Big Sandy Community and Technical College

Course Syllabus

PS Number: 15646  Semester: SRING  Year: 2015

Faculty Name: JOSEPH COMPTON  Title: PROFESSOR

Course Prefix and Number: EET277  Course Credit Hours: 2

Course Prerequisites: ELT 110 and ELT 114) and (EET 270 and EET 272) or (EET 274) minimum grade of “C” or consent of Electrical Technology program advisor(s)

Course Title: PROGRAMMABLE LOGIC CONTROLLERS (TR 1ST BITERM)

Catalog Course Description: Provides practical applications of programmable logic controllers including installation, logic fundamentals, and numbering systems; basic programming of inputs, outputs, timers, and counters, comparators, basic data manipulation, and safety circuits of industrial PLCs

Instructor Contact Information:

Campus Location: PIKEVILLE  Building & Room: N329

Office Hours: 1ST BiTerm M-W (1:50-3:05) – 2ND BiTerm T-R (1:50-3:05) AND/OR (Email, Blackboard and Phone)

Office Phone Number: 6062181262  Alternate Number: 6062182060

Best Times to Call: 8AM – 3:30PM

KCTCS Email: Joseph.compton@kctcs.edu

Special Instructions: It is imperative that you review the Article II Academic Policies and Procedures, Center for Enrichment Resources, Americans with Disabilities Act (ADA) Statement. If you have questions regarding this syllabus and its attachments, please do not hesitate to contact me or the listed supervisor.

Supervisor Contact Information:
Name: KEITHEN MCKENZIE

Campus  Location: MAYO  Building & Room: C-118

Office Phone Number: 606-788-2896

KCTCS Email: Keithen.mckenzie@kctcs.edu

Text and Supplies:
ISBN# 978-0-07-351088-0 (This is for the Lecture Textbook Only)
ISBN# 978-0-07-747407-2 (This is for the Lab Book Only)
Scientific calculator
Three ring binder and loose-leaf paper.
Safety glasses (must be equal to or exceed ANSI Z87.1 - 2003 High Impact requirements), scientific calculator, spiral notebook, three ring binder, loose-leaf paper and pencils are required

KCTCS General Education Competencies
Students should prepare for twenty-first century challenges by gaining:

A. Knowledge of human cultures and the physical and natural worlds through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts.
   Method to Achieve Competency:
   To be implemented in 2015-16

B. Intellectual and practical skills, including
   • inquiry and analysis
   • critical and creative thinking
   • written and oral communication
   • quantitative literacy
   • information literacy
   • teamwork and problem solving
   Method to Achieve Competency: 
   To be implemented in 2015-16

C. Personal and social responsibility, including
   • civic knowledge and engagement (local and global)
   • intercultural knowledge and competence
   • ethical reasoning and action
   • foundations and skills for lifelong learning
   Method to Achieve Competency: 
D. Integrative and applied learning, including synthesis and advanced accomplishment across general and specialized skills.

**Method to Achieve Competency:**
To be implemented in 2015-16

**Course Specific Competencies (Student Outcomes):**

Task List:

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<td>Number Systems and Codes</td>
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<td>Fundamentals of Logic</td>
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<td>Basics of PLC Programming</td>
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<td>Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs</td>
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<td>Math Instructions</td>
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<td>Sequencer and Shift Register Instructions</td>
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<td>PLC Installation Practices, Editing, and Troubleshooting</td>
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<td>Process Control and Data Acquisition Systems</td>
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<td>ControlLogix Controllers</td>
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**Lab Competencies (Student Outcomes):** (Enter N/A if this does not apply.)

I. PLC's: An Overview
   A. Principles of Operation
   B. Parts of a PLC
   C. PLC size and Application

II. PLC Hardware Components
   A. Discrete I/O modules
   B. Analog I/O modules
   C. Special I/O modules
   D. I/O specifications
   E. The CPU
   F. Memory design and types

III. Number Systems and Codes
   A. Decimal System
   B. Binary System
   C. Octal System
   D. Hexadecimal System
   E. Binary Arithmetic

IV. Fundamentals of Logic
   A. The Binary Concept
   B. AND, OR, NOT Functions
   C. Boolean Algebra and Expressions
   D. Producing PLC Ladder circuits from Logic Gates

V. Basics of PLC Programming
   A. Processor Memory Organization
   B. Program Scan
C. Relay-Type Instructions
D. Instruction Addressing
E. Branch Instructions
F. Internal Relay Instructions
G. Programming EIO and EIC Instructions
H. Entering the Ladder Diagram
I. Modes of Operation

VI. Developing PLC Wiring and Ladder Logic Diagrams
   A. Examine Contactors, and Motor Starters as PLC Output Devices
   B. Examine Manual, Mechanical, and Automatic Control as PLC Input Devices
   C. Examine Pilot Lights, Control Relays, Solenoids, Heaters, Alarms, and Horns as PLC Output Devices
   D. Examine Seal-In Circuits in PLC Programs
   E. Latching Relays
   F. Converting EMC Diagrams to PLC Ladder Diagrams
   G. Writing PLC Ladder Diagrams from a Narrative
   H. Safety Circuitry

VII. Programming Timers
   A. Timer Instructions
   B. Non-Retentive On-Delay Timers
   C. Non-Retentive Off-Delay Timers
   D. Retentive Timers
   E. Cascading Timers

VIII. Data Manipulation Instructions
   A. Data Transfer Operations (Move Instruction)
   B. Data Compare Instructions (Comparators)

IX. Programming Counters
   A. Counter Instructions
   B. Up-Counter
   C. Down-Counter
   D. Cascading Counters
   E. One-Shot (Transitional) Contact
   F. Combining Counter and Timer Functions

X. Program Control Instructions
   A. Jump Instructions and Subroutines
   B. Master Control and Zone Control Instructions

XI. Troubleshooting Techniques
   A. Grounding
   B. Electrical Noise
   C. Preventative Maintenance
   D. PLC Shutdown Procedure

Course Outline:
Course Outline (Not necessarily in the following order)
Upon completion of this course, the student can:
1. Define a Programmable Logic Controller (PLC) and list its advantages over relay systems.
2. Identify, list, and describe the function of the main parts of the hardware components used in PLC systems.
3. Outline the basic sequence of operation for a PLC.
4. Identify the general classifications of PLCs.
5. Describe the basic circuitry and applications for discrete and analog input and output (I/O) modules.
6. Identify and interpret typical PLC I/O and CPU specifications.
7. Identify and explain PLC I/O addressing formats.
8. Describe the general classes and types of PLC memory.
9. List and describe different types of PLC peripheral support modules.
10. Define the decimal, binary, octal, and hexadecimal numbering systems and demonstrate conversion from one numbering system to another.
11. Perform basic addition, subtraction, multiplication, and division of binary numbers.
12. Define the terms bit, byte, word, least significant bit (LSB) and most significant bit (MSB) as they apply to binary memory locations.
13. Review common electromechanical symbols and devices and their implementation in I/O connectivity diagrams.
14. Program and run PLC ladder logic programs from electromechanical relay ladder logic programs.
15. Describe the binary concept and the function of AND, OR, and NOT gates.
16. Develop and run elementary programs based on logic gate functions.
17. Describe input and output image table files and types of data files as functions of the PLC memory map.
18. Describe and test the PLC program scan sequence for single and continuous scan.
19. Identify and use common operating modes found in PLCs.
20. Identify and program the internal relay and the LATCH/UNLATCH instruction functions.
21. Program the PLC utilizing symbol and comment functions.
22. Write and run PLC programs directly from a narrative description of a process control circuit.
23. Describe the PLC timer instruction and their instructional control bits also differentiating between non-retentive and retentive timers.
24. Program and run the control of outputs using various types of PLC timers and their instruction control bits.
25. Describe the PLC UP and DOWN counter instruction and their instructional control bits.
26. Program and run the control of outputs using various types PLC counter instructions and their instructional control bits.
27. Program and run the control of outputs applying combinations of counters and timers to control systems.
28. Describe the operating principle of a transitional or one-shot contact.
29. Program the operation of the master control reset (MCR) instruction and describe it use.
30. Describe the operations of the jump (JMP) and label (LBL) instructions.
31. Explain the function of subroutines.
32. Describe safety considerations built into PLCs and programmed into a PLC installation.
33. Define data manipulation and apply the move (MOV) instruction to accomplish this in a PLC program.
34. Define compare instructions and apply various comparator instructions to accomplish this in a PLC program.
35. Describe proper grounding practices and preventative maintenance tasks associated with PLC systems.
36. List and describe specific PLC troubleshooting procedures.
37. Plan an orderly shutdown for PLC managed equipment.
**Course Structure:**
This is a WEB-ENHANCED class. Students will be expected to participate in class/group discussions and activities. Students will also be required to develop and maintain a notebook of course content. Outside assignments are an integral component of this course.

**Technology/Media Component:**
Calculators (not supplied by the program) may be used to work mathematical problems encountered during the class.

