CURRICULUM COMMITTEE CHECKLIST

NAME OF PROGRAM: Mechatronics

Date: March 2, 2012

Step 1 Reviewed change at division meeting.

Step 2 Presented as informational item at Division Chair Meeting(s) and checked if it affects other departments. Like programs must meet with Division Chairs on all affected campuses (North Mankato and Faribault).

Division Chair’s signature

Step 3 Instructional Dean reviewed and indicated need for Curriculum Committee approval.

Instructional Dean’s signature

Step 4 Advisory Committee approval indicated in meeting minutes if necessary. Minutes provided to Curriculum Committee.

Step 5 Curriculum Committee made recommendations (changes, additional approvals, etc.). If no, skip to Step 7.

Step 6 Committee’s recommendations completed. (Skip if not applicable.)

Step 7 Curriculum Committee approved.

Curriculum Committee Chair’s signature

Step 8 Minutes and necessary materials provided to VP of Academic Affairs.

Step 9 Vice President of Academic Affairs approved.

Vice President of Academic Affairs’ signature

Step 10 New Course Maximum Enrollment to Shared Governance.

Step 11 President’s approval for all changes requiring MnSCU approval.

President’s signature
### Appendix B

#### New Course or Course Change Proposal Form

<table>
<thead>
<tr>
<th>Date of Proposal:</th>
<th>February 22, 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author:</td>
<td>Doug Laven</td>
</tr>
</tbody>
</table>

**Proposal Type:**
- New Course
- *Modify Course*
- Delete Course

**Contact for the Course:** Doug Laven

**Course Designator, Number and Title:** MECA 1000: Introduction to Mechatronics

**Number of Credits:** 3

**Prerequisites:** None

**Course Description:** Introduction to Engineering Design is a foundation course in the Mechatronics program. By exploring various technology systems and manufacturing processes, students will learn how technicians use technology in manufacturing and production settings. Theoretical and hands-on problem-solving activities are emphasized. This course will also engage the student to the proper and safe use of hand and shop tools. Hands-on labs and software are used as learning tools for students to design and produce projects related to industry. Students should take this as the first course in the sequence of Mechatronics courses. This course will also provide an overview of decision-making techniques and the application and benefits of decision-making using the Value Method process. Prerequisites: None.

**Grading Method:**
- *Grade* *Pass/Fail*

**Scheduling:**
- *Fall*
- Spring
- Summer
- Alternate Years
- Variable
- On Demand

**Instructional Type:**
- Lecture: 2
- Lab: 1
- Lecture/Lab: Internship
- Seminar

**Class Maximum:** (For New Courses Only) All Unlimited faculty members of a program or discipline must sign.

<table>
<thead>
<tr>
<th>Faculty Name</th>
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</thead>
</table>

**Dean's Name**

<table>
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<tr>
<th>Dean's Signature</th>
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*If there is not enough space provided, please use the back of this form for additional signatures or click on a row with the right button of the mouse, select insert and then select insert rows below to add rows to the table.*

**Is this Course Proposed as a Liberal Arts Course:** Yes *No*

**If Yes, Which MnTC Area/Areas Will it Fulfill (http://www.mntransfer.org)?**

**Is This Course a Requirement/Elective for a Specific Program or Programs:** *Yes* No

**If Yes, Which Program(s)? Mechatronics**

**Describe What is Changing/Being Added, and the Rationale:** This course name and number changed from ENG 1005: Introduction To Engineering to MECA 1000: Introduction to Mechatronics.

**What Impact Will This New Course or Change Have on Other Programs or Areas?** These changes will enhance the Mechatronics program by allowing the students to have a better understanding of the use of hand tools, welding and general shop practices.

* Attach Common Course Outline to this Form.
Introduction to Mechatronics
Common Course Outline

Course Information
Organization South Central College
Developers Doug Laven
Development Date 2/18/2012
Course Number MECA 1000
Potential Hours of Instruction 64
Total Credits 3

Description
Introduction to Engineering Design is a foundation course in the Mechatronics program. By exploring various technology systems and manufacturing processes, students will learn how technicians use technology in manufacturing and production settings. Theoretical and hands-on problem-solving activities are emphasized. This course will also engage the student to the proper and safe use of hand and shop tools. Hands-on labs and software are used as learning tools for students to design and produce projects related to industry. Students should take this as the first course in the sequence of Mechatronics courses. This course will also provide an overview of decision-making techniques and the application and benefits of decision-making using the Value Method process. Prerequisites: None.

Types of Instruction

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</table>

Prerequisites
None

Exit Learning Outcomes

Institutional Core Competencies
A. Intercultural knowledge and competence
B. Foundations and skills for lifelong learning
C. Teamwork and problem-solving
D. Analysis and inquiry
E. Critical and creative thinking
F. Written and oral communication

Competencies

1. Describe the Basic Building Blocks of a Mechatronics System
   Learning Objectives
   a. Identify basic design tools
b. Discuss Hardware
   c. Characterize Software
   d. Explain Communications and Interfacing
   e. Describe Sensing, Control and Actuation

2. **Apply Formal Research Techniques**
   **Learning Objectives**
   a. Analyze Technical Data and General References
   b. Construct a Contact Log
   c. Analyze Design Contracts
   d. Interpret Working Drawings

3. **Demonstrate Welding Techniques**
   **Learning Objectives**
   a. Plan Welding Project
   b. Review Welding Safety Practices
   c. Construct Welding Project

4. **Apply Safe Solder Practices**
   **Learning Objectives**
   a. Explain soldering procedure
   b. Demonstrate soldering techniques
   c. Demonstrate desoldering techniques
   d. Identify safety precautions
   e. Analyze solder joint, connection

5. **Keep daily research journal**
   **Learning Objectives**
   a. Develop working drawings
   b. Review technical data
   c. Identify source information
   d. Keep contact log

6. **Apply Measurement and Statistics to the Design Process**
   **Learning Objectives**
   a. Review History of Measurement
   b. Apply English and Metric Linear Measurements
   c. Use a Dial Caliper
   d. Use a Micrometer
   e. Review Geometric Shapes
   f. Review Linear Dimensions
   g. Adapt Applied Statistics
   h. Identify Dimensioning Conversions
   i. Factor Tolerancing

7. **Use Hand and Shop Tools**
   **Learning Objectives**
   a. Apply Safe Tool Use in Shop Environment
   b. Use Drill Press, Break and Sheer
   c. Demonstrate Welding and Brazing Skills
8. **Explore design project parameters**
   **Learning Objectives**
   a. Explain Decision Matrix
   b. Apply Brainstorming Techniques
   c. Demonstrate Teamwork
   d. Identify Subsystems
   e. Review Project Budget
   f. Calculate Cost Analysis
   g. Create Prototype

9. **Develop a Manufacturing System**
   **Learning Objectives**
   a. Meet desired needs within realistic constraints such as economic and environmental terms.
   b. Apply manufacturability,
   c. Ensure sustainability
   d. Formulate and solve engineering problems

10. **Develop Troubleshooting Methods**
    **Learning Objectives**
    a. Review technical manuals
    b. Analyze problem solving activities
    c. Use test equipment

11. **Apply Computer / Information Systems**
    **Learning Objectives**
    a. Review Virtual Instrumentation
    b. Study Rapid Control Prototyping
    c. Identify PC-based Data Acquisition and Control

12. **Discuss the Benefits of a Mechatronics System**
    **Learning Objectives**
    a. Explain Precision as it Applies to a Control System
    b. Evaluate a Flexible Design
    c. Describe an Efficient Reprogrammable Design

13. **Apply the Use of Controls in a Mechatronics System**
    **Learning Objectives**
    a. Analyze System Operation
    b. Compare Manual System to Automated Systems
    c. Explain Automated System Advantages and Disadvantages

14. **Deliver Formal Presentation**
    **Learning Objectives**
    a. Format Technical Research Paper
    b. Document Sources
    c. Prepare Formal Presentation
    d. Participate in Group Evaluation
    e. Generate Peer Feedback
Appendix B

New Course or Course Change Proposal Form

Date of Proposal: February 22, 2012

Author: Doug Laven / David Ewel

<table>
<thead>
<tr>
<th>Proposal Type:</th>
<th>New Course</th>
<th>*Modify Course</th>
<th>Delete Course</th>
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</table>

Contact for the Course: Doug Laven

Course Designator, Number and Title: MECA 1131: Computer Applications

Number of Credits: 3

Prerequisites: None

Course Description: This course is designed to provide students enrolled in technical programs an understanding of how computers can be used as a tool to address a variety of applications utilizing input and output sources common to industry. Activities will also include, but are not limited to browser usage, word processing, spreadsheets, graphing capabilities, engineering scheduling applications and modeling & simulation software. Prerequisites: None.

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Scheduling: | *Fall | Spring | Summer | Alternate Years | Variable | On Demand |

Instructional Type: | Lecture: 2 | Lab: 1 | Lecture/Lab: | Internship | Seminar |

*Class Maximum: (For New Courses Only) / All Unlimited faculty members of a program or discipline must sign.

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Dean's Name | Dean's Signature | Date |

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Is this Course Proposed as a Liberal Arts Course: | Yes | *No |

If Yes, Which MnTC Area/ Areas Will it Fulfill (http://www.mntransfer.org)?

Is This Course a Requirement/Elective for a Specific Program or Programs? | *Yes | No |

If Yes, Which Program(s)? Mechatronics

Describe What is Changing/Being Added, and the Rationale: This course name and number changed from MECA 1130: Computer Applications and Programming 2 credits to MECA 1131: Computer Applications 3 credits.

What Impact Will This New Course or Change Have on Other Programs or Areas? These will focus more on preparing the student with computer skills needed throughout the Mechatronics program. Students will install program software and be exposed to an overview of automation found in mechatronics systems.

▶ Attach Common Course Outline to this Form.
Computer Applications
Common Course Outline

Course Information
Organization South Central College
Developers Doug Laven
Development Date 1/7/2009
Revised Date 2/27/2012
Course Number MECA1131
Potential Hours of Instruction 64
Total Credits 3

Description
Course Description - This course is designed to provide students enrolled in technical programs an understanding of how computers can be used as a tool to address a variety of applications utilizing input and output sources common to industry. Activities will also include, but are not limited to browser usage, word processing, spreadsheets, graphing capabilities, engineering scheduling applications and modeling & simulation software.

Types of Instruction

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</table>

Prerequisites
None

Exit Learning Outcomes
Institutional Core Competencies
A. Intercultural knowledge and competence
B. Foundations and skills for lifelong learning
C. Teamwork and problem-solving
D. Demonstrate critical thinking and troubleshooting skills
E. Analysis and inquiry
F. Critical and creative thinking
G. Written and oral communication

Competencies
1. Display understanding of computer hardware
   Learning Objectives
   a. Explain ESD and electrical safety practices
   b. Name major components of a computer
2. **Install computer software**
   **Learning Objectives**
   a. Install browser(s)
   b. Install circuit simulation software
   c. Install control system simulation software
   d. Install solid modeling software

3. **Demonstrate basic computer operation**
   **Learning Objectives**
   a. Use keyboard
   b. Exhibit proper use of a two button and scroll wheel computer mouse
   c. Demonstrate backing up files
   d. Download files from D2L
   e. Obtain working knowledge of Windows OS standard commands

4. **Demonstrate operation of word processing, spreadsheet, presentation and project management software**
   **Learning Objectives**
   a. Plan the tasks associated with a technical project.
   b. Diagram project task contingencies.
   c. Demonstrate ability to modify fonts and page layouts.
   d. Demonstrate paragraph modification and use of ruler when formatting a paragraph.
   e. Demonstrate use of cell referencing
   f. Construct graphs from spreadsheet data
   g. Demonstrate usage of presentation slide design, transitions and animations

5. **Demonstrate ability to use SPICE software for circuit simulation**
   **Learning Objectives**
   a. Select components from standard libraries
   b. Insert interconnections between components
   c. Demonstrate the ability to insert instruments into simulation
   d. Demonstrate operation of the simulator
   e. Interpret data from instruments

6. **Demonstrate ability to use simulation software of fluid power and electromechanical systems**
   **Learning Objectives**
   a. Create simulation of fluid power control system
   b. Create simulation of electromechanical control system
   c. Demonstrate ability to operate simulation software

7. **Demonstrate ability to use solid modeling software**
   **Learning Objectives**
   a. Operate solid modeling software
   b. Create simple part using solid modeling software
   c. Create drawing of simple part

8. **Create technical presentation**
   **Learning Objectives**
a. Develop PowerPoint presentation
b. Incorporate scheduling software
c. Import files i.e. graphics, photos and charts
d. Deliver technical presentation
**Appendix B**

**New Course or Course Change Proposal Form**

**Date of Proposal:** March 27, 2012

**Author:** Doug Laven / David Ewel

**Proposal Type:** | New Course | *Modify Course | Delete Course

**Contact for the Course:** David Ewel

**Course Designator, Number and Title:** MECA 1210 Digital Electronics

**Number of Credits:** 3

**Prerequisites:** *None*

**Course Description:** This course explores the general fundamentals of digital electronic circuits. To learn the theory and operation of digital electronics, students will get hands-on experience with basic logic gates; sequential logic circuits, such as flip-flops, counters, and shift registers; and combinational logic circuits that include encoders, decoders, multiplexers, and arithmetic devices. A variety of measurement equipment will be used to test and troubleshoot solid state and digital circuits created on breadboards during lab sessions. Teamwork, critical thinking skills, and practical applications of circuits will be emphasized. (Prerequisite: None.)

**Grading Method:** *Grade | Pass/Fail

**Scheduling:** | Fall | Spring | Summer | Alternate Years | Variable | On Demand

**Instructional Type:** Lecture: 2  Lab: 1  Lecture/Lab: Internship  Seminar

*Class Maximum: (For New Courses Only) / All Unlimited faculty members of a program or discipline must sign.*

**Faculty Name** | Faculty Signature | Class Max | Date
---|---|---|---
Doug Laven | 24 | 
David Ewel | 24 | 

**Dean's Name** | Dean's Signature | Date
---|---|---
Dr. Suzanne Nordblom | | 

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**Is this Course Proposed as a Liberal Arts Course:** Yes  *No

**If Yes, Which MnTC Area/Areas Will it Fulfill (http://www.mntransfer.org)?**

**Is This Course a Requirement/Elective for a Specific Program or Programs?** *Yes  No

**If Yes, Which Program(s)? Mechatronics Engineering Technology**

**Describe What is Changing/Being Added, and the Rationale:** This course is being modified to eliminate the prerequisite. It will be taught as both face-to-face as well as online. The manner in which it will be taught eliminates the need for the prerequisite that was attached to earlier versions of the course.

