Exam 1 Review

Basics
Control Loops
Block Diagrams

Terms
Manipulated Variable, Disturbance, Measured Variable
Process Time Constants (K_p, τ_p, θ_p)
Control Time Constants (K_C, τ_I, τ_D) ..... $u(t) = u_{bias} + K_C e(t) + \frac{K_C}{\tau_I}\int e(t)dt + K_C\tau_D\frac{de(t)}{dt}$

Tuning Relations
Feedback Control, Feedforward Control
Open Loop, Closed Loop
Linear vs. Nonlinear Systems
Bias, Offset, Reset Windup, Derivative Kick, Derivative on Measurement
Oscillations, Overshoot, Decay Ratio, Noise
Valves
- Fail open, Fail Closed, etc.
- linear, equal percentage, square root, etc.
- l, f(l)

P, PI, and PID control (and variations like w/D on meas., etc.)

Application
FOPDT Model ..... $y(t) = y_0 + K_p\Delta u\left[1 - \exp\left(-\left\{t - \theta_p\right\}/\tau_p\right)\right]$
Graphical fitting
Fitting using ControlStation software (step, pulse, doublet)
Methods for obtaining tuned controller constants (IAE, ISE, ITAE)
General Rules (Effect of Dead Time on K_C, etc.)
When to use P, PI, and PID control
Open loop testing vs. Continuous loop testing
Troubleshooting ideas
Effect of system on control valve operation and control (Long pipe vs. Short pipe, etc.)

Demonstration
Control Station Software (how to use, why use it, limitations)
Process Control Equipment
- Control Valves ..... $q = C_v f(l)\sqrt{\Delta P_v / S.G.}$
- Temperature Measurement (Thermocouple, etc.)
- Flow Meters and Controllers