Chemical Engineering Department

ChE 331 Principles of Materials Engineering

Catalog Data: (3 credits, 4 contact hours)
Introduction to materials science and engineering is the theme of this course.

Text Book:
Materials Science and Engineering, an Introduction, Mcallistar.

Topics (14 weeks total 42 lectures)

1- Introduction of materials science (2L)
   a. Fields of materials science
   b. Application of materials science

2- Atomic structure of materials (3L)
   a. Atomic bonds
   b. Molecular bonds (Vander Waals)
   c. Electronic structure

3- Classification of materials based on structure (2L)
   a. Metals, Ceramic, Polymers, Semiconductors, Composites.
   b. Effect of structure on properties.

4- Crystalline structure of materials (6L)
   a. Miller indices (planes and directions)
   b. Crystalline systems
   c. FCC, BCC, HCP
   d. X-ray of crystalline materials

5- Imperfection in crystalline materials (3L)
   a. Point defects
   b. Line defects
   c. Macro-defects

6- Materials and their properties (10L)
   a. Mechanical, electrical and chemical properties of metals (4L)
   b. Mechanical, electrical and chemical properties of ceramics (2L)
   c. Mechanical, electrical and chemical properties of polymers (4L)

7- Phase diagrams of solid materials (8L)
   a. Equilibrium phase diagrams of binary alloys.
   c. Non-equilibrium phase diagrams (application of steel Heat treatment).
8- Materials deterioration and failure (8L)
   a. Metals (3L)
   b. Polymers (3L)
   c. Ceramics (2L)

9- At least two sessions of laboratory experiments,
   A) Tension test of steel and copper using Universal testing machine in the department (recently acquired)
   B) Hardness testing of steel before and after hardening by heat treatment (using the hardness tester, furnace and oil bath recently acquired in the department)

Class Requirements:
   1- Homework assignment
   2- Midterm exams and final
   3- Two lab sessions to demonstrate tension tests and hardness testing of copper and steel.

Laboratory: Minimum two lab sessions or tensile and hardness measurements.