

Appendix D:

Dual Degree Agreement between Instituto Superior Técnico (IST) and Escola Tècnica Superior d'Enginyeria de Telecomunicació de Barcelona (ETSETB) of the Universitat Politècnica de Catalunya (UPC)

Duration: Academic Year 2014/2015 to 2018/2019

IST	
Degree programme at IST:	Instituto Superior Técnico (IST)
Degree awarded:	M.Sc. in Electrical and Computer Engineering (MEEC) Major: Telecommunications or Electronics (120 ECTS)
Language of instruction:	English
Entrance Admission criteria	Students from ETSETB-UPC who successfully completed their studies on Bachelor's degree in Telecommunications Science and Technology or Bachelor's degree in Telecommunications Technologies and Services Engineering (to be enrolled in the 1 st semester of IST program). Also students from ETSETB-UPC who successfully complete their first 2 semesters from the Master's degree in Telecommunications Engineering at UPC.
ETSETB-UPC	
Degree programme at:	Escola Tècnica Superior d'Enginyeria de Telecomunicació de Barcelona (ETSETB)
Degree Awarded:	Master's degree in Telecommunications Engineering (MET) (120 ECTS)
Language of instruction:	English
Entrance Admission criteria	Students from IST who successfully completed their studies giving access to the Electrical and Computer Engineering (MEEC) Major: Telecommunications or Electronics . Also students from IST who successfully complete their first 2 semesters from the Electrical and Computer Engineering (MEEC) Major: Telecommunications or Electronics at IST.

The require background for the applicants is a completed Bachelor degree in engineering, science or equivalent to at least 180 ECTS undergraduate credits, at least 60 ECTS in Telecommunications, Electronics or Computer Science).

The applicants must provide proof of their proficiency in English, e.g. via an internally recognized test such as TOEFL or accepted university tests recognized by the corresponding institutions or a Bachelor degree from a University where English is the only language of instruction.

All the degrees will be awarded at the end of the formation, once the student has finished all the required courses at both institutions.

1. Schematic Study Plan:

Option 1:

Year	Institution	Studies	Remarks
1	UPC	Compulsory and elective courses	60 ECTS
2	IST	Courses + Master Thesis (co-supervised)	30+30 ECTS

Option 2:

Year	Institution	Studies	Remarks
1	IST	Compulsory and elective courses	60 ECTS
2	UPC	Courses + Master Thesis (co-supervised)	30+30 ECTS

2. Academic guides *

- Academic guide of Master in Telecommunications Engineering (ETSETB-UPC):

N°	Semester	Type	Course	ECTS credits
1	1	Obligatory (no-thesis)	Advanced communications for wireless systems	5
2	1		Wireless communication links and antennas	5
3	1		Communication networks	5
4	1		Overlay networks	5
5	1		Electronic system design for communications	5
6	1		Electronic instrumentation and optoelectronics	5
7	2		Telecommunications systems	5
8	2		Innovation based service management	5
9	2		Management of telecommunications projects	5
10	2	Specialization	3 Specialization courses	15
11	3	Elective	6 Elective courses	30
12	4	Obligatory (thesis)	Master's thesis	30
Total: 120 ECTS credits which corresponds to 3000 work hours for the student.				

*: Modifications on current Study Plans, and substitutions of Courses by similar ones do not break the agreement.

- **Academic guide of M.Sc. in Electrical and Computer Engineering (IST)*:**

N°	Type	Course	ECTS credits
1	Main specialization area	9 specialization courses	54
2	Secondary specialization area	3 specialization courses	18
3	Soft skills	Engineering Management Projects + Entrepreneurship, Innovation and Technology Transfer	12
4	Elective	1 Elective course	6
5	Obligatory (thesis)	Master's thesis	30
Total: 120 ECTS credits which corresponds to 3360 hours for the student			

***: Modifications on current Study Plans, and substitutions of Courses by similar ones do not break the agreement.**

3. Credits and work hours for students

- **Master in Telecommunications Engineering (ETSETB-UPC):**

The Master in Telecommunications Engineering (ETSETB-UPC) is composed of **120 ECTS credits**. **1 ECTS credit** corresponds to **25 work hours** for the student (8 for lecture + 17 for self-study). Therefore, the ETSETB-UPC master program requires **3,000 work hours** for each student.