**What Impact Will This New Course or Change Have on Other Programs or Areas?** None.

➢ Attach Common Course Outline to this Form.
Digital Electronics
Course Outcome Summary

Course Information
Organization South Central College
Developers Ray Schmid/Doug Laven
Development Date 2/18/2010
Course Number MECA 1210
Potential Hours of Instruction 64
Total Credits 3

Description
This course explores the general fundamentals of digital electronic circuits. To learn the theory and operation of digital electronics, students will get hands-on experience with basic logic gates; sequential logic circuits, such as flip-flops, counters, and shift registers; and combinational logic circuits that include encoders, decoders, multiplexers, and arithmetic devices. A variety of measurement equipment will be used to test and troubleshoot solid state and digital circuits created on breadboards during lab sessions. Teamwork, critical thinking skills, and practical applications of circuits will be emphasized. (Prerequisite: None)

Types of Instruction

<table>
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<tr>
<th>Instruction Type</th>
<th>Contact Hours</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom Presentation</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>On-Campus Lab</td>
<td>32</td>
<td>1</td>
</tr>
</tbody>
</table>

Prerequisites
None.

Exit Learning Outcomes

Core Abilities
A. Intercultural knowledge and competence
B. Foundations and skills for lifelong learning
C. Teamwork and problem-solving
D. Demonstrate critical thinking and troubleshooting skills
E. Analysis and inquiry
F. Critical and creative thinking
G. Written and oral communication

Competencies
1. Describe Digital Electronics Learning Objectives
   a. Identify characteristics of digital circuits
   b. Identify characteristics of linear (analog) circuits
c. Describe the different types of multivibrators
d. Analyze simple logic-level inductor circuits
e. Demonstrate the basic operation of several lab instruments

2. **Examine Number Systems**

   **Learning Objectives**
   
a. Describe the idea of place value in the decimal, binary, octal and hexadecimal number system
b. Convert binary number to decimal and decimal numbers to binary
c. Convert hexadecimal numbers to binary, binary to hexadecimal, hexadecimal to decimal, and decimal numbers to hexadecimal
d. Convert octal numbers to binary, binary to octal, octal to decimal, and decimal numbers to octal
e. Use terms such as bit, nibble, byte, and word when describing data groupings

3. **Examine Logic Gates**

   **Learning Objectives**
   
a. Memorize the name, symbol, truth table, function, and Boolean expression for the eight basic logic gates
b. Draw logic diagrams
c. Convert basic gates to other logic functions using inverters
d. Troubleshoot simple logic gate circuits

4. **Combine Logic Gates**

   **Learning Objectives**
   
a. Draw logic diagrams from minterm and maxterm Boolean expressions
b. Design a logic diagram from a truth table
c. Reduce a minterm Boolean expression to its simplest form using Karnaugh maps
d. Identify the fundamentals of Programmable Logic Devices (PLDs)

5. **Explain the inputs and outputs for basic logic gates, sequential logic circuits, and combinational circuits**

   **Learning Objectives**
   
a. Draw the logic symbol for the inverter, and, or, nor, xor, and xnor logic gates
b. Identify the function of the inverter, and, or, nor, xor, and xnor logic gates
c. Explain the function of a basic RS flip-flop and explain its primary variations to include D, JK, and latch
d. Describe the operation of both an asynchronous and synchronous counter
e. Generalize the loading (data in) and unloading (data out) of a shift register
f. Identify the schematic symbols for encoders, decoders, multiplexers, and comparators
g. Explain the applications for combinational logic circuits

6. **Practice basic troubleshooting techniques**

   **Learning Objectives**
   
a. Use isolation techniques to verify and eliminate problems in a circuit
b. Understand the common types of defects for both hard-wired and PCB circuits
c. Read a schematic diagram
d. Use basic troubleshooting tools, such as meters, documentation, and effective notes

7. **Utilize various test equipment, to include the multimeter, oscilloscope, logic probe, and function generator**

   **Learning Objectives**
a. Connect a digital multimeter into a circuit to measure resistance, voltage, and current
b. Acquire and measure alternating signals using an oscilloscope
c. Use a logic probe to determine the operation of digital circuits
d. Explain the various functions and purposes for inputting signals using a function generator

8. Build a final project that includes logic gates, sequential logic circuits, and combinational logic circuits

Learning Objectives
a. Read a digital electronics schematic that includes sequential and combinational logic circuits
b. Breadboard a moderately complicated digital electronics circuit onto a breadboard
c. Test and report the results of a digital circuit

9. Acquire skills to allow effective teamwork

Learning Objectives
a. Accept responsibility to complete projects as part of a team, not only as an individual
b. Build, test, demonstrate, and report on a capstone project as part of a team
c. Foster a learning environment by helping all team members maintain an equal level of competence
d. Adjust to team member's learning style, especially during lab experiments
## Appendix B

### New Course or Course Change Proposal Form

**Date of Proposal:** April 9, 2012  
**Author:** Jerry Soost

<table>
<thead>
<tr>
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<th>New Course</th>
<th>*Modify Course</th>
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<tr>
<td>Contact for the Course:</td>
<td>Jerry Soost</td>
<td></td>
<td></td>
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</table>

**Course Designator, Number and Title (i.e.: ACCT 1800, Business Law):** MECA 1220 Mechanical Systems  
**Number of Credits:** 3

**Prerequisites:** PHYS 101, Introductory Physics or comparable with approval of Instructor

Course Description: This course includes an introduction to mechanical drive systems, power transmission systems, chain drives, v-belt and, multiple shaft drives, linear motion assemblies, and auxiliary control functions. The student will study the application of spur, helical, bevel and worm gears as well as the use of keys, pins, and splines to attach gears to shafts. Machine elements such as: displacement, velocity, acceleration, springs, power screws, brakes and clutches will also be topics covered. Computer simulation and 3D software will be used throughout the course. Troubleshooting of mechanical systems will be emphasized. Technical writing skills and safety procedures will be implemented throughout the course. (Prerequisite: PHYS 101, Introductory Physics or comparable with approval of Instructor)

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| Instructional Type: | Lecture: 2 | Lab: 1 | Lecture/Lab | Internship | Seminar |

**Grading Method:** *Grade*  
**Pass/Fail**

**Faculty Name**  
Jerry Soost  
David Ewel  
Doug Laven  
**Dean's Name**  
Dr. Suzanne Nordblom  
*Faculty Signature*  
24  
4/9/12

**Class Max**  
24  
4/9/12

*Class Maximum: (For New Courses Only) / All Unlimited faculty members of a program or discipline must sign.*

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**Is this Course Proposed as a Liberal Arts Course:**  
Yes  
*No*

**If Yes, Which MnTC Area/Areas Will it Fulfill (http://www.mntransfer.org)?**

**Is This Course a Requirement/Elective for a Specific Program or Programs?**  
*Yes*  
No

**If Yes, Which Program(s)?** Mechatronics

**Describe What is Changing/Being Added, and the Rationale:** Adding the prerequisite of Physics so students have a better foundation to learn about Mechanical Systems.

**What Impact Will This New Course or Change Have on Other Programs or Areas?** None.

[Attach Common Course Outline to this Form.]
Mechanical Systems
Common Course Outline

Course Information
Organization          South Central College
Developers            Doug Laven
Development Date      10/30/2009
Course Number         MECA 1220
Potential Hours of Instruction      64
Total Credits         3

Description
This course includes an introduction to mechanical drive systems, power transmission systems, chain drives, v-belt and, multiple shaft drives, linear motion assemblies, and auxiliary control functions. The student will study the application of spur, helical, bevel and worm gears as well as the use of keys, pins, and splines to attach gears to shafts. Machine elements such as; displacement, velocity, acceleration, springs, power screws, brakes and clutches will also be topics covered. Computer simulation and 3D software will be used throughout the course. Troubleshooting of mechanical systems will be emphasized. Technical writing skills and safety procedures will be implemented throughout the course.
(PREREQUISITE: PHYS 101 or Introductory Physics or comparable with approval of Instructor)

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Prerequisites

PHYS 101 or Introductory Physics or comparable with approval of Instructor

Exit Learning Outcomes

Institutional Core Competencies
A. Maintain / Use reference materials
B. Demonstrate safe work habits
C. Establish ethical practices in the classroom and while engaged on the World Wide Web
D. Exhibit professionalism
E. Explore new ways to use technology

Competencies
1. Describe Mechanical Drive System Safety

Learning Objectives
a. Describe Lock-Out Tag-Out
b. Apply General Safety
c. Use Bell Drives
d. Understand Sheave and Belt Installation
e. Describe Sheave Alignment
f. Utilize Belt Tensioning
g. Describe Sheave and Belt Maintenance

2. **Explain Belt Drives**
   
   **Learning Objectives**
   
   a. Use Wedge and Notched Wedge V-Belts
   b. Understand Multiple-Belt Drive
c. Understand Variable-Speed Belt Drives
d. Understand Synchronous Belt Drives
e. Define High Torque Synchronous Belt Drives
f. Use Idler Pulleys
g. Use Bell Drives

3. **Explain Chain Drives**
   
   **Learning Objectives**
   
   a. Understand Chain Drives
   b. Explain Sprocket Installation
c. Explain Sprocket Alignment
d. Explain Chain Installation
e. Explain Chain Tensioning
f. Construct a Pareto Chart
g. Analyze Speed, Torque, and Sprocket Ratios
h. Explain Sprocket and Chain Maintenance
i. Use Chain Drives

