

**MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION,
MUMBAI -51**

1	Name of Course	CERTIFICATE COURSE IN EMBEDDED SYSTEMS & PLC (W.E.F. 2017-2018)																																									
2	Couse code	301134																																									
3	Max No of Students Per Batch	25																																									
4	Duration	6 Months																																									
5	Type	Part Time																																									
6	No of Days/Week	6 Days																																									
7	No of Hours Per Day	4 Hours																																									
8	Required Space	Class Room – 200 sq.ft, <u>Laboratory – 200 sq.ft</u> Total – 400 sq.ft																																									
9	Minimum Entry Qualification for Student	SSC + 1 Year Experience in relevant field OR ITI (Electrical / Electronic related Trade) OR HSC (Voc) (Electrical / Electronic Group)																																									
10	Objective of Course	To Create man power in Embedded System & PLC filed																																									
11	Employment Opportunity	Automation Industry / Electronics Companies & Industry.																																									
12	Teacher’s Qualification	1) Degree in Electrical / Electronic with 1 Year Experience in related field. 2) Diploma / Degree in Electronics with one year Experian’s in Embedded Systems / PLC																																									
13	Training System	<table><tr><th colspan="3">Training System Per Week</th></tr><tr><td>Theory</td><td>Practical</td><td>Total</td></tr><tr><td>06 Hrs</td><td>18 Hrs</td><td>24 Hrs</td></tr></table>							Training System Per Week			Theory	Practical	Total	06 Hrs	18 Hrs	24 Hrs																										
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Theory - I & Practical – I

Sr. No.	Practical - I Practical of Embedded Systems and PLC	Theory - I Embedded Systems and PLC
1	Familiarization of MP kit Program Execution using - Data Transfer Group, Logic Group, Arithmetic Group, Branch Group. Interface microprocessor kit with different application boards and run the applications	Introduction to basic Computer architecture, CPU & its specification. Accumulator & Register based processors Microprocessor an overview of 8 bit (8085) Processor, architecture, Interrupt system, Mapping & DMA, Basic programming Concept-Assembler, flowchart, debugging. Addressing modes, types of instructions, Instruction set Comparison with other 8 bit processors.
2	Familiarization of MC kit Program Execution using -Data Transfer Group, Logic Group, Arithmetic Group, Branch Group Study of interfacing techniques	Microprocessor and Microcontroller- A comparison Microcontroller an over view of 8051 & its Architecture, Instruction set, Addressing modes, Programming-Data Transfer, Arithmetic, Logic, Boolean Variable manipulation & branching Instruction
3	Hard ware and software Exercises in ports & Read the status of a switch using MC port pin. Drive a relay using MC port pin Develop & run programs using Timer, Counter & Interrupt applications	I/O ports pins and their functions, I/O Programming, Bit manipulation, Timers, modes of Timers, application of Timer to generate Time Delays. Interrupts and polling, various interrupt SFR's related to Interrupt Programming Edge Triggered and level triggered interrupts Priority of interrupts
4	Transmit & Receive Data with PC using serial link, Connection of Microcontroller kit to PC	Difference between serial and parallel Communication , serial Communication protocol, synchronous and Asynchronous communication, Data Framing, RS232 Standard, max 232 chips. Baud Rates, programming Techniques.

5	Interfacing of MC using 8255 and study the working of: Traffic light controller, DAC, ADC, Stepper motor, Elevator, LCD. Keyboard interface.	Various methods of A to D & D to A conversion-counter type ADC, Successive type, Integrating type ADC's Specification of DAC & ADC. 8255-programmable peripheral device, Concepts of Traffic light control, Fundamentals of Stepper motor-Types, driving methods, Elevator, Key board and LCD.
6	Exercise on PIC MC	Introduction to PIC MC, Architecture, Instruction set, Additional Features
7	Identify physical topology of a network and members of the network, identify the protocols installed and check resource sharing Identify the cables and components in the network Identify controls and ports on servers Identify the hardware of servers and configuration Starting and shutting down servers Identifying and using basic features Using Win 2000/Linux/Unix/Novell features Making UTP cross cables and testing, Making straight cables and testing, Making cable layout drawing Installing information outlet points. Install different common protocols one by one and test communication and features Install and check TCP/IP utilities and services	Network features-Network topologies, protocols- TCP/IP,UDP/FTP, models, types, components, network medias,- specification and standards, types of cables Difference between PC & Server, Server-Usages of Server, Types, Server hardware, Operating system-OS ,NOS-features, types.
8	Identification of different digital input and output field devices used in Process/ mechanical industries categorized w.r.t voltage levels, single end and differential end etc. Operate and test the above mentioned field devices Identify different type of cables used to connect field devices to closed loop single/multi loop controllers and programmable controllers. Identify different cables and connectors used to connect programming terminals such as, PC etc to the programmable controllers.	Evolution of different control techniques like manual, hardwired, Electronic gate control and programmable control. Advantages and disadvantages of different techniques mentioned above. Different type of analog and digital input and output field devices used in process industries. Types of voltage and current formats used in field devices. Types of connections of field devices to controllers. Type of cables used for connecting field devices to controllers.