Credits	ETSETB	Work for the student (hours)		
		Lecture	Self-study	Total
1	ECTS credit	8	17	25
120	Master in Telecommunications Engineering	720	2,280	3,000

According to this, a **course of 5 ECTS credits** (no Treball de Fi de Màster, TFM) corresponds to **125 work hours** (40 for lectures and 85 for self-study). On the other hand, the **master thesis course** (Treball Fi de Màster) corresponds to **750 work hours** for the student under an advisor supervision.

ETSETB	ECTS credit	Work for the student (hours)		
		Lecture	Self-study/thesis development	Total
1 course (no TFM)	5	40	85	125
Treball Fi de Màster (TFM)	30			750
Master in Telecommunications Engineering	120	720	2,280	3,000

- **Master in Electrical and Computer Engineering (MEEC-IST):**

The Master in Electrical and Computer Engineering (MEEC-IST) is composed of **120 ECTS credits**. **1 ECTS credit** corresponds to **28 work hours** for the student (10,5 for lecture + 17,5 for self-study). Therefore, the MEEC-IST master program requires **3,360 work hours** for each student.

Credits	ETSETB	Work for the student (hours)		
		Lecture	Self-study	Total
1	ECTS credit	10,5	17,5	28
120	Master in Telecommunications Engineering	945	2,415	3,360

According to this, a **course of 6 ECTS credits** (except the Master Thesis) corresponds to **168 work hours** (63 for lectures and 105 for self-study). On the other hand, the **master thesis course** corresponds to **840 work hours** for the student under an advisor supervision.

ETSETB	ECTS credit	Work for the student (hours)		
		Lecture	Self-study/thesis development	Total
1 course	6	63	105	168
Master Thesis	30			840
Master in Telecommunications Engineering	120	840	2,520	3,360

Detailed syllabus

First year studies	
IST	UPC
Autumn Semester (minimum 30 ECTS)	Autumn Semester (minimum 30 ECTS)
Major Telecommunications	
Radio Wave Propagation (6 ECTS)	Advanced communications for wireless systems (5 ECTS)
Wireless Telecommunication Systems (6 ECTS)	Wireless communications links and antennas (5 ECTS)
Telecommunication Networks (6 ECTS)	Communication networks (5 ECTS)
Data Coding and Compression (6 ECTS)	Overlay networks (5 ECTS)
	Electronic system design for communications (5 ECTS)
	Electronic instrumentation and optoelectronics (5 ECTS)
Optional Courses Students must take 6 ECTS among these courses	
Audio and Video Communications (6 ECTS)	
Optimization and Algorithms (6 ECTS)	
Microwaves (6 ECTS)	
Networks and Internet Services (6 ECTS)	
Entrepreneurship, Innovation and Technology Transfer (6 ECTS)	
Major Electronics	
Power Electronics (6 ECTS)	Advanced communications for wireless systems (5 ECTS)
Computer Electronics (6 ECTS)	Communication networks (5 ECTS)
Analog and Digital Filters (6 ECTS)	Electronic system design for communications (5 ECTS)
Microelectronics (6 ECTS)	
Optional Courses Students must take 6 ECTS among these courses	
Optimization and Algorithms (6 ECTS)	Bridge: Antennas and Microwaves (5 ECTS)
PC-Based Instrumentation (6 ECTS)	Bridge: Telecommunication Systems Fundamentals (5 ECTS)
Digital Systems Design (6 ECTS)	Bridge: Digital Communications (5 ECTS)
Entrepreneurship, Innovation and Technology Transfer (6 ECTS)	
Engineering Management Projects (6 ECTS)	

