Mechatronics Courses by School Period

Year One

P1	Integrated Systems
P1+P2	Industrial Math (Geometry, Trig, Algebra,)
P1+P2	Blueprint Reading
P1	Machine Tool I (Hand tools-Measuring-Saws & Drill presses)
P2	Machine Tool II (Lathes, Mills, Grinders)
P1+P2	Electrical DC/AC
P1+P2	Software applications for business
P1+P2	Industrial Safety plus hoists, cranes
P3	Electronics (Solid State)
P3	Gen Ed
P3	Electro-Hydraulics I,II,III
P4	Industrial Controls and Instrumentation
P4	Mechanical Drives I,II III
P4	Gen Ed

Year Two

P5	General Preventative/Predictive Maintenance
P5	Programmable Controller Applications
P5	Gen Ed
P5	Fundamentals of Pipefitting
P6	Introduction to Gas/Arc/MIG/TIG Welding
P6	Advanced Programmable Controller Applications
P6	Gen Ed
P6	Gen Ed

P7	Gen Ed
P7	Introduction to Robotics Technology
P7	Shop Floor Networking
P7	Seminar – Project Management
P7	Seminar - Material Science
P7	Seminar - Environmental Considerations
P7	Seminar - Quality Control

Year Three

P8	Gen Ed
P8	Manufacturing Processes & Economics
P8	Gen Ed
P9	Capstone - Integrated Systems Troubleshooting

Mechatronics DACUM (Learning Objectives)

Year 1

- Applied Physics (not defined)

Safety

- Detect threats to safety and health at the workplace and initiate preventative measures (lock out tag out, OSHEA, hazardous training, chemical, sound, crushing, etc.)
- Apply work-related safety and accident-prevention methods
- Describe ways to react to accidents and initiate first steps
- Rules for preventative fire protection, describe behavior in case of fire and undertake measures for fire fighting

Environmental Protection

- To contribute in the prevention of work-related environmental pollution, especially
- To be able to explain possible environmental contamination by the training company and its part in environmental protection
- Apply company rules for environmental protection
- Make use of possibilities for economic- and environmentally-friendly materials
- Avoid waste and dispose of materials in an environmentally-friendly way

Technical and organizational communication

- Obtain and assess information for problem solving
- Apply conflict management methods
- Handle computer facilities, software and peripherals
- Save and protect data
- Use standard software, create protocols and reports
- Read and apply part-, group- and total drawings
- Read and apply circuit diagrams of fluids gear and tools
- Read and apply electrical plans, function plans and schemes
- Create drafts and parts lists
- Update technical plans of modules, machines and equipment
- Apply presentation techniques (may be verbal, written, demonstration)

Year 2 OJT

- Explain products and work results at hand-over and work into the functions
  Use company information- and communication systems

Planning & controlling of processes and results

- Determine work steps depending on functional, manufacturing and economic criteria
- Determine criteria for informational and organizational workflow processes
- Order and provide materials and tools
- Prepare machines for the workflow processes
- Prepare tools, machines and measurement and technical equipment for work, check and initiate methods for troubleshooting (checklist, flowchart)

Year 3

- Plan work in a team and delegate tasks
- Plan and arrange work space
- Control and assess own and other's work
- Document materials, spare parts and technical controls

Quality Management

Year 2

- Being Aware of norms and specifications for quality assurance, as well as ensure quality of the tasks
- Assess quality assurance system in connection with technical documents and their efficiency
- Chose measurements and test and document their suitability
- Search for causes in quality deficiencies, eliminate them and document
- Assist in continuous improvement of workflow processes

Material science, material property fundamentals, basic metallurgy principles

Year 1

- Describe characteristics and properties of materials such as plastics, metals, rubber, composites,
- Select appropriate material for specific applications
- Differentiate between grades and types of ferrous and non-ferrous metals
- Identify common heat treat and plating methodologies

Checking, Laying out, Marking

Year 1

- Choose and handle measuring tools to assess lengths, angles and areas
- Measure lengths, keep tolerances and assess accuracy
- Assess areas on smoothness, form accuracy and angularity, and assess surface qualities
- Control surface form and condition of areas under technical requirements
- Marking out work pieces
- Measure angles and check with angle gauges

Manual and automatic turning, cutting and forming

Year 1

- Saw metals, plates and synthetic materials with markings
- File surfaces and shapes of work pieces, angular parallel to length
- Drill holes
- Create male and female threads
- Turning
- Milling
- Assembling
- Doweling
- Soldering--circuit assembly

Year 2

- Create and retain bolted connections in accordance with the sequence of parts and the torque

Year 3

- Welding and brazing

Installation Electric Components

Year 1

- Chose, install, connect and mark components for electrical control and support units
- Wire components and devices in various types of wiring according to documents and samples
- Connect low voltage wiring with correct color code
- Wire code and standards

- Determine number of leads, shields
- Change errors and document

Year 3

- Install and mark components to control, measure and monitor
- Determine cableways through structural and local circumstances (cable routing)
- Chose, set-up and run cables under aspects of electrical charges, uses and transfer categories

