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

### Chapter 9
**Valves (We covered this early in the semester)**
- Equipment
  - 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 $\infty$ ($Y/Y_{sp}=?$, $Y/D=?$)
  - offset (P-control only)

**Stability**
- Definition of stability
- Characteristic equation
- Methods
  - Roots of Polynomial (Charact. Eqn.)
  - Routh
    - Padé approximation for time delay
      $$e^{-\theta s} = \frac{1 - \frac{\theta s}{2}}{1 + \frac{\theta s}{2}}$$
    - 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.*