Last update: 04-07-2019

230613 - AFOC - Advanced Fiber Optical Communications

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2019

Degree: MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)
MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: GABRIEL JUNYENT

Others: JAUME COMELLAS, JOAN MANUEL GENÉ, JOSEP PRAT, JOSÉ A. LÁZARO

Degree competences to which the subject contributes

Specific:

1. Ability to apply advanced knowledge in photonics, optoelectronics and high-frequency electronic

2. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals

3. Ability to develop, direct, coordinate, and technical and financial management of projects in the field of: telecommunication systems, networks, infrastructures and services, including the supervision and coordination of other's subprojects; common telecommunications infrastructures in buildings or residential areas, including digital home projects; telecommunication infrastructures in transport and environment; with corresponding energy supply facilities and assessment of electromagnetic emissions and electromagnetic compatibility.
4. Ability to implement wired/wireless systems, in both fix and mobile communication environments.

5. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process

Transversal:

6. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
7. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Teaching methodology

- Lectures
- Laboratory practical work
- Individual work (distance)
- Exercises
- Short answer test (Control)
- Extended answer test (Final Exam)

Learning objectives of the subject

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Learning objectives of the subject:

The aim of this course is to train students in methods of analysis, design, dimensioning and performance evaluation of optical fibre based communications systems. First, we consider the parameters of interest for systems planning using different photonic technologies as well as advanced optical signal processing models. Then, using this knowledge, we will study the design and evaluation of modern optical fibre based communication systems.

Learning results of the subject:

- Ability to dimension and design WDM high bit-rate fibre optic communication systems.
- Ability to analyse, model and implement advanced optical communication systems.
- Ability to use optical communications simulation tools to assess the results obtained from theoretical studies.

Study load

Total learning time: 125h	Hours large group:	26h	20.80%
	Hours medium group:	0h	0.00%
	Hours small group:	13h	10.40%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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Content

1. Introduction

Learning time: 11h

Theory classes: 2h
Self study : 9h

Description:
- Historical evolution of optical fibre communications
- State of the art

2. WDM fundamentals

Learning time: 32h

Theory classes: 6h
Laboratory classes: 4h
Self study : 22h

Description:
- Optical devices for WDM communications
- Long haul and metro WDM systems
- WDM systems analysis, design and performance evaluation

3. Advanced Optical amplification

Learning time: 27h

Theory classes: 6h
Laboratory classes: 3h
Self study : 18h

Description:
- Doped Fiber Amplifiers
- Semiconductor Optical Amplifiers
- Raman Amplifiers
- Optical amplification in WDM communication systems

4. Optical fibre propagation effects

Learning time: 28h

Theory classes: 6h
Laboratory classes: 3h
Self study : 19h

Description:
- Chromatic and Polarization Mode Dispersion
- Non-linear effects in optical fibres
- Compensation (optically and electrically) of propagation effects.

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5. Advanced modulation formats for optical communications	Learning time: 27h Theory classes: 6h Laboratory classes: 3h Self study : 18h

Description:
- Advanced multiplexing (wavelength, time, polarization, code...)
- Single carrier advanced formats (QPSK, m-QAM, OFDM¿)
- Multi-carrier formats (O-OFDM, Nyquist-WDM)
- Systems analysis and evaluation

Planning of activities

LABORATORY

Hours: 10h
Laboratory classes: 10h

Description:
Design and evaluation of WDM systems using Matlab.

EXERCISES

Description:
Exercises to strengthen the theoretical knowledge.

SHORT ANSWER TEST (CONTROL)

Description:
Mid term control.

SHORT ANSWER TEST (TEST)

Description:
Partial evaluation test with theoretical questions and short exercises.

EXTENDED ANSWER TEST (FINAL EXAMINATION)

Description:
Final examination.

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Qualification system

Final examination: 40%
Partial examinations and controls: 20%
Exercises: 10%
Individual assessments: 5%
Group assessments: 5%
Laboratory assessments: 20%

Bibliography

Basic:

Kartalopoulos, S.V. Introduction to DWDM technology: data in a rainbow. New York: IEEE Press, 2000. ISBN 978-0780353992.

Kaminov, I.P.; Li, T.; Willner, A.E. (eds.). Optical fiber telecommunications: V: vol.B: systems and networks. San Diego: Academic Press, 2008. ISBN 978-0123741721 (VOL. B).

Kazovsky, L.G.; Benedetto, S.; Willner, A.E. Optical fiber communication systems. Boston: Artech House, 1996. ISBN 0-89006-756-2.

Saleh, B.E.A.; Teich, M.C. Fundamentals of photonics. 2nd ed. New York [etc.]: John Wiley & Sons, 2007. ISBN 9780471358329.

Agrawal, G.P. Nonlinear fiber optics. 6th ed. London: Elsevier : Academic Press, 2019. ISBN 9780128170427.

Complementary:

Ramaswami, R.; Sivarajan, K.N.; Sasaki, G.H. Optical networks: a practical perspective [on line]. 3rd ed. San Francisco: Morgan Kaufmann, 2010 [Consultation: 18/07/2013]. Available on: <http://www.sciencedirect.com/science/book/9780123740922>. ISBN 9780123740922.