



**ADVANCED DIPLOMA IN  
MACHINE MAINTENANCE AND  
AUTOMATION  
(ADMMA)**



**curriculum**

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

## **COURSE/MODULE TEMPLATE**

**COURSE NAME: ADVANCED DIPLOMA IN MACHINE MAINTENANCE AND AUTOMATION**

**COURSE CODE: MSME/ADMMA/00**

**COURSE OUTCOMES: After completion of course Student should be able to:**

1. Describe, specify & care of maintenance of common tools that is involved in maintenance work. Use appropriate Electrical protecting devices, measuring instruments etc. at appropriate place.
2. Perform Preventive & Break down Maintenance of different machines (turning, milling, grinding, drilling, radial grinding etc.),
3. Identify different parts of machine, study working mechanism of different machines, select, check and connect cable in control panel
4. Design & configure basic pneumatics components.
5. Design various circuits by using different valves, for industrial control
6. Control the Pressure using pressure control valve for controlling linear actuators or rotary actuator.
7. Configure of PLC hardware modules in the rack and setup the communication between PLC modules.
8. Install the programming software & driver tools. Program the PLC with LAD Programming with Bit Operand, Block Operands.
9. Connect the Remote I/O, Profibus PLC and Ethernet Profibus PLC, Logic Board Simulation, Interfacing of I/O devices and Fault Monitoring systems.
10. Configure the communication console parameter with Controller (PLC), Configure the communication console parameter with MTU.
11. Create a single user and multi user SCADA Project. Activate & Deactivate a Project. Copy a Project.
12. Create process picture of conveyor control logic & Simulate using simulator. Design PC-Based HMI. Interface different field devices with SCADA system & monitoring process
13. Establish Communication link of different PLC modules with HMI.
14. Select & configure different hardware for HMI by TIA Portal, Use Tag Management for Controlling Different I/P & O/P by Graphical Screen, HMI Based I/P & O/P Control by Tia Portal.

**THEORY HOURS: 260      PRACTICAL HOURS: 560      THEORY MARKS: 1100      PRACTICAL MARKS: 1000**

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	Marks
UNIT-I	Machine Operation	Perform Different Types Of Machine Operation	Workshop safety rules Use of personal protective equipment (PPE). Cutting tool materials. Parts of lathe machine and their function. Lathe and Lathe operations Milling and Milling Operations Grinding and Grinding operations. De-burring process Cutting Tools Accessories and Attachments	20	100
UNIT-II	Electrical Hardware Logic Control	Design the Electrical Hardware Logic Control System to control different electrical actuators.	Electrical safety. Measuring instrument. Introduction to control. Types of switches. Types of electrically active switches. Creating and testing control and power circuit.	20	100
UNIT-III	Electrical Machines	Perform Electrical Machine operations in various power supply & ratings.	Single phase and three phase connection. Function and working principle of different types of motors. Oscilloscope. Frequency generator, counter & wave shaping. Power measurement method. Transformer. Load characteristics.	20	100
UNIT-IV	Pneumatics & Hydraulics	Design Pneumatics & Hydraulics Process control for different plant applications.	Valves and cylinders demonstration. Tubing valves and cylinders. Flow control valves. Dual pressure valves Shuttle valves. Electrical application with pneumatics and hydraulics. Interfacing with plc.	30	100
UNIT-V	Machine Maintenance	Perform different conventional & non-conventional Machine Maintenance.	Demonstration on tools. Circuit breakers. Process to dismantle machines. Fault finding methods. Preventive and breakdown maintenance. Facing operation. Plain and step turning operation. Zigzag facing operation. Tracing signal by LAD. Coolants and Lubricants.	30	100
UNIT-VI	Programmable Logic Controller	Design Automation Process & Control System By Using Programmable Logic Controller.	NO NC programming for switches. Memory bit application. Move and comparator. Timer and counter application.	30	100

