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

MODEL CURRICULUM

Qualification Name:

PROCESS DESIGNER – AUTOMATION

Qualification Code:

Version: 2.0

NSQF Level: 5.5

Model Curriculum Version: 2.0

Submitted By:

MSME TECHNOLOGY CENTRE

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COURSES / MODULE TEMPLATE

NOS /Module: Development of Industrial Automation system using PLC, SCADA, HMI & DCS.

NOS /Module Code: MSME/MCCAPC/01

Outcomes:

After completion of course Student should be able to

- Explain about electricity AC & DC.
- Identify the types of switches and design control circuitsfor AC &DC loads
- Develop various control and power circuit for different industrial control logic.
- Understand about different types of control & controlling elements.
- Understand about SLD designs and rules.
- Identify electrical faults in control & power circuit both in three phase &single phase.
- Design relay control logic, different stator for motor control, automation using sensors.
- Install PLC hardware modules & configure communication with programming device.
- Develop PLC program and diagnose different errors.
- Create different automation program using PLC software.
- Connect different sensors or field I/O devices with PLC.
- Explain about SCADA system.
- Configure the communication console parameter between Controller (PLC), with MTU.
- Create a single user and multi user SCADA Project.
- Configure communication between PLC & HMI.
- Explain about DCS system architecture.
- Understand about AS, OS & ES configuration.
- Configure the communication console parameter between AS, ES &OS.
- Create a single user and multi user Project in DCS.
- Connect different sensors or field I/O devices with DCS.
- Create Alarm & Trend reports.
- Diagnose different DCS network errors & modify it.

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

Unit No.	**Unit Name**	**Unit level outcomes**	**Contents (chapters/topics)**	**TH hours**	**PR hours**
Unit I	**Electrical hardware logic control.**	After completion of unit Student should be able to • Explain about SLD design & rules. • Understand about different types of control.	Types of control based on application i.e. Manual Control, Feedback Control, Sequential Control, Motion Control, and Logical Control. Industrial wiring & JIC symbol, IEC symbol. Types of switches		

		• Understand about different electrical, mechanical, electro-mechanical switches. • Design various industrial control wirings using relay logic. • Design automation using sensors & timers.	and design control circuits for AC &DC loads. Different electro- mechanical switching components as: relay, contactor and timer, NO & NC contacts terminology and operation, SLD design. DOL Starter, Panel board wiring of relay and contactors for motor control logic as: start stop, forward reverse. Control and power circuit: 3-ø star-delta starter. Electrical fault monitoring.	**4**	**10**
Unit II	**Programmable Logic Controller (PLC)**	After completion of unit Student should be able to • Understand the process of automation • Install PLC hardware modules & configure communication with programming device. • Develop PLC program and diagnose different errors. • Create different automation program using PLC software. • Connect different sensors or field I/O devices with PLC. • Diagnose different fault and communication error in PLC.	Industrial Automation, different type of automation & control, advantages & dis - advantages, area of application, Levels of automation. Automation in various industrial process & future scopes. Programmable Logic Controller (PLC), types of PLC. Scan cycle, Work Memory, Data memory, PLC hardware modules, communication protocols and gateway. PLC Hardware installation and communication. Diagnosis of communication errors by indication and error-messages. Correction of error. Identify of PLC Hardware and Communicate PLC with PC/LAPTOP system, Installation of PLC software & simulation.PLC-programming software& features, IEC-programming languages as LAD, FBD, and STL.program using bit & block-Operands. Logic Gates, AND, OR, NANAD, NOR, XOR. TIMER,	**4**	**20**

			COUNTER, COMPARATOR blocks, DB, FB & FC block in software. Analog control in PLC, analog sensors and Voltage control method with 0-10v dc I/O signal /Current control method with 4-20 mA DC I/O signal. Connection of I/O field devices in signal I/O of plc. Connection of different sensors & actuators with signal modules. Connection of remote I/O PLC with server PLC using profibus cable. Fault analysis of Profibus / Ethernet network. Multiple users with multiple PLC using Ethernet communication network (LAN).		
Unit III	**Supervisory Control And Data Acquisition (SCADA)**	After completion of unit Student should be able to • Understand the concept of SCADA. • Understand the Functionalities and security features in SCADA architecture. • Explain about SCADA system. • Configure the communication console parameter between Controller (PLC), with MTU. • Create a single user and multi user SCADA Project. • Monitor and control the industrial process using SCADA. • Configure Process Alarm &Trend. • Generate the process report.	Supervisory Control And Data Acquisition system (SCADA).Functionalities and security features in SCADA architecture. SCADA software and driver tools. Types of SCADA projects using software. Graphic designer, tag management, and communication to PLC. New projects, copy of project, activation & deactivation of project. Object Properties of Object Palette & Library. Editing Of Static Properties Style, Flashing, and Display. Use of Standard Color Palette. Configure Controls in Process Pictures. Alarm Logging screen of a process. Archiving Messages. Display Message In Run Time. Online Trend, Table Trend report. Accessing Real-Time & Historical Trends. PC-	**4**	**20**

		• Configure field devices in SCADA System.	Based HMI Interface different field devices with SCADA system & monitoring process values.		
Unit IV	**Human Machine Interface (HMI)**	After completion of unit Student should be able to • Acquire confidence building attitude. • Acquire Personal goal setting.	HMI, types of HMI, installation & configuration. Configuration of HMI and PLC .Upload/ Transfer programs. Different HMI-models as KTP, TP.Configuration between hard ware module & I/O field devices. Fault finding with alarm and system messages,	**4**	**20**
Unit V	**Distributed Control System(DCS)**	After completion of unit Student should be able to • Understand the principle of operation of a range of sensors and transducers used in the Distributed Control System (DCS). • Review the construction and operation of the most important Distributed Control System (DCS). • Design, build and test using a given specification of Distributed Control System (DCS). • Identity components and features of a Distributed Control System (DCS) • Optimize control by using relevant software of Distributed Control System (DCS)	Distributed Control System (DCS), advantages & dis - advantages, area of application, Levels of automation.DCS Automation in various industrial process & future scopes, Identity components and features of a Distributed Control System (DCS). Explain about DCS system architecture. Discuss Process view, object view, plant view. Understand about AS, OS & ES configuration. Plant hierarchy levels in DCS.Configuration of AS, ES and OS Objects. Single-user and Multi -user Project in DCS. CFC Chart& SFC Charts. Motor control faceplate Import /export of projects. Different sensors or field I/O devices interface with DCS.Alarm & Trend reports. Remote user access. Different DCS network errors & modifications.	**4**	**20**

COURSES / MODULE TEMPLATE

NOS /Module: Design and testing of control & power connections of different AC & DC industrial Drives.

NOS /Module Code: MSME/MCCAPC/02

Outcomes:

After completion of course Student should be able to

- Understand about electricity.
- Explain about electrical safety & safety precautions.
- Describe about different electrical parameters.
- Describe about different electrical safety devices.
- Demonstrate different electrical measuring instruments as voltmeter, ammeter, frequency meter, power factor meter, watt meter etc.
- Describe electrical equipment's like motor, transformer.
- Develop electrical wiring for different electrical machines.
- Explain about different types of earthing methods.
- Understand about various electrical domestic appliances & industrial machines maintenance.
- Understand about different types of conventional machines & non –conventional machine maintenance.
- Understand about preventive & breakdown maintenance.
- Explain about types and activities of plant maintenance and Documentary report.
- Explain about different electronic components, applications and advantages.
- Demonstrate to find Source, part inventory repairing, purchasing and cause and factor analysis for all machines.
- Demonstrate Hydraulic power pack, pneumatic compressor, Diesel generator maintenance.