First year studies

IST	UPC
Spring Semester (minimum 30 ECTS)	Spring Semester (minimum 30 ECTS)
Major Telecommunications	
Optical Fibre Telecommunications Systems (6 ECTS)	Telecommunication systems (5 ECTS)
Computer Networks and the Internet (7.5 ECTS)	Innovation Based Service Management (5 ECTS)
Antennas (6 ECTS)	
Mobile Communication Systems (6 ECTS)	Intensification in 1 of 4 areas: <ul style="list-style-type: none"> - Communications - Networks - Electronics - Multimedia
	Students must take 3 courses from the 6 offered in each area.
Optional Courses Students must take 6 ECTS among these courses	Communications: <ul style="list-style-type: none"> - Microwave, terahertz and photonic technologies. - Remote sensing systems for Earth observation. - Radar and radionavigation systems. - Information theory. - Advanced mobile communications. - Advanced optical fibre communication
Wireless Mobile Networks (6 ECTS)	Networks: <ul style="list-style-type: none"> - Distributed systems, Internet and web technologies. - Information technology service management. - Quality of service in networks. - Network security. - Wireless access networks. - Networks
High Frequency Electronics (6 ECTS)	Electronics: <ul style="list-style-type: none"> - Advanced analog circuit techniques. - Control theory and applications. - Introduction to microelectronic technologies. - Power electronic circuits. - Programmable electronics. - Sensors, instruments and measurement systems.
Digital Transmission (6 ECTS)	Multimedia: <ul style="list-style-type: none"> - Image and video processing. - Introduction to computer vision. - Digital speech and audio processing. - Speech technologies. - Biometrics. - Machine learning.
Photonics (6 ECTS)	
Object Oriented Programming (6 ECTS)	
Engineering Management Projects (6 ECTS)	

First year studies

IST	UPC
Spring Semester (minimum 30 ECTS)	Spring Semester (minimum 30 ECTS)
Major Electronics	
High Frequency Electronics (6 ECTS)	Telecommunication systems (5 ECTS)
Advanced Computer Architectures (6 ECTS)	Innovation Based Service Management (5 ECTS)
Sensors and Actuators (6 ECTS)	Electronic system design for communications (5 ECTS)
Signal Processing Electronic Systems (6 ECTS)	Overlay networks (5 ECTS)
	Electronic system design for communications (5 ECTS)
Optional Courses Students must take 6 ECTS among these courses	Electronic instrumentation and optoelectronics (5 ECTS)
Telecommunications Systems (6 ECTS)	Intensification in 1 of 4 areas: <ul style="list-style-type: none"> - Communications - Networks - Electronics - Multimedia
Object Oriented Programming (6 ECTS)	Students must take 1 courses from the 6 offered in each area.
Audio and Video Communications (6 ECTS)	
Engineering Management Projects (6 ECTS)	

