INTEGRATED CIRCUITS FOR SPECIALIZED APPLICATIONS

1. GENERAL

SCHOOL	ENGINEERING		
SECTION	INFORMATICS & COMPUTER ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE		**SEMESTER OF STUDY**	7th, 9th
COURSE TITLE	INTEGRATED CIRCUITS FOR SPECIALIZED APPLICATIONS		

INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded in distinct parts of the course e.g. Lectures, Laboratory Exercises, etc. If the credits are awarded uniformly for the entire course, indicate the weekly teaching hours and the total number of credits*	**WEEKLY HOURS TEACHING**	**CREDIT UNITS**
Lectures	2	
Practice Exercises	1	
Laboratory	1	
Add rows if needed. The organization of teaching and the teaching methods used are described In detail at 4.	**4**	**5**

COURSE TYPE *Background, General Knowledge, Scientific Area, Development Skill*	Scientific Area, Skills Development
PREREQUISITES COURSES:	Electronics, Microelectronics
LANGUAGE OF INSTRUCTION and EXAMINATION:	Greek, English
THE COURSE IS OFFERED TO ERASMUS STUDENTS	Yes
ONLINE COURSE PAGE (URL)	

2. LEARNING OUTCOMES

Learning Outcomes

The learning outcomes of the course are described, the specific knowledge, skills and abilities of an appropriate level that students will acquire after the successful completion of the course.

Consult Appendix A

- *Description of the Level of Learning Outcomes for each course of study according to the European Higher Education Area Qualifications Framework*
- *Descriptors of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Summary Guide for writing Learning Outcomes*

Upon successful completion of the course, the student must:

- fully understand the processes for the construction of integrated circuits
- recognizes any form of O.K.
- distinguishes the appropriate software for the development of the structure
- comfortably handles the basic applications related to the construction of software for the development of the structure
- uses software for the hardware
- understand and use the different hardware development methods
- implements O.K. circuits.
- is competent provides for safety based on international data in the clean room
- is capable of designing OK

- manages complex techniques , taking responsibility
- He has a wide range of cognitive and practical skills required to find solutions to problems in his field.
- Develops specialized skills, which are required in research in order to develop new knowledge
- Expands existing knowledge
- Collaborates at a research level
- leverages expertise to fulfill tasks and solve problems

General Skills

Taking into account the *general competencies that* the *graduate must have acquired (as listed in* the *Diploma Supplement and listed below) which of them is the subject aimed at?*

Search, *analysis* and synthesis *of data and information, using the necessary technologies*
Adapting to new situations Decision making
Autonomous work
Teamwork
Working in an international environment Working in an interdisciplinary environment
Generating new research ideas
Project planning and management
Respect for diversity and multiculturalism Respect for the natural environment
Demonstrate social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism
Promotion of free, creative and inductive thinking

- Search and synthesis of data
- Generating new research ideas
- Autonomous Work
- Working in an international environment
- Promotion of creative and inductive thinking

3. COURSE CONTENT

Theoretical part

- Historical development of the O.K.
- Ultra-high purity room. Design, requirements, protocols
- Stages of manufacture of the tablet
- Approach: Circuit, Gate, Base, System
- Use of Masks in the construction steps of an O.K.
- Photolithography
- Structural development techniques - Molecular beam epitaxy, Ion Implantation
- Thin-film structures
- Carbonic Fibre Transistors and O.K.
- Basic principles of three-dimensional integration
- Special purpose subsystems (PLL, DLL, I/O systems, Packaging and refrigeration, etc.)
- Performance of the O.K. system
- System control and debugging

Laboratory place Pad frame with MOSIS VIRTUOSO Layout Editing

- O.K. Structure Development Software
- Circuit simulation
- Material description languages
- Demonstration of the development of structures
- Visit to a clean area for the creation of a silicon circuit