			<p>Plc interfacing. Analog signal application. FBD and STL programming. Networking topology. Plc fault finding process. Plc maintenance.</p>		
UNIT-VII	SCADA & HMI	Design GUI based control by SCADA & HMI	<p>Installation of scada software. Creating single user project. Creating multi-user project. Graphics designer tools. Process to set tags. Windows object. Analog process. Moving object. Alarm logging and tag logging. HMI configuration.</p>	20	100
UNIT-VIII	TIA- Portal	Work on advanced industrial automation by TIA portal (Totally Integrated Automation-Portal).	<p>Introduction to the software. Creation of different types of blocks. IEC Timers and counters application. Analog process. PLC to PLC communication.</p>	20	100
UNIT-IX	Communication Skill	Improve personal skills.	<p>Introduction to soft skills. Basics of communication. Introduction to nonverbal communication.</p>	10	100
UNIT-X	AUTOCAD Electrical	Prepare electrical drawing using AutoCAD Electrical.	<p>Introduction on AutoCAD. Co-ordinate systems. Types of commands and function keys. Modify menu bar &amp; draw menu bar, layer, text &amp; dimension. 2-d and 3-d drawing. E-cad introduction. Component library.</p>	30	100
UNIT-XI	Basic Electronics	Create and operate electronics circuits based on requirement.	<p>Introduction to basic electronics. Diodes, transistors and op-amps. Rectifiers. Logical gates.</p>	30	100

## COURSE WISE DETAILS CONTENTS

**Program Name** : ADVANCED DIPLOMA IN MACHINE MAINTENANCE AND AUTOMATION

**Course Title** : Machine operation.  
: Electrical hardware logic control system.  
: Electrical machines.  
: Pneumatic and hydraulic control.  
: Machine maintenance.  
: Programmable logic controller.  
: SCADA and HMI.  
: TIA Portal.  
: Communication skills.  
: AutoCAD Electrical.  
: Basic electronics.

**Course Code** : MSME/ADMMA/00

### **Rationale:**

Indian manufacturing industry sector which comprises majority of Small & Medium scale enterprises requires highly skilled “Machine Maintenance professionals” who can be engaged in industry to make machines ready without disturbing the continuous production by doing maintenance of machines. The aim of the training is to develop highly skilled maintenance professionals to contribute in the overall development of the Indian industry through maintaining the machines by using modern software’s like TIA PORTAL, WINCC EXPLORER.

### **Outcomes:**

Learners who attain this qualification are competent in Civil Construction work and can get a job in a captive or commercial construction work or become an entrepreneur.

- Qualifying learners attain skills to work in SIMATIC MANAGER, WINCC, PNEUMATICS AND FLUIDSIM-P, FLUIDSIM-H, AND TIA PORTAL software.
- Qualified learners are capable of designing efficient electrical circuits with zero error.
- Participants will be able to do efficient electrical wiring to minimize ambiguity.

**Theory:**

Topic and Contents	Hours	Marks
<b>Topic 1: MACHINE OPERATION (100 MARKS)</b>	60	100
MAJOR CHAPTERS		
• 1.1 Measuring instruments (30 Marks)		
• 1.2 Dimensioning (30 Marks)		
• 1.3 3D Modeling (40 Marks)		
Contents:		
• Identify and know the purpose of the work-holding and driving accessories		
• Operate the conventional turning lathe machine and produce components.		
• Prepare the job as per the drawing provided using Milling Machine.		
• Perform drilling & boring operation as per drawing given.		
• Operate the grinding machine as per drawing.		

