Fall 2019

ME 438-001: Introduction to Physical Metallurgy

Veljko Samardzic

COURSE NUMBER	**ME 438**
COURSE TITLE	**Introduction to Physical Metallurgy**
COURSE STRUCTURE	(3-0-3) (lecture hr/wk - lab hr/wk – course credits)
COURSE COORDINATOR	**Veljko Samardzic**
COURSE DESCRIPTION	Introduction to metallic microstructures, solid solutions and the mechanical properties of metals and alloys. Physical understanding of diffusion processes is emphasized in covering the relationship between the nature of metals and different heat treating processes.
PREREQUISITE(S)	Chem 126 – General Chemistry II, ME-215 Engineering Materials and Processes
COREQUISITE(S)	None
REQUIRED, ELECTIVE OR SELECTED ELECTIVE	Elective
REQUIRED MATERIALS	Herman W. Polack, Materials Science and Metallurgy, 4th Edition, A Reston Book, A Pearson Education Company, NJ, 1988.
Other supplemental materials (not Required)	1. William D. Callister, Jr., Materials Science and Engineering: An Introduction. John Wiley and Sons, Inc., NY, 8 th Edition, 2010. 2. E. Paul De Garmo, J.T. Black, R.A. Kohler. Materials and Processes in Manufacturing, 10th Edition, MacMillian, NY, 2008
COMPUTER USAGE	Use of NJIT Library search sources and engines for materials and metallurgy research purpose and practical implications to project execution and presentation. Use of computer software for microstructure analysis.

COURSE LEARNING OUTCOMES/ EXPECTED PERFORMANCE CRITERIA:

Course Learning Outcomes	SOs*	Expected Performance Criteria
1 **apply** principles of quantum mechanics to materials engineering practice.	1, 2, 4	**Exam Question** (80% of the students will earn a grade 70% or better on this question
2 **apply** material transport in engineering solids phenomena to solid solution alloying practice.	1, 2, 4, 7	**Exam Question** (80% of the students will earn a grade 70% or better on this question
3 **characterize** microstructure of engineering alloys using optical microscopy and image analyzer.	1, 2, 4	**Project Report**(80% of the students will earn a grade 70% or better on this question
4 **apply** web based search engines and internet application principles	1, 2, 4	**Project Report** (80% of the students will earn a

	to information acquisition for advanced materials engineering.		grade 70% or better on this question)
5	**explore and apply** interdependence of microstructure and materials properties to practice of materials engineering.	1, 2, 4	**Exam Question** (80% of the students will earn a grade 70% or better on this question)
6	**design** new alloys or select new alloy for required.	1, 2, 4	**Project Report** (80% of the students will earn a grade 70% or better on this question)
7	**select** a desired material for engineering component design.	1, 2, 4, 7	**Project Report** (80% of the students will earn a grade 70% or better on this question)
8	**describe** the mechanical properties of different steels, cast iron and nonferrous metals and alloys, ceramics and composites	1, 2, 4	**Exam Question** (80% of the students will earn a grade 70% or better on this question)
9	**select** appropriate heat treating process to modify properties of alloys	1, 2, 4	**Exam Question** (80% of the students will earn a grade 70% or better on this question)

CLASS TOPICS

1. Introduction: Basic Atomic Structure & Crystalline Solids; The Solid State; Forming of Engineering Materials.
2. Materials from the Elements.
3. Fundamentals of Metal Alloys; Equilibrium Diagrams.
4. Testing of Engineering Materials.
5. Heat Treatment of Metals.
6. Classification of Steels. Material Selection for Designed Product.
7. Manufacturing Processes. Material Deformation Processes
8. Casting, Welding, Powder Metallurgy and Their Influence on the Design Aspects of Machine Components.
9. Measurement, Inspection, System of Fits, Computer Controlled Inspected Stations.
10. Theory of Cutting.
11. Machining Processes: Conventional and Computer Controlled.

STUDENT OUTCOMES (SCALE: 1-3)

1	**2**	**3**	**4**	**5**	**6**	**7**
3	3		3			3

3 – Strongly supported 2 – Supported 1 – Minimally supported