Chemical Engineering 436
Exam #3 Review

Chapter 8
PID controller transfer functions
Ideal derivative vs. practical
Reverse acting vs. direct acting
Trends

Chapter 9
Equipment
Valves *(We covered this early in the semester)*
- how to linearize and get G_v
- Air to Open vs Air to Close

Gains from transmitters, measurement devices

Skipped Chapter 10 *(Safety, Fault Tree, Risk Assessment) – covered in ChEn 311*

Chapter 11
Block Diagrams
Get block diagram from physical diagram
Closed loop transfer functions
Block diagram algebra
Closed loop behavior
- time constants
- final values as t approaches ∞ (Y/Y_{sp}=?, Y/D=?)
- offset (P-control only)

Stability
Definition of stability
Characteristic equation
Methods
- Roots of Polynomial (Charact. Eqn.)
- Routh
- Padé approximation for time delay

$$e^{-\theta s} = \frac{1-\frac{\theta}{2}s}{1+\frac{\theta}{2}\theta s}$$

- Direct substitution
- Euler identity for time delay ($e^{-j\omega\theta} = \cos(\omega\theta) - j\sin(\omega\theta)$)
- Root locus

Chapter 12
Controller Design
Direct Synthesis & IMC (add model to correct control)
PID parameters from ITAE and IMC
Tuning Relations (like in Control Station)

Note: Chapter 12 was not formally covered, but it has good material.