Sign-in Sheet

Event Name: Mechatronics / Industrial Automation – Industry Forum
Event Date: September 14th, 2017
Location: Room 310, Herndon Center, Clovis Community College 390 W Fir Avenue, Clovis, CA 93611
Time: 5 pm – 7 pm

	Name (Please Print)	Organization	Signature
1	Matthew Graff	Clovis Community College	
2	GURMINDER SANGHA	COS/CCCCO	
3	Glenn Pangh	Lyon Managers	
4	Dale Putman	Allied Electric	
5	Colleen Brannon	CCC	
6	David Pruitt	Producers Dairy	
7	William Dean	Producers Dairy	
8	Ed Schmalzel	Clovis Adult School	
9	Alain Spaland	Allied Electric	
10	MIKE VASILESCU	READY ROAST	
11	BRIAN EMERSON	CTEC High School	
12	JOHN MARR	BETTS COMPANY	
13	DORAN ALFORD	PRODUCERS	
14	A Alexander	Fresno State	

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	Name (Please Print)	Organization	Email	Phone Number	Signature
29	Chris K Cruz	Mi Rancho	C.K.Cruz@favorite4orthtec.	(559)994-2160	
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Mechatronics / Industrial Automation – 1st Advisory Board Meeting

HC308

September 14th, 2017

Present:

Industry:

- Criss K Cruz (Mi Rancho)
- John Marr (Betts Company)
- Joel Ratto (ICAD/Lighthouse Elec)
- Anthony Olivo (ICAD- Industrial Control and Design)
- William "Bill" Dean (Producers Dairy)
- Frank Corgiat (Producers Dairy)
- David Pruitt (Producers Dairy)
- Hyung Yam (Producers Dairy)
- Doran Alford (Producers Dairy)
- Dale Putman (Allied Electric)
- Alain Spalard (Allied Electric)
- Travis Asher (Allied Electric)
- Mike Vasilescu (Ready Roast)
- Glenn Peugh (Lyons Magnus)

Other:

- Brissa Quiroz (Fresno State)
- Walter Mizuno (Fresno State)
- Athanasios Alexandrou (Fresno State)
- Gurminder Sangha (COS/Deputy Sector Navigator)
- Ed Schmalzel (Clovis Adult School)
- Brian Emerson (CTEC High School)
- Matthew Graff (Clovis Community College)
- Colleen Brannon (Clovis Community College)
- Robbie Kunkel (Clovis Community College)

I. Dinner served 7:00 pm

II. Meeting called to order 7:15 pm

III. Powerpoint Overview of Program- Matthew Graff

IV. Program Outcomes

A. Large Group discussion

B. The follow items were recommended to be considered in the Program Outcomes

1. Job placement
2. Independence added into point #6
3. General industry knowledge

C. Advisory board agreed to Program Outcomes

V. Program Courses

A. The following courses were shared with Advisory Board
   1. Mechanical Systems
   2. Electricity and Electronics (AC & DC)
   3. Electric Motors - Controls
   4. Programmable Logic Controllers (PLCs)
   5. Industrial Automation Systems
   6. Instrumentation and Process Control
   7. Industrial Communications Networks
   8. Work Experience/Internship

B. Advisory board went into small groups and looked at course outlines

C. In large group discussion the following changes were discussed/recommended:
   1. MECH 2- Mechanical Systems
      a) Prerequisites
      b) Remove some topics from Mechanical Drives to give more time for Pneumatics and Hydraulics
   2. MECH 3- Electricity and Electronics (AC & DC)
      a) Prerequisites
      b) Using basic algebra and physics… perform related student learning outcomes.
   3. MECH 4- Electric Motors Control
      a) Add to Student Learning Outcome #3 to emphasis on motor torque and horsepower formules
      b) Miscellaneous other changes to equipment, course objectives, outline and textbook.
   4. MECH 5- Programmable Logic Controllers
      a) Prerequisites
      b) Equipment recommendations
   5. MECH 15- Industrial Automation Systems (Distributed Manufacturing)
      a) Various recommendations on Outcomes, Objectives and updating outline in areas where obsolete equipment is mentioned.
   6. MECH 23- Instrumentation/Process Control
      a) Prerequisites: add MECH 5
      b) Other small changes
   7. MECH 35- Industrial Communications Networks
      a) Various small changes including Fieldbus, HART, ect

VI. Advisory Board agreed that classes and program fill a need in industry and look forward to Clovis Community College moving forward with program

VII. Meeting adjourned at 9:00 pm

Clovis Community College

Proposed Mechatronics Program and Courses 9/12/17 Draft

Mechatronics / Industrial Automation- Program Outcomes

Upon completion of this program students will be able to:

1. **Safety-** Describe the hazards associated with automated machinery and determine appropriate safety methods for working in an industrial environment.
2. **Troubleshooting-** Utilize electrical/mechanical troubleshooting and communication skills to diagnose, repair, test, and return to service failed components.
3. **Identify and Solve Problems-** Identify, analyze, and solve narrowly defined technical problems.
4. **System Design and Programing-** Use basic understanding of programing and industrial system design to enhance systems via incremental changes software and/or hardware modifications.
5. **Communication-** Apply written, oral and graphical communication skill in both technical and non-technical environments; identify and use appropriate tech literature.
6. **Teamwork, Professionalism and Quality-** Function effectively as a team member demonstrating a commitment to quality, timeliness, and continuous improvement in a professional manner.

Courses:

Course	Title	Prerequisites
MECH 2	Mechanical Systems	
MECH 3	Electricity and Electronics (AC & DC)	
MECH 4	Electric Motors - Controls	
MECH 5	Programmable Logic Controllers (PLCs)	
MECH 15	Industrial Automation Systems	MECH 5
MECH 23	Instrumentation and Process Control	MECH 3
MECH 35	Industrial Communications Networks	MECH 5
MECH ??	**Independent Study?**	
MECH 19V	**Work Experience/Internship**	???

Number: MECH 2
Title: Mechanical Systems
Units: 4 units (3 hours lecture, 3 hours lab)
Equipment needed:

- **Hand tools**
  - Common hand tools (screw drivers, pliers, etc.)
  - Drilling devices, twist drills, punch presses
  - Abrasives
  - Saws and shears
  - Arbors and hydraulic presses
  - Screw threads, thread forms, and threaded fasteners
  - Pop rivets and other mechanical fasteners
  - Sheet metal shear, brake
- **Power tools**
  - Drill press
  - Hand drill
  - Pneumatic tools
  - Hand grinders and bench grinders
- **Measuring Tools**
  - Measurement Systems, Decimal Measurement, Fractional Measurement
  - Tools for dimensional measurement: rule, caliper, micrometer, depth gage
- Mini Lathe and CNC Mill
- Mechanical drive training system (gears, belts and pulleys, clutches)
- Pneumatic training system
- Hydraulic training system

Prerequisite: None
Advisory: ???

Catalog Description:
Introduction to machinery and machining processes, essential elements of mechanical systems, mechanical drives (gears, belts and pulleys, clutches), mechanical hardware, bushings, bearings, lubrication systems, basic properties of materials, hydraulics and pneumatics, preventive maintenance, basic hand and power tools, and basic precision dimensional measurement.

Course Outcomes (SLOs):
Upon completion of this course students will be able to:

1. Describe the hazards associated with automated machines and determine appropriate safety methods for working around machinery.
2. Perform leveling and alignment for electric motors.

        - Assembly Concepts
        - Bolt: types, sizes, grades
        - Washers
    - Wrenches: Fixed, Adjustable, Allen Ratchet
    - Pneumatic system fabrication
        - Fluid circuit components
        - Pipe thread components
        - Pneumatic fittings & tubings
    - Screwdrivers: Screws,nut drivers, flat & Phillips head screwdriver
    - Pliers and locking devices
        - Clamps & Vises
        - Pliers
        - Locking Nut Devices
        - Rings
    - Mallets and non-threaded fasteners
        - Mallets and Hammers
        - Key Fasteners
        - Press fit assembly
        - Pins
    - Torque wrench: Concepts and Applications
    - Portable Power Tools: Safety, operation

III. Mechanical Drives 1 (2 Weeks)
    - Introduction to Mechanical Drive Systems
        - Mechanical Power Transmission Safety
        - Machine Installation
        - Motor mounting
        - Shaft speed measurement
    - Key fasteners: key & seat
    - Torque and power measurement
    - Mechanical efficiency
    - Power transmission systems: shafts, bearings, couplings, alignment
    - V-belt drives: concepts, operation, tensioning
    - Chain drives: concepts, operation, tensioning, fixed center chain installation
    - Spur gear drives: concepts, designs, operation, installation, analysis
    - Multiple shaft drives: analysis, installation, sleeve couplings

IV. Mechanical Drives 2 (2.5 Weeks)
    - Heavy duty V-belt drives
    - V-belt selection and maintenance: specification, identification and troubleshooting
    - Synchronous belt drives: timing, torque, selection
    - Lubrication concepts: oils, greases, management

Number: MECH 3
Title: Electricity and Electronics (AC & DC)
Units: 4 units (3 hours lecture, 3 hours lab)
Equipment:

- Function Generator
- Power Supply
- Electronic test boards

Prerequisite: None

Catalog Description:
Introduction to electricity and electronics including basic components, electronic circuit calculations, basic electronic test equipment use, electrical measurement, relays and ladder diagrams, alternating current (AC) circuits, and electronic schematic diagrams.

Course Outcomes (SLOs):
Upon completion of this course, students will be able to:

1. Identify the production, characteristics, applications, and voltage change methods of Direct Current and Alternating Current.
2. Apply circuit analysis methods for DC and AC circuits containing resistive devices, capacitors, and inductors using Ohm's Law, Watt's Law, and Kirchoff's Laws.
3. Choose and perform measurements using multimeters, oscilloscopes, and signal generators, perform circuit fabrication using electronic schematic diagrams, and perform simple problem-isolation techniques on laboratory circuits.
4. Identify common component symbols, and explain the functions of common electronic components.
5. List the career opportunities in electronics technology, the methods for receiving training in those areas, and essential workplace skills that are needed for career success in a technical field.

Course Objectives:
In the process of completing this course, students will:

1. Solder wire and various electrical junctions
2. Use schematic to build and troubleshoot a circuit.
3. Calculate voltage, current, resistance and power in a circuit.
4. Use electrical measurement tools (i.e. multi-meter, oscilloscope)

Course Outline:

Lecture:
Introduction to Electricity and Electronics
Basic Electricity and Electrical Quantities (charge-voltage-current-power-energy)

Matt, Stephen R. *Electricity and Basic Electronics*. Tinley Park, Ill: Goodheart-Willcox Co, 2013. Print.

14. Demonstrate methods for reversing AC and DC motors.
15. Explain the methods for accelerating and braking motors.
16. Demonstrate ability to read and interpret technical documents.
17. Demonstrate ability to use various types of software applicable to course.

Course Outline:

I. Safety: lockout/tagout system, importance of equipment ground
II. Basic Electrical Motors
    - Motor specification: size, application, type
    - DC Series motor, reversing DC series motor
    - DC Shunt and compound motors
    - Motor speed and torque: calculations and measurement
    - Motor performance: power, efficiency and analysis
    - Split-phase AC motors
    - Capacitor-start AC motors
    - Permanent-capacitor and two capacitor motors
    - Three-phase AC induction motors: operation, characteristics, configurations, reversing
    - Servo motors
III. Electric Motor Control
    - Intro to motor control: Three-phase power, disconnects and protective devices
    - Manual motor control: starter operation, overload protection
    - Control transformers: operation and applications
    - Electrical control ladder logic: ladder diagram and logic elements (AND, OR, etc)
    - Control relays and motor starters: two-wire control and three-wire start/stop
    - System troubleshooting: control component, motor starter, power component
    - Reversing motor control: manual, magnetic, interlocking, hands-off-automatic
    - Automatic input devices: float & pressure switches, sequence control
    - Basic timer control: on-delay and off-delay timers
IV. VFD Wiring and PLC Wiring | Electrical Wiring Training
    - Wiring emergency stop
    - Low voltage AC drives (i.e. Powerflex drives)
V. Troubleshooting techniques and theory
    - Diagnosis of motor failure
    - Troubleshooting safety relays
    - Troubleshoot motors with a insulation tester (i.e. Megger)
    - Basic troubleshooting and programming of the VFD

Number: MECH 5
Title: Programmable Logic Controllers
Units: 4 units (3 hours lecture, 3 hours lab)
Prerequisite:
Equipment:
Allen Bradley Compactlogix PLC trainer
Electric Relay Control Trainer

Catalog Description:
The function and application of programmable logic controllers. Students will become familiar with the programming of Programmable Logic Controllers. Topics covered include bit-level input and output instructions, timers, counters, latches, documentation, and troubleshooting.

Course Outcomes (SLOs):
Upon completion of this course, students will be able to:

1. Establish communications with PLC and perform documentation control.
2. Develop ladder logic diagrams for a PLC application and program the PLC.
3. Accurately explain PLC addressing and successfully create input/output configurations.
4. Implement program timer-on/timer-off and up-counter/down counter instructions.
5. Utilize math instructions, logic comparisons, bit shift instructions and sequencer instructions in PLC programming.
6. Control PLC programs using master control reset instructions and subroutines.

Course Objectives:
In the process of completing this course, students will:
See Outline

Course Outline:
Lecture:

I. Programmable Logic Controller (PLC) Overview (1 week)
   - History and development
   - PLC block diagram
   - Discrete input and output modules
   - Analog input and output modules

II. PLC and Control System Components (1 week)
   - PLC Communication Systems
   - PLC Memory Maps
   - PLC Terminology

- Equal To(EQU)
- Not Equal To (NEQ)
- Less Than (LES)
- Greater Than (GRT)
- Less Than or Equal To (LEQ)
- Greater Than or Equal To (GEQ)
- Limits Test (LIM)

X. Program Control Instructions (1 week)
- Master Control Reset (MCR)
- Jump (JMP) and Label (LBL) Instructions
- Jump to Subroutine (JSR)
- Label Subroutines (SBR)
- Return from Subroutine (RET)
- Subroutine Applications

XI. Sequencer Functions (1 weeks)
- Sequencer Concepts
- Sequencer Output Function (SQO)
- Sequencer Compare Function (SQC)
- Sequencer Load Function (SQL)
- Cascading Sequencers
- Paralleling Sequencers

Lab Content:

1. View a directory of processor files using PLC software
2. Restore a PLC processor file using PLC programming software
3. Monitor a PLC processor file using PLC programming software
4. Run a PLC processor file using PLC programming software
5. Stop a PLC processor file using PLC programming software
6. Convert between Decimal and Binary
7. View the status of the PLC Input and Output Data tables
8. Create a PLC project using PLC software
9. Configure the I/O for a PLC project using PLC software
10. Enter a basic PLC program using PLC software
11. Save a PLC program to disk using PLC software
12. Edit a PLC program using PLC software
13. Generate and print out a ladder logic report using PLC software
14. View project documentation and use it to operate a PLC program
15. Document a PLC program file
16. Troubleshoot a PLC program with manual and automatic modes
17. Design a motor control program which uses both manual and automatic modes
18. Design a PLC program which has both a Halt and Cycle-Stop functions
19. Troubleshoot a PLC program which has both Halt and Cycle-Stop functions

Number: MECH 15
Title: Industrial Automation Systems (Distributed Manufacturing)
Units: 4 units (3 lecture, 1 lab)
Prerequisite: MECH 5 PLC
Equipment:
Capstone Mechatronics System

Catalog Description:
Introduction to industrial automation technologies and the procedures utilized when troubleshooting automated control systems. Topics include programmable logic controllers (PLC), machine control, industrial robots, barcode readers, material handling systems, and Ethernet communications.

Course Outcomes (SLOs):
Upon completion of this course, students will be able to:

1. Safety- Know eight mechatronics operator safety rules.
2. Design a PLC program that provides manual/auto/reset functions for a servo robotic assembly station.
3. Design a PLC program that sequences a powered parts feeder.
4. Configure and operate an automatic storage and retrieval system (ASRS).

Course Objectives:
In the process of completing this course, students will:

1. Define a pick and place automation system and give an application.
2. Define a flexible manufacturing system and give an application.
3. Describe how to manually override an electro-pneumatic valve.
4. Describe how to adjust pneumatic actuator stroke position and/or speed.
5. Describe how to manually override a magnetic motor starter.
6. Describe the operation of a digital I/O interface module.
7. Describe how to adjust a limit switch.
8. Describe how to adjust a proximity sensor.
9. Describe three types of material feeding systems: ASRS, servo robot, and non-servo pick and place.
10. Describe how to adjust a vacuum gripper.
11. Describe how to adjust a shock absorber.
12. Describe a sequence of operation of a powered parts feeder.
13. Design a PLC program that sequences a 2-axis pick and place pneumatic manipulator
14. Operate an automated gauging station
15. Describe how to adjust non-servo electric traverse axis travel
16. Adjust a synchronous belt drive
17. Design a PLC project that sequences a non-servo electric traverse axis

- Function, Operation, and Configuration of the 1747-KE Interface Module

VI. PLC Serial Communications (2 weeks)
- Communication Channels of the Allen Bradley SLC-500 PLC
- RS-232 Interface of the SLC-500
- ASCII Instructions of the SLC-500

VII. Barcode Pallet Tracking (1 week)
- Barcode System Concepts
- Barcode Readers
- Function and Operation of an Barcode Reader Network
- Operation of PLC's with Barcode Readers

VIII. Enterprise Resource Planning (1 week)
- Definitions of Computer Integrated Manufacturing
- Introduction to Enterprise Resource Planning (ERP) Software
- Manufacturing Resource Planning (MRP)
- Capacity Requirements Planning (CRP)
- Bills of Material (BOM's)
- Manufacturing Execution Systems (3 weeks)

IX. Definition of Manufacturing Execution Systems (MES)
- Introduction to MES software
- Process Planning
- Work Centers and Product Cost
- Product Routing using ERP Software

X. Manufacturing Management and Simulation (1 weeks)
- Definition of Manufacturing Order Management
- Applications of Production Planning
- Master Production Schedules
- Human Machine Interfaces (HMI)

XI. Ethernet Operation (1 weeks)
- Local Area Networks and LAN topologies
- Components of Ethernet
- Function and Operation of TCP/IP communications
- IP Addresses

XII. Ethernet Applications (1 weeks)
- File Transfer via Ethernet Communications
- Robot and PLC Programming via Ethernet

Number: MECH 23
Title: Instrumentation/Process Control
Units: 3 (2 lecture, 1 lab)
Prerequisite: MECH 3 Basic Electronics (AC & DC)
Advisory (prerequisites): MECH 5 PLCs, MECH 4 Motor Controls
Equipment:
Level/Flow Process Control Trainer
Temperature Process Control Trainer
Pressure Process Control Trainer

Transfer:

Catalog Description:
Basic principles of process instrumentation and control. Topics include: level, pressure, flow, and level measurement, final control elements, piping and instrument diagrams and tags, PID controller programming, and basic control algorithms.

Course Outcomes (SLOs):
Upon completion of this course, students will be able to:

1. Explain the operation, programming, and calibration of closed loop process controllers and control systems, including liquid level, flow, pressure, and temperature.
2. Define closed-loop tuning and give an application.
3. Create and interpret instrument tags and line symbols used in piping and instrument (P&ID) diagrams.
4. Describe the operation of current and pressure methods of transmitting instrument valves, and the applications of current-to-pressure converters.
5. Describe the operation of PID control and give an application.

Course Objectives:
In the process of completing this course, students will:

Course Outline:
Lecture:

- Basic Electronics Applied to Instrumentation
- Introduction to Instrumentation and Basic Industrial Measurement
- Instrumentation Symbols and Diagrams
- Process Variables
- Control Loops and Loop Controllers
- Final Control Elements
- Level Measurement and Control

Number: MECH 35
Title: Industrial Communications Networks
Units: 3 (2 lecture, 1 lab)
Equipment:
Capstone Mechatronics System

Prerequisite:

Transfer:

Catalog Description:
Fundamentals of Industrial communication networks including: EtherNet/IP & TCP/IP operations, setting IP addresses, remote I/O network operation/configuration/tags, and troubleshooting.

Course Outcomes (SLOs):

Course Objectives:
1. Troubleshoot control and data networks.
2. Know difference between hub and a switch
3. Learn about gateways
4. Understand different types of networks, Profibus, devicenet
5. Troubleshoot/maintain switch.
6. Use network analyzer, test cable
7. Troubleshoot HMI issues
8. Understand the difference between cat5, and cat6
9. Terminate the communication wiring and know how to run cables
10. Know how ping the node
11. Looking at packet servers, when a node is talking
12. What an IP address is what standards look like IEEE standpoint
13. How to troubleshoot fiber network
14. Understand differences between fiber vs cable

Course Outline:
I. Industrial Communications Networks: network operation, installation, configuration
II. Remote I/O: operation, configuration, tags
III. Produced/Consumed data and messages: transfer between controllers, message instruction
IV. Troubleshooting Ethernet/IP: viewing Ethernet/IP network counters, troubleshooting MSG instruction
V. Troubleshooting Ethernet/IP: viewing Ethernet/IP network counters, troubleshooting MSG instruction

Number: MECH 19V
Title: Work Experience/Internship
Units: Students may enroll for a maximum of 6 units per semester. Students earn units using the following formula: for paid work, 75 hours = 1 unit; for volunteer work, 60 hours = 1 unit.

Prerequisite:

Transfer:

Catalog Description:
Supervised employment, directly related to the student's major.

Course Outcomes (SLOs):
Upon completion of this course, students will be able to:
1. compare and analyze work environments related to career goal decisions.
2. evaluate work experience, in regards to human relations and skill attainment needed for gainful employment.
3. explain positive work ethics for the workplace experience
4. describe how the work experience has influenced career decisions and goals.
5. identify how classroom knowledge integrates into the workplace

Course Objectives:
In the process of completing this course, students will:
1. prepare a detailed time log and work experience record
2. assess the work environment and the skills needed to perform in the workplace
3. evaluate the work experience as it relates to career decisions
4. research and evaluate work ethics
5. prepare a work performance self-analysis
6. prepare a self-improvement plan
7. identify the future skills needed for jobs in the selected career

Course Outline:

Readings: