**Draft Syllabus for NE 309**

**Materials Analysis for Nuclear Engineering**

**Fall 2021 or Spring 2022**

NE 309 is constituted an introduction to materials analysis pertinent to nuclear engineering. It focusses on continuum mechanics, thermodynamics and kinetics of nuclear materials. NE 309 will serve as a foundational course for students to take advanced courses both at the undergraduate and graduate level, as well as enabling them to perform senior design pertaining to materials, fuel and structural engineering.

**(1) Introduction to Materials (10%)**

* 1. Continuum and atomic perspectives
  2. Bonding and atomic structures
  3. Crystals and defects, disordered and amorphous structures

**(2) Mechanics of Materials (40%)**

* 1. Deformation, Stress-strain, Linear elasticity
  2. Theories of failure, Design of pressure vessel
  3. Kinematic equations, Cauchy's stress, Constitutive equations (3D)
  4. Yield and plasticity

**(3) Thermodynamics and Kinetics (50%)**

* 1. Thermodynamics states, Entropy, Free energy
  2. Phase diagrams and Gibbs phase rule
  3. Non-equilibrium constitutive models, chemical and thermodynamic potentials
  4. Introduction to rate theory and diffusion
  5. Thermal and activation energy, Arrhenius Law

**Materials Stream (400 and 500 Levels)**

NE 309: Jacob

NE 409: KL

NE 5XX: Djamel

NE 5YY: Ben

NE 550: Jacob