MSE 4006: Processing and Applications of Engineering Alloys (required)

Catalog Description: (3-0-3)
Prerequisites: MSE 2021 – Materials Characterization and MSE 3002 - Structural Transformations
Solidification, deformation, and powder processing of metals and alloy;, microstructural design at nano- and meso-length scales; and structure-property correlations.

Textbooks: William F. Smith, *Structure and Properties of Engineering Alloys*, McGraw-Hill, 2nd ed., 1993
George Krauss, *Heat Treatment and Processing Principles*, ASM, Materials Park, Ohio, 1990.

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Topics Covered: The course will emphasize the basic elements of processing and properties of ferrous and non-ferrous metals and alloys, with a focus on process-structure-property correlations and microstructural design at nano-, micro- and meso-length scales.

Course Outcomes:

Outcome 1: The student will demonstrate understanding of how process conditions and alloy chemistry affect solidification microstructure

Outcome 2: The student will demonstrate understanding of deformation processing of engineering alloys and how the deformation processing parameters affect microstructure and mechanical properties

Outcome 3: The student will develop understanding of isothermal and continuous cooling transformations, major heat treatments, and thermo-mechanical processing of steels

Outcome 4: The student will develop understanding of applications of different classes of steels based on their chemistry, microstructure, and processing

Outcome 5: The student will develop understanding of processing-structure-properties relationships and applications of Al-, Mg-, Ti- , and Cu- and Ni-alloys

Outcome 6: The student will develop understanding of processing-structure-properties relationships and applications of Ni- , Co-, and Fe-base superalloys

Correlation between Course Outcomes and Student Outcomes:

Course Outcomes	Student Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
1. The student will demonstrate understanding of how process conditions and alloy chemistry affect solidification microstructure.	x		x		x						x
2. The student will demonstrate understanding of deformation processing and how the deformation processing parameters affect microstructure and mechanical properties.	x		x		x						x
3. The student will develop understanding of isothermal and continuous cooling transformations, major heat treatments, and thermo-mechanical processing of steels.	x		x		x						x
4. The student will develop understanding of applications of different classes of steels based on their chemistry, microstructure, and processing.	x		x		x						x
5. The student will develop understanding of processing-structure-properties relationships and applications of Al-, Mg-, Ti- , and Cu- and Ni-alloys.	x		x		x						x
6. The student will develop understanding of processing-structure-properties relationships and applications of Ni- , Co-, and Fe-base superalloys.	x		x		x						x
Entire Course	**3**	**0**	**3**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**
0 = None or insignificant; 1 = Some; 2 = Moderate; 3 = Strong											

School of Materials Science and Engineering Student Outcomes:

a) an ability to apply knowledge of mathematics, science and engineering
b) an ability to design and conduct experiments, as well as to analyze and interpret data
c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d) an ability to function on multidisciplinary teams
e) an ability to identify, formulate, and solve engineering problems
f) an understanding of professional and ethical responsibility
g) an ability to communicate effectively
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i) a recognition of the need for, and an ability to engage in life-long learning
j) a knowledge of contemporary issues
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice