Zarqa University
Faculty: Science
Department: physics

Course title: materials science (0302391)

Instructor: Dr. Rana Al-faleh
Lecture's time: 10-11
Semester: 2nd semester 2018/2019
Office Hours: 11- 12 S, Tu, Th

Course description:
This course is intended to provide the classification of materials (metals, ceramics, polymers, composites) and its properties. The crystal structure, present the crystallography and phase transformation, material deformation, the course assume a basic knowledge of mechanical properties, heat treatment, smart materials.

Aims of the course:

- Comprehend why the design of structure in all classes of inorganic materials has profound impact on observed properties.
- Identify different types of structure in all classes of inorganic materials.
- Define crystal structures and identify phases using x-ray diffraction.
- Describe the impacts of defects at the atomic and microstructure scales.
- Interpret unary and binary phase diagrams, understand the concepts of solid solution and solubility limits, and be able to predict the development of microstructures and impacts of phase transformations.
- Explain basic diffusion.
- Describe how different classes of inorganic materials are processed.
- Explain the qualities and quantifications of mechanical, thermal, electrical, optical, magnetic, and chemical properties.

Intended Learning Outcomes: (ILOs)
Knowledge and Understanding

A1.ConceptsandTheories: The aims of the course is to give fundamental knowledge about type of materials, their usage, properties and characteristics, which are important in engineering design. It is also aimed to give a theoretical background about the analysis of behavior of engineering materials by emphasizing important relationships between internal structure and properties.

A2.Contemporary Trends, Problems and Research: Concepts of relationships between structure and thermal, optical, magnetic, electrical, and mechanical properties of inorganic materials.

A3.Professional Responsibility: Use computer, graphical and algebraic tools to analyze crystal structure and to explain basic diffusion.

B. Subject-specific skills

B1. Problem solving skills: Students solve problems on the board. I giving them group assignments and homework and encourage group projects, but I can say that technology has become an integral part of their lives, and use computer programs to draw and solve mathematical equations, derivation and integration and they feel confident in this area.

B2.ModelingandDesign: this course attempts to present ways of modifying and control the material microstructures and especially mechanical properties (toughness, strength, fatigue and creep resistance) by suitable heat treatment operation.

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B3.ApplicationofMethodsandTools: The course assumes a basic knowledge of general physics, general chemistry, and mathematics. With these tools and the subject matter outlined in this course, students will obtain a wide knowledge of modern challenges to the application of modern materials

C. Critical-Thinking Skills

C1.Analytic skills: student will grasp concepts of structure from bonding to microstructure, and then learn to consider the interrelationships between structure and property. Properties ranging from mechanical, thermal, electrical, optical, magnetic, and chemical in nature will all be considered. Further, examples will be given to discuss the manipulation of these structure-property relationships in terms of the engineering of materials.

C2.Strategic Thinking: invent or discover new phenomena, materials, device, and application of materials.

C3.Creative thinking and innovation: Strengthen an understanding of the concepts and principles through a broad range of the interesting applications to the real world.

D. General and Transferable Skills (other skills relevant to employability and personal development)

D1. Communication:

Students will be able to communicate with teacher, ask questions, solve problems, and use computers. Students ask questions during the lecture, work in groups, and communicate with each other and with me electronically, and periodically visit the sites I recommended.

D2. Teamwork and Leadership:

- I encourage the student to attend lectures regularly by giving bonus marks for attendance, give students tasks, and ask questions about previous lectures.
- Mutual respect is between the lecturer and students and among students themselves. I deal with them as young mature people, responsible for their actions and schedules.
- I apply educational standards and behavioral control when they work in groups, I can assess the response of students as a whole and the team spirit and good character.
- I enable students to communicate with me discuss any needs they have related to the course, and I welcome students' comments when they face challenging problems.

Course structures:

Week	Credit Hours	ILOs	Topics	Teaching Procedure	Assessment methods
1,2	3	A1,B1,C3	Introduction to Materials Science	Lecture discussion Oral inquiry	Class participation Homework: Text exercises (1.1,1.2,1.3 ,1.4, 1.6) page 19 quizzes
3,4	3	A2,B2	Atomic Structure	lecture	Class participation Homework: Text exercises (2.16, 2.18, 2.20 , 2.24) page 52 & 53 quizzes
5,6,7	3	A1.B1,C3	Imperfection in the atomic and ionic arrangements	Lecturing discussion	Class participation Homework: Text exercises (4.5, 4.13, 4.19 , 3.23 , 4.37, 4,40 4, 51) page 148&149 & 150 quizzes
8,9	3	A1.A2.B2	Atoms and ions movement in materials (Diffusion)	Lecturing Discussion, Oral inquiry	Class participation Homework: Text exercises (5.1, 5.9 , 5.18, 5.24) page190 quizzes
10,11	3	A1.B2.C1	Mechanical properties	Lecturing Discussion, Oral inquiry	Class participation Homework: Text exercises (6.1, 6.5, 6.17, 6.22, 6.34) page 123 quizzes

References:

A. Main Textbook:

The science and engineering of materials, Donald R. Askeland, 6th edition, Global engineering,2006

B. Supplementary Textbook(s):

Material science and engineering: an introduction, 6th edition, by Callister W.D., John Wiley and Sons, 2000Wiley

- *Foundations of Materials Science and Engineering*, William F. Smith, 3rd Ed., McGraw-Hill, 2004.

- *Introduction to Materials Science for Engineers***,** James F. Shackelford, 5th Ed., Prentice Hall, 2000.

Assessment Methods:

Methods	Grade	Date
Fist Exam	25%	17-28/3/2019
Second Exam	25%	21/4-2/5/2019
Final Exam	50%	9-20/6/2019