Universidad de Ingeniería y Tecnología

Course Syllabus – Period 2017-1

1. **Course code and name**: AM0037 – Materials Science

2. **Credits**: 04 credits

3. **Hours per session (concepts and practice)**: 02 hours (concepts) – 02 hours (practice)
   Total number of sessions: 29 sessions (13 concepts and 16 practice sessions)

4. **Course instructor's or coordinator name, e-mail and attention hours**:

   Course coordinator and Instructor:

   Juan Carlos González González, PhD — jcgonzalez@utec.edu.pe
   Monday, 14:00 – 16:00 hours
   Office 615

   Course Instructors

   Prof. Angela Pinedo Flores — apinedo@utec.edu.pe
   Tuesday, 10:00 – 12:00 hours
   Instructors office, 6th floor

   Prof. Davy Olivera Oliva — volivera@utec.edu.pe
   Monday, 14:00 – 16:00 hours
   Instructors office, 6th floor

   Prof. Alejandro Ríos Cuadros — arios@utec.edu.pe
   Thursday, 12:00 – 13:00 hours
   Tuesday, 12:00 – 13:00 hours
   Instructors office, 6th floor

   Prof. Percy Paz Retuerto — ppaz@utec.edu.pe
   Saturday, 15:00 – 17:00 hours
   Instructors office, 6th floor

   Laboratory assistant

   luis.cayupe@utec.edu.pe

   Mr. Luis Cayupe
   Laboratory 402, 4th. floor

5. **References**

   a. **Basic**

   - James Newell. *Essentials of modern Materials Science and Engineering*. Ed. John Wiley and Sons. USA. 2009

b. Complementary

- W.D. Callister and D.G. Rethwish. *Materials Science and Engineering: An Introduction*. 9th Ed. Wiley. USA. 2014
- Kenneth G. Budinski and Michael K. Budinski. *Engineering Materials: Properties and Selection*. 9th Ed. Prentice Hall-Pearson Education. USA. 2010
- Michael F. Ashby and David R.H. Jones. *Materiales para Ingeniería: Introducción a las propiedades, las aplicaciones y el diseño*. Vol 1. Ed. Reverté. Spain. 2008.
- Michael F. Ashby and David R.H. Jones. *Materiales para Ingeniería: Introducción a las propiedades, las aplicaciones y el diseño*. Vol 2. Ed. Reverté. Spain. 2009.
- Raymond A. Higgings. *Materials for Engineers and Technicians*. 4th Ed. Elsevier – Newnes. U.K. 2006
- James F. Shackelford. *Introducción a la Ciencia de Materiales para Ingenieros*. Ed. Pearson Education. Mexico. 2005.
- William F. Smith and Javad Hashemi. *Fundamentos de la Ciencia e Ingeniería de Materiales*. Mc Graw Hill – Interamericana. Mexico. 2004.

6. Course information

a. Brief description of the content of the course:

This introductory and innovative course starts by presenting selected overall fundamentals of Materials Science Engineering. Next, faculty and student seminars focus on specific families of materials, such as: metals and alloys, ceramics and glasses, polymers and copolymers, composites and nanomaterials. Applications encompass both traditional and cutting-edge uses of materials. The study of these applications covers the role played by the materials, the applications themselves and their relevance. Cases of breakthrough materials and innovative applications of potential relevance to the Peruvian context are covered (be they already employed in the country or not).

b. **Pre requisites o Co-requisites**:

QI0027 – General Chemistry

c. **Required or elective**: Required

7. Course objectives

a. Competencies

At the end of the course the student will be able to:

- d1: Capacity for teamwork (level 2)
- e1: Capacity to identify Engineering problems (level 1)
- g1: Capacity to communicate orally (level 1)
- g2: Capacity to communicate in writing (level 1)

The course addresses the following student outcomes from ICACIT/ABET: d, e and g.

b. Learning outcomes

Specific outcomes:

- Explain basic properties and how they define the overall behavior of materials.
- Pin out how basic properties of materials can be tailored.
- Identify opportunities in the Engineering practice to innovate with materials.
- Recognize processing and handling methods proper with regard to the main families of materials.
- Estimate the economic, environmental, health and safety impact in order to associate with materials.
- Recognize the importance to acquire a basic understanding of materials for progressing autonomously in the area.

Transversal outcomes:

- Prepare effective PowerPoint presentations.
- Communicate orally with effectiveness using specific technical vocabulary.
- Demonstrate that can work in working in groups.