Second year studies

IST	UPC
Autumn Semester (minimum 30 ECTS)	Autumn Semester (minimum 30 ECTS)
Major Telecommunications	Management of telecommunication engineering projects and companies 2 (5 ECTS)
<i>Students must take at least 30 ECTS from these courses, each course corresponding to 6 ECTS:</i>	<i>Students must take at least 25 ECTS from these courses, each course corresponding to 5 ECTS:</i>
	Advanced Analog Circuit Techniques
Entrepreneurship, Innovation and Technology Transfer	Advanced Digital Systems
Stand-Alone Power Supply Systems	Advanced Fibre Optical Communications
Radio Wave Propagation	Advanced Mobile Communications
Wireless Telecommunications Systems	Array Processing and Smart Antennas
Communication Theory	Biometrics
Networks and Internet Services	Control Theory and Applications
Optimization and Algorithms	Convex Optimization
Radio Wave Propagation	Critical Thinking and Scientific Writing
Telecommunication Networks	Design and Analysis of RF and Microwave Systems for Communications
Data Coding and Compression	Digital Image and Video Processing
Microwaves	Digital Speech and Audio Processing
Audio and Video Communications	Distributed Systems, Internet and Web Technologies
Engineering Management Projects	Engineering Electromagnetics for High Frequency Applications
Elective course	GPS and Galileo Data Processing: From Fundamentals to High Accuracy Navigation
	IP Networks and Protocols
	Information Technology Service Management
	Information Theory
	Instrumentation and Sensors
	Introduction to Computer Vision
	Introduction to Microelectronic Technologies
	Machine Learning From Data
	Matlab. Fundamentals And/Or Applications
	Matrix Algebra
	Micro and Nano Electronic Design
	Micro and Nanotechnologies
	Microwave Remote Sensing
	Microwave, Terahertz and Photonic Technologies
The courses are chosen in accordance with student's mentor.	... to be continued in next page...
Spring Semester (minimum 30 ECTS)	Spring Semester (minimum 30 ECTS)
Thesis related activities 30 ECTS supervised by both partners	


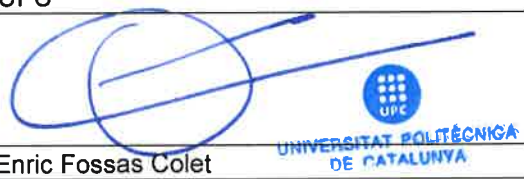
Second year studies



IST	UPC
Autumn Semester (minimum 30 ECTS)	Autumn Semester (minimum 30 ECTS)
Major Electronics	Management of telecommunication engineering projects and companies 2 (5 ECTS)
<i>Students must take at least 30 ECTS from these courses, each course corresponding to 6 ECTS:</i>	Intensification in 1 of 4 areas: <ul style="list-style-type: none"> - Communications - Networks - Electronics - Multimedia
	Students must take 2 courses from the 6 offered in each area.
Entrepreneurship, Innovation and Technology Transfer	
Engineering Management Projects	Students must take at least 15 ECTS from these courses (and previous list), each course corresponding to 5 ECTS:
Power Electronics	Network Security
Analog and Digital Filters	Networks
Microelectronics	Optical Fiber Telecommunications
Computer Electronics	Optical Networks
Information Systems and Databases (7.5 ECTS)	Power Control and Processing
Data Coding and Compression	Power Electronic Circuits
Digital Systems Design	Programmable Electronics
Elective course	Quality of Service in Networks
	Radar and Radionavigation Systems
	Remote Sensing Systems for Earth Observation
	Seminar: LIDAR Remote Sensing
	Seminar: Software-based digital control applications
	Sensors, Instruments and Measurement Systems
	Speech Technologies
	Start-Up Initiation: Theory and Strategy
	Stochastic Processes
	Technology Asset Management
	Waves and Systems
	Wireless Access Networks
	Also electives from MSc: Master in Photonics
	Also electives from MSc: Interuniversity Master for Computer Vision
The courses are chosen in accordance with student's mentor.	
Spring Semester (minimum 30 ECTS)	Spring Semester (minimum 30 ECTS)
Thesis related activities 30 ECTS supervised by both partners	

Contacts:

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Signatures:

Date: June 12 th , 2015	Date: June 12 th , 2015
For IST	For UPC
	
Prof. Arlindo Oliveira	Dr. Enric Fossas Colet
President	Rector

Date: June 12 th , 2015	Date: June 12 th , 2015
For IST	For the Barcelona School of Telecommunications (ETSETB)
	
Prof. Luís Miguel Silveira	Dr. Ferran Marqués
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Escola Tècnica Superior d'Enginyeria de Telecomunicació de Barcelona
UNIVERSITAT POLITÈCNICA DE CATALUNYA
ÀREA RELACIONS EXTERNES