4. **Explain Gear Drives**
   
   **Learning Objectives**
   
   a. Understand Gear Drives
   b. Explain Spur Gear Installation
c. Review Gearboxes
d. Calculate Backlash
e. Use Gears with Split Taper Bushings
f. Use Gear Trains

5. **Explain Worm Gears**
   
   **Learning Objectives**
   
   a. Understand Worm Gears
   b. Explain Worm Gear Installation
c. Use Worm Gears
d. Document Calculations

6. **Explain Helical Gears**
   
   **Learning Objectives**
   
   a. Explain Helical Gear Installation
   b. Identify Right and Left Handed Helical Gears
c. Use Helical Gears
7. Conduct Lubrication Schedule
   Learning Objectives
   a. Identify Viscosity Measurement
   b. Use Lubrication
   c. Understand Maintenance Schedules
   d. Maintain Maintenance schedules

8. Explore Couplings
   Learning Objectives
   a. Analyze Mechanical joint
   b. Demonstrate Coupling of a Mechanical System
   c. Define Coupling Materials
   d. Build a Coupled Mechanical System

9. Manipulate Shaft Alignment
   Learning Objectives
   a. Describe Shaft Alignment
   b. Align Shafts and Sprockets
   c. Use Alignment Tools
   d. Document Alignment Procedure

10. Manipulate Bearings
    Learning Objectives
    a. Describe Bearings in a Mechanical System
    b. Identify Bearing Types
    c. Select Bearing
    d. Use Bearing in a Mechanical System

11. Use Ball Screws
    Learning Objectives
    a. Describe Ball Screws in a Mechanical System
    b. Identify Ball Screw types
    c. Select Ball Screw
    d. Use Ball Screw in a Mechanical System

12. Use Linear Bearings
    Learning Objectives
    a. Describe Linear Bearings in a Mechanical System
    b. Identify Linear Bearings Types
    c. Select Linear Bearings
    d. Use Linear Bearings in a Mechanical System

13. Use Gaskets and Seals
    Learning Objectives
    a. Describe Gasket and Seals in a Mechanical System
    b. Identify Gasket and Seal Material Types
    c. Select Gasket and Seal Material
    d. Use Gaskets and Seals in a Mechanical System

14. Use Clutches
Learning Objectives
a. Analyze Clutches in a Mechanical System
b. Describe the Purpose of Clutches in a Mechanical System
c. Select Clutch Type
d. Use Clutches in a Mechanical System

15. Use Brakes
Learning Objectives
a. Analyze Brakes in a Mechanical System
b. Identify Brake Material Types
c. Select Braking Type
d. Use Brakes in a Mechanical System

16. Understand Vibration Metering
Learning Objectives
a. Identify Unbalanced System
b. Explain Acceleration
c. Explain Velocity
d. Correct Unbalanced System
Appendix B

New Course or Course Change Proposal Form

Date of Proposal: April 5, 2012
Author: Doug Laven

Proposal Type: New Course  *Modify Course  Delete Course
Contact for the Course: Doug Laven
Course Designator, Number and Title: MECA 1222: Electricity - Devices and Circuits II
Number of Credits: 3
Prerequisites: MECA 1122: Electricity - Devices and Circuits I

Course Description: This course provides an exploration of the basics in electricity and electronics. Topics include an overview of alternating current, circuit laws, components, and use of test equipment. Students learn the basic technique of troubleshooting electric circuits, including measurement techniques, analysis of faults, and repair procedures. Teamwork, critical thinking, and problem solving are emphasized. Hands-on experience and practical applications are included. Prerequisites: MECA 1122: Electricity - Devices and Circuits I.

Grading Method: *Grade  Pass/Fail
Scheduling: Fall  *Spring  Summer  Alternate Years  Variable  On Demand
Instructional Type: Lecture: 2  Lab: 1  Lecture/Lab:  Internship  Seminar
*Class Maximum: (For New Courses Only) / All Unlimited faculty members of a program or discipline must sign.

<table>
<thead>
<tr>
<th>Faculty Name</th>
<th>Faculty Signature</th>
<th>Class Max</th>
<th>Date</th>
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<tr>
<th>Dean's Name</th>
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If there is not enough space provided, please use the back of this form for additional signatures or click on a row with the right button of the mouse, select Insert and then select insert rows below to add rows to the table.

Is this Course Proposed as a Liberal Arts Course: Yes *No

If Yes, Which MnTC Area/Areas Will it Fulfill (http://www.mntransfer.org)?

Is This Course a Requirement/Elective for a Specific Program or Programs? *Yes No

If Yes, Which Program(s)? Mechatronics

Describe What is Changing/Being Added, and the Rationale: The course number changed from MECA 1125 to MECA 1222. Some course content changed as well.

What Impact Will This New Course or Change Have on Other Programs or Areas? These changes will enhance the Mechatronics program by allowing the students to have a better understanding of motor and AC circuits.