8. Brief list of topics to be covered:

Week	Theme	Topics
1	Introduction to applied understanding of materials	- Course presentation and organization - Importance of materials for Engineering Sciences.
2		- Overall classification of materials - Some desirable functions for materials.
3	Group formation. Presentation of the students of the chosen project. (PPT, video and first dossier)	
4, 5, 6	Dealing with Metals and Alloys	Other specific fundamentals needed. Properties and correlated applications Survey of metals and alloys – traditional applications Survey of metals and alloys – cutting-edge applications.
7, 8, 9	Dealing with Ceramics and Glasses	Other specific fundamentals needed. Properties and correlated applications Survey of ceramics and glasses – traditional applications Survey of ceramics and glasses – cutting-edge applications

10, 11	Dealing with Polymers and Copolymers	Other specific fundamentals needed. Properties and correlated applications Survey of polymers y copolymers – traditional applications Survey of polymers and copolymers – cutting-edge applications
12, 13	Dealing with Composites and with Nanomaterials	Other specific fundamentals needed. Properties and correlated applications Survey of composites – traditional and cutting-edge applications Survey of nanomaterials – traditional and cutting-edge applications
14	Searching new materials and developing applications	Innovative pair: material ↔ application, e.g.: - Art and archeological conservation/restoration. - Environment - Nanomaterials - Bioengineering - 3D-printing - Functional Materials - Packing
15	Student seminar presentation of their projects (PPT, video and final dossier)	
16	Final exposition of all projects (Poster)	

9. Methodology and evaluation system

Methodology:

The course is offered to all engineering majors on a co-teaching basis (One Teach, One Support model). The course coordinator (or guest) performs the concepts seminars for all the engineering students (auditorium) whereas the instructors carry out the practice classes in more small groups (classroom).

On one hand, as a cross-curricular course, concept seminars are also supported by other professors from UTEC engineering careers and guests. These seminars cover a wide, but not exhaustive, range of pre-selected topics with the expectation of addressing issues of general interest for all majors. On the other hand, in practice classes, the course instructor often gives open-ended questions and lets students work in groups. Small challenges are also organized in certain classes to promote the active participation of students and groups

The practice classes are divided into two groups throughout the semester. The first part, which is the first two (02) weeks, adopts a problem-based learning (PBL) strategy, while the second part, which are the remaining weeks, a project-based learning (PjBL) and workshops strategy are taken, where each learning strategy conducted every fortnight. On one hand, in the project-based learning (PjBL) strategy the students in groups of up to 5 people should choose a project, which is a device, application or product that consists of at least three materials, such as: metal, alloy, ceramic, glass, polymer, copolymers or composite, in order to evaluate and

understand their operation, as well as the properties of each material present separately and subsequently together. On the other hand, the workshops (dealing with metals, alloys, ceramics, glasses, polymers, copolymers, composites and nanomaterials) are based on guidelines given by other professors from UTEC engineering careers and carried out by the instructors.

In addition, reading materials and assignments are constantly assigned by instructors, students are also expected to search for reference material on the web as well as brainstorm it. Based on this, students can be asked about the progress of the selected project and to present the progress in class. The final presentation takes place at the end of the course.

Evaluation system:

The course has no partial or final exam. The evaluation will be continuous throughout the development of the materials science course. On one hand, in order to evaluate the concept seminars, a test with some questions will be carried out at the end of each class (start in the second week), which will include the key concepts of the seminar and the basic reference for the course. On the other hand, in order to assess the practice classes based on problem-based learning (PBL) and project-based learning (PjBL) a rubric for each one will be employed. Students will be informed of the rubrics from the first class. The individual and group performance of the students in the practice classes is evaluated, based on the objectives point out for the course and class.

To evaluate student performance throughout the course, these will be evaluated each week. The grade for each week is weighted. The maximum grade for each week for the entire course is shown in the table 1. The final grade is the arithmetic sum of the all grade obtained each week.

Table 1

Week	**1**	**2**	**3**	**4**
Grade	0,5	0,60	0,65	0,70

Week	**5**	**6**	**7**	**8**	**9**	**10**
Grade	0,75	0,80	0,85	0,90	0,95	1,10

Week	**11**	**12**	**13**	**14**	**15**	**16**
Grade	1,30	1,50	1,80	2,00	2,60	3,00