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Competence Matrix

Partner Institution	Course	Knowledge	Skills	Competences
	'learning outcomes' means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence;	'knowledge' means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study.	'skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems.	'competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development
TUS	Design of Nanoscale MOS ICs	Highly specialised knowledge on CMOS integrated circuit layout, basic technology, IC design and modelling and specific physical effects in short channel transistors.	Ability to design submicron CMOS ICs using CADENCE and solving problems with modelling of submicron devices behaviour.	Demonstrate innovation, autonomy, scholarly to the development of new modelling and design rules at the forefront of work or study contexts including research in nanoelectronics design.
TUS	Nanomaterials	Advanced knowledge of a field of materials for nanoelectronics and their use in nanodevices fabrication, involving a critical understanding of theories and principles of their physical and chemical properties.	Advanced skills, demonstrating mastery and innovation in the use of new materials for the fabrication of new submicronic devices.	Manage complex technical and professional activities and projects in using new materials for nanoelectronics.
UNED	Microelectronics literacy and Technologies	Overview of fundamentals of microelectronics. Basic knowledge in the main technology processes in microelectronics.	Skills in classification materials, definition of semiconductor substrates and crystals. Ability of understanding the crystal growth processes, all the main manufacturing processes and thin film processes and	Able to use different types of large scale integrated circuits Able to design the oxidation and deposition layers and the diffusion and ion implantation in microelectronics

			choosing which is the best process to use for a specific design	
UNED	Integrated circuits and design	Advanced knowledge in Technologies of integrated circuits and methods for designing digital integrated circuits.	Advanced skills in choosing which is the best technology to use for specific requirements in the production of an integrated circuit and advanced ability of choosing more suitable method for designing a specific integrated circuit	Able to use Lithography technology in the design of integrated circuits. Able to use CMOS technology sequence and BiCMOS integrated circuits. Able to manage and design custom circuits and logical matrices
TUB	Superconductive materials	Thin film deposition technologies; applications of HTS-wires, energy efficiency; thin film photovoltaic technologies; optical and electronic properties of materials	Instrumental analytics in practice applied to thin films; data processing and presentation	Instrumental analytics of tin films (XRD- stresses' analysis, mechanical properties, EBSD, SEM, AFM, EDX, EPMA, XPS); various methods of digital modulation; new materials in energy saving technologies
TUB	Survival in Labor Market	Behavior strategies, psychological effects, current economic trends, judicial basis, transformational versus transactional leadership theory	Superior performance abilities, carrier managing, employment and reemployment, targeterd job search, leadership skills	Self-presentation, retraining, respesializing, goal and problem definition, skill-improvement
TUB	Project management	Business planning, funding, marketing, performance, quality management	Determination of the problem's context, team building and defining abilities, stakeholder management and communication, budget estimation, acquiring and assigning resourcing to projects	Estimate costs, identify and analyze risks, team work, delegate responsibilities, deal with project's changes, manage the full project cycle
TUB	Effective communication with groups, presentation	verbal and non-verbal communication, conflict	effective listening, overcoming barriers, effective perception,	Communicate in clear, respectful and non-

	techniques	solving theory and practice, etiquette (guide) and career	building speeches, questioning/conversation/ presentation techniques	judgemental ways, present information efficiently
POLITO	Modelling and Design of ULSI circuits and systems	Highly specialized knowledge on CMOS integrated circuit layout, basic technology, IC design and modelling, considering specific physical effects in short channel transistors.	Ability to design submicron CMOS ICs using CADENCE and solving problems with modelling of submicron devices behavior.	Demonstrate innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new modelling and design rules, at the forefront of work or study contexts, including research in nanoelectronics design.
POLITO	Design and realisation of Micro-Nano-BioSensors	Knowledge of the basics of quantum mechanics useful for the design and use of nanodevices, in particular nanosensors. Knowledge of the possible device production techniques of nanosystems, in particular of nano-probing solutions.	Skills in designing nanosystems for sensing, in choosing the needed interfaces for reading the signals and transferring the information, from the nanolevel to the user interface, passing through microcircuitries.	The students will reach a sufficient knowledge and skill for being able of choosing novel solutions in terms of nanodevices and nanosensors, with the capability of guiding the strategical choices for the the system level design.
INSA	Electromagnetic Compatibility of Integrated Circuits	Understanding of basic concepts, challenges, measurement & modelling standards, influence of technology roadmaps to EMC, introduction to 3D-IC technologies from EMC viewpoint.	Application of standard measurement methods for emission and immunity using dedicated test boards. Simulation and analysis of EMC performances of fast IOs, modelling of conducted & radiated noise. Susceptibility analysis to radio-frequency interference	Ability to characterize EMC performances of ICs. Ability to compare measured and simulated EMC performances of ICs. Design for improved EMC using a selection of guidelines and good practice.
UPB-CETTI	Design for manufacturing of microsystems	Advanced knowledge in the field of Design For Manufacturing (DFM) of microsystems and modules,	Ability to design specific electronic modules which contain microsystems using the Cadence design	Demonstration of advanced ability to use engineering knowledge, skills, innovation, autonomy and methodological