4. TEACHING AND LEARNING METHODS - ASSESSMENT

<table>
<tr><td>HOW TO DELIVER
Face-to-face, Remote education , etc.</td><td>Face-to-face and remotely in terms of material for the creation and implementation of integrated circuits</td></tr>
<tr><td>USE OF TECHNOLOGIES INFORMATION AND COMMUNICATIONS
Use of ICT in Teaching, in Laboratory Training, in Communication with students</td><td>• Posting of theoretical material (notes, lecture slides, exercises, topics examinations, etc.) on the e-learning platform (e-class).
• Use of email and announcements on the e-learning platform for communication with students.</td></tr>
<tr><td>TEACHING ORGANIZATION
The way and methods of teaching are described in detail.
Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography Study & Analysis, Tutorial, Practice (placement), Clinical Practicum, Art Workshop, Interactive teaching, Educational visits, Project preparation, Writing of work / assignments, Artistic creation, etc.
The student's study hours for each learning activity as well as the hours of unguided study are listed so that the total workload at semester level corresponds to ECTS standards</td><td>
<table>
<tr><th>Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures Tutorial</td><td>26</td></tr>
<tr><td>Laboratory Exercises</td><td>13</td></tr>
<tr><td>Elaboration of Assignements</td><td>13</td></tr>
<tr><td>Independent Study</td><td>43</td></tr>
<tr><td>Course Total
(25 hours of load working per credit unit)</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT EVALUATION
Description of the evaluation process

Assessment Language, Assessment Methods, Formative or Inferential, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Patient Examination,
Artistic Performance, Other / Other

Explicitly defined assessment criteria are indicated and if and where they are accessible to students.</td><td>I. Written final exam (40%) including :
- Short answer questions
- Multiple choice questions
II. Elaboration of a study of a subject in the O.K. which is assigned during the laboratory practice to the student with the aim of developing skills (40%)
III. Active participation during the theoretical course (20%)
A grade of at least 50/100 is required for successful completion.
The syllabus to be examined and the above procedure assessments are communicated to students in the lecture hall and posted in the e-class.</td></tr>
</table>

5. RECOMMENDED-BIBLIOGRAPHY

- Suggested Bibliography :

1. CMOS Analog IC Design Fundamentals, Erik Bruun, 2018
2. Integrated Circuit Design for Space Applications, Space Microelectronics Volume 2, Anatoly Belous, Vitali Saladukha, Siarhei Shvedau, Artech House, 2017
3. Compact Models for Integrated Circuit Design: Conventional Transistors and Beyond. Samar K. Saha, 2017
4. Graphene CNT and Nanostructures, James Morris, Kris Iniewski, CRC Press, 2017

5. Power Management Techniques for Integrated Circuit Design, Ke-Horng Chen, IEEE, Wiley, 2016
6. Electronic Design Automation for Integrated Circuits System Design Verification and Testing, Handbook, Two Volume Set, 2nd , Luciano Lavagno, Igor L. Markov, Grant E. Martin, Louis K. Scheffer, 2016
7. Carbon Nanotube Based VLSI interconnects, Analysis and Design, Brajesh Kumar Kaushik, Manoj Kumar Majumder, Springer, 2014
8. Analog Integrated Circuit Design, International Student Ed., Chan Carusone, Wiley, 2013
9. High Performance IC design, Emre Salman, Eby G. Friedman ,Mc Graw Hill, 2012
10. The Industrial Electronics Handbook - Five Volume Set ,2nd , Bogdan M. Wilamowski, J. David Irwin, CRC Press, 2011
11. CMOS VLSI Design, 4th, Neil Weste and David Money Harris, Pearson, 2011
12. Design of Analog CMOS Integrated Circuits, Solutions– Behzad RAZAVI, Mc Graw, 2008
13. Digital Integrated Circuits Design, A design Perspective, Jan Rabaey, A. Chandrakasan, B.Nikolic, PHI, 2003
14. High Speed Integrated Circuit Technology - Towards 100 Ghz Logic (Selected Topics in Electronics and Systems), Mark Rodwell , 2001

- Additional Bibliography :

1. Handbook of 3D integration, Paul D. Franzon, Erik Jan Marinissen , Muhannad S. Bakir Wiley, 2019
2. Graphene–CNT hetero-structure for next generation interconnects, K.Ghosh, N.Ranjan, Y. K. Verma, C. S. Tan, 2016 (https://pubs.rsc.org/en/content/articlelanding/2016/ra/c6ra04820j#!divAbstract)
3. Physical Design for 3D Integrated Circuits, Aida Todri-Sanial, Chuan Seng Tan, 2015
4. Carbon Nanotube electronics, Ali Javey, Jing Kong, Springer, 2009
5. ARM System-on-Chip Architecture, 2nd, Steve Furber, 2000