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

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
Unit I	**Basic electrical fundamentals & safety.**	After completion of unit Student should be able to • Understand fundamental concept of electricity. • Work safely while doing electrical work. • Explain about different types of electrical safety equipment's and devices. • Understand about Single phase & three phase system.	Basic fundamental of electricity. Electrical safety rules, safety precaution kit and tools. PPE in Industrial Safety. Common hand tools. Basic injury prevention, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety. Electrical shock and its effect, effect of electrical current on human being, method of avoiding electrical shock, first aid for victim of electric shock. Nature of electricity and	**6**	**15**

			fundamental laws. Single phase & three phase system. Different types of electrical safety fuses. Earthing methods. Electrical protective devices as MCB, MCCB, RCCB, ELCB, OLR, MPCB etc.		
Unit II	**Measuring instruments for electrical parameters**	After completion of unit Student should be able to • Understand the Use of measuring instruments for measurement of electrical parameters •Perform electrical wiring • Fault measuring	Measuring instrument for electrical parameters as voltmeter, ammeter, frequency meter, power factor meter, watt meter, lux meter, tacho meter, clamp meter, anemometer, flux meter. Meggering methods, earthing test.cable test. Insulation testing, body short circuit testing.	**6**	**15**
Unit III	**Introduction To Electrical Machines.**	After completion of unit Student should be able to • Understand the concept of single phase & three phase transformer. • Understand DOL-starter, auto starter, star delta starter, three phase induction motor • Start of three phase induction motor by DOL-starter, auto starter, star delta starter, • Understand the Three phase induction motor routine test. Testing block rotor of single phase and three phase induction motor	Types of electrical motors, classifications, applications. Construction and working principle of a single phase & three phase transformer. Transformation ratio (step up, step down, isolation), polarity test, short circuit test, open circuit test.construction & working principle of single phasemotor. Test Single phase induction motor routine test of capacitor start & run, permanent capacitor start & run. Method of staring an induction motor. Construction & working principle of three phase induction motor. Start of three phase induction motor by DOL-starter, auto starter, star delta starter, three phase induction motor routine test. Testingblock rotor of single phase and three phase induction motor. Working	**9**	**15**

			of watt meter to measure power for different load. Power Measurement by two wattmeter method of three phase resistive load, inductive load. Construction & working of DC shunt & series motor. DC series motor, shunt motor routine test.Load and no load characteristics DC series, shunt generator. Method of speed control of motors. Different motors by varying the speed with load condition. Speed control of series motor by field diverter method & voltage control method. Speed control of DC shunt motor by voltage control & field control. Run of alternator, induction start synchronous run brushless dc motor, repulsion motor, synchronous motor with external dc source.		
Unit IV	**Variable Frequency Drive.(VFD)**	After completion of unit Student should be able to • Understand the Frequency control method. • Understand Parameter structure and quick commissioning procedure of AC& DC drive. • Demonstrate various drive parameters & expert list. • Demonstrate Drive data and Command data sets, Ramp UP & Ramp down Time. • Drive Fault diagnostics, troubleshooting.	Basic fundamental of VFD, AC drive & DC drive Frequency control method. Inverter principle, PWM technique and power switching devices, vector control. Different control terminals. Specifications, range, features and hardware details. Parameter structure and quick commissioning procedure & motor id run.BICO technology, working with programmable binary and analog I/O. Drive data and Command data sets, Ramp UP & Ramp down Time. Various drive parameters & expert list. Details of Ramp Function Generator, Speed Controller, and Current & Torque Limiter. Analog Set point & Local mode	**9**	**15**

			of operation. Local mode of Operation through Locally Operated Control Panel. Motor-Operated from Potentiometer, Binary Weighted Potentiometer, and Fixed Set point. Jog Forward & Jog Reverse Operation through Local Control. Different types of CDS & DDS, Control & Status words. Types of Parameterization, command word settings. Monitoring of actual motor Status, Speed, Current, Torque & Power, and Temperature etc. Various types of Fault Codes, Error messages, diagnostics, troubleshooting.		

COURSES / MODULE TEMPLATE

NOS /Module: Development of Industrial Automation system using Pneumatics & Hydraulics system

NOS /Module Code: MSME/MCCAPC/03

Outcomes:

After completion of course Student should be able to:

- Understand about the Pneumatics system & Hydraulic System.
- Explain about the basic Pneumatics & Hydraulic controlling equipment and its use.
- Understand Electro-Pneumatics & Electro-Hydraulics controlling equipment and its use.
- Explain about the Purpose of fluids and Basic controlling equipment used in hydraulics.
- Explain the use of different valves & actuation method's.
- Explain about different types of Pneumatics and Hydraulics Actuators.
- Understand the actuation techniques of cylinders.
- Demonstration on Hydraulics and check the quality requirements of oil.
- Demonstrate and mark internal parts of a Power pack/Compressor and its related equipment.
- Explain various operations performed on pneumatic & Hydraulic in industrial controls/machines.
- Design various circuits by using different valves, for industrial control.
- Explain about hydraulics &pneumatics maintenance.

Theory Hours: - **Practical Hours: - 60** **Theory Marks: -** **Practical Marks: -100**

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	PR hours
UNIT-I	**Introduction of Pneumatics system.**	At the end of this Unit the student should be able to: • Understand about Pneumatics system. • Understand about the different symbolic representation of pneumatic equipment's. • Understand about the pressure Measurement by different pressure gauges. • Understand about the various different parts of air generation & preparation unit. • Understand about the various different parts of air consuming unit. • Understand about the various different valves and their different actuation process • Understand about the pneumatic linear actuators and Rotary actuators • General maintenance of compressor.	Introduction of Pneumatic system, Advantages & Limitations of pneumatic system applications. Safety precaution in pneumatic operations. Pneumatics Basic controlling equipment, ISO symbols, air generation & preparation unit compressor& dryer. Gauge pressure, atmospheric pressure, absolute pressure. Different pressure gauges (Digital and Analog type), FRL.Tubes & fittings, Pneumatic converters, reducers, DC-valves as 3/2 and 5/2, Flow control valve, throttle valve ,suttle valve, two pressure valve, logic valve Pressure Control Valves ,Combination Valve, Pressure Control Valves. Pressure relief valve, quick exhaust valve. Pneumatic linear actuators and Rotary actuators SAC, DAC. Pneumatic Industrial Control Logic & Operations. General maintenance of compressor.		10
UNIT-II	**Introduction of Electro-Pneumatics system.**	At the end of this Unit the student should be able to: • Understand about electro-Pneumatics system. • Understand about the different symbolic representation of electro -pneumatic equipment's & electrical control.	Introduction of Electro Pneumatic system, Advantages & Limitations of Electro -pneumatic system applications. Safety precaution in electro-pneumatic operations. Electro- Pneumatics Basic controlling equipment,		10

		• Understand about the AC & DC supply. • Understand about the various different parts of electro -pneumatic system. • Understand about push button, selector, limit switch, sensors, reed switches application. • Understand about the RELAY & solenoid actuation. • Understand about the solenoid actuated pneumatic valves. • Understand about the pc based communication through OPC SERVER. • Understand about the pc based communication through PLC with electro-pneumatic system.	electrical switches, push button, selector switch, limit switch, pressure sensor,Idcutive,Capacitive,Optical Sensor, Reed switch, timer, Solenoid actuated DC-valves as 3/2 and 5/2, pneumatic linear actuators and Rotary actuators SAC, DAC. Pneumatic Industrial Control Logic & Operations.PLC-Communication & application in electro-pneumatic system. Opc –server communication with pc based control.		
UNIT-III	**Introduction of hydraulics system.**	At the end of this Unit the student should be able to: • Understand about hydraulic system. • Understand about the different symbolic representation of hydraulic equipment's. • Understand about the hy draulic pressure Measurement by different manometers. • Understand about the various different parts of power pack unit. Selection of hydraulic oil. • Understand about the various different parts of air consuming unit. • Understand about the various different hydraulic	Introduction of hydraulics system, Advantages & Limitations of hydraulics system applications. Safety precaution in hydraulics operations. Hydraulics Basic controlling equipment, oil pressure generation, power pack unit, Hose pipes & fittings, types of seals, leakage. Pump, Oil pressure, ISO symbols of valves, filters and their application, check valves, DC-valves as 2/2, 4/3, 4/2 and 5/2. Flow control valve, throttle valve, Pressure Control Valves, and Pressure Control Valves. Pressure relief valve, hydraulics linear actuators and Rotary actuators SAC, DAC.		20

		valves and their different actuation process • Understand about the hydraulic linear actuators and Rotary actuators. • General maintenance of hydraulic system.	Hydraulics Industrial Control Logic & Operations. General maintenance of power pack, seals, filters & hose pipes, oil check.		
UNIT-IV	**Introduction of Electro-hydraulic system.**	At the end of this Unit the student should be able to: • Understand about electro-Hydraulics system. • Understand about the different symbolic representation of electro - Hydraulics equipment's & electrical control. • Understand about the various different parts of electro - Hydraulics system. • Understand about the solenoid actuated Hydraulics valves. • Understand about the pc based communication through OPC SERVER. • Understand about the pc based communication through PLC with electro-Hydraulics system.	Introduction of electro - Hydraulics system, Advantages & Limitations of electro - Hydraulics system applications. Safety precaution in electro-Hydraulics operations. Electro- Hydraulics controlling equipment, electrical switches, push button, selector switch, limit switch, pressure sensor,Idcutive,Capacitive,Optical Sensor, Reed switch, Timer, Solenoid actuated DC-valves as 2/2,4/3, 4/2 and 5/2, electro - Hydraulics linear actuators and Rotary actuators SAC, DAC. Electro - Hydraulics Industrial Control Logic & Operations.PLC-Communication & application in electro - Hydraulics system. Opc –server communication with pc based control.		20

COURSES / MODULE TEMPLATE

NOS /Module: Design and development Process Automation as Flow control, Temp control, Level control, Pressure control with PID.

NOS /Module Code: MSME/MCCAPC/04

Outcomes:

After completion of course Student should be able to

- Explain about Explain briefly types of control based on application.
- Explain about Open loop control, Close loop control, Cascade control, Ratio control.
- Design of P & ID Flow Diagram
- Identify the types of switches and design control circuitsfor AC &DC loads
- Develop various control and power circuit for different industrial control logic.
- Design relay control logic, different stator for PUMP control, automation using sensors.
- Introduction Electro pneumatic. Overview on different types of valve direction control, flow control,
- Conditional valve by using electrical signal.
- Install PLC hardware modules & configure communication with programming device.
- Develop PLC program and diagnose different errors.
- Connect different sensors or field I/O devices with PLC.
- Explain about HMI system.
- Configure the communication console parameter between Controller (PLC), with MTU.
- Configure communication between PLC & HMI.
- Design PID program for temperature, flow, pressure& level in controller.
- Demonstrate P, PI &PID control methods using simulation kit.
- Demonstrate the configuration of Iot interface using raspberry pi.

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

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
Unit I	**PROCESS AUTOMATION**	After completion of unit Student should be able to • Explain about SLD design & rules. • Explain about different types of control. • Explain about different electrical, mechanical, electro-mechanical switches. • Design various industrial control wirings using relay logic. • Perform PLC &HMI Communication & driver configurations.	•Introduction about process Automation. Levels of automation. •Explain about Types of automation. Tools of automation as PLC, SCADA, HMI & Electro-Pneumatic system. •Opc server communication •Installations of different kind of flow control valves ,Pressure control valves, DC Valves, solenoid valves,	**5**	**10**

		• Install of different kind of flow control valves, Pressure control valves, DC Valves, solenoid valves. • Design Electro-Pneumatic system.	• Types of control based on application i.e. Manual Control • Feedback Control, Sequential Control, Motion Control, and Logical Control. • PLC & HMI configuration • Opc server communication • Design Electro-Pneumatic system. • Develop process automation program in plc software.		
Unit II	**SENSORS**	• Explain about different types of sensors. • Measuring & Control, Characteristics different sensors. • Install different sensors with controller in an automation process.	•Different measuring properties & types of sensors •Study of strain measurement and cantilever assembly. •Study of load cell, Piezoelectric sensor, IR sensor, IC temperaturesensor (LM 35) •Photoconductive cell (LDR),Photodiode phototransistor •IR receiver and transmitter sensor, IR Led with TSOP1738 IR •L.V.D.T., Gas sensor, Hall effect sensor, Alcohol sensor •Colour sensor on LCD, Limit switch, Capacitive, optical and Inductive sensor, Opto-coupler sensor, Magnetic Reed Switchsensor, Smoke Sensor, Fire sensor, Diode (1N4007) ,AD590 Temperature sensor •Level sensor(ultrasonic) , Flow sensor, Pressure sensor & Temperature sensor-RTD, •Measurement of electrical quantity, Voltmeter, ammeter, frequencymeter, Power factor meter, watt meter, tachometer User interface and setting preferences, Clamp meter, multi meter.	**10**	**20**

