Politehnica University of Bucharest
Faculty of Electronics, Telecommunications and Information Technology

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	Politehnica University of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Electronics Technology and Reliability
1.4 Domain of studies	Electronics and Telecommunications Engineering
1.5 Cycle of studies	License (Bachelor)
1.6 Program of studies/Qualification	Applied Electronics

2. Course identification information

2.1 Name of the course				Initiation in practical realization of electronic circuits			
2.2 Lecturer				Prof.dr.ing. Ciprian Ionescu			
2.3 Instructor for practical activities				As.dr.ing. Cristina Marghescu			
2.4 Year of studies	I	2.5 Semester	II	2.6 Evaluation type	Verification	2.7 Course choice type	Optional

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which	2	3.2 course	1	3.3 practical activities	1
3.4 Total hours in the curricula, out of which	28	3.5 course	14	3.6 practical activities	14

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	24
Supplemental documentation (library, electronic access resources, in the field, etc.)	8
Preparation for practical activities, homework, essays, portfolios, etc.	14
Tutoring	
Examinations	2
Other activities	

3.7 Total hours of individual study	46
3.9 Total hours per semester	102
3. 10 Number of ECTS credit points	2

4. Prerequisites (if applicable)

4.1 curricular	Not the case

4.2 competence-based	Not needed

5. Requisites (if applicable)

5.1 for running the course	Video projector and screen
5.2 for running of the applications	Specific facilities for electronics laboratory with emphasis on electronic components assembly on printed circuit boards (PCB).

6. Specific competences

Professional competences	Familiarizing the students with usual electronic components and the procedure to realize electronic modules. Building the ability to transpose a simple electronic schematic in a real physical circuit at the prototype level.
Transversal competences	Familiarizing the students with writing an order to purchase electronic components. Familiarizing with technical documents in English language.

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	The aim of discipline is to familiarize students with the general aspects of the way in which the electronics. Initiating students interested in knowing how the electronic modules are designed and manufactured. This discipline aims to stimulate students' interest in understanding and designing electronic products of varying degrees of complexity, with application to year projects or license diploma work.
4.2 Specific objectives	Introduction to identify electronic components. Familiarize students with the main types of passive and active components (resistors, capacitors, diodes, LEDs, transistors, integrated circuits for general use). Introduction to Electronic assembly of modules. Introduction to soldering of electronic components. Introduction to Computer Aided Design of interconnection structures of electronic components. Introduction to Design for Manufacturing. Introduction to the standards of the electronics industry, IPC A610D standard (International Standard used in assembling electronic modules everywhere in EMS companies). Prototyping of electronic modules for low complexity.

8. Content

8.1 Lectures	Teaching techniques	Remarks
1. Introduction to electronic packaging; levels of the packaging. Usual electronic Components.	Teaching method is based on video projector slides	2 hours

2. Printed circuit boards - realization technology. The single layer (single-sided) and multilayer with metallized holes.	simultaneously having the option to use the printed book as notes handout. Teaching Materials are: Books, problem books, other materials from course WEB site.	2 hours
3. Fundamentals of soldering of electronic components. Manual and automatic soldering, wave and reflow soldering process. Type of reflow ovens: IR type, convection type and and vapor phase type. Hand soldering technology of through hole mount components.		2 hours
4. Introduction in assembly technology for electronic modules. Features of use surface mount components. Manual and automatic equipment for PCB assembly. Applicability, cost, performance.		2 hours
5. Rules for drawing electronic schematics. Using CAD methods and programs; Making layout. List of components - Bill of Materials.		2 hours
6. Technologies to achieve the support of modules. Physical realization of printed circuit based on data from CAD programs. Features for prototypes. Method "Press and peel".		2 hours
7. Procedures for repair and rework in the electronics industry. Methods based on the heat transfer by conduction and convection (hot air). IPC standards.		2 hours
Bibliography 1. P. Svasta, V. Golumbeanu, C. Ionescu, A. Vasile, Rezistoare, Editura Cavallioti, 2010.. 2. P. Svasta, V. Golumbeanu, Componente electronice pasive – Condensatoare, UPB, editura Cavallioti 2009. 3. Harper C. A., „*Electronic packaging and interconnection handbook*", McGraw-Hill, 2000. 4. C. Harper, Passive Electronic Component Handbook, McGraw-Hill, New York, 1997. 5. Svasta P., Codreanu N. D., Golumbeanu V., Ionescu C., Leonescu D., Dumitraşcu D., „*Proiectarea asistată de calculator a modulelor electronice*", Editura Tehnică, Bucureşti, 1998. 6. J. Lau, C.P.Wong, J. L. Prince, W. Nakayama, "*Electronic Packaging – Design, Materials, Process and Reliability*", McGraw-Hill, 1998. 7. www.cetti.ro		
8.2 Practical applications	Teaching techniques	Remarks
1 **Introductory elements of the electronics laboratory**. Safety concepts, laboratory equipment. Description of the main working tools: alloy extraction pump, soldering iron, metal de-soldering braid, solder flux, solder paste, isopropyl alcohol. Soldering and de-soldering of electronic components.	15 min. oral presentation of the current laboratory work. Teaching is based on the use of the video projector (covering	2 hours
2 **Study of usual electronic components**. Basic structure of an electronic equipment. Electronic packaging basics. Passive		2 hours

