

**CUYAMACA COLLEGE**  
**COURSE OUTLINE OF RECORD**

**ENGINEERING 261 – MATERIALS LABORATORY**

3 hours laboratory, 1 unit

**Catalog Description**

Experimental methods used to characterize engineering materials and their mechanical behavior. Students will use a variety of material testing equipment to gain hands-on experience testing for materials properties and exploring the mechanical behaviors of materials.

**Prerequisite**

None

**Corequisite**

ENGR 260 – Engineering Materials

**Entrance Skills**

Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:

- 1) Knowledge of the mechanical properties of metals: stress-strain behavior, tensile properties, compressive, shear and torsional deformation, hardness
- 2) Knowledge of dislocations and strengthening mechanisms: slip systems, plastic deformation of polycrystalline materials, re-crystallization and grain growth
- 3) Knowledge of the fundamentals of fracture: impact, cyclic stresses, crack propagation
- 4) Knowledge of phase diagrams: phases, microstructure

**Course Content**

- 1) Laboratory analysis of the hardness of a material
- 2) Laboratory analysis of cold working a material
- 3) Laboratory analysis of different phases of materials with emphasis on phase diagrams
- 4) Laboratory analysis of the toughness of a material
- 5) Laboratory analysis of the ductile-to-brittle transition of a material
- 6) Laboratory analysis of the tensile strength of a material

**Course Objectives**

Students will be able to:

- 1) Experimentally determine the hardness of materials.
- 2) Construct phase diagrams of binary alloys using experimental data.
- 3) Plastically deform a material with cold working to strengthen it and determine its's new yield and ultimate strengths.
- 4) Experimentally determine the impact energy of a material.
- 5) Construct impact energy vs. temperature graphs to determine the temperature range of the transition of a material from brittle to ductile.
- 6) Construct stress-strain curves of materials to determine its' Young's Modulus, ultimate tensile strength, yield strength, and fracture strength.
- 7) Create laboratory reports to communicate experimental findings with peers and instructor.

**Method of Evaluation**

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in the subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

- 1) Laboratory reports: students will write reports for each lab summarizing their procedure in the laboratory, report their collected data, and use their collected data to analyze the properties of materials.
- 2) Quizzes can be used to ensure students are prepared for laboratory experiments and to ensure students know safe practices in the laboratory space.

**Special Materials Required of Student**

Calculator

**Minimum Instructional Facilities**

- 1) Laboratory with blackboard, Smart Cart
- 2) Appropriate lab/demonstration equipment including but not limited to:
  - a. Rockwell and Vickers hardness tester
  - b. Rolling mill
  - c. Kiln
  - d. Charpy impact tester
  - e. Universal Testing Machine (UTM)
- 3) Computers with data acquisition probes
- 4) Safety gear (High heat gloves, safety glasses, hearing protection)

**Method of Instruction**

- 1) Integrated lecture, demonstration, discussion
- 2) Small/large group discussion
- 3) In-class activities and independent homework, research projects
- 4) Group work in a laboratory situation
- 5) Auxiliary use of study groups, peer tutoring and/or instructional office hours

**Out-of-Class Assignments**

- 1) Laboratory reports

**Texts and References**

- 1) Required (representative example): Callister, William and David Rethwisch. *Materials Science and Engineering, An Introduction*. 10th edition. Wiley, 2018. ISBN: 978-1-119-40549-8
- 2) Supplemental: None

**Student Learning Outcomes**

Upon successful completion of this course, students will be able to:

- 1) Apply experimental techniques to analyze material properties.