**ELT 248 Automation Control Circuits**

**Course Description:** Introduces the fundamentals of automatic controls including process control methodologies used to regulate a system or multiple systems for the purpose of establishing and maintaining a predictable manufacturing process.

**Standard Competencies:**

1. Define the term process control.
2. Describe how feedback is used in closed loop process control
3. Define open loop control
4. List the three criteria for evaluating the performance of closed loop control
5. List three key characteristics that determine the response of a system to a supply or demand disturbance
6. Describe the response of a single capacity process to a step change disturbance
7. Define the response of a multiple capacity process to a step change disturbance
8. Explain the relationship between process gain and time constant
9. Describe the inputs and outputs of a two position controller
10. List two advantages and two disadvantages of a two position control
11. Define integral control
12. List one advantage and one disadvantage of integral control
13. Given the equation and the applicable system parameters, calculate the output of an integral controller at some time after a step change in input
14. Define proportional control
15. Describe the relationship between proportional band and gain
16. List one advantage and one disadvantage of proportional control
17. Explain the effect of changing the controller gain on offset error
18. Given the equation and applicable system parameters, calculate the output of a PI controller at some time after a step change input
19. Describe the effect of changing the integral time on the proportional band
20. Describe the effect of changing integral time and proportional band on system stability
21. Define derivative control
22. Given the equation and applicable system parameters, calculate the output of a PD controller at some time during a ramp change input
23. Discuss the effect of changing the proportional band on the derivative action
24. Discuss the effect of changing the proportional band on the proportional action
25. Describe the phase relationship between the proportional, integral and derivative action in a PID controller
26. Given the equation for a PID controller, identify the proportional term the integral term and the derivative term
27. Describe the effect of each mode of a PID controller on stability
28. Explain the difference between feedback control and cascade control
29. Evaluate a control loop and determine if it is a feedback or feed forward control
30. List the major characteristics of feedback, feedforward and cascade control
31. Analyze three element control and describe its use in a control system as compared to one and two element control

**Topical Outline**

I. Fundamentals of Automatic Process Control

A. Theory of a process

B. Analog and digital control

C. Process control elements

II. Process Control Systems

A. Block diagrams

B. Open loop

C. Closed loop

III. Process Characteristics

A. Single capacity

B. Dead time

C. Two capacity

D. Multiple capacity

IV. Control Theory

A. Two position control

B. Integral control

C. Proportional control

D. Proportional plus integral control

E. Proportional plus derivative control

F. Proportional plus integral plus derivative control

V. Controller Tuning Basics

A. Factors affecting stability

B. Closed loop methods

C. Open loop methods

VI. Advanced Control Methods

A. Cascade control

B. Feedforward control

C. Three element control