MECH 340 ENGINEERING MATERIALS 3 CR.

The course introduces fundamental concepts in materials science as applied to engineering materials: crystalline structures, imperfections, dislocations, and strengthening mechanisms, diffusion, phase diagrams and transformations, ferrous and non-ferrous metal alloys, ceramics, and polymers, structure-property relationships, Material selection case studies.

Required for all ME students.

Prerequisite by topics Basic physics, chemistry and differential equations.

Topics include Atoms and Bonds, Structure of Materials, Imperfections, Diffusion Phenomena, Mechanical Properties of Materials, Dislocations and strengthening old, Mechanical Failure, Phase Diagrams, Phase transformations, Heat treatment, Metal Alloys, Ceramics and Polymers

Textbook
Materials Science and Engineering: An Introduction, by W.D. Callister, 7th Ed., Wiley.
Resources The textbooks and a number of other related reference books (which are mostly accessible via the Eng. Library), class notes and handouts, the instructor, teammates, library material, vendors product catalogs, the World Wide Web, etc.

Contribution of Course Towards Meeting the Professional Component
Students will develop their ability to apply knowledge of mathematics, science, and engineering principles to solve problems in materials science and engineering.
Course Topics deals heavily with fundamental engineering properties and characteristics of materials (Phase diagrams, phase transformations, etc)
Mini projects involves manufacturing of Basic crystallographic structures
The entire class is involved in mini-researches covering key manufacturing processes that are commonly used to fabricate products to support concepts and points dicussed in class

Topics covered
1. Structural properties (2 weeks)
2. Diffusion Phenomenas, Dislocations and imperfections (3 weeks)
3. Mechanical Properties, Failure (2 weeks)
4. Phase Diagrams, Phase transformations (4 weeks)
5. Heat Treatment, Manufacturing processes and specific topics (4 weeks)

Course Outcomes

At the end of the course, students will have (the):	*Correlation to program outcomes**		
	H	*M*	*L*
ability to apply knowledge of mathematics, science, and engineering principles to solve problems in materials science and engineering.	a,c,k,i	b,e	f
ability to identify, formulate, and solve engineering problems in materials selection, processing, and application utilizing relationships between structure, processing, properties, and performance of all materials families and systems.	a,c,b,e,k,d	f	g
ability to design and conduct experiments, and to collect, analyze, and interpret data on the behavior of materials in engineering applications, including the use of statistical and computational methods.	a,c,b,e,k,i,f	d	g
ability to use modern techniques, skills, and tools required in the practice of materials science and engineering.	i,j,b	b	f
ability to utilize principles of design for application of materials in components, systems, and processes, in conjunction with economic, environmental, ethical, and other considerations.	b,a,c	d,j	h
ability to communicate effectively at a personal level and through written reports and oral presentations which utilize professional-quality visual aids.	f,h	c	b
ability to work in, and provide leadership for, diverse teams in the solution of engineering problems.	e,f	c	b
understanding of professional and ethical issues	d	f	b

* *H: High correlation, M: Medium correlation, L: Low correlation*

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