**Elgin Community College**

**Course Outline**

**IMT 0212 Metallurgy-The Study Of Steel**

**Instructor: David Reich**

**Phone: 847-214-7235**

**Prerequisite: None**

**Description:**

**Basic introduction to ferrous and nonferrous materials and alloys and their molecular activity during processing from raw material to finished product. The composition and changes of the metal are analyzed under laboratory testing to heat treatment, destructive and nondestructive testing, and various fabrication processes. 2 Credit Hours**

**Textbooks/Reading list**

**Brandt. Metallurgy Fundamentals . Goodheart & Wilcox, 1999**

**Course Outline**

**A. Early history of iron and steel**

 **1. Direct processes**

 **2. Early steel making processes**

**B. Producing of iron and steel**

 **1. The smelting processes**

 **a. Raw materials**

 **b. The blast furnace**

 **2. Direct reduction processes**

**C. Refining into steel**

 **1. Modern processes**

 **2. Ingot production**

**D. Shaping and forming of metals**

 **1. Hot rolling**

 **2. Hot forging**

 **3. Effects of hot and cold working metals**

**E. Physical metallurgy**

 **1. Crystalline or solid state**

 **2. Grain structures**

 **3. Deformation**

 **4. Cold crystallization**

**F. Mechanical properties of metals**

 **1. Carbon steels**

 **a. Types**

 **b. Selection**

 **c. Mechanical properties**

**G. Testing of material**

 **1. Destructive**

 **a. Tensile**

 **b. Impact**

 **c. Shock**

 **d. Fracture**

 **e. Fatigue**

 **f. Hardness**

 **g. Corrosion tests**

 **h. Salt spray**

 **2. Nondestructive testing**

 **a. Liquid penetrant**

 **b. Magnetic particle**

 **c. Ultrasonic**

 **d. Eddy current**

 **e. Radiographic**

**H. Theory of alloys**

 **1. Diagramming and analyzing grain structures**

 **a. Equilibrium**

 **b. Thermal curves**

 **c. Iron carbon diagram**

 **d. Eutectic**

 **e. Grain size changes**

**I. Heat treatment of steels**

 **1. Heat treating various alloys and tool steels**

 **a. Heating with various furnaces**

 **b. Quenching materials**

 **c. Stress relieving**

**J. Surface treatments**

 **1. Surface hardening**

 **a. Carburizing**

 **b. Nitriding**

 **2. Diffusion processes**

 **a. Flame hardening**

 **b. Induction**

 **3. Coatings**

 **a. Paints IMT - 212**

 **b. Oxides coating**

 **c. Metal spray**

**K. Alloy or special steels**

 **1. Behavior and influence of special elements**

 **a. Alloy steels**

 **1. Nickel**

 **2. Chrome**

 **3. Manganese**

 **4. Tungsten**

 **5. Molybdenum**

 **b. High speed steels**

 **1. Vanadium**

 **2. Silicon**

 **c. Magnetic steels**

**L. Classification of steels**

 **1. SAE and AISI systems**

 **a. Steel tool classification**

 **b. Stainless and heat resistant steels**

 **c. Classification of hardenability**

**M. Cast irons**

 **1. Types of cast irons**

 **a. Gray cast**

 **b. White cast**

 **c. Malleable**

 **d. Ductile**

 **e. Alloy cast irons**

**N. Welding metallurgy**

 **1. Types of welding**

 **a. Gas**

 **b. Oxyacetylene**

 **c. Arc**

 **d. Gas shielded**

 **2. Resistance welding**

 **3. Effects of welding on metal structures**

**O. Powder metallurgy**

 **1. Production of metal powder**

 **2. Sintering, furnaces, and atmospheres**

 **3. Applications of powdered metal production**

**P. Light metals and alloys**

 **1. Aluminum and other such light metals**

 **a. Properties**

 **b. Machinability**

 **c. Die casting, methods, and equipment**

**Course Content Outcomes**

**Be able to describe the processes of the production of metals from their raw materials and their shaping and forming into standard size.**

**Be able to relate the physical and mechanical properties to selected performance and use of metals.**

**Be able to understand test results produced by destructive and nondestructive methods.**

**Be able to explain the basic heat treating, drawing, and tempering procedures and be able to describe the physical and chemical changes of each.**

**Be able to recognize basic metal classification codes to determine alloy types and amounts within the metal.**

**Be able to relate the differences between types of cast iron and their uses.**

**Be able to explain the basic welding processes and their effect upon the physical and chemical properties of metals.**

**Become familiar with basic nonferrous materials, their properties, their uses, and how they are produced.**

**General Education learning outcomes**

**Speaking Outcomes**

**Students will demonstrate oral presentation skills by being able to: Compose a presentation that has appropriate content. Organize and connect major ideas. Express ideas using clear, effective and appropriate language. Speak in a clear and coherent manner. Use effective nonverbal skills. Include effective supporting materials.**

**Critical Thinking Outcomes**

**Students will demonstrate critical thinking skills by being able to:**

**• interpret and analyze information by categorizing, clarifying meaning in context, identifying ideas, detecting arguments and analyzing arguments into component elements;**

**• evaluate ideas by assessing claims and arguments and justifying procedures;**

**• draw inferences by questioning evidence, selecting alternatives, and drawing conclusions; and**

**• demonstrate inductive and deductive reasoning skills.**

**Students are expected to attend all classes. Individual students missing class session are responsible for work assigned during their absence. Excessive absences may warrant reduction of grade as appropriate.**

**Grades will be based on a combination of student performance within specified areas. Performance areas include text and related material, quiz, final exam and attendance.**

This course meets the agreed upon terminal objectives for the Computer Numerical Control Operator Program.

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