9	<p>Identify the CPU type and the memory inside. Identify typical module software given PLC systems (such as power supply, Digital and Analog I/O(signal modules), basic module, high speed module, special function modules, RTD/Thermocouple etc)</p> <p>Identify the type of connectivity between the CPU and different Modules of PLC. Identify the type of communication between different modules with PLC.</p>	<p>Block diagram of a basic PLC system and the Architecture, PLC components principles of working of PLCs, Specifications of PLCs.</p> <p>Different type of modules like Digital and Analog input and output modules and their working Hardware description of I/O, power supply Modules I/O addressing concepts. Types of memory used in PLCs. Memory and its impact on performance of PLC Memory map and Data files used in PLCs Different functional blocks/files and their uses</p>
10	<p>Install the PLC Software on the PC. Configure the software to Communicate with a PLC. Familiarization with the software and use of different Data files/ function blocks etc. Develop simple programs and Download them for execution for simple digital I/O Develop programs using timers and counters and execute. Develop programs to cover different instructions and execute.</p>	<p>Different industry Bus communication standards like RS232, RS 422, DH, DH+, 485 etc and their characteristics. Different type protocols used in the field of PLCs. Programming of PLCs using different techniques such as Ladder, Instruction list, Control system flow chart etc.</p> <p>Instruction set covering basic I/O operations, timer, counter, data copy, arithmetic Logical, compare type, program control and shift instructions etc., PLC interrupts, PLC subroutines, PLC sequencers.</p> <p>Wiring, entering, documenting and testing program.</p>
11	<p>Develop and run simple tasks such as control of a relay, contactor, lamp & motor etc. for different input conditions. Monitor the status of the application ONLINE. Perform some Force operations. Develop programs to acquire analog data using Analog input card. Develop programs to display/ control data using Analog output card. Make a closed loop control system using analog I/Os and control a process. PID Control using PLC. Interrupts using PLCs. Sub-routine development in PLCs. Repeat all the above for any two popular commercial PLCs.</p>	<p>Types of special function modules such as memory module, high Speed counter, Communication processor module and its importance.</p> <p>Introduction to SCADA and DCS system</p>

12	Familiarization and interpretation of the screen sandits contents provided for diagnostic purpose in the software. Interpretation of the error codes. Clearing the minor errors and major errors. Troubleshooting screens.	Common faults in a typical PLC- based system with respect to Hardware i.e power supply, digital/analog I/Os, special function modules, communication modules etc. Diagnostic capabilities of the PLC Software and the typical codes generated by the system for the effective troubleshooting of different modules of PLCs
13	Exercise on wireless	Wireless communication standards & various types of networks
14	Revision & Examination	
15	One Project should be done as above syllabus.	

List of Tools and Equipment Embedded System and PLC

Sr. No.	Description of Item	Qty
1	8085 based Microprocessor Kit	2
2	8051 based Microcontroller with USB Programmer kit	2
3	Interfacing Modules such as DAC,ADC,TRAFFIC LIGHT, STEPPER MOTOR,LCD Display & Key board	2 each
4	PIC Microcontroller Kit	2
5	Computer Server with latest configuration	1
6	Computers with latest configuration	4
7	Window software latest version	1
8	8 Port Hub	1
9	NIC cards, cables and peripherals	4
10	Bread Boards	2
11	Components (MC, Memories, Resistors, Cap, Wires ETC)	As Required
12	Soldering Iron (Temperature Controlled)	4

13	Digital Multimeter	4
14	PLC Trainer Systems (Branded)	1 each
15	PLC development software for Branded PLC systems.	1 each
	Working Models for PLCs	
16	a) Bottle fill trainer	1
17	b) Speed control module	1
18	c) Batch process reactor	1
19	d) Start delta starter	1
20	e) Discrete application trainer	1
21	SCADA software	1
22	Sensors Training Kit including following :- Sensors: Thermal, Optical, Pressure, Flow, Position, Motion etc.	1 No.
23	Different types of Electronic push buttons (NC & NO), toggle switches, valves, relays, solenoids valves	1 each
24	Variable DC Power supplies 0-30 V	2
25	Dual trace oscilloscope 20 MHz	2
26	Online UPS (5 KVA)	1
27	Scanner A4 continuous type	1
28	LCD Projector + LAP TOP	1 + 1
29	Printers Laser jet	1
