College of San Mateo
Course Outline

Department: ELEC  Number: 422
Course Title: Introduction to Programmable Logic Controllers  Units: 4.0
Hours/Week: Lecture: 3  Lab: 3  By Arrangement: 0
Length of Course: Semester-long
Grading: Letter

1. Prerequisite (Attach Enrollment Limitation Validation Form.)
   Completion of ELEC 421 or the equivalent with a final grade of C or higher

2. Corequisite (Attach Enrollment Limitation Validation Form.)
   None

3. Recommended Preparation (Attach Enrollment Validation Form.)
   None

4. Catalog Description (Include prerequisites/corequisites/recommended preparation.)
   A review of the component parts of a programmable logic controller and their function and their interrelationship. PLC input/output systems and requirements are examined. Ladder logic programming using basic I/O instructions, logic instructions, timers, counters, comparison, and math functions is covered in depth. Sequence of PLC operation, hardware installation, troubleshooting, and industrial applications of PLCs are also introduced. (CSU)

5. Class Schedule Description (Include prerequisites/corequisites/recommended preparation.)
   Same as above

6. Student Learning Outcomes (Identify 1-6 expected learner outcomes using active verbs.)
   Upon successful completion of the course, the student will be able to:
   1. Identify the parts of a programmable logic controller and describe their function
   2. Use the binary, decimal, and hexadecimal number systems to code information needed in a PLC program
   3. Explain the operation of basic input/output elements, timers, counters, sequencers, math elements, and logic elements used in a PLC
4. List the eight steps needed to develop a program for a PLC
5. Translate the description of a control process into a ladder diagram
6. Translate a ladder diagram into instructions which particular PLC can execute
7. Correctly enter and debug a program using a CRT or a programming panel
8. Identify the important installation requirements for PLC hardware
9. Describe and perform typical PLC troubleshooting
10. Write, enter, and run PLC diagnostic programs
11. Describe the steps needed to properly maintain a functioning PLC system

7. Course Objectives (Identify specific teaching objectives detailing course content and activities. For some courses, the course objectives will be the same as the student learning outcomes. If this is the case, please simply indicate this in this section).

Same as above

8. Course Content (Brief but complete topical outline of the course that includes major subject areas [1-2 pages]. Should reflect all course objectives listed above. In addition, you may attach a sample course syllabus with a timeline.)

I Overview and history of programmable logic controllers (objective 1)
   A Definition of a programmable logic controller
   B History of industry
   C Major manufacturers of programmable logic controllers

II Parts of a programmable logic controller (objective 1)
   A Power Supply
   B Central Processor Unit (CPU)
   C Memory
   D Input/Output
   E Programming Panels

III Number Systems used with Programmable Logic Controllers (objective 2)
   A Decimal number system review
   B Binary number system
   C Octal number system
   D Hexadecimal number system
   E Integers, floating point numbers, high-order numbers, and fixed point numbers

IV Basic Input and output elements (objective 3)
   A Sources of basic input signals

V Timers (objective 3)
   A Time base
   B Off delay or on delay contacts
   C No and NC contacts
   D Reset, retentive and nonretentive functions
   E Adjustable present time and accumulative time
   F Count done bits
   G Symbology used for PLC timers

VI Counters (objective 3)
   A Symbology used for PC counters
   B Parts of the counters
   C Counter values
   D Counter cascading techniques
E Overflow and underflow

VII Sequencers (objective 3)
A Sequence instruction allows the programmable to insure that the PLC will properly step through a set of machine operations
B A sequencer will activate a single output with each enable or advance of the sequencer via a set of input switch contacts
C Sequencer symbology

VIII Math functions (objective 3)
A Most PLCS can perform addition, subtraction, multiplication, and division

IX Gate Logic (objective 3)
A The AND logic function
B The OR logic Function
C The NOT logic function
D The NOT AND (NAND) logic function
E The NOT OR (NOR) logic function

X Programmable logic controller programming (objective 4)
A Eight steps used to program a PLC

XI Programming examples (objectives 5, 6)
A Automatic control of warehouse door
B Automatic lubricating oil supplier
C Conveyor belt motor control
D Automatic car washing machine
E Bottle label detection

XII Programmable logic controller installation (objective 7, 8)
A Installing the PLC

XIII Programmable logic controller maintenance (objective 11)
A Inspection of system
B Tools and supplies needed for maintenance
C Battery considerations

XIV Programmable logic controller troubleshooting (objectives 9, 10)
A A troubleshooting philosophy
B Troubleshooting tools
C Recommended troubleshooting tools

9. Representative Instructional Methods (Describe instructor-initiated teaching strategies that will assist students in meeting course objectives. Include examples of out-of-class assignments, required reading and writing assignments, and methods for teaching critical thinking skills.)

1. Lectures
2. Analytical problem sets
3. Essay question sheets
4. Topic reading assignments
5. Assigned individual and group case studies
6. Assigned computer simulation activities

10. Representative Methods of Evaluation (Describe measurement of student progress toward course objectives. Courses with required writing component and/or problem-solving emphasis must reflect critical thinking component. If skills class, then applied skills.)

1. Graded problem sets
2. graded homework word problems
3. graded case study solutions
4. graded program examples
5. graded program interpretation
6. quizzes
7. midterm
8. final exam

11. **Representative Text Materials** (With few exceptions, texts need to be current. Include publication dates.)


Prepared by: ________________________________  
(Signature)

Email address: diskin@smccd.edu

Submission Date: November 16, 2006