. 2011. [Consultation: 31/05/2022]. Available on: [https://doi.org/10.1007/978-0-387-85820-3\\_5](https://doi.org/10.1007/978-0-387-85820-3_5).- Gelman, Andrew.



Bayesian data analysis [on line]. 3rd. ed. Boca Raton, Fl.: Chapman & Hall, 2014 [Consultation: 06/09/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=1438153>. ISBN 9781439840955.

- Ayers, P.; Matthews, C.; Yastes, B. How Wikipedia works [on line]. 1st ed. San Francisco: No Starch Press, 2008 [Consultation: 15/09/2022]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1137543>. ISBN 9781593272272.