**COURSE DESCRIPTION**

**name** **Electronic packaging and assembling technologies of microsystems**

**shortname**/**abbr**. **EPAT**

**course objectives see in syllabus (Knowledge, Skills, Competences)**

**description** **see in syllabus**

**target students bachelor, master, Ph.D. students**

**intro** **see in syllabus**

**developed** **by**  **POLITEHNICA University of Bucharest, Center for Technological Electronics and Interconnection Techniques (UPB-CETTI)**

**evaluation**  **see in syllabus**

# Syllabus "Electronic packaging and assembling technologies of microsystems"

## Course topic

A practice oriented course for understanding the electronic packaging and the related assembling technologies of microsystems and electronic modules.

## Number of credits

3 ECTS

## *Course responsible*

POLITEHNICA University of Bucharest

Prof. Norocel Codreanu

## *Course lecturers*

Prof. Norocel Codreanu

Prof. Ciprian Ionescu

Assoc. Prof. Ioan Plotog

## *Prerequisites*

Basic knowledge of electronics, passive and active electronic components and circuits, materials for electronics, microelectronics and modern technologies used in electronics industry.

## *Learning outcomes*

Knowledge: 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.

Skills: 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.

Competences: 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.

## Abstract

The course introduces students to modern electronic packaging and assembling technologies of microsystems and modules. It exposes students the fundamentals of microsystems packaging and assembling technologies, packaging materials, current assembling technologies, basics of nanopackaging and packaging technologies trends. Labs are integral parts of the course, and expose students to various practical manufacturing and assembling issues/problems found in industry. This course provides students with the opportunity to develop and demonstrate an understanding of manufacturing processes, techniques and technologies which are used to optimise the development of microsystems/modules. It will also enable students to experience the full cycle of manufacturing and testing of electronic products. Additionally, each student will manufacture a small complexity electronic module, receiving permanently real feedback from various industrial partners.

## Content

1. Fundamentals of microsystems packaging and assembling technologies

1.1 Introduction

1.2 The packaging hierarchy

1.3 Milestones in packaging

1.4 Packages and technologies

1. Packaging materials

2.1 Materials for packaging technology

2.2 Plastic materials and processes

2.3 Dielectric materials used in the manufacture of printed circuit boards

2.4 Materials for lead-free products

1. Assembling technologies

3.1 Chip packaging technologies

3.2 Package/Board assembling technologies

1. Basics of nanopackaging

4.1 Introduction

4.2 Nanomaterials

4.3 Carbon nanotubes

4.4 Applications of nanomaterials

4.5 Nanotechnology images

1. Packaging technologies trends

## *Teaching methods*

The theoretical part of the course is presented with PowerPoint slides, technological examples, case studies and problem-based learning. Based on the MECA Knowledge Alliance project, a Moodle learning environment in the form of HTML tutorials is also considered, in partnership with Giga Electronic International, Romania. The laboratory is based on interactive activities using the Lite version of the Cadence/OrCAD 16.6-2015 design environment, other various CAD-CAM tools and the technological facility of UPB-CETTI for microsystems/modules manufacturing. Additionally, during the lab, students are involved in practical technological tasks, addressing various electronic packaging issues and related assembling technologies for the development of microsystems and electronic modules.

## Evaluation/Assessment

The evaluation is based on the examination of concepts acquired in the course and consists of the following components:

40% - Final report targeting various problems and issues, according to those solved during the lectures and the labs;

60% - Knowledge test with a multiple choice questionnaire and oral discussion.

## Recommended reading

* Tummala, R. - *Fundamentals of Microsystems Packaging*, McGraw-Hill, 2001, ISBN: 0071371699
* Kalpakjian, S. and Schmid, S. R. - *Manufacturing Engineering and Technology*, 4th ed., Prendice-Hall, N.J., 2001;
* Linbeck, J. R. - *Product Design and Manufacture*, Prendice-Hall, N.J., 1995;
* Harper C. A., *Electronic packaging and interconnection handbook*, McGraw-Hill, 2000;
* Coombs C. F., Jr., *Printed circuits handbook*, 6th ed., McGraw Hill Professional, 2007, ISBN 978-0071510790;
* J. Lau, C. P. Wong, J. L. Prince, W. Nakayama, *Electronic Packaging – Design, Materials, Process and Reliability*, McGraw-Hill, 1998;
* Jin Y., Wang Z., Chen J., *Introduction to Microsystem Packaging Technology*, CRC Press, Boca Raton, 2011, ISBN 978-143981910-4.