Measure & Check electric Components

Year 1

- Select techniques and measurement tools, estimate measurement error and set-up measuring equipment
- Measure Voltage, current, resistance and power in DC and AC circuit and calculate their dependency on each other
- Note, illustrate and evaluate measurements and characteristics, in particular voltage, temperature-and light-dependent resistors
- Examine electrical characteristics of assemblies and components
- Build electrical switches and examine their function
- Soldering--circuit assembly

Installation & Test Hardware & Software Components

Year 1

- Examine hardware and software interfaces, compatibility of Hardware components and system requirements software
- Assemble and connect system components
- Configure hardware, install and adjust software
- Install and configure networks and bus systems
- Examine signals at cutting points, interpret protocols, test systems
- Change software versions
- Document changes in hard- and software

Installation & Test pneumatic & hydraulic Systems

Year 1

- Understand fitting types, standards and uses
- Demonstrate fitting compatibility
- Build and connect pneumatic and fluid circuits
- Connect, test and adjust equipment for supplying electric, pneumatic or hydraulic energy
- Measure and adjust the pressure in fluidic systems

Programming mechatronic Systems

Year 1

- Assign control concepts and select control devices

- Develop electrical and fluidic circuits according to given problems
- Install sensors, actuators, bar code readers and transducers
- Check and adjust the interaction of related functions, limit errors when taking interfaces into account
- Assess control modes in different forms of realization
- Entering and adjust control programs, create and use test programs
- Create application programs for control
- Monitor computer operations in mechatronic systems, determine and eliminate errors

Assembling components to machines & systems

Year 3

- Identify assembly parts and components, as well as check for error-free condition
- Execute preassembly
- Install lubrication and cooling equipment
- Install fluid components, especially cylinders and valves
- Analyze tasks, in particular movements and interactions at the interfaces of the system to be controlled
- Fit assemblies and components, align and secure
- Install sliding and rolling bearings, mount assemblies with moving parts
- Install motors, gears and couplings
- Install and wire switchgear
- Install and wire assemblies for regulating, measuring and monitoring
- Install, adjust and connect sensors
- Analyze tasks, in particular movements and interactions at the interfaces of the system to be controlled
- Examine functions during the assembly operation

Installation of machines & systems

Year 3

- Identify assembly parts and components, as well as check for error-free condition
- Create connections to piping systems for supply and disposal, choose and create transitions
- Install guards, shields, fairings and insulations
- Choose, attach and connect lines and equipment for power distribution equipment and communication technology in compliance with the mechanical and electrical load and the installation method
- Examine nature of the site for the attachment
- Adjust, attach and secure machinery, equipment and support structures to reference variables
- Assess spaces with respect to their environmental conditions and the additional requirements for facilities of a special kind
- Determine protective measures and carry out potential equalization
- Use ladders and scaffolds
- Choose and use hoists, lifting-, and transport equipment

Test and Prepare of function for mechatronic systems

Year 3

- Chose measuring and testing procedures, as well as diagnostics systems, examine electrical signals at cutting points
- Connect signal processing components and check input and output signals
- Check Measuring devices for detecting motion, pressure and temperature
- Check and adjust devices to detect limit values, in particular switches and sensors
- Assess and adjust actuators for safety considerations
- Check measurement, control and monitoring equipment, adjust control parameters
- Adjust nominal values of process-relevant variables, in particular of movements and pressure
- Limit errors of the interfaces with respect to mechanical, fluidic and electrical components by visual inspection, testing and measuring and test systems and test with the help of systematic programs
- Assess and adjust Electric and electronic drive trains
- Evaluate faults and errors for possible causes, evaluate the possibilities of their removal and repair
- Assess and document individual and overall function

Start-up operations of mechatronic systems

Year 3

- Assess protection against direct contact
- Check effectiveness of protective measures, in particular RCD, measure insulation, grounding and loop resistances
- Check mechanical and electric safety devices, especially OFF buttons and notification systems
- Check and put into operation auxiliary and control circuits including associated signaling and control devices for measurement, control and monitoring equipment
- Check primary circuits and put into operation step by step, measure and set nominal value
- Take fluidic devices into operation
- Check and adjust mobility, density, smoothness, rotation frequency, pressure, temperature, and procedural methods
- Check and secure mounting, power supply, lubrication, cooling and waste disposal
- Load and save programs and data, check and adjust program procedures
- Check and put into operation signal transmission systems, in particular field buses
- Put into operation mechatronic systems, execute system check
- Check precautionary measures for electromagnetic compatibility
- Determine system parameters during commissioning, compare to preset standards and adjust
- Evaluate system to performance specification and identify all items that need to be corrected
- Document results from system evaluation
- Operate machines and systems, execute test run with nominal and limit values

Maintenance of mechatronics systems

Year 3

- Inspect mechatronic systems, functions of safety devices and protocol
- Maintain mechatronic systems corresponding to the maintenance and repair plans, exchange wear and tear parts in context with preventative maintenance
- Take out devices and assembly parts, taking into account their function, mark parts regarding to their position and function
- Eliminate disturbances caused by reworking and replacement of parts and assemblies
- Eliminate software errors
- Compare system parameters to nominal values and adjust
- Restore mechatronic systems to original operating state
- Adjust mechatronic systems to changed operating conditions
- Use diagnostic- and warning systems