



**MASTER CERTIFICATE COURSE IN  
MECHATRONICS  
(MCCM)**



**curriculum**

**Ministry of Micro, Small and  
Medium Enterprises, New Delhi  
(MSME-Technology Centre)**

### Attachment 3: Curriculum document

SEMESTER: I

COURSE NAME: PROGRAMMABLE LOGIC CONTROLLER

COURSE CODE:

COURSE OUTCOMES:

- Understand the relay logic and its working detail.
- Understand about various types of programming languages.
- Describe the techniques used to write a programme in software.
- Explain the hardware components of a PLC.

THEORY HOURS: 40

PRACTICAL HOURS: 100

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks
I	Introduction	At the end of this unit students should be able to- <ul style="list-style-type: none"><li>• Understand the concept of industrial automation.</li><li>• List the advantages and disadvantages of automation.</li><li>• Describe different control systems.</li></ul>	Introduction to industrial automation. Advantage of automation. Application of plc in industrial automation. Overview of different control system.	5	5
II	Details of electrical hardware control (manual control)	At the end of this unit students should be able to- <ul style="list-style-type: none"><li>• Understand &amp; draw various electrical symbols.</li><li>• Draw and explain one line diagram for different situations.</li><li>• List the different field devices.</li><li>• Understand the working of field input and output devices.</li></ul>	Introduction to electrical hardware control. Study of electrical symbols and application in one line diagram. Details of field input and output devices.	5	5
III	Relay hardware logic control	At the end of this unit students should be able to- <ul style="list-style-type: none"><li>• Explain the working of a relay.</li><li>• Describe the construction of a relay.</li></ul>	Working principle of relay. Application of actuators in various industrial control circuits	10	5

		<ul style="list-style-type: none"> <li>• Explain the importance of relay.</li> <li>• Give applications of relay in industrial circuits.</li> </ul>			
IV	Programming	<p>At the end of this unit students should be able to-</p> <ul style="list-style-type: none"> <li>• Demonstrate the hardware configuration of PLC</li> <li>• Understand the addressing of inputs and outputs in PLC</li> <li>• Explain the environment of PLC software.</li> </ul>	<p>Programmable logic controller introduction to programmable logic controller.  Hardware configuration of plc  Addressing concept of PII PIQ of signal modules.</p>	10	15
V	Practices with software	<p>At the end of this unit students should be able to-</p> <ul style="list-style-type: none"> <li>• Demonstrate the software installation</li> <li>• Develop the programme in the PLC with different formats.</li> <li>• Understand the output of a programme.</li> <li>• Use the different internal peripherals of PLC.</li> <li>• Demonstrate the networking of the PLC.</li> </ul>	<p>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</p>	10	30

SEMESTER: I

COURSE NAME: SCADA

COURSE CODE:

COURSE OUTCOMES:

- Understand functional relationships in mechatronic systems.
- Understand energy flow in electrical, pneumatic and hydraulic sub-systems.
- Plan and organize work flow
- Commission, troubleshoot and repair mechatronic systems

THEORY HOURS: 20

PRACTICAL HOURS: 80

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks	
I	INTRODUCTION, ROLE OF SCADA IN INDUSTRIAL AUTOMATION	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• Understand the need of SCADA system in automation.</li><li>• Differentiate between PLC &amp; SCADA.</li><li>• Describe the application of SCADA system.</li></ul>	Introduction to SCADA. What is industrial automation, advantages of automation, application of programmable logic controller, and need of SCADA system in automation	6	5	
II	COMMUNICATION OF SCADA WITH PLC, CREATING PROCESS SCREENS	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• Understand procedure of installing the SCADA software.</li><li>• Create new application in software.</li><li>• Work on graphic designer window.</li><li>• Create and modify graphic display with animation.</li><li>• Detect the fault in the production system by using the software</li></ul>	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	12	10	
III	CREATING DATA BASE OF TAGS	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• Understand the details of process tags and internal tags.</li><li>• Apply the LAD programming on</li></ul>	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.	12	10	

		<p>SCADA projects.</p> <ul style="list-style-type: none"> <li>• Use the property setting of tags.</li> <li>• Apply standard and other objects for the graphic design.</li> </ul>			
IV	APPLICATION OF LAD PROGRAM ON SCADA PROJECTS	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>• Create a picture window related to any process.</li> <li>• Develop multi screens.</li> <li>• Apply LAD programme to simulate the screen designed.</li> <li>• Use the different tags in a project.</li> </ul>	Use of LAD program, use of input, output & memory tags, creating new picture window, multi screens.	20	15
V	CREATING A PROCESS CONTROL WINDOW	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>• Understand the concept of logging system.</li> <li>• Understand the principles of message system.</li> <li>• Create on line trend.</li> <li>• Develop a new system.</li> <li>• Interface field devices with the SCADA system.</li> <li>• Simulate the designed SCADA system.</li> </ul>	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.	30	20

