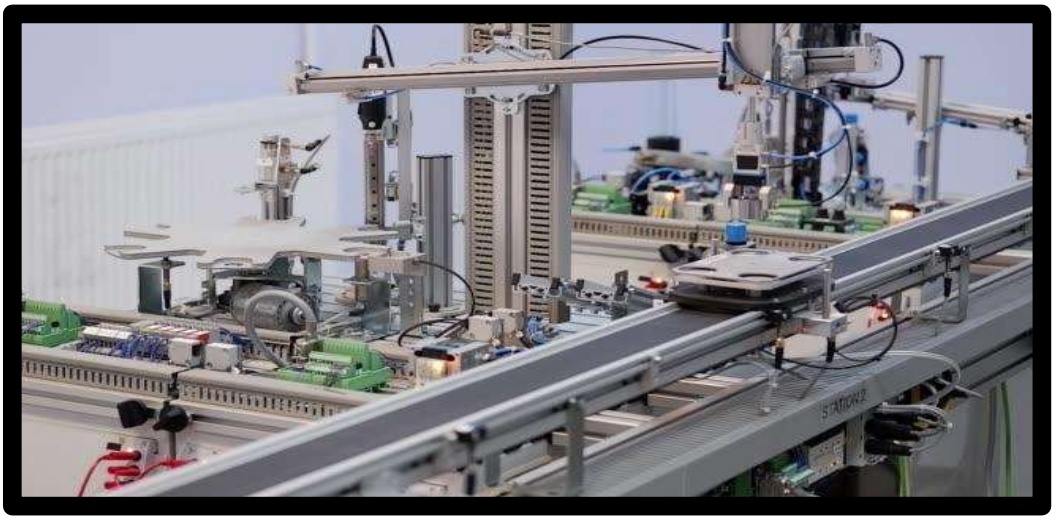
सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय
DEVELOPMENT COMMISSIONER
MINISTRY OF MICRO, SMALL & MEDIUM ENTERPRISES
MSME TECHNOLOGY CENTRE

MODEL CURRICULUM



Qualification Name:

SR. TECHNICIAN -MECHATRONICS

Qualification Code:

Version: 2.0

NSQF Level: 4.5

Model Curriculum Version: 2.0

Submitted By:
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NOS / MODULE: Demonstrate the Application of Sensors and Actuators

NOS / MODULE CODE: MSME/MCCM/01

COURSE OUTCOMES:

After completion of course Student should be able to

- Describe and explain different measurement techniques.
- Explain and demonstrate Mechanical Measuring instruments.
- Classify & describe various Electrical measuring devices.
- Describe applications of smart sensors in various fields.
- Elaborate different types of actuators.

THEORY HOURS: 30 PRACTICAL HOURS: 60 THEORY MARKS: 100 PRACTICAL MARKS:

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	Hours	Marks	Hours
I	SCIENCE OF MEASUREMENT	After completion of unit Student should be able to ● Describe units and standards. ● Discuss errors in measurement. ● Explain characteristics of transducers. ● Classify the transducers	Units and Standards – Calibration techniques –Errors in Measurements – Generalized Measurement System – Static and dynamic characteristics of transducers – Generalized Performance of Zero Order and First Order Systems - Response of transducers to different time varying inputs – Classification of transducers	18	10	5
II	MECHANICAL MEASUREMENTS	After completion of unit Student should be able to ● Describe functioning of different temperature measuring instruments. ● Explain working of different gauges.	Temperature: Filled thermometer – Bimetallic thermometer – monometers – elastic transducers – Bourdon gauge – bellows – diaphragm. Vacuum: McLeod gauge, thermal conductivity gauge – Ionization gauge, flow measurement: orifice, venture, nozzle, pilot tube, turbine flow meter, hot wire anemometer.'	18	20	10
III	ELECTRICAL MEASUREMENTS	After completion of unit Student should be able to ● Explain working of different transducers. ● Differentiate between different transducers. ● List functions of transducers.	Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in Displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.	18	25	15

IV	SMART SENSORS	After completion of unit Student should be able to ● List smart sensors ● Differentiate between smart sensors and others ● Explain Nano sensors. ● Give applications of smart sensors.	Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.	18	20	10
V	ACTUATORS	After completion of unit Student should be able to ● List types of actuators ● Describe the function of each type of actuator. ● Differentiate between mechanical, electrical and other actuators. ● Give applications of each type of actuator.	Definition, need, working, applications. Different types of actuator: Electrical DC motors, series, shunt and compound, Ac single-phase motor, AC poly phase motor, Servomotors, Stepper motors, Linear motors. Hydraulic & Pneumatic actuation system: Linear actuators, its classification, working, construction, applications, Rotary actuators, its classification, working, Mechanical actuation systems, Types of motion, kinematic chains, cams, gear trains, ratchet and pawl, belt and chain drives, bearing fundamentals, Arrangements / working, applications.	18	25	10

NOS / MODULE: Develop Automation Logics using PLC and SCADA

NOS / MODULE: MSME/MCCM/02

COURSE OUTCOMES:

- Understand the relay logic and its working detail.
- Understand about various types of programming languages.
- Describe the techniques used to write a PLC programme in software.
- Explain different types of PLC.
- Explain the hardware components of a PLC.
- Explain PLC programming, installation, operation and maintenance
- Understand the SCADA system and its working detail.
- Explain the hardware and software components of SCADA.
- Explain SCADA different communication protocol.
- Explain SCADA programming, Design, installation, operation and maintenance

THEORY HOURS: 30 PRACTICAL HOURS: 90 THEORY MARKS:--- PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	PR Hours	Marks
I	Introduction	At the end of this unit students should be able to- ● Understand the concept of industrial automation. ● List the advantages and disadvantages of automation. ● Describe different control systems.	Introduction to industrial automation. Advantage of automation. Application of PLC in industrial automation. Overview of different control system.	3	5	5
II	Details of electrical hardware control (manual control)	At the end of this unit students should be able to- ● Understand & draw various electrical symbols. ● Draw and explain one line diagram for different situations. ● List the different field devices. ● Understand the working of field input and output devices.	Introduction to electrical hardware control. Study of electrical symbols and application in one line diagram. Details of field input and output devices.	3	5	10
III	Relay hardware logic control	At the end of this unit students should be able to- ● Explain the working of a relay. ● Describe the construction of a relay. ● Explain the importance of relay. ● Give applications of relay in industrial circuits.	Working principle of relay. Application of actuators in various industrial control circuits	3	10	10
IV	Programming	At the end of this unit students should be able to- ● Demonstrate the hardware configuration of PLC ● Understand the addressing of inputs and outputs in PLC	Programmable logic controller introduction to programmable logic controller. Hardware configuration of PLC Addressing concept of PII PIQ of signal modules.	3	10	15

		• Explain the environment of PLC software.				
3V	Practices with software	At the end of this unit students should be able to- • Demonstrate the software installation • Develop the programme in the PLC with different formats. • Understand the output of a programme. • Use the different internal peripherals of PLC. • Demonstrate the networking of the PLC.	Software installation and application. Introduction to programming language-LAD, FBD, STL. Details of bit, byte, word and memory. Application of block operands-comparator, timer, counter. Interfacing of i/o with signal module. Demo board practice. Networking between profibus PLC and remote PLC	3	10	10
V3I	INTRODUCTION, ROLE OF SCADA IN INDUSTRIAL AUTOMATION	At the end of this unit Student should be able to • Understand the need of SCADA system in automation. • Differentiate between PLC & SCADA. • Describe the application of SCADA system.	Introduction to SCADA. What is industrial automation, advantages of automation, application of programmable logic controller, and need of SCADA system in automation	3	10	5
VII	COMMUNICATION OF SCADA WITH PLC, CREATING PROCESS SCREENS	At the end of this unit Student should be able to • Understand procedure of installing the SCADA software. • Create new application in software. • Work on graphic designer window. • Create and modify graphic display with animation. • Detect the fault in the production system by using the software	Installation of SCADA software, communication drivers for SCADA, creating a new SCADA application, types of projects in SCADA, activate & deactivate a project, working with graphic designer screen, create & edit process picture, Creating & editing graphic display with animation. fault finding systematic fault finding on a production system	3	10	10
VIII	CREATING DATA BASE OF TAGS	At the end of this unit Student should be able to • Understand the details of process tags and internal tags. Apply the LAD programming on SCADA projects. • Use the property setting of tags. • Apply standard and other objects for the graphic design.	Tag management & tag selection dialog box, tag types, create & edit tags, details of process tag, internal tag, and property setting of tags, application of LAD program on SCADA projects. Application of Standard objects, window objects, smart objects.	3	10	10

IX	APPLICATION OF LAD PROGRAM ON SCADA PROJECTS	At the end of this unit Student should be able to ● Create a picture window related to any process. ● Develop multi screens. ● Apply LAD programme to simulate the screen designed. ● Use the different tags in a project.	Use of LAD program, use of input, output & memory tags, creating new picture window, multi screens.	3	10	15
X	CREATING A PROCESS CONTROL WINDOW	At the end of this unit Student should be able to ● Understand the concept of logging system. ● Understand the principles of message system. ● Create on line trend. ● Develop a new system. ● Interface field devices with the SCADA system. ● Simulate the designed SCADA system.	Alarm logging. Principles of message system. Archiving messages. Display message in run time, creating an online trend. Creating & accessing real-time & historical trends. Use of all applications. Simulation of the project. Interfacing of various field devices with SCADA system.	3	10	15

NOS / MODULE: Create & Modify the Electrical circuit diagram using CAD software

NOS / MODULE CODE: MSME/MCCM/03

COURSE OUTCOMES:

- Use the fundamental features and precision drafting tools in Electrical CAD to develop accurate technical drawings.
- Present drawings in a detailed and visually impressive manner.
- Generate and update customizable reports, and use folders to organize drawings.
- Customize the application to meet your specific design in Electrical CAD.
- Interpret drawings, draw interferences and workout other technical details

THEORY HOURS:------ PRACTICAL HOURS: 60 THEORY MARKS: ----- PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR Hours	Marks
I	Introduction Of AutoCAD	At the end of this unit Student should be able to ● Understand Procedure to be adopted for computer aided drawings ● Describe co-ordinate system ● Understand the applications of co-ordinate system ● Use the AutoCAD workspace and user interface.	Introduction to AutoCAD Advantage of AutoCAD. Application of AutoCAD. Co-ordinate System Application of co-ordinate system	10	20
II	Basics of AutoCAD	At the end of this unit Student should be able to ● Optimize commands effectively ● Use more advanced editing and construction techniques. ● Add parametric constraints to objects.	Using Commands for Line, Circle, Arc, Fillet, Mirror, Offset, Array, Tan Tan Radius, Tan Tan Tan, Hatch, Gradient. Designs using AutoCAD	20	30
III	Introduction Of E-CAD	At the end of this unit Student should be able to ● List the steps of Computer aided electrical drawing ● Use the Electrical CAD workspace and user interface. ● Customize the application to meet your specific design in Electrical CAD.	Introduction of E-CAD Advantage of E-CAD Application of E-CAD Software Exploration	15	20
IV	Basics of E-CAD	At the end of this unit Student should be able to ● Draw various electrical circuits using CAD software. ● Build intelligent ladder diagrams and panel layouts. ● Insert and edit parametric PLC modules, nonparametric PLC modules, and Stand-alone PLC I/O points	Toolbars, Tool Pallets, Insert Component, Working With Project Manager, Implement Layers ,Text Wire & Ladder, Trim, Parent-Child Component Discussion, Multiple Wire Bus & Edit Component, Forward Reverse Control Circuit, Star Delta Control Circuit , Star Delta Control Power Circuit, Forward Reverse Control Circuit,	15	30

			Star Delta Control Circuit , Star Delta Control Power Circuit Attribute, Scoot ,Move, Dash-link, Reverse and Flip Schematic Report and insert PLC module in drawing Circuit Designs using E-CAD		

NOS MODULE: Develop Hydraulics & Pneumatics circuit for automation application

NOS / MODULE CODE: MSME/MCCM/04

COURSE OUTCOMES:

After completion of course Student should be able to

- Understanding the basic Hydraulics & Pneumatics system components.
- Draws a basic pneumatic components (compressor, receiver, drain valves, check valves, pneumatic cylinders) and pneumatic circuit diagram with symbols
- Able to understand the working principal and symbolic representation of different energy supply elements.
- Understand hazards of hydraulic and pneumatic circuits and be able to work safely.
- Understand the concepts of Hydraulic and Pneumatic as applied to commercial and industrial control.
- Understand the concepts Electro-Pneumatic and Electro-Hydraulics
- Draw a hydraulic circuit diagram, understand the basic elements. Know the properties of the basic elements used in the hydraulic system.
- Explain types of hydraulic pumps, the basic functions and features