		involving deep understanding of Electronic Design Automation (EDA) theories and of manufacturing principles based on optimum design solutions	environment and ability to solve Design For Manufacturing (DFM) problems based on pre-layout and post-layout simulation	abilities in the design for manufacturing of specific electronic modules, including research and development in this field; ability to manage and design custom modules with microsystems
UPB-CETTI	Electronic packaging and assembling technologies of microsystems	Advanced knowledge in the field of electronic packaging and assembling technologies of modules and microsystems, involving solid understanding of manufacturing theories based on world recognized standards.	Ability in selecting the proper the packaging technology, based on specific requirements, in the manufacturing of electronic modules and advanced ability of selecting the suitable assembling technology for realizing specific microsystems	Demonstration of advanced ability to use engineering knowledge, skills, innovation, autonomy and methodological abilities in electronic packaging and assembling technologies of microsystems, including research and development in this field; ability to manage and perform engineering packaging tasks
INOMA	PV Power Electronics maintenance	Knowledge and specialization in IGBTs technology and micro-controllers to use in PV regulators. Maximum Power Point trackers as special capability in PV.	The industrial sector need workers specialized in this task. The electronic regulator and the different kind of inverters are very important components of PV installations.	The PV companies need high specialization in error detect and operation of power inverters. Too knowledge of different parts and its functions in PV electronic power devices.
BME	Technology of Electronics Products	The primary objective of the course is to provide knowledge and practical skills for students related to circuit modules and systems. The course gives a comprehensive overview on microelectronic devices, components, mechatronic, optoelectronic and other modules; and also	Students will be capable to elaborate the manufacturing methods, procedures and technologies of electronic devices.	With the acquired competences the students can design the mass production of electronic components and devices optimally; they can install production lines and also take quality management and environmental protection requirements into consideration.

		on the structure of electronic equipment including their manufacturing, maintenance and assembly technologies.		
BME	Virtual Laboratory Support for Microelectronics Packaging Education	The objective of the virtual laboratory is to get the students be acquainted with the principles of packaging technologies, the operating mechanism of machines in the manufacturing line and with their basic specifications.	Students will be capable to make a distinction between different packaging technologies (e.g. thick-film, thin-film, PCB based) and to relate the proper equipment and infrastructure for these technologies.	The acquired competences allow the students to analyse machines operating in the electronics production, and to provide aid for design engineers during the stages of designing, purchasing and building manufacturing lines for electronic products.
BME	Multi-Media Enhancement of Teaching Sensors and MEMS	Thorough knowledge on the field of sensors and MEMS, starting with the basic principles, production technologies, structural compositions, related physical effects, measuring methodologies of given parameters, specific device descriptions, and application possibilities with examples according to the different adopting fields.	Students will be able to gain a wide scale view on the field of sensors and MEMS, with an ability to find, differentiate and apply specific devices for their electronic designs or their research tasks. The course deepens knowledge on working principles, which provides initial skills required for direct sensor/MEMS development.	The obtained competences can be applied in industrial situations, where sensor/MEMS devices are manufactured, or such devices are part of the manufactured product, moreover these devices are integral part of the manufacturing infrastructure. Also, the students will be able to perform, analyse and iterate on electronic design involving sensor/MEMS devices.
BME	Assembling and Inspection Technologies	Knowledge in assembly and inspection technologies of electronics products based on the course of “Technology of Electronics Products”; in common steps of automated, mass soldering technologies (reflow- and wave soldering) in details, and gives a brief	Students will be capable to fully control the different process steps of automated soldering technologies, to plan testing strategies and to develop inspection algorithms for aiding the defect-free manufacturing of electronic products.	The acquired competences allow the students to analyse in-manufacturing defects and failures and to provide solutions for eliminating those defects which are closely related to the automated manufacturing of electronic products. Consequently, the

		insight into inspection and test methods applied during the manufacturing of electronic products.		students can also use their obtained skills to effectively reduce failure costs in production.
AMGT	Design, Prototype Fabrication and Applications of Silicon Microsystems with Piezoresistive Feedback	Knowledge of theory, facts, and principles of embodiment of application specific microsystems with piezoresistive feedback - emphasize on correlation between electronic and mechanical properties of materials, exploited technologies, microsystems' design rules, and devices' performance	Ability to transduce the targeted specification of the microsystem into a relevant selection of base material, exploited technology and microsystems' layout in application specific prototyping, emphasizing on the differences between microelectronics and microsystems	Ability to provide autonomously exploitable outcomes of all main intermediate stages of design, computer simulation, mask layers' extraction, selection of the best processing option for microsystems' fabrication, and implementation of devices' validation
UKIM	MEMS Sensors and Actuators	Basics of MEMS sensors and MEMS actuators, and of the physical concepts and principles involved in their functioning. Knowledge of the control laws and techniques implemented in MEMS	The students will reach a sufficient level of knowledge and skill to be able to work with MEMS sensors and actuators, and to be able to choose a suitable control methodology for a given MEMS control problem.	The students will gain capabilities of working with MEMS systems and of designing of control loops for MEMS systems
UKIM	Semiconductor Device Modeling	Knowledge on the field of semiconductor device modeling on a physical level, such as, drift-diffusion, hydrodynamic and particle-based simulation methods.	The students will be able to understand multiple scale transport in semiconductors and skill to design drift-diffusion and particle based device simulator.	The students will gain ability to design novel simulation methods needed for modeling state-of-the-art nanoscale devices.
INES	Fabrication and characterization of solar cells	The fundamentals and principle of solar cells; electrical and optical properties; the fabrication process of solar cells; the	To be able to assess solar cells characteristics; to be able to compare different solar cells fabrication processes; to be able to identify the limitations	Fabrication and characterization of solar cells

		characterization of solar cells; the limitations in efficiency	in the efficiency of solar cells;	

Definitions

For the purposes of the RECOMMENDATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning, the definitions which apply are the following:

(a) 'qualification' means a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards;

(f) 'learning outcomes' means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence;

(g) 'knowledge' means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual;

(h) 'skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);

(i) 'competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.