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Course Outline for ENGR 46
MATERIALS OF ENGINEERING
Effective: Fall 2007

I. CATALOG DESCRIPTION:

ENGR 46 — MATERIALS OF ENGINEERING — 3.00 units

Application of principles of chemistry and physics to the properties of engineering materials; the relation of microstructure to mechanical, electrical, thermal and corrosion properties of metals; ceramics and polymers. Prerequisites: Physics 8A and Chemistry 1A (both completed with a grade of "C" or higher). 2 hours lecture, 3 hours laboratory.

2.00 Units Lecture 1.00 Units Lab

Grading Methods:

Letter Grade

Discipline:

	MIN
Lecture Hours:	36.00
Lab Hours:	54.00
Total Hours:	90.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT:

III. PREREQUISITE AND/OR ADVISORY SKILLS:

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

1. write technical reports
2. apply materials engineering knowledge to engineering problems
3. explain terminology as related to materials engineering
4. perform basic materials characterization tests
5. analyze basic materials failure issues
6. apply safety principles to laboratory experimental activities
7. perform metallographic specimen preparation

V. CONTENT:

- A. Identification of ferrous and non-ferrous metals
- B. Determination of mechanical properties for materials through experimentation and research, including the following:
 1. Tension
 2. Compression
 3. Hardness
 4. Bending
 5. Shear
 6. Torsion
- C. Determination of heat transfer properties for metals through experimentation and research, including the following:
 1. Expansion
 2. Contraction
 3. Coefficient of thermal expansion
- D. Apply technical writing criteria for authoring technical reports.
- E. Learn and apply basic materials characterization tests.
- F. Learn and apply materials engineering knowledge needed to produce professional laboratory and research reports.

VI. METHODS OF INSTRUCTION:

- A. **Demonstration** - Classroom demonstrations
- B. **Guest Lecturers** - Videos and guest speakers
- C. Group problem solving
- D. **Lecture** -
- E. Collecting and evaluating data
- F. **Discussion** - Review and discussions on lecture topics
- G. **Lab** - Laboratory experiments

VII. TYPICAL ASSIGNMENTS:

- A. Reading: 1. Read and be prepared to discuss hardening and tempering of plain carbon steel, Chapter 9, Practical

Metallurgy and Materials of Industry. B. Writing: 1. Perform material characterization tests on the given five materials samples and try to determine what material each specimen is. Report the results in a formal laboratory report. Explain in the report what sources of error were encountered and what could be done to improve the quality of the data. C. Oral discussion of written assignments and lectures 1. Be prepared to discuss in class the important issues discussed in the last lecture and reading/written assignments.

VIII. EVALUATION:

A. **Methods**

1. Exams/Tests
2. Quizzes
3. Research Projects
4. Lab Activities
5. Other:
 - a. Methods:
 1. Topic assignment laboratory reports
 2. Laboratory performance
 - a. Perform experiments and tests
 - b. Use safety principles while performing laboratory experiments
 3. Research project
 4. Examinations
 - a. Quizzes as needed
 - b. Final
 - b. Typical problems
 1. Make three hardness tests on the standard Rockwell tester and two tests on the superficial tester. Report the data taken during the hardness tests in a formal laboratory report. The report consists of the following:
 - a. Title page
 - b. Table of contents
 - c. Description of experiment
 - d. Purpose of lab
 - e. Equipment used
 - f. Method(s) used to perform work and collect data
 - g. Data
 - h. Calculations, if necessary
 - i. Summary of results (sources of error, recommendations)
 - j. References used
 - k. Do research on an engineering materials subject and submit a technical report (semester long project)
 - l. The research project technical report consists of:
 - a. Title Page
 - b. Table of Contents
 - c. Introduction
 - d. Discussion (Body of report)
 - e. Illustrations, graphs of other means of supplementing the report
 - f. Conclusions and Recommendations
 - g. Bibliography and References (10)
 - h. Appendices

B. **Frequency**

1. Laboratory reports
2. Research technical report throughout the semester
3. Final examination
 - a. How would you determine Young's Modulus for any steel material? Delineate the procedure.
 - b. Looking at metallographic sample xyz, determine what phase in the metallurgical phase diagram the material is in. Explain your reasons why.

IX. TYPICAL TEXTS:

1. Neely, John E. *Practical Metallurgy and Materials of Industry*. 5th ed., Prentice Hall, 2003.
2. Callister, Jr., William D. *Materials Science and Engineering, An Introduction*. 6th ed., Wiley, 2003.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Safety glasses
- B. Calculator
- C. Reporting-writing materials