Attach Common Course Outline to this Form.
Electricity - Devices and Circuits II
Common Course Outline

Course Information
Organization South Central College
Developers Doug Laven
Development Date 2/18/2010
Revised Date 4/9/2012
Course Number MECA 1222
Potential Hours of Instruction 64
Total Credits 3

Description
This course provides an exploration of the basics in electricity and electronics. Topics include an overview of alternating current, circuit laws, components, and use of test equipment. Students learn the basic technique of troubleshooting electric circuits, including measurement techniques, analysis of faults, and repair procedures. Teamwork, critical thinking, and problem solving are emphasized. Hands-on experience and practical applications are included. Prerequisites: MECA 1122: Electricity - Devices and Circuits I.

Types of Instruction

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<tr>
<th>Instruction Type</th>
<th>Contact Hours</th>
<th>Credits</th>
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<td>2</td>
</tr>
<tr>
<td>On-Campus Lab</td>
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</table>

Prerequisites
MECA 1122: Electricity - Devices and Circuits I

Exit Learning Outcomes

Institutional Core Competencies
A. Intercultural knowledge and competence
B. Foundations and skills for lifelong learning
C. Teamwork and problem-solving
D. Analysis and inquiry
E. Critical and creative thinking
F. Written and oral communication

Competencies
1. Learn Alternating Current and Voltage Learning Objectives
   a. Review AC Terminology
   b. Understand Types of AC Waveforms
   c. Analyze the Sine Wave
d. Review AC Generator

2. Explain Power in AC Circuits
   Learning Objectives
   a. Measure Power in Resistive AC Circuits
   b. Analyze Power in Out-of-Phase Circuits
   c. Explain True Power and Apparent Power
   d. Review Power Factor

3. Understand Electrical Quantities and Units
   Learning Objectives
   a. Comprehend Charge, Current and Current Carriers in AC Circuits
   b. Explain the Unit of Current, Unit of Voltage and the Unit of Resistance
   c. Explain Conductors, Insulators and Semiconductors
   d. Review Power and Energy

4. Summarize Capacitance and Inductance in AC Circuits
   Learning Objectives
   a. Describe Basic Capacitor Action
   b. Example Voltage Rating and Specifications
   c. Describe Factors Determining Inductance and The Henry
   d. Explain Types of Capacitors and Symbols
   e. Analyze Capacitors in Series and Parallel Circuits

5. Learn Transformers
   Learning Objectives
   a. Describe Transformer Fundamentals
   b. Explain Efficiency of Transformers
   c. Demonstrate How to Wire a Transformer
   d. Know the Different Types of Transformers
   e. Calculate Transformer Ratings
   f. Explain Three-Phase Transformers

6. Evaluate R, C, and L Circuits
   Learning Objectives
   a. Explain Impedance
   b. Demonstrate Adding Phasors
   c. Use RC Circuits
   d. Use RL Circuits
   e. Use RCL Circuits
   f. Explain Resonance
   g. Create Filters

7. Review Power in AC Circuits
   Learning Objectives
   a. Understand Resistive AC Circuits
   b. Explain Power Factor
   c. Develop Three-Phase Circuits
   d. Use AC Power Terminology
8. **Learn Instruments and Measurements**
   **Learning Objectives**
   a. Use Digital Multimeter
   b. Describe Meter Movements
   c. Demonstrate Analog Ammeter and Voltmeter Use
   d. Explain Wheatstone Bridge, Wattmeter and Frequency Meters
   e. Measure Inductance and Capacitance

9. **Use Electric Motors**
   **Learning Objectives**
   a. Study Motor Classifications
   b. Integrate Motors in Circuits
   c. Analyze Motor Ratings

10. **Explore Residential and Industrial Wiring Concepts**
    **Learning Objectives**
    a. Study Electrical Codes
    b. Construct AC Circuits
    c. Define Power Distribution
# Appendix B

## New Course or Course Change Proposal Form

**Date of Proposal:** March 2, 2012  
**Author:** Doug Laven  
**Proposal Type:** New Course  
**Contact for the Course:** Doug Laven  
**Course Designator, Number and Title:** MECA 1250: Mechatronics Systems Operations I  
**Number of Credits:** 3  
**Prerequisites:** MECA 1122: Electricity – Devices and Circuits I

**Course Description:** This course will provide the student with the principles of programmable logic controllers (PLC) hardware and fundamental sequence control systems. The student will gain essential knowledge necessary to create and edit basic PLC programs that will include timers, counters and special function blocks. As well as gaining an understanding of interfacing discrete input-output (I/O). The student will also perform fundamental PLC troubleshooting procedures. Technical writing skills and safety procedures will be implemented throughout the course. Prerequisites MECA 1122: Electricity - Devices and Circuits I

