LEARNING MODULE DESCRIPTION

GENERAL INFORMATION

1. Module title: **Phase Diagrams as a powerful tool for understanding materials properties**

2. Module code: **PDaPT**

3. Programme title: **Chemistry**

4. Cycle of studies: **4th semester**

5. Year of studies (where relevant): **second year**

6. Terms in which taught (summer/winter term): **summer**

7. Type of classes and the number of contact hours: **Lecture: 15 hrs, laboratory: 30 hrs**

8. Number of ECTS credits: **5**

9. Name, surname, academic degree/title of the module lecturer/other teaching staff/ e-mail:

Module lecturer: **prof. Simona Delsante, simona.delsante@unige.it**

10. Language: **English**

DETAILED INFORMATION

1. Module aim (aims)

The course will give to the students the feeling how phase diagrams are useful to material scientists for the development of new materials for specific applications. During the lecture students will learn the scientific bases of phase diagrams with a special attention to alloy phase diagrams. They will be able to know the relations between the composition, temperature and phase amounts, to apply it to phase diagrams of different systems, understand how the microstructure is formed influencing materials properties and the microstructural evolution of materials with temperature. The discussion of several cases (i.e Ti-alloys, Al-based alloys, lead-free solder alloys), will be employed to improve the understanding of scientific concepts and to link the course to application in modern industry.

2. Pre-requisites in terms of knowledge, skills and social competences

Basic knowledge related to inorganic chemistry and thermodynamics.

READING LIST

1. H. Rhines, "Phase Diagrams in Metallurgy", Mc Graw-Hill Book Company, p. 1- 170.
2. W.D. Callister: Materials Science and Engineering, ed. Wiley

NB: Additional references and reading material will be given during the course

SYLLABUS:

Lectures

Week 1: The Gibbs phase rule. From unary (allotropy) to binary phase diagrams. Isomorphic binary systems The lever rule. Solid solutions and intermetallic phases. Description of eutectic, eutectoidal, monotectic, peritectic, peritectoidal invariant reactions.

Week 2: Complex binary equilibrium phase diagrams. Introduction to ternary phase diagrams: isothermal sections and liquidus projection. Microstructural evolution: equilibrium and non-equilibrium crystallization paths. Non-ferrous alloys phase diagrams: description and features.

STUDENT WORKLOAD (ECTS credits)

Module title: **Phase Diagrams as a powerful tool for understanding materials properties**	
Activity types	Mean number of hours* spent on each activity type
Contact hours with the teacher as specified in the programme	45
Preparation for laboratory project	20
Study of the results from laboratory	15
Reading of the indicated literature	10
Writing of the reports	15
Preparation for exam	20
Total hours	125
Total ECTS credits for the module	5

** Class hours – 1 hour means 45 minutes*

#Independent study – examples of activity types: (1) preparation for classes, (2) data analysis, (3) library-based work, (4)writing a class report, (5) exam preparation, etc.

GRADING SYSTEM:

5	EXCELLENT – outstanding performance	(91-100%)
4+	VERY GOOD – above the average standard with only minor errors	(81-90%)
4	GOOD – generally sound work with some minor errors	(71-80%)
3+	SATISFACTORY – fair but with a number of notable errors	(61-70%)
3	SUFFICIENT – fair but with significant shortcomings	(51-60%)
2	FAIL	below 51%