1. MME 3321, Engineering Alloys

2. 3 credits and 3 contact hours per week

3. Stephen W. Stafford

4. Elements of Metallurgy and Engineering Alloys, ed. F. Campbell, ASM International, 2008.

5. Specific course information
    a. The study of the selection and specification of engineering alloys for use in industrial applications. Topics related to ferrous and nonferrous metals in the cast, wrought, powder and particulate state will be covered.

       (Mill test reports (MTR) and how to interpret them as well as interpreting compliance with various specification entities to include ASTM. API, ABS, etc. are inherent to the course.)
    b. MME 3407
    c. Elective course

6. Specific goals for the course
    a. Learning Outcomes
        - Students will have the fundamental knowledge of alloy design principles used to optimize strength, fracture toughness and pertinent physical properties (Homework, exams and course project)
        - Students will be able to explain alloy strengthening mechanisms applied to low and high alloy steels; tool steels, cast irons; aluminum alloys; nickel alloys, copper alloys, titanium alloys; beryllium alloys; and various metal matrix composites (Homework, in-class projects, exams, course project)
        - For any given alloy category, the students will be familiar with the chemical and structural states; processing and fabrication; properties and performance abilities with emphasis on alloy selection and applications (Homework, exams and course project)
        - Students will have a fundamental knowledge in reading specifications (ASTM, API and SAE), interpreting mill test reports and production records (Homework, exams and course project)
        - Students will hone their microstructural interpretation skills with various ferrous and non-ferrous alloys (Homework, exams and course project)

    b. Student Outcomes addressed by the course
        - Outcome 1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science & mathematics
        - Outcome 2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety & welfare, as well as global, cultural, social, environmental, and economic factors

- Outcome 3: an ability to communicate effectively with a range of audiences
- Outcome 5: an ability to function effectively on a team whose members together provide leadership, create a collaborative & inclusive environment, establish goals, plan tasks & meet objectives
- Outcome 6: an ability to develop & conduct appropriate experimentation, analyze & interpret data, and use engineering judgment to draw inclusions
- Outcome 7: an ability to acquire & apply new knowledge as needed, using appropriate learning strategies.

7. A brief list of topics to be covered: Fundamentals of metallic alloy design; the Fe/Fe_3C system and the heat treatment of ferrous alloys; carbon, alloy, HSLA, micro-alloyed, stainless steels; cast irons; tool steels; aluminum and aluminum alloys; titanium and titanium alloys; copper and copper alloys; nickel and nickel alloys; cobalt and cobalt alloys and miscellaneous alloy systems, which will include metal matrix composites (MMCs).