THEORY HOURS: 30 PRACTICAL HOURS: 90 THEORY MARKS: PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	Marks	PR Hours
I	INTRODUCTION TO HYDRAULICS & PNEUMATICS	At the end of this unit Student should be able to ● List different energy supply elements relate to hydraulics & pneumatics. ● Identify the hydraulics & pneumatic power system elements. ● Select appropriate elements / components / symbols for the given process. ● Select different standard elements ● Recommend variation within the standards, symbols. ● Describe the functioning of different elements, systems ● Differentiate between systems	Merits of Fluid power & its utility for increasing productivity through Low Cost Automation, Transmission of Fluid Power through various types of Cylinders), Symbolic representation of Pneumatic elements (CETOP), Compressors and Air supply system including airline installations, Signaling & control system. Introduction to Industrial Hydraulics, Hydraulics Power System elements and standard symbolic Representation (CETOP symbols).	5	20	10
II	CONTROL ELEMENTS	At the end of this unit Student should be able to ● Perform basic mathematical calculation required for cylinder speed. ● Select appropriate Hydraulic Pump ● Describe the functioning of different control valves.	Pneumatic & hydraulic control elements (control valves & hydraulic pumps, accessories), Basic circuits for controlling single & double acting cylinder, Basic circuits, Advantages of Hydro-Pneumatics and its applications, Hydraulics system and their classification.	5	20	20

		● Identify different type of control valves & accessories. ● Discuss applications & advantages of hydro - pneumatic systems				
III	HYDRAULICS & PNEUMATICS BASIC CIRCUITS	At the end of this unit Student should be able to ● Design the conceptual circuit diagram. ● Simulate the circuit diagrams. ● Identify different electrical, pneumatic, hydraulic elements ● Apply logic & creativity to design circuits. ● Analyze the simulation results. ● Communicate the simulation results	Hydraulics circuits Hydraulic Motors, Hydraulic Fluids and effective contamination control. Advanced pneumatic circuits for controlling multi-cylinders (operable & inoperable circuits), Electro pneumatics with relay logic, Application of fluidics a non-moving part logic.	10	20	25
IV	ADVANCED CONTROLS & CIRCUITS	At the end of this unit Student should be able to ● Design the programmable circuit sequence ● Analyze stepper control outputs. ● Explain servo controls applications. ● Design circuits with proportional valves. ● Design cartridge valves.	Programmable sequential control using pneumatic modular elements, Stepper controls. Electro hydraulics system, Servo valves and proportional valves, Design of Cartridge Valves,	5	20	25
V	SAFETY, TROUBLE SHOOTING & REMEDIES	At the end of this unit Student should be able to ● Trouble shoot faults in system, components. ● Follow safety standards. ● Suggest remedy for the fault.	Safety in hydraulics & pneumatics systems, Trouble shooting and remedial measures in Hydraulics & Pneumatics system.	5	20	10

NOS /MODULE: MECHATRONICS TECHNOLOGY

NOS / MODULE CODE: MSME/MCCM/05

COURSE OUTCOMES:

After completion of course Student should be able to

- Understand the Mechatronics kits and its component.
- Understand the interfacing of PLC with robotics.
- Understand the trouble shooting of all the kits.
- Discuss about input outputs of the kits.
- Understand the mechanical set up, electrical connection , pneumatics connection

THEORY HOURS: 30 PRACTICAL HOURS: 60 THEORY MARKS: PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	Marks	PR Hours
I	Mechatronics System and technology	At the end of this unit Student should be able to ● Understand the Mechatronics project kits and its components. ● Understand the mechanical set up, electrical connection, pneumatics connection ● Understand the trouble shooting of all the kits. ● Discuss about input outputs of the kits. ● Understand the interfacing of PLC with robotics. ● Understands the working ,principle and how actually robot is working	Introduction to Mechatronics project kits, mechanical set up, electrical connection , pneumatics connection, commissioning of all the stations, adjustment of pneumatic actuators ,adjustment of sensors, testing the project, trouble shooting of all the kits identification of inputs to the kits identification of outputs to the kits, structural programming of the kit	100	60

COURSES / MODULE TEMPLATE

NOS /Module: Employability Skills

NOS /Module Code: MSME/ES/02

THEORY HOURS: 60 PRACTICAL HOURS: - THEORY MARKS: 100 PRACTICAL MARKS: -

Refer Standard Curriculum developed by NCVET. (60-hours-MC-Employability-Skills_v4-DGT (1).pdf)