

## A GRADUATE PROGRAM IN INTEGRATED COMMUNICATION SYSTEMS

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### 1. Introduction

Current Microelectronics technologies potentially allow complete system integration. In fact, yield is no longer the limiting factor. The new frontier is System Knowledge and Complexity Management.

Traditional Microelectronics curricula is centered on IC design based on specifications. System Architects and IC designers live independent lives. System Integration, if ever a reality, will change this state of affairs. In fact, these two independent profiles will necessarily converge in such a way that each domain will have an impact on the other through design constraints to be taken into account at the earliest stages.

EURECOM Institute, an industry-driven research establishment, is a joint initiative of ENST (France) and EPFL (Switzerland), and a consortium of European Industrial Partners. It proposes a Graduate curriculum in Integrated Communication Systems Engineering.

### 2. A new profile for engineers

The world of telecommunications is undergoing profound change. Sophisticated technologies are already available: optical fibers, integrated circuits. Digital networks can be interconnected, superimposed, globalized. The opening up of markets, deregulation and competition are the rule of the day.

Simple transmission and switching of messages is giving way to the offer of content and services. The aim is to offer the user a transparent network, accessible everywhere, that swiftly provides him with useful innovative services at a reasonable cost. The resulting communication systems are large-scale, dynamic, complex, heterogeneous systems which it is not easy to learn to operate and to design. High economic stakes are involved in such systems which, through their social impact, are laying the foundations of a new information society. To design and deploy future networks, the engineer becomes a systems architect skilled in the most sophisticated technological components, and with the ability to integrate them into coherent systems that satisfy user needs while complying with specific economic parameters and well-controlled time-frames.

This engineer-architect's profile corresponds to insistent demand from companies, which have to cope with the management of highly complex projects. For advanced education establishments, it is a challenge requiring technical excellence that cuts across disciplinary boundaries and traditional standard teaching practices.

### **3. International dimension**

To respond to the globalization of networks, skills and economies, Eurécom is a truly international Institute. The engineers must understand cultural factors, conduct international technical and business negotiations, and be aware of the strategies of operators and their alliances. In this context, they are able to benefit from a job market that transcends the national borders of their diplomas. This transnational makeup is inherent in the nature of Eurécom's partners, in the origins of its students, in the recruiting pattern of its teachers.

### **4. Industry**

In this sophisticated, rapidly-evolving technical area, the academic and industrial worlds must combine their efforts and transfers between them must gain pace. The trained engineers must be operational, fine-tuned to companies' needs and with a capacity for creative development. The companies in turn must become increasingly involved in the training of today's and tomorrow's executives. At Eurécom we work in partnership with our industrial members within a framework of dedicated cooperation. The Institute is located at the heart of a markedly telecommunications-oriented science park.

### **5. Integration**

Integration is the art of combining the components of a system, adjusting them to their environment and ensuring they interact perfectly so that the integrated system meets user requirements and offers the expected services under acceptable economic and social conditions. It is essential for the engineer-architect to possess this capacity which gives him powers of synthetic and global vision. It is a capacity he can use at different levels (each component can be a system in itself) and which is tailored to the targeted user. The will for integration must be present right from the design stage of the system and must guide all the stages of its accomplishment.

### **6. Admissions**

Several advanced European establishments have entrusted Eurécom with the responsibility of their students' final training period (three semesters) covering a communication systems engineer curriculum.

They are ENST, ENST Bretagne, INT, EPFL, EPFZ, Politecnico di Torino and, on an experimental basis, other European universities such as Linz and Helsinki.

## 7. The Faculty

The curriculum is taught by Institut Eurécom's full-time staff of professors recruited at international level, and by their assistants. Courses are also taught by professors from EPFL and ENST and by experts from the local or international scientific and industrial community.

## 8. Teaching method

Because of Eurécom's international vocation, half of the technical courses are in English. These courses cover aspects of communications systems and incorporate theory and hands-on experimentation. Eurécom draws extensively on its industrial contacts to define the courses, projects and case studies.

## 9. Curriculum

The curriculum is divided into 3 semesters beginning in March and ending in July the following year. Courses in economics, law, human sciences and modern languages complement the technical courses of the first two semesters. The third semester is devoted to an "industrial thesis" (six-month internship).

### 9.1 Semester 1

The aim of this semester is to give all the students a high level of knowledge in communication systems theory and the associated sciences and techniques.

To take into account the students' different origins, they are offered a broad menu of courses from which they can choose those ten that best complete their skills.

Typical courses include: Intelligent Systems, Distributed Advanced Programming, Network Security, Advanced Networking, Computer Networks, Real-Time Systems, Wireless LANs, Internet Application Layer Protocols, Image and Video Compression, Stochastic Processes, Digital Communication Theory, Advanced Signal Processing, Introduction to, Communications, Signal Modelling and Coding, Performance Evaluation and Cellular Radio

### 9.2 Semester 2

This semester is devoted to the option-specific courses, which provide more in-depth study of the chosen specialization. It also includes case studies guided by business experts. The students also do a 170-hour project on a subject usually proposed by Eurécom members, companies on the Sophia Antipolis site or other businesses. It can also be linked with the research activities of Institut Eurécom. Typical courses include:

9.2.1 *Corporate Communications*: Advanced Protocols and Algorithms, Network Management, Network Security, Network Architecture and Services, Protocol Engineering and Network Technologies

9.2.2 *Mobile Communications*: Wireless Communications, Mobility Protocols, Speech Transmission, Mobile Communications Services, Management of Mobile Networks and Mobile Communication Systems

9.2.3 *Multimedia Communications*: Multimedia Networking, Multimedia Documents, Multimedia Technology, Speech & Sound Processing, Image Synthesis and Virtual Reality and Video Processing and Communications

### 9.3 Semester 3

This semester is reserved for the "industrial thesis", a six-month internship, usually in an industrial company, the subject of which is approved by a Eurécom professor.

This internship must have a content that is both industrial (professional) and academic (thesis). Each student is monitored by a supervisor from Eurécom and from the host company. On completion of his internship, the student submits a report and makes an oral presentation of his work before an examination board.

### 10. Associated courses

While students are studying at Institut Eurécom, they can also follow a DEA postgraduate course (Diplôme d'Etudes Approfondies) at the University of Nice Sophia Antipolis. At present the courses offered are DEAs in Distributed Networks and Systems and the "ARAVIS" DEA (Image-Vision option). Some Eurécom courses are validated for the DEA, and additional 2 to 3-month courses count for an additional diploma.

### 11. Diploma

Successful students receive the engineering diploma of their school of origin. At the same time, Institut Eurécom awards the "Eurécom Certificate", accredited by the participating schools, according to a joint graduate system.

### 12. Research and Environment

Research subjects include radio transmission, digital cellular networks, wireless data transmission, radio local area networks, mobility, audio-visual communications, multimedia networks, communications support for dispersed groups, user centered design, man-machine interface, multimedia document indexing, network design, operation and management, network interconnection, broadband communications, network security, intelligent networks, etc.

Current projects include Software Radio Platform, Exploitation of UMTS platforms for experimenting process algorithms for mobile telecommunication systems, etc.

The industrial context in Sophia Antipolis includes a set of large companies, a number of small companies, an increasing number of start-ups, and top-quality research centers, working hand-in-hand with local organizations.