

MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI - 51

1	Name of Course	Certificate Course In Process Control Instrumentation (308104)																																								
2	Max.Nos. of Student	25 Students																																								
3	Duration	6 Month																																								
4	Type	Full Time																																								
5	Nos Of Days / Week	6 Days																																								
6	Nos Of Hours /Days	7 Hrs																																								
7	Space Required	Laboratory = 1000 Sq feet Class Room = 200 Sq feet TOTAL = 1200 Sq feet																																								
8	Entry Qualification	S.S.C.+ Any Course in Instrumentation Group of MSBVEE																																								
9	Objective Of Syllabus/ introduction	Awareness of Safety precautions. Awareness of Instrumentation. Awareness of Process Control Instrumentation Awareness of Repair & Maintenance of Process Control Instrument.																																								
10	Employment Opportunity	The trainee will either to be able to take up jobs with agencies which Develop, maintain and repair Process Control Instrumentation related machines or with working experience will be in a position to start his own independent Business.																																								
11	Teacher’s Qualification	Diploma in Instrumentation Engineering. With 3 year Teaching experience in Process Control Instrumentation. Diploma or Degree in Instrumentation Engineering or equivalent profession Qualification. With 1 year Teaching experience in Process Control Instrumentation.																																								
12	Training System	Training System Per Week																																								
		Theory		Practical		Total																																				
		12 Hours		30 Hours		42 Hours																																				
13	Exam. System	<table><tr><th>Sr. No.</th><th>Paper Code</th><th>Name of Subject</th><th>TH/PR</th><th>Hours</th><th>Max. Marks</th><th>Min. Marks</th></tr><tr><td>1</td><td>30810411</td><td>Process Control Instrumentation</td><td>TH-I</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30810421</td><td>Basic Electronic & Electronics Instrumentation.</td><td>PR-I</td><td>3 hrs</td><td>100</td><td>50</td></tr><tr><td>3</td><td>30810422</td><td>Process Control Instrumentation</td><td>PR-II</td><td>6 hrs</td><td