<b>Topic 2: ELECTRICAL HARDWARE LOGIC CONTROL SYSTEM</b>	<b>(100 marks)</b>	60	100
<b>MAJOR CHAPTERS</b>			
<ul style="list-style-type: none"> <li>• 2.1 Introduction to control (25 marks)</li> <li>• 2.2 Rules of one line diagram (25 marks)</li> <li>• 2.3 Types of switches (25 marks)</li> <li>• 2.4 Control and power circuit (25 marks)</li> </ul>			
<b>Contents:</b>			
2.1 Introduction to control			
<ul style="list-style-type: none"> <li>• Explain briefly types of control based on application i.e. manual control, feedback control, sequential control, motion control, and logical control.</li> <li>• Types of control based on forces i.e. Mechanical control, electrical control, and spring control.</li> </ul>			
2.2 Rules of one line diagram			
<ul style="list-style-type: none"> <li>• Briefly explain the rules of one line diagram.</li> <li>• Difference between AC diagrams and DC diagrams.</li> </ul>			
2.3 Types of switches			
<ul style="list-style-type: none"> <li>• Explain briefly about types on contacts i.e. normally closed and normally closed contacts.</li> <li>• Briefly explain the function and types of toggle switches.</li> <li>• Briefly explain the function and types of push buttons.</li> <li>• Briefly explain the function and types of limit switches.</li> <li>• Briefly explain the function and types of selector switches.</li> <li>• Briefly explain the function and types of limit switches.</li> <li>• Introduction to relays.</li> <li>• Introduction to contactors.</li> </ul>			
2.4 control and power circuit			
<ul style="list-style-type: none"> <li>• Explain briefly about single phase and three phase connection.</li> <li>• Process to create control circuit.</li> <li>• Process to create power circuit.</li> </ul>			

<b>Topic 3: ELECTRICAL MACHINES</b>	<b>(100 marks)</b>	60	100
<b>MAJOR CHAPTERS</b>			
3.1 Measurement of electrical quantity	(30 Marks)		
3.2 Study of motor	(30 Marks)		
3.3 Oscilloscope	(40 Marks)		
<b>Content</b>			
3.1 Measurement of electrical quantity.			
<ul style="list-style-type: none"> <li>• Voltmeter, ammeter, frequency meter.</li> <li>• Power factor meter, watt meter, tachometer User interface and setting preferences.</li> <li>• Clamp meter, multi meter.</li> </ul>			
3.2 Study of motor			
<ul style="list-style-type: none"> <li>• Describe Briefly Single Phase And Three Phase Motor.</li> <li>• Three phase induction motor routine test.</li> <li>• DC series &amp; shunt motor routine test.</li> <li>• Polarity test, load test.</li> </ul>			
3.3 Oscilloscope			
<ul style="list-style-type: none"> <li>• Function and working of oscilloscope and also measuring different quantities.</li> </ul>			



<p><b>Topic 4: PNEUMATIC AND HYDRAULIC CONTROL (100 marks)</b></p> <p><b>MAJOR CHAPTERS</b></p> <ul style="list-style-type: none"> <li>• 4.1 Introduction to pneumatics (25 marks)</li> <li>• 4.2 Pneumatic valves and cylinders &amp; introduction to software (25 marks)</li> <li>• 4.3 Introduction to Electro-Pneumatics (25 marks)</li> <li>• 4.4 Introduction to hydraulics and electro hydraulics (25 marks)</li> </ul> <p><b>Contents:</b></p> <p>4.1 Introduction to Pneumatics</p> <ul style="list-style-type: none"> <li>• Briefly explain the use of compressed air.</li> <li>• Use of Pneumatics in Automation.</li> </ul> <p>4.2 Pneumatic valves and cylinders</p> <ul style="list-style-type: none"> <li>• Single acting cylinder.</li> <li>• Double acting cylinder.</li> <li>• Normally open and normally closed valves.</li> <li>• Dual pressure valve.</li> <li>• Shuttle valve.</li> <li>• Introduction to the software.</li> </ul> <p>4.3 Introduction to Electro-Pneumatics</p> <ul style="list-style-type: none"> <li>• Briefly explain about Electro-Pneumatics.</li> <li>• Process to create control and power circuits.</li> <li>• Explain inputs and outputs used.</li> </ul> <p>4.4 Introduction to hydraulics and electro hydraulics</p> <ul style="list-style-type: none"> <li>• Briefly explain the characteristics of hydraulic oil.</li> <li>• Explain difference between pneumatics and hydraulics.</li> <li>• Types of valves and actuators.</li> <li>• Introduction to Electro hydraulics.</li> </ul>	90	100
<p><b>Topic 5: MACHINE MAINTENANCE (100 marks)</b></p> <p><b>MAJOR CHAPTERS</b></p> <ul style="list-style-type: none"> <li>5.1 Hand tools (30marks)</li> <li>5.2 Breakdown (30marks)</li> <li>5.3 various machinery operations (40marks)</li> </ul> <p><b>Contents:</b></p> <p>5.1 Hand tools</p> <ul style="list-style-type: none"> <li>• Demonstration on different types of tool and its working principle.</li> <li>• Connection of different circuit breaker and test with motor.</li> </ul> <p>5.2 Breakdown</p> <ul style="list-style-type: none"> <li>• Practice of weekly, quarterly, monthly preventive and breakdown maintenance.</li> <li>• Dismantle the machine one by one parts to see the different mechanism by which it is running.</li> </ul>	90	100

<ul style="list-style-type: none"> <li>• Fault finding methods. Solving the error.</li> <li>• Preventive and breakdown maintenance of:</li> <li>• Lathe machine</li> <li>• Milling machine</li> <li>• Grinding machine</li> <li>• Drilling machine</li> <li>• CNC lathe</li> <li>• CNC milling machine</li> </ul> <p>5.3 various machinery operations</p> <ul style="list-style-type: none"> <li>• Facing operation</li> <li>• Plane turning operation</li> <li>• Step turning operation</li> <li>• Zigzag facing operation.</li> <li>• Circular pocketing operation.</li> <li>• Tracing signal by LAD.</li> </ul>		
<p><b>Topic 6: PROGRAMMABLE LOGIC CONTROLLER (100 marks)</b></p> <p><b>MAJOR CHAPTERS</b></p> <ul style="list-style-type: none"> <li>• 6.1 PLC hardware (25 marks)</li> <li>• 6.2 Introduction to software (25 marks)</li> <li>• 6.3 PLC communication (25 marks)</li> <li>• 6.4 Networking (25 marks)</li> </ul> <p><b>Contents:</b></p> <p>6.1 PLC hardware</p> <ul style="list-style-type: none"> <li>• History of PLC.</li> <li>• Types of PLC according to I/O capacities.</li> <li>• Types of communication.</li> <li>• Operating principle of PLC.</li> <li>• Addressing procedure in software.</li> </ul> <p>6.2 Introduction to software</p> <ul style="list-style-type: none"> <li>• Creation of new project.</li> <li>• Process to complete hardware configuration and download PLC.</li> <li>• NO and NC programming.</li> <li>• Memory bit operations</li> <li>• Bit logic operations.</li> <li>• Timer operations.</li> <li>• Counter operations.</li> <li>• Analog process.</li> <li>• Function block.</li> <li>• Data block.</li> <li>• Variable table.</li> </ul>	90	100

<ul style="list-style-type: none"> <li>• Function block diagram.</li> <li>• Statement list.</li> </ul> <p>6.3 PLC communication</p> <ul style="list-style-type: none"> <li>• Profinet connection.</li> <li>• Profibus connection.</li> <li>• Multipoint interface (MPI) connection</li> <li>• Point to point (PPI) connection</li> <li>• Ethernet connection.</li> </ul> <p>6.4 Networking</p> <ul style="list-style-type: none"> <li>• Single PC to multiple PLC communication</li> <li>• Multiple PC to multiple PLC communication.</li> <li>• Multiple PC to single PLC communication.</li> <li>• Single PLC to RIO communication.</li> <li>• Single PLC to multiple RIO communication.</li> </ul>		
<p><b>Topic 7: SCADA and HMI (100 marks)</b></p> <p><b>MAJOR CHAPTERS</b></p> <p>7.1 Introduction to scada system (20 marks)</p> <p>7.2 Introduction to software (20 marks)</p> <p>7.3 Use of object pallet (20 marks)</p> <p>7.4 Different functions of programs (20 marks)</p> <p>7.5 Multiuser project and introduction to HMI screen (20 marks)</p> <p><b>Content</b></p> <p>7.1 Introduction to scada system</p> <ul style="list-style-type: none"> <li>• Introduction to scada system.</li> <li>• Installation of communication drivers.</li> <li>• Configuration of communication console parameter with Controller (PLC).</li> <li>• Configuration of communication console parameter With MTU.</li> </ul> <p>7.2 Introduction to software</p> <ul style="list-style-type: none"> <li>• Process to create single user project.</li> <li>• Process to activate and deactivate a project.</li> <li>• Process to copy a project.</li> <li>• Explain graphics designer tools.</li> </ul> <p>7.3 Use of object pallet</p> <ul style="list-style-type: none"> <li>• Difference between standard object, windows object and smart objects.</li> <li>• Functions of standard objects.</li> <li>• Functions of smart objects.</li> <li>• Functions of windows objects.</li> </ul>	60	100

<p>7.4 Different functions of programs</p> <ul style="list-style-type: none"> <li>• Multiscreen.</li> <li>• Picture window.</li> <li>• Window operations.</li> <li>• Internal tags usage.</li> <li>• Analog control.</li> <li>• Alarm logging.</li> <li>• Tag logging.</li> </ul> <p>7.5 Multiuser project and introduction to HMI screen</p> <ul style="list-style-type: none"> <li>• Process to connect one system to another.</li> <li>• Process to create multiuser project.</li> <li>• Process to transfer wincc project from one system to another.</li> <li>• Explain the process to configure HMI screen.</li> <li>• Explain the procedure to download programs to the HMI panel.</li> </ul>		
<p><b>Topic 8: TIA Portal (100 marks)</b></p> <p>8.1 Introduction to software (20 marks)</p> <p>8.2 Bit logic operations (20 marks)</p> <p>8.3 Timer and counter application (20 marks)</p> <p>8.4 Analog application (20 marks)</p> <p>8.5 PLC to PLC communication (20 marks)</p> <p>content</p> <p>8.1 Introduction to software</p> <ul style="list-style-type: none"> <li>• Introduction to software</li> <li>• Briefly explain the creation and downloading of function block, data block and variable table.</li> </ul> <p>8.2 Bit logic operations</p> <ul style="list-style-type: none"> <li>• Negate assignment</li> <li>• Set coil operation</li> <li>• Reset coil operation</li> <li>• Set bit field operation</li> <li>• Reset bit field operation</li> <li>• Set-reset block</li> <li>• Reset-set block</li> <li>• Scan RLO for positive edge triggering.</li> <li>• Scan RLO for negative edge triggering.</li> </ul> <p>8.3 Timer and counter application</p> <ul style="list-style-type: none"> <li>• Explain the difference between simatic timers and IEC timers.</li> <li>• Pext timer block and coil.</li> <li>• On delay timer block and coil.</li> </ul>	60	100

<ul style="list-style-type: none"> <li>• Off delay timer block and coil.</li> <li>• Retentive on delay timer and coil.</li> <li>• Reset timer coil.</li> <li>• Load time duration coil.</li> </ul> <p>8.4 Analog application</p> <ul style="list-style-type: none"> <li>• Analog to analog direct conversion.</li> <li>• Analog to analog inverse conversion.</li> <li>• Analog to digital conversion.</li> </ul> <p>8.5 PLC to PLC communication</p> <ul style="list-style-type: none"> <li>• Connection between sender block to receiver block.</li> <li>• Byte to byte transfer process.</li> </ul>		
<p><b>Topic 9: COMMUNICATION SKILLS (100 marks)</b></p> <p><b>MAJOR CHAPTERS</b></p> <p>9.1 basics of communication (60 marks)</p> <p>9.2 Introduction to soft skills. (20 marks)</p> <p>9.3 Introduction to nonverbal communication (20 marks)</p> <p><b>Content:</b></p> <p>9.1 basics of communication</p> <ul style="list-style-type: none"> <li>• Forms, types, purpose, theory, examples from daily schedules.</li> </ul> <p>9.2 Introduction to soft skills.</p> <ul style="list-style-type: none"> <li>• Presentation Skills – elocution, debates, extempore, etc.</li> <li>• Newspaper reading</li> <li>• Introduction to Body Language – positive gestures, handshakes, eye contact, smiles, styles of walking, hand movements, etc.</li> <li>• Activities on Listening Skill</li> <li>• Role Plays and Situation Handling</li> <li>• Etiquette and Manners – general and specific, greetings/salutations, etc.</li> <li>• Personal and Professional Goal Setting.</li> </ul> <p>9.3 Introduction to nonverbal communication</p> <ul style="list-style-type: none"> <li>• One- to-one interaction &amp; group exercises.</li> <li>• Presentation of an effective cover letter, resume/curriculum vitae</li> <li>• Group Discussion</li> <li>• Personal Interview</li> <li>• Corporate Interface</li> </ul>	10	100

<b>Topic 10: AUTOCAD ELECTRICAL</b>	<b>(100 marks)</b>	<b>30</b>	<b>100</b>
<b>MAJOR CHAPTERS</b>			
10.1 co-ordinate system	(20 marks)		
10.2 Software opening	(20 marks)		
10.3 Drafting features	(20 marks)		
10.4 Introduction to 3d and eCAD	(40 marks)		
<b>Content:</b>			
10.1 co-ordinate system			
<ul style="list-style-type: none"> <li>• Absolute co-ordinate system.</li> <li>• Polar co-ordinate system.</li> <li>• Incremental co-ordinate system.</li> </ul>			
10.2 Software opening			
<ul style="list-style-type: none"> <li>• Introduction to the software.</li> <li>• Use of function keys and shortcut keys.</li> <li>• Process to draw circle, rectangle, arc etc.</li> </ul>			
10.3 Drafting features			
<ul style="list-style-type: none"> <li>• Process to create region.</li> <li>• Explode</li> <li>• Fillet</li> <li>• Chamfer</li> <li>• Copy</li> <li>• Move</li> <li>• Offset</li> <li>• Array</li> <li>• Process to add text.</li> <li>• Hatch and gradient.</li> <li>• By layer.</li> </ul>			
10.4 Introduction to 3d and eCAD			
<ul style="list-style-type: none"> <li>• Process to crate 3d diagram</li> <li>• Introduction to E-cad.</li> <li>• Overview about relay, contactors, timers and OLD.</li> <li>• Process to add ladder, reverse ladder and add rung option.</li> <li>• Drafting features like dash link line, align and scoot.</li> <li>• Multiple wire bus.</li> <li>• PLC positioning and schematic report generation.</li> </ul>			

**Intellectual Skills:**

1. Study and interpret one line diagram.
2. Select proper electrical/electronic elements for designing operation.
3. Use proper tools to rectify error in machines.
4. Analyse and develop process logic for industrial control system.
5. Identify various control system elements and specify it.

**Motor Skills:**

1. Operate the conventional as well as CNC Machines to test their functionality.
2. Develop working drawing using eCAD
3. Design and generate the programme for automation by using TIA Portal software.
4. Design and Apply SCADA system for monitoring and control using PLC and HMI.
5. Trouble shooting of different machineries.

**List of Practical:**

1. Motor forward reverse logic in three phase and single phase connections.
2. Milling, grinding and lathe machine operation.
3. Star delta connection
4. Pneumatics tubing and hydraulics hose pipe connection.
5. PLC to PLC networking
6. Interfacing PLC to system.
7. Circuit breaker and fuse connection.
8. Generator and oscilloscope connection.
9. Creating graphics for PLC controller.
10. S7-1200 PLC to PLC communication.

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
1	GARRY DUNNING	Introduction to programmable logic controllers	THOMSON
2	E. A. PARR	Hydraulics and Pneumatics	Plant Engineering
3	Er. Tanuj Kumar Bisht	SCADA and Energy Management System	Kat son books
4	Jon sternson, David dreg	TIA portal	Siemens
5	Ricky smith, R. Keith Mobley	Industrial machinery repair	Plant Engineering
6	Stephen chapman	Electrical machines: fundamental	Tata McGraw-Hill
7	Gaurav Verma and Matt Weber	AutoCAD Electrical 2016 Black Book	CADCAMCAE Work