**Service-Learning:**
Service-Learning is a teaching methodology that connects learning to service. Both the learning and the service are strengthened by the connection. Students are taught course specific skills (PREPARATION), solve real community issues using classroom learning (ACTION/SERVICE), return to the classroom setting and REFLECT upon the application of course skills and are given the opportunity to CELEBRATE their victories. This is known as the PARC Model.

The BSCTC Center for Enrichment Resources (CER) offers students academic assistance in all subject areas. Students may receive one-on-one tutoring, small group tutoring, assistance writing papers and performing research, and other academic support services. Assistance is available both by appointment and on a walk-in basis. Tutoring availability is contingent upon the availability of tutors. It is recommended that students call ahead to schedule an appointment if tutoring is needed in a particular subject.

Locations by Campus

Prestonsburg Campus: Magoffin Building 219

Pikeville Campus: N204

Mayo Campus: C200 and 202

For more information at Pikeville or Prestonsburg, please contact LeeAnn Helton (Magoffin 211 or ext. 64774), or Jennifer Leedy (ext. 82827) at the Mayo Campus
**Course Requirements and Evaluation:**
This course provides you with the foundation for all of your study in PLCs. It is very important to understand each topic covered.
All classroom distractions should be kept to a minimum. Cell phones, pagers, etc., should be turned off or silenced during class time. If there are extenuating circumstances, see me immediately.
Evaluation will be made in the following manner for the final grade:

Labs 80%
Safety Quizzes 20%

**Projects:**
Projects will include typed papers demonstrating knowledge of how a particular item works. Each paper will be typed in 11 fonts, double spaced, and be 2 pages in length, not including the cover sheet and work sited page. These papers will be saved as a word document with a file extension of (doc) or a rich text document. **Each project will need to be approved by me before they will be accepted as a grade.**

**Homework:**
Homework will be located on BlackBoard. You must complete each homework assignment by either typing your answers in the textbox on BlackBoard or attach a word document file. **No homework assignment will be accepted by turning a hard copy in to me.**

**Grading Policy:**
The Final grade for the course will be determined by averaging the scores you have earned from class assignments, written exams, performance exams, and other miscellaneous assignments. Note: Some class assignments may not be included in the grade calculations. The Grading Scale will be as follows:

100%-90%=A; 89%-80%=B; 79%-70%=C; 69%-60%=D; 59% and below=E

**Attendance Policy:**
This is a high technology accelerated course. The information presented during this course is vital to successful employment in the electronics/ electrical industry. Because this is a vital course, you must be present in class to receive maximum benefit from it. Regular attendance and punctuality are expected.
Regular attendance and punctuality are expected of all students.

Work missed because of absence(s) for any reason shall be made up satisfactorily to the instructor. Makeup work not turned in by the time designated by the instructor shall receive a grade of “0”. It is the student’s responsibility to contact the instructor to arrange for makeup work. Any assignment that is turned in late will receive an automatic 15% deduction. If you are tardy for a class, please come in quietly as to not disturb the rest of the class. Quizzes relating to both the lecture and lab cannot be made up

**Missed Exam Policy:**
Make-up work is the responsibility of the student. If the student misses an exam or assignment it is his/her responsibility to meet with the instructor to determine a make-up date. This can be accomplished by email or phone. Any assignment that is turned in late (one week from the due date) will receive an automatic 15% deduction. **Beyond one week from the due date, work will not be accepted.** Quizzes cannot be made up

**Late Assignment Policy:**
All missed assignments or exams may not be considered if not completed within seven days of the exam or assignment date. A 15% deduction will applied to all late work.

**Withdrawal Policy:**
A student may officially withdraw from class as stated in the academic calendar guidelines for that particular semester. The student must initiate the official withdraw.

If the student decides to drop this course, please let the instructor know. This allows for the proper paperwork and grade to be issued.

**Information Available at the Current Student Portal**
http://www.bigsandy.kctcs.edu/current_students

**ARTICLE II - ACADEMIC POLICIES AND PROCEDURES**
(Referenced in the Rules of the Community College Senate, Section VII and in the Rules of the Technical College Senate, Section VII).

The following information is available on the BSCTC Homepage: [www.Bigsandy.kctcs.edu](http://www.Bigsandy.kctcs.edu) go to Current Students and under Right to Know click on **Student Code of Conduct**. Paper copies of all the documents listed under Right to Know are also available upon request at the Admissions Office or Library on the Mayo, Pikeville and Prestonsburg Campuses.