components R, C. Marking of passive THT components using colour code. Main parameters: R_n, t, rated power, rated voltage. Knowledge of components appearance. Packages for transistors and diodes in through-hole technology (TO and DO) and in surface mount technology (SMT). Bill of Materials (BOM).	the communication and demonstrative functions); the oral communication methods used are the expository method and the problem-based method, involving all of the students. Laboratory materials are the laboratory platforms.	
3. **Presenting methods of drawing electronic diagrams** – Electronic drawing symbols. Drawing of an electronic schematic. Introduction to computer aided design.		2 hours
4 **Electronic circuits on prototype board (breadboard) -** Realization of the experimental circuit on prototype board with metallic contacts (breadboard). The circuit will be a two-transistor astable circuit with LEDs in THT version. Identifying components after schematic diagram, identifying markings, terminals of polarized components, component mounting, circuit operation and troubleshooting.		2 hours
5. **Manual soldering technology for through-hole components (THD) -** Soldering and de-soldering of electronic components, checking and sorting of used components.		2 hours
6 **Electronic circuits on prototype board (perfoboard) -** Realization of the experimental assembly on perfoboard. Identify components after schematic diagram, identifying markings, terminals of polarized components, assembly of components, soldering of components, circuit operation and troubleshooting.		2 hours
7. Final evaluation		2 hours
Bibliography 1) The course web page: www.cetti.ro; 2) Cătuneanu V. et. al., *Electronic Technology* (“*Tehnologie electronică”)*, Didactic and Pedagogic Publishing House, Bucharest 1984; 3) www.elect2eat.eu.		

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

The designer of electronic devices, for realizing a professional product, has to understand well each electric and non-electric component which is being used. In order to use a component according to its features, a first necessary condition is that the user should have basic knowledge about it. Discrete components are present in every electronic applications, from consumer products (digital cameras, mobile terminals), automotive electronics and medical electronics. The course syllabus is appropriate to actual development and evolution trends, being connected to novelties and technological achievements in the field of electronic components and devices. From direct discussion with representatives from companies as Infineon and Continental, it has

resulted that during employment interviews they require from candidates and do appreciate the right choosing of components for a certain application. In the same direction, the President of ARIES- Romanian Association for Electronics Industry and Software, the largest Association in this field from Romania, does appreciate the knowledge transferred to students at this course.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	-- Knowledge of fundamental theoretical concepts related to soldering of electronic components. - Comparative analysis / differential choice of components for a specific application	Final Verification (multiple choice grid test) 20%	20%
10.5 Practical applications	-Knowledge about type and identication of common electronic components. -Writing lab reports.	Final laboratory test 40% Laboratory Papers 20% Home work 20%	80%
10.6 Minimal performance standard			
Knowledge of interconnection of components used in the laboratory on a circuit layout. The ability to transpose (implement) an electronic schematic in a perforated circuit board (perfoboard) or the one with metallic contacts (breadboard). Compile a list of components for acquisition (Bill of Materials) correctly.			

Date: Lecturer, Instructor for practical activities,

27.10.2015 Prof. dr. ing. Ciprian Ionescu As. dr. ing. Cristina Marghescu

Date of department approval : Director of Department,

Prof. Dr. Ing. Paul Șchiopu