EGR 221
Materials Science
Fall, 2015, Exam 5
Study Guide

The exams will be closed book, closed notes, NO CALCULATOR.

You should understand the vocabulary terms sufficiently well to answer "fill in the blank" or multiple-choice type questions. In some instances (marked with * or **) you will need to have a "working knowledge" (i.e. be able to solve related problems, and/or provide a more meaningful answer than "fill in the blank" level of knowledge).

Chapter 12

austenite
austenitizing
bainite*
cementite (Fe_3C)*
ferrite (α-ferrite)*
martensite*
martensitic transformation
metastable
pearlite*
tempered martensite*
eutectic reaction, temperature, composition
eutectoid reaction, temperature, composition
pro-eutectoid ferrite (aka primary α)
pro-eutectoid cementite (aka primary cementite)
nucleation
solid state phase transformation
isothermal transformation diagram, aka time-temperature-transformation diagram (TTT)**

Chapter 12.2 through 12.7

precipitation heat treating (include all three steps – solution heat treat, quench, age)
age hardening, aka precipitation hardening
natural aging compared to artificial aging
over-aging

Chapter 13:

hardenability (compared to hardness)
Jominy test (aka Jominy end quench test) – describe the test and describe what the results can tell an engineer.
spheroidite*
spheroidizing (what is it and why is it done?)
continuous cooling transformation curve (aka CCT diagram)**

*for these microstructures and/or phases:

- Describe in general terms how they are formed. For example: *tempered martensite is formed by holding martensite at an elevated temperature (well below the eutectoid temperature) for times on the order of many minutes to a few hours.*
- Describe the relative strength and ductility of these. For example: *spheroidite is the lowest strength and most ductile microstructure of steel and martensite is the hardest but has no ductility.*

**Read/use TTT diagrams and continuous cooling diagrams sufficiently well to determine the likely microstructure that will result from various quenching processes (described by temperature and time).