2.1 Academic Honesty Policy
2.2 Academic Rights of Students
2.2.1 Information about course content
2.2.2 Information about course grading criteria
2.2.3 Contrary opinion
2.2.4 Academic evaluation
2.2.5 Academic records
2.2.6 Evaluation of student character and ability
2.3 Student Academic Offenses and Academic Sanctions
2.3.1 KCTCS Academic Offenses
2.3.1.1 Plagiarism
2.3.1.2 Cheating
2.3.1.3 Student Co-Responsibility
2.3.1.4 Misuse or Student Falsification of Academic Records
2.3.2 Academic Sanctions/Penalties of Students
2.3.2.2 Other Academic Sanctions
2.4 Student Appeals and Responsibilities
2.4.1 Student Responsibilities
2.4.1.1 Responsibility Involving Academic Rights of Students (section 2.0)
2.4.1.2 Responsibility Involving Academic Offenses (section 2.3)

Please refer to flowchart: **Appeals in Cases of an Alleged Violation of Student Academic Rights Figure 1)** 2.4.1.2 Responsibility Involving Academic Offenses (section 2.3) When a student is believed to be guilty of any of the four academic offenses (2.3.1.1 – 2.3.1.4), a student will find information concerning responsibilities of college personnel in section 2.5.2.
ARTICLE III—NON-ACADEMIC DISCIPLINARY POLICIES AND PROCEDURES

3.1 General Regulations Concerning Student Behavior
3.2 Disciplinary Offenses
3.3 Penalties and Sanctions
3.4 Enforcement
3.5 The Procedures
3.5.1 The Role of the Chief Executive Officer in Student Disciplinary Matters
3.5.2 The College Judicial Board
3.5.2.1 Authority
3.5.2.2 Composition
3.5.2.3 Eligibility Requirements
3.5.2.4 The Appointment Process
3.5.2.5 Terms of Office
3.5.2.6 Absence
3.5.2.7 Temporary Appointments to the Judicial Board
3.5.3 The College Appeals Board
3.5.3.1 Jurisdiction on Cases of Disciplinary Offenses
3.5.3.2 Disposition of cases of Disciplinary Offenses
3.5.3.3 Composition of the College Appeals Board
3.5.3.4 Composition of the College Appeals Board
3.6 Temporary Sanctions

CAMPUS SECURITY
http://www.bigsandy.kctcs.edu/Student_Life/Campus_Security.aspx

Learn more about our safety and security initiatives:
Download the BSCTC Safety Manual (PDF)
Safety Notification and Alert Procedure (SNAP)
Pandemic Flu Response Plan (PDF)
HIV and AIDS Information
Hepatitis B Information
Incident Reports

KCTCS SAFETY NOTIFICATION ALERT PROCESS (SNAP)
http://kctcs.edu/snap
- Minutes Matter — Get SNAP Messages Quickly by E-mail, Text or Call
- SNAP is the official Safety Notification Alert Process for the Kentucky Community and Technical College System (KCTCS). SNAP alerts users to on-campus emergencies and college closings or delays for all 16 KCTCS colleges and the System office.

CENTER FOR ENRICHMENT RESOURCES
http://www.bigsandy.kctcs.edu/en/Academics/Center_for_Enrichment_Resources.aspx
The BSCTC Center for Enrichment Resources (CER) offers students’ academic assistance in all subject areas. Campus Locations: Prestonsburg Campus the CER is located in the Magoffin Building, room 219. The Testing Center is located in the Magoffin Building, room 218. Pikeville Campus the CER is located in room N202. The Testing Center is located in room N216. Mayo Campus the CER is located in Building C, room 124. The Testing Center is located in Building C, room 112.

STUDENT RIGHT TO KNOW
http://www.bigsandy.kctcs.edu/en/Academics/Student_Right_To_Know.aspx
Additional Information Available at the Current Student Portal
http://www.bigsandy.kctcs.edu/current_students

MAIN
Academic Calendar  Blackboard  Email  Help
Library  Student Service Center

ACADEMIC PROGRAMS AND CLASSES
Class Schedules  KCTCS Catalog  Programs of Study

STUDENT RESOURCES
College Bookstore  Cost & Financial Aid  Cost & Financial Aid
Employee Directory  How To: Student Self Service  Schedules, Syllabi, & Office Hours
Student Life  Tuition & Fees

Americans with Disabilities Act (ADA) Statement
Students with disabilities: If you are in need of an accommodation because of a documented disability, you are required to register with Disability Support Services each semester.
Contact: Janie Beverley, Coordinator for Disability Support Services; Student Center Room 103; Ph: (606) 886-7359; Toll-free 888-641-4132, ext. 67359; Email: janie.beverley@kctcs.edu