**Grading Method:** *Grade*  
**Scheduling:**  
- Fall  
- Spring  
- Summer  
- Alternate Years  
- Variable  
- On Demand  
**Instructional Type:**  
- Lecture: 2  
- Lab: 1  
- Lecture/Lab:  
- Internship  
- Seminar  

*Class Maximum: (For New Courses Only) / All Unlimited  
faculty members of a program or discipline must sign.*

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**Is this Course Proposed as a Liberal Arts Course:**  
- Yes  
- No  

**If Yes, Which MnTC Area/Areas Will it Fulfill (http://www.mntransfer.org)?**

**Is This Course a Requirement/Elective for a Specific Program or Programs?**  
- Yes  
- No  

**If Yes, Which Program(s)? Mechatronics**

**Describe What is Changing/Being Added, and the Rationale:** Updated the prerequisite and core competencies.

**What Impact Will This New Course or Change Have on Other Programs or Areas?** These changes will enhance the Mechatronics program by allowing the students to have a better understanding PLC systems.

- Attach Common Course Outline to this Form.
MECHATRONICS SYSTEMS OPERATIONS I
Course Outcome Summary

Course Information
Organization: South Central College
Developers: Doug Laven
Development Date: 10/15/2009
Course Number: MECA 1250
Potential Hours of Instruction: 64
Total Credits: 3

Description
This course will provide the student with the principles of programmable logic controllers (PLC) hardware and fundamental sequence control systems. The student will gain essential knowledge necessary to create and edit basic PLC programs that will include timers, counters and special function blocks. As well as gaining an understanding of interfacing discrete input-output (I/O). The student will also perform fundamental PLC troubleshooting procedures. Technical writing skills and safety procedures will be implemented throughout the course. Prerequisites MECA 1122: Electricity - Devices and Circuits I

Types of Instruction

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Prerequisites
MECA 1122: Electricity - Devices and Circuits I

Exit Learning Outcomes
Core Abilities
A. Intercultural knowledge and competence
B. Foundations and skills for lifelong learning
C. Teamwork and problem-solving
D. Analysis and inquiry
E. Critical and creative thinking
F. Written and oral communication

Competencies
1. Describe Programmable Logic Controllers
   Learning Objectives
   a. Discuss PLC Background
   b. Recognize Principles of Operation
   c. Analyze PLCs Versus Other Types of Controls
   d. Identify Typical Areas of PLC Applications
2. **Define Number Systems and Codes**  
   **Learning Objectives**  
   a. Explain Number System  
   b. Apply Number Conversions  
   c. Identify One's and Two's Complement  
   d. Interpret Binary Codes  

3. **Apply Logical Concepts**  
   **Learning Objectives**  
   a. Explain the Binary Concept  
   b. Identify Logic Functions  
   c. Demonstrate the Principles of Boolean Algebra and Logic  
   d. Use PLC Circuits and Logic Contact Symbology  

   **Learning Objectives**  
   a. Explain Processor Architecture  
   b. Characterize Processor Scan  
   c. Identify Error Checking and Diagnostics  
   d. Describe System Power Supply  
   e. Identify Programming Devices  

5. **Clarify Memory System and Input/Output Interaction**  
   **Learning Objectives**  
   a. Identify Memory Types  
   b. Describe Memory Structure and Capacity  
   c. Identify Memory Organization and I/O Interaction  
   d. Translate Memory Mapping and I/O Addressing  
   e. Plan Memory Considerations  

6. **Identify Discrete Input/Output System**  
   **Learning Objectives**  
   a. Complete I/O Table Mapping  
   b. Configure I/O Rack Enclosure  
   c. Evaluate Discrete Inputs  
   d. Evaluate Discrete Outputs  
   e. Interpret I/O Specifications  

7. **Explain Input and Output Voltage and Current Requirements**  
   **Learning Objectives**  
   a. Identify Open Collector Circuit  
   b. Explain Current Sourcing  
   c. Explain Current Sinking  
   d. Read Schematic Circuits  

8. **Identify PLC System Selection Guidelines**  
   **Learning Objectives**  
   a. Identify PLC size and Scope of Applications  
   b. Define Process Control System
c. Calculate Noise, Heat and Voltage Requirements

d. Document System Considerations

e. Communicate PLC Start-up and Checking Procedures

9. Interpret Programming Languages
   Learning Objectives
   a. Identify Types of PLC Instructions
   b. Incorporate Ladder Diagram Format
   c. Utilize Basic Relay Instructions
   d. Utilize Timer and Counter Instructions
   e. Review Non-Ladder Programming Languages
   f. Apply Data Transfer Instructions

10. Implement Programming Language to the PLC
    Learning Objectives
     a. Identify Control Definition
     b. Create Control Strategy
     c. Implement Control Strategy Guidelines
     d. Develop Short Programs

11. Describe PLC System Documentation
    Learning Objectives
     a. Identify Steps of Documentation
     b. Apply Engineering-Level Record Keeping
     c. Debug PLC Programs
     d. Deliver Presentation