University of Wisconsin - Madison
College of Engineering [EGR]
Last Offered: 2013 Fall [1142]
Direct Link to this Syllabus :
http://aefis.engr.wisc.edu/index.cfm/page/CourseAdmin.ViewABET?coursecatalogid=869&pdf=True

1. **M S & E 463, Materials for Elevated Temperature Service**
2. **Credits :** 3 **Contact Hours :** 2.5
3. **Textbook and Materials :**

   Heat-Resistant Materials, J.R. Davis, ASM International , 1997 (recommended) C.T. Sims, N.S. Stoloff, and W.C. Hagel, J. Wiley, 1987

a. **Other Supplemental Materials :** None

- **Specific Course Information :**

a. **Brief description of the content of the course (Course Catalog Description) :** The design, properties, processing and selection of high temperature materials for structural applications. The fundamentals of diffusion, phase transformations, dislocation motion and oxidation governing the high temperature mechanical properties and structural performance of metallic and ceramic materials.
b. **Pre-requisites or Co-requisites :** Consent of instructor or senior standing

- **Specific Goals for the Course :**

a. **Course Outcomes :**
b. **ABET Student Learning Outcomes :**

   (a) Ability to apply mathematics, science and engineering principles.
   (b) Ability to design and conduct experiments, analyze and interpret data.
   (c) Ability to design a system, component, or process to meet desired needs.
   (e) Ability to identify, formulate and solve engineering problems.
   (g) Ability to communicate effectively.
   (h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.
   (i) Recognition of the need for and an ability to engage in life-long learning.
   (k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

- **Brief List of Topics to be Covered :**

  Elevated-temperature characteristics of engineering materials;

  Mechanical properties and corrosion at elevated temperatures;

  Processing, properties and industrial applications of heat-resistant materials

  Structure, metallurgy, processing and properties of directionally superalloys;

Microstructural instabilities;

Protective coatings

Titanium alloys; refractory metals and alloys; structural Intermetallics;

Ceramics; carbon-carbon composites

Analysis and design: creep-rupture data; thermomechanical properties; elevated-temperature Crack growth; creep-fatigue interaction

Design for elevated temperature applications, oxidation resistance and future challenges