Unit III	**Process Control**	After completion of unit Student should be able to • Explain about P & ID Flow Diagram & rules. • Perform different types of control. • Demonstrate loop control, Close loop control, Cascade control, Ratio control. mechanical switches. • Design P, PI &PID Control in Closed loop. • Design automation using sensors & timers. • Measuring & Control, Characteristics of Level, Flow, Pressure & Temperature.	•Introduction about process control. •Identification of different Assembly components, Assembly and commissioning ,Study of P & ID Flow Diagram •Types of control based on application i.e. Manual Control • Feedback Control, Sequential Control, Motion Control, and Logical Control. • Explain about process control, P, PI &PID control methods. • Explain about Open loop control, Close loop control, Cascade control, Ratio control. • P&ID FLOW DIAGRAM, Measuring & Control, Fill level, Flow & Pressure Control with P& PID, Level Control using 2Pkt, P& PID • Measuring & Control, Characteristics of Level, Flow, Pressure & Temperature, Closed loop Control using 2Pkt and Continues Process. • Measuring & Control ,Characteristics of Level, Flow, Pressure & Temperature, Closed loop Control using 2Pkt and Continues Process(using P, PI, PI(Math), PD, PID)	**10**	**20**
Unit IV	**INTERNET OF THINGS (IOT)**	•After completion of unit Student should be able to •Explain about industry 4.0 •Insllation of different drivers and tools for Arduino. •Design Basic python programming. •Installation of raspberry pi	• Introduction to IOT • Interaction with controller like arduino,nodemcu • Connection of sensors, wifi module with controller • Cloud system like thinkspeak,thinker i/o utilization • Basics of python and raspberry pi	**5**	**10**

		•Demonstrate the configuration of Iot interface using raspberry pi.			

COURSES / MODULE TEMPLATE

NOS /Module: Develop Programme for industrial Robot & Cobot.

NOS /Module Code: MSME/MCCAPC/05

Outcomes:

After completion of course Student should be able to:

- Understand about the Pneumatics system & Hydraulic System.
- Explain about the basic Pneumatics & Hydraulic controlling equipment and its use.
- Understand Electro-Pneumatics & Electro-Hydraulics controlling equipment and its use.
- Explain about the Purpose of fluids and Basic controlling equipment used in hydraulics.
- Explain the use of different valves & actuation method's.
- Explain about different types of Pneumatics and Hydraulics Actuators.
- Understand the actuation techniques of cylinders.
- Demonstration on Hydraulics and check the quality requirements of oil.
- Demonstrate and mark internal parts of a Power pack/Compressor and its related equipment.
- Explain various operations performed on pneumatic & Hydraulic in industrial controls/machines.
- Design various circuits by using different valves, for industrial control.
- Explain about hydraulics &pneumatics maintenance.

Theory Hours: -30 Practical Hours: - 30 Theory Marks: - Practical Marks: -100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH Hours	PR hours
UNIT-I	**Introduction of robot**	At the end of this Unit the student should be able to: • Explain about INDUSTRIAL ROBOT. • Explain Robot anatomy • Measure working limit of an axis • Demonstrate Manipulation of the Robot in Cartesian Co-ordinate & world-coordinate System.	History & evolution of INDUSTRIAL ROBOT. Robot anatomy - Anatomy, Links, joints and joint notation scheme • Explain types of mechanical joints, progressive advancement, types of robot configurations, Robot's working limit. • Explain SAFETY of industrial robot. Robotics and scope. • Demonstrate mechanical joints, configurations, working limit, degree of Freedom. • Demonstrate Manipulating the Robot, Measurement of angular limits of Robot.	7	7