SEMESTER: I

COURSE NAME: COMPUTER AIDED DESIGN

COURSE CODE:

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: 120

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks	
I	Introduction Of AutoCAD	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• Understand Procedure to be adopted for computer aided drawings</li><li>• Describe co-ordinate system</li><li>• Understand the applications of co-ordinate system</li><li>• Use the AutoCAD workspace and user interface.</li></ul>	Introduction to AutoCAD Advantage of AutoCAD. Application of AutoCAD. Co-ordinate System Application of co-ordinate system	20	9	
II	Basics of AutoCAD	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• Optimize commands effectively</li><li>• Use more advanced editing and construction techniques.</li><li>• Add parametric constraints to objects.</li></ul>	Using Commands for Line, Circle, Arc, Fillet, Mirror, Offset, Array, Tan Tan Radius, Tan Tan Tan, Hatch, Gradient. Designs using AutoCAD	20	9	
III	Introduction Of E-CAD	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• List the steps of Computer aided electrical drawing</li><li>• Use the Electrical CAD workspace and user interface.</li><li>• Customize the application to meet your specific design in Electrical CAD.</li></ul>	Introduction of E-CAD Advantage of E-CAD Application of E-CAD Software Exploration	30	12	
IV	Basics of E-CAD	At the end of this unit Student should be able to	Toolbars, Tool Pallets, Insert Component,	50	30	

		<ul style="list-style-type: none"> <li>• Draw various electrical circuits using CAD software.</li> <li>• Build intelligent ladder diagrams and panel layouts.</li> <li>• Insert and edit parametric PLC modules, nonparametric PLC modules, and Stand-alone PLC I/O points</li> </ul>	<p>Working With Project Manager, Implement Layers ,Text</p> <p>Wire &amp; Ladder, Trim, Parent-Child Component Discussion, Multiple Wire Bus &amp; Edit Component, Forward Reverse Control Circuit, Star Delta Control Circuit , Star Delta Control Power Circuit, Forward Reverse Control Circuit, 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</p>			
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SEMESTER: I

COURSE NAME: SENSORS AND ACTUATORS

COURSE CODE:

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: 60

PRACTICAL HOURS: 80

THEORY MARKS: 60

PRACTICAL MARKS: 50

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks	
I	SCIENCE OF MEASUREMENT	After completion of unit Student should be able to <ul style="list-style-type: none"><li>• Describe units and standards.</li><li>• Discuss errors in measurement.</li><li>• Explain characteristics of transducers.</li><li>• Classify the transducers</li></ul>	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	12	12	
II	MECHANICAL MEASUREMENTS	After completion of unit Student should be able to <ul style="list-style-type: none"><li>• Describe functioning of different temperature measuring instruments.</li><li>• Explain working of different gauges.</li></ul>	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.'	12	12	



III	ELECTRICAL MEASUREMENTS	<p>After completion of unit Student should be able to</p> <ul style="list-style-type: none"> <li>• Explain working of different transducers.</li> <li>• Differentiate between different transducers.</li> <li>• List functions of transducers.</li> </ul>	<p>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.</p>	12	12	
IV	SMART SENSORS	<p>After completion of unit Student should be able to</p> <ul style="list-style-type: none"> <li>• List smart sensors</li> <li>• Differentiate between smart sensors and others</li> <li>• Explain Nano sensors.</li> <li>• Give applications of smart sensors.</li> </ul>	<p>Radiation Sensors - Smart Sensors - Film sensor, MEMS &amp; Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.</p>	12	12	
V	ACTUATORS	<p>After completion of unit Student should be able to</p> <ul style="list-style-type: none"> <li>• List types of actuators</li> <li>• Describe the function of each type of actuator.</li> <li>• Differentiate between mechanical, electrical and other actuators.</li> <li>• Give applications of each type of actuator.</li> </ul>	<p>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 &amp; 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.</p>	12	12	

SEMESTER: I

COURSE NAME: INDUSTRIAL HYDRAULICS & PNEUMATICS

COURSE CODE:

COURSE OUTCOMES:

After completion of course Student should be able to

- Understanding the basic Hydraulics & Pneumatics system components.
- Identify, formulate, and develop solution for specific problems.
- Discuss solutions with team.
- Able to understand the working principal and symbolic representation of different energy supply elements.

THEORY HOURS: 60

PRACTICAL HOURS: 60

THEORY MARKS: 60

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks	
I	INTRODUCTION TO HYDRAULICS & PNEUMATICS	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• List different energy supply elements relate to hydraulics &amp; pneumatics.</li><li>• Identify the hydraulics &amp; pneumatic power system elements.</li><li>• Select appropriate elements / components / symbols for the given process.</li><li>• Select different standard elements</li><li>• Recommend variation within the standards, symbols.</li><li>• Describe the functioning of different elements, systems</li><li>• Differentiate between systems</li></ul>	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).	12	12	
II	CONTROL ELEMENTS	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• Perform basic mathematical calculation required for cylinder speed.</li><li>• Select appropriate Hydraulic Pump</li><li>• Describe the functioning of different control valves.</li></ul>	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.	12	12	

		<ul style="list-style-type: none"> <li>Identify different type of control valves &amp; accessories.</li> <li>Discuss applications &amp; advantages of hydro -pneumatic systems</li> </ul>				
III	HYDRAULICS & PNEUMATICS BASIC CIRCUITS	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>Design the conceptual circuit diagram.</li> <li>Simulate the circuit diagrams.</li> <li>Identify different electrical, pneumatic, hydraulic elements</li> <li>Apply logic &amp; creativity to design circuits.</li> <li>Analyze the simulation results.</li> <li>Communicate the simulation results</li> </ul>	<p>Hydraulics circuits Hydraulic Motors, Hydraulic Fluids and effective contamination control.</p> <p>Advanced pneumatic circuits for controlling multi-cylinders (operable &amp; inoperable circuits), Electro pneumatics with relay logic, Application of fluidics a non-moving part logic.</p>	12	12	
IV	ADVANCED CONTROLS & CIRCUITS	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>Design the programmable circuit sequence</li> <li>Analyze stepper control outputs.</li> <li>Explain servo controls applications.</li> <li>Design circuits with proportional valves.</li> <li>Design cartridge valves.</li> </ul>	<p>Programmable sequential control using pneumatic modular elements, Stepper controls.</p> <p>Electro hydraulics system, Servo valves and proportional valves, Design of Cartridge Valves,</p>	12	12	
V	SAFETY, TROUBLE SHOOTING & REMEDIES	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>Trouble shoot faults in system, components.</li> <li>Follow safety standards.</li> <li>Suggest remedy for the fault.</li> </ul>	<p>Safety in hydraulics &amp; pneumatics systems, Trouble shooting and remedial measures in Hydraulics &amp; Pneumatics system.</p>	12	12	

SEMESTER: I

COURSE NAME: MECHATRONICS TECHNOLOGY & KITS

COURSE CODE:

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:

PRACTICAL HOURS: 120

THEORY MARKS:

PRACTICAL MARKS: 60

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks	
I	<b>PROGRAMMING OF PROJECT KITS</b>	At the end of this unit Student should be able to <ul style="list-style-type: none"><li>• Understand the Mechatronics project kits and its component.</li><li>• Understand the mechanical set up, electrical connection, pneumatics connection</li><li>• Understand the trouble shooting of all the kits.</li><li>• Discuss about input outputs of the kits.</li><li>• Understand the interfacing of plc with robotics.</li><li>• Understands the working ,principle and how actually robot is working</li></ul>	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	120	60	

SEMESTER: I

COURSE NAME: ENTREPRENEURSHIP

COURSE CODE:

COURSE OUTCOMES:

- Developing a detailed understanding of entrepreneurship along with the perspective of initiating and propelling new ventures.
- Developing the linkage between strategy, innovation, entrepreneurship and creativity.
- Inculcating the role of Intellectual Property perspective and Innovation as the key to entrepreneurship.

THEORY HOURS: 40

PRACTICAL HOURS:

THEORY MARKS: 60

PRACTICAL MARKS:

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks	
I	ENTREPRENEURSHIP AND THE ENTREPRENEURIAL PROCESS	At the end of this unit Student should be able to <ul style="list-style-type: none"> <li>• Meaning and importance of entrepreneurship</li> <li>• Motivations and reasons to start business</li> <li>• Entrepreneurial process</li> <li>• Entrepreneurship framework.</li> </ul>	Introduction, entrepreneurship, Views on Entrepreneurship, Definitions of Entrepreneurship, historical perspectives on entrepreneurship, motivations to start a business, skill requirement, Entrepreneurial Qualities, Difference between an Entrepreneur and a Manager, different types of entrepreneurs, an entrepreneur converts the demand into supply, role of attitude, values and entrepreneurship, areas of skill development for entrepreneurs.	5	6	
II	ENTREPRENEURSHIP FRAMEWORK AND THE ENTREPRENEURIAL PERSONALITY	At the end of this unit Student should be able to <ul style="list-style-type: none"> <li>• Role of information in opportunity recognition</li> <li>• Emergence of entrepreneurship</li> <li>• Entrepreneurship framework</li> <li>• Entrepreneurial personality.</li> </ul>	Introduction, opportunity recognition, opportunity factors, three ways to identify an opportunity, opportunity recognition process, factors impacting emergence of entrepreneurship, entrepreneurial framework, framework of entrepreneurship, mental sequences in idea development, entrepreneurial development - four major themes, the entrepreneurial personality, personality traits, fourteen character traits of an entrepreneur, competitive advantages of an entrepreneurial firm, difference between self-employment and entrepreneurship, entrepreneurial competencies, entrepreneurial women,	5	6	
III	START-UP FACTORS, ORGANISATIONAL PLANNING AND WOMEN ENTREPRENEURSHIP	At the end of this unit Student should be able to <ul style="list-style-type: none"> <li>• Meaning and importance of start-up factors of entrepreneurship</li> <li>• Entry barriers</li> </ul>	Starting the venture, creativity, from creativity to entrepreneurship, environment scanning, swot (strengths, weaknesses, opportunities and threats), competitor analysis, industry analysis, porter's five forces analysis, feasibility studies, market analysis, business plan,	6	9	

		<ul style="list-style-type: none"> <li>• Significance and associated details of new ventures</li> <li>• Organizational planning</li> <li>• Women entrepreneurship</li> </ul>	preparing project report, marketing plan, marketing research for the new venture, the marketing concept for entrepreneurs, the marketing system, organization plan, barriers to entrepreneurship, women entrepreneurship.			
IV	ORGANISATIONAL STRUCTURE AND FORMS OF OWNERSHIP	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>• Meaning and importance of various organizational structures in new ventures</li> <li>• Through the perspective of entrepreneurship</li> <li>• Forms of ownership</li> <li>• Job design</li> <li>• Financial planning</li> <li>• Budgeting</li> </ul>	Basic forms of ownership, organizational structure, job design, meaning and importance of manpower planning, financial planning, cash budget, working capital, performance income statement, performance balance sheet, break even analysis, sick industries, board for industrial and financial reconstruction,	8	12	
V	STAGES OF GROWTH AND STRATEGIC MANAGEMENT PROCESS	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>• Stages of growth of entrepreneurial ventures</li> <li>• Barriers to growth</li> <li>• Entrepreneurship in small firms</li> <li>• Strategic management process</li> <li>• Linkage of strategy and entrepreneurship</li> </ul>	Five stages of growth and development, Greiner's model of organizational growth, business model, Definitions of the Term "Business Model", business model process, importance of the business model, business model analysis, the life cycle of entrepreneurship, crossing the chasm, barriers to small firm growth, strategic factors of entrepreneurship in small firms, the strategic management process, managerial competencies of entrepreneurs, turbulence in a firm's environment, environmental strategies.	8	12	
VI	INTELLECTUAL PROPERTY CONCEPT AND INNOVATION	<p>At the end of this unit Student should be able to</p> <ul style="list-style-type: none"> <li>• Concept of intellectual property</li> <li>• Role perspective of intellectual property concept in entrepreneurship</li> <li>• Intellectual property rights</li> <li>• IP rights as strategic tools in entrepreneurship</li> <li>• Innovation as an important tool for</li> </ul>	Concept of property, intellectual property, objectives of intellectual property, nature of intellectual property rights, source of intellectual property, intellectual property and economic development, brief history in the development of intellectual property, important milestones in area of IPR & IPM, types of intellectual property, criteria for patentability, some exclusion from patentability, special requirements for patent, trademarks, trade names & services marks, geographical indications (GI), industrial designs (ID), integrated circuit layout designs, intellectual property	8	15	

		entrepreneurship <ul style="list-style-type: none"><li>• Advantages and disadvantages of family businesses</li></ul>	management (IPM), transition from entrepreneur to entrepreneurial leader, family business, the planning process, changing face of family business,			
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