

# **NUEN Qualifying Exam – Potential Topics List**

## **Nuclear Materials Engineering**

### **Spring 2008**

1. Atomic Structure and Chemical Bonding
2. Crystal lattices, unit cells, and basic properties
3. Miller indices
4. Complex crystal structures and stacking of atomic planes
5. Ceramic structures
6. Thermochemistry (Free Energy, H, S, Arrhenius Relations)
7. Crystalline defects: Point defects, dislocations, grain boundaries
8. Dislocation theory – physical metallurgy
9. Dislocation theory – mechanical properties
10. Solid state diffusion – physical science & engineering application
11. Phase diagrams – basics
12. Phase diagrams – the Fe-C system
13. Phase transformation – Temperature-time-Transformation diagrams
14. Stainless Steel, Ferrous, and non-ferrous alloys
15. Mechanical properties – elasticity (Hooke's Law)
16. Mechanical properties – plasticity (dislocations, resolved stress, slip)
17. Creep
18. Corrosion (General)
19. Corrosion (localized types of corrosion)
20. Cladding degradation
21. Radiation effects in solids
22. Radiation damage (cascades, Frenkel pairs, microstructural evolution)
23. Void Swelling in Metals – phenomena and theory
24. Ion-solid interactions – phenomena and theory
25. Nuclear Fuel Performance Issues (swelling, restructuring, el. al.)