			• Demonstrate Manipulation of the Robot in Cartesian Co-ordinate & world-coordinate System. • Explain plant layout design for industrial Robot application & Work space		
UNIT-II	**Introduction of calibration(tool&base)**	At the end of this Unit the student should be able to: • Demonstrate Robot Tool Calibration	• Explain about base calibration. • Explain about tool calibration. • Demonstrate Robot Base Calibration. • Demonstrate Robot Tool Calibration • Explain about teach pendant • Programming keys. safety buttons are provided on the teach pendant: Hold key, Dead man switch, and the Emergency stop button	7	7
UNIT-III	**Introduction of motion programing**	At the end of this Unit the student should be able to: • Demonstrate Motion Programming using LOOPS and INTERRUPTS • Demonstrate Robot Motion Programming using Profiles • Demonstrate Automatic Operation of Industrial Robots • Demonstrate Robot Motion programming Using Logical Commands.	• Explain about Point to Point (PTP) & Linear (LIN) Robot Motion Programming. • Demonstrate Point to Point (PTP) & Linear (LIN) Robot Motion Programming. • Explain about Circular (CIRC) Robot Motion Programming. • Demonstrate Circular (CIRC) Robot Motion Programming. • Explain Robot Motion Programming using Profiles. • Demonstrate Robot Motion Programming using Profiles. • Demonstrate Motion Programming using Custom Tool and Base. • Demonstrate Motion Programming using LOOPS and INTERRUPTS. • Demonstrate Automatic Operation of Industrial Robots • Explain & Demonstrate Robot Motion programming Using Logical Commands.	7	7
UNIT-IV	**Introduction of mastering**	At the end of this Unit the student should be able to: • Mastering the manipulator. • Demonstrate different mechanical positions of axis.	• Explain about mechanical position of motor and the sensors electronic position of the robot are aligned. • Moving axes to the pre-mastering position	9	9

			• Explain about how to master all the axis of robot using EMD and understood. • Explain about why mastering is required for robots.		

COURSES / MODULE TEMPLATE

NOS /Module: Create and modify electrical circuit diagram, estimation & data linking using Ecad software.NOS /Module Code: MSME/MCCAPC/06

Outcomes:

After completion of course Student should be able to

- Explain the application of engineering drawing.
- Construct orthographic Projections giving proper dimensioning with title block using appropriate line type and scale for any geometrical figure in Auto CAD
- Explain various drawing Equipment's.
- Understand of Engineering Dimensioning method and their application
- Distinguish between Isometric view and Isometric projections.
- Explain about GD&T
- Create 2D geometric sketches by using Auto CAD Software
- Develop 3D modeling by using advanced command
- Understand design generative & interactive drafting
- Understand Electrical SLD design.
- Develop various type of motor-stator control design.
- Explain about HT& LT power lines with design.
- Understand & development of electrical wiring for industrial machines.
- Develop various type of industrial Electrical panels wiring design.

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

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
Unit-I	Introduction to auto cad	At the end of this Unit the student should be able to: • Understand CAD software.	Capability of Auto Cad, Starting AUTOCAD ,Various Visualization commands, Documentation Quick	-	

