CONS 220 / MECH 220 – Engineering Materials

A. **TITLE:** Engineering Materials

B. **COURSE NUMBER:** CONS 220 -OR-MECH 220

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** Yes

This is a designated writing intensive course for the 2 year and 4 year Mechanical Engineering Technology and 4 year Civil Engineering Technology programs.

E. **COURSE LENGTH:** 15 weeks

F. **SEMESTER(S) OFFERED:** Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY**
   
   2 – 1 hour lectures/recitation, 1 - 3 hour lab per week

H. **CATALOG DESCRIPTION:** A study of the wide spectrum of materials used in manufacturing of discrete parts and machines. Material structure, characteristics, mechanical properties and applications will be stressed for ferrous and non-ferrous metals, plastics, and composites. Two hours lecture, three hour laboratory per week.

I. **PRE-REQUISITES/CO-COURSE:** MATH123, PHYS121 or permission of instructor

J. **GOALS (STUDENT LEARNING OUTCOMES):** At the completion of this course students will be able to:

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<th>Course Objective</th>
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| a. apply standard testing procedures to measure, collect and interpret laboratory data for material testing in a team environment; | 1. Communication Skills  
2. Critical Thinking Skills  
3. Professional Competence  
4. Inter/Intrapersonal Skills |
| b. determine and identify the mechanical properties of material; | 3. Professional Competence |
| c. identify material property-processing interactions related to heat treatment, cold working, and hot forming; | 2. Critical Thinking Skills  
3. Professional Competence |
| d. select the best material (metal, polymer, ceramics or composite) for a particular application; | 2. Critical Thinking Skills  
3. Professional Competence |
e. appraise materials in terms of degradation, oxidation, corrosion, and failure; and
f. write laboratory reports that are clear, well organized, and professionally accepted.


L. REFERENCES:
Tool and Manufacturing Engineers Handbook, Society of Manufacturing Engineers
Introduction to Physical Metallurgy, Avner, McGraw-Hill General Dynamics series on non-destructive testing.
American Welding Society series on nondestructive testing, Van Vlack.
Elements of Materials Science and Engineering, Addison-Wesley

M. EQUIPMENT: Material test lab (NS110), Computer Lab

N. GRADING METHOD: A-F

O. MEASUREMENT CRITERIA/METHODS:

- Homework
- Quizzes
- Exams
- Lab activities with written reports

P. DETAILED COURSE OUTLINE:

I. Introduction to Materials in Manufacturing

II. The Nature and Structure of Materials
   A. Atomic Structure
   B. Atomic Bonding
   C. Atomic Arrangement

III. Mechanical Properties of Materials
   A. Mechanical
   B. Strain Hardening and Annealing
IV. Structure of Materials
   A. Ferrous Metals and Alloys
   B. Nonferrous Metals and Alloys
   C. Polymers
   D. Composites
   E. Wood

V. Degradation, Oxidation and Corrosion of Materials
   A. Corrosion
   B. Oxidation
   C. Wear

Q. LABORATORY OUTLINE:

I. Library Research
II. Tensile Test of Steel (Hot rolled vs. Cold rolled)
III. Tensile Test of Aluminum (2011-T4 vs. 6061-T6)
IV. Tensile Test of Cast Iron (Class 20 vs. Class 40)
V. Tensile Test of Plastics
VI. Shear Test (Steel and Aluminum)
VII. Impact Test (1095 & 4140 annealed, hardened, tempered)
VIII. Hardenability Test (Jominy End-Quench Test) (1018, 1095, 4140)
IX. Metallography
X. Heat Treatment of Tool Steel