University of Engineering and Technology
School of Computer Science
Syllabus of Course
Academic Period 2018-II

1. **Code and Name:** AM0037. Science of Materials
2. **Credits:** 4
3. **Hours of theory and Lab:** 4 HT;
4. **Professor(s)**

   Meetings after coordination with the professor
5. **Bibliography**

[CR14] W.D. Callister and D.G. Rethwisch. *Materials Science and Engineering: An Introduction.* John Wiley & Sons, Inc., 2014.

6. **Information about the course**

   (a) **Brief description about the course** The introduction and innovation of this course begins with the selected presentation of the general fundamentals on Materials Science and Engineering. Then, it focuses on seminars on the family of materials: metals and alloys, ceramics and glass, polymers and copolymers, and composites and nanomaterials.Applications encompass traditional and state-of-the-art materials. The study of these applications covers the role played by the materials, the same applications and their relevance. Advanced cases on materials and innovative applications of potential relevance on the Peruvian context are covered.

   (b) **Prerrequisites:** QI0027. General Chemistry. (1^{st} Sem)

   (c) **Type of Course:** Mandatory

   (d) **Modality:** Face to face

7. **Specific goals of the Course**

   - Capacity for teamwork.
   - Capacity to identify Engineering problems.
   - Capacity to communicate orally.
   - Capacity to communicate in writing.

8. **Contribution to Outcomes**

   d) An ability to function on multidisciplinary teams. (**Usage**)

   f) An ability to communicate effectively. (**Usage**)

9. **Competences (IEEE)**

   C20. Ability to connect theory and skills learned in academia to real-world occurrences explaining their relevance and utility.⇒ **Outcome a,j**

10. **List of topics**

    1. Applied understanding of materials
    2. Dealing with Metals & Alloys

3. Dealing with Ceramics & Glasses
4. Dealing with Polymers & Copolymers
5. Dealing with Composites and with Nanomaterials
6. Searching new materials and developing applications

11. Methodology and Evaluation
Methodology:

Theory Sessions:
The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

Lab Sessions:
In order to verify their competences, several activities including active learning and roleplay will be developed during lab sessions.

Oral Presentations:
Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

Reading:
Throughout the course different readings are provided, which are evaluated. The average of the notes in the readings is considered as the mark of a qualified practice. The use of the UTEC Online virtual campus allows each student to access the course information, and interact outside the classroom with the teacher and with the other students.
Evaluation System:

12. Content

Unit 1: Applied understanding of materials (0)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Understanding the overall fundamentals and desireble functions for materials. • Acknowledging the importance of acquiring a basic understanding of materials for progressing autonomously in the area.	• Course presentation and organization • Importance of materials for Engineering Sciences • Overall classification of materials • Desirable functions for materials – Mechanical properties (e.g. structural materials) – Electrical and heat conductivity (e.g. circuits, cells, sensors) – Chemical resistance (e.g. chemical compatibility; corrosion) – Environmental and biological compatibility • Overall fundamentals – Chemical bond and its impact on malleability and ductility – Alloys and phase diagrams – Crystal growth and defects – Chemical reactivity (defects, grain boundaries) – Galvanic pairs – Pourbaix diagrams – Band theory and heat and electrical conduction – Conductors, semiconductors
Readings : [CR14]	

Unit 2: Dealing with Metals & Alloys (0)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Recognize the purpose, requirements, and general characteristics of Metals and Alloys.	• Other specific fundamentals needed • Properties and correlated applications • Survey of metals & alloys - traditional applications • Survey of metals & alloys - cutting-edge applications
Readings : [CR14]	

Unit 3: Dealing with Ceramics & Glasses (0)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Recognize the purpose, requirements, and general characteristics of Ceramics and Glasses.	• Other specific fundamentals needed • Properties and correlated applications • Survey of ceramics & glasses - traditional applications • Survey of ceramics & glasses - cutting-edge applications
Readings : [CR14]	

Unit 4: Dealing with Polymers & Copolymers (0)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Recognize the purpose, requirements, and general characteristics of Polymers and Copolymers.	• Other specific fundamentals needed • Properties and correlated applications • Survey of polymers & copolymers - traditional applications • Survey of polymers & copolymers - cutting-edge applications
Readings : [CR14]	

Unit 5: Dealing with Composites and with Nanomaterials (0)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Recognize the purpose, requirements, and general characteristics of Composites and 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
Readings : [CR14]	

Unit 6: Searching new materials and developing applications (0)	
Competences Expected: C20	
Learning Outcomes	**Topics**
• Ability to integrate understanding of the new materials to developing applications	• Innovative pair "material - application", e.g.: – Art and archeological conservation/restoration – Environment – Nanomaterials – Bioengineering – 3D-printing – Functional materials – Packaging
Readings : [CR14]	