		• Capability of Auto CAD • Use of various Visualization command • Documentation Quick tour • Create and Access documentation • Layout and plotting	tour, Creating and Accessing documentation, Layout and plotting, Concept of software, Design criteria, Geometric modeling, entities, 2D & 3D Primitives. Different Types of cad software. Also comparison of various CAD Software. CAD software features..		5
Unit-II	Editing methods and controlling drawing display	At the end of this Unit the student should be able to: • AUTOCAD & interface • Setting new drawing. • Accessing command • Opening & saving existing file & function keys etc. • Work with Co-ordinates system and their type • Drawing Line, curve objects (Circle, Arc, Ellipse, elliptical arcs,) • Create solid filled areas-Regions, Hatch, Dot-nut, DD type	Create the replica of model using copy, array, Work with models in the modify toolbar, Work with Erase, Trim, Break, Break at point, Create mirror, fillet & chamfer, Execute dimensions through dimension style option Understand of design intent & edit the design intent, Identify Sketch Entities line arc, rectangle, circle etc., Use sketch settings, Use of Style toolbar (text style, Multilayer style etc.),Concept of creating single entity object, Perform Revision cloud and wipe out command	-	10
Unit-III	Layer management	At the end of this Unit the student should be able to: • Edit objects using the object property tool bar and various method • Adjusting snap & Grid alignment using Ortho mode • Use object snap and object tracking methods. • Understand the concept and use of layers • Work with Layer	Edit objects using the object property tool bar and various method, Concepts of layers, Create the layers by various line property., Extract the layers from the saved file by design Centre option, Application of layers on/off, Use of layers for block, text, dimension, freeze, lock. Work with snap & Grid alignment using Ortho modes, Define Attributes for variable text of block, Use of purge to eliminate the unused layers, blocks, Create title block using table option.	-	7

Unit-IV	Basic Dimensioning , Geometric dimensioning & Tolerance.	At the end of this Unit the student should be able to: • Need for Dimension • Detailed discussion on Dimensioning and tolerance method in AUTOCAD • Edit method • Add text with various engineering symbols • Concept of block, formation of block, Attribute definition • DD attribute and edit block • Insert, Modify, renaming block	Use of linear dimensioning (Linear, Align, Ordinates), Use of circular dimensioning (Radius, Diameter, Arc length), Create Baseline dimension & continuous dimensions for linear & angular dimension. Identify the appropriate Tool to create and modify the model, Add text with various engineering symbols, Deform the object by scale, lengthen, stretching, extend, Change the orientation of the object by align, offset, rotate, Concept of standard dimension, Use of angular dimension, Use of leader with text, block reference, concepts of Block, create the Block, Write block & extract the block from saved block.	-	6
Unit V	Getting started with 3d & Working in 3d space"	At the end of this Unit the student should be able to: • Concept of Isometric Drawing, axes and planes • Defining the paper setting • View ports • Overview of 3D model • Solid modeling in AutoCAD • Surface modeling in AutoCAD	Concept of Isometric Drawing, axes and planes, so-circle, Defining the paper setting ,Overview of 3D model, Solid modeling in AutoCAD(creating technique),Solid modeling in AutoCAD(editing and modification technique),Solid modeling in AutoCAD(editing and modification technique), Surface modeling in AutoCAD(creating, editing and modification technique),Converting wire frame models in to surface mode , Use of Sweep, Loft, and Press pull. 3d Move, 3d Rotate, 3d Array, 3d Align.	-	6

Unit VI	Electrcal CAD	After completion of unit Student should be able to • Explain applications and advantages electrical CAD. • Understand and explain difference between Drawing and Engineering Drawing. • Demonstrate and explain various Drawing options in software. • Understand and demonstrate method of dimensioning. • Understand electrical control ckt & power ckt design. • Understand about HT & LT lines representation in SLD using multicolor, multi buses.	AutoCAD Electrical software Workspace Awareness, Tool Bars, Tool Pallets, Insert component working with project manager. Overview about relay, contactor, timer and old. Drafting features-copy, move, delete, scoot, align, link component, attribute reverse/ flip component, retag and update component. Create For/Rev Control circuit ,power circuit diagrams,SLD Presentation, various electrical motor stator design, Multibus, wire number, wire color, wire size, wire labeling, and overview on HT & LT Lines, grids. Develop PLC- I/O positioning, symbol macro, report generation.	-	20
Unit VII	E PLAN	After completion of unit Student should be able to • Understand to design the various types of electrical panel. • Understand the wiring standard of industrial panels. • Understand to design various electrical HT & LT Panels as per power ratings.	Introduction to EPLAN Software, Panel design of F-R, A-D, panel design of F-R with S-D, schematic and panel report generation, export data to excel format. Representation of all dimensions and specifications of panel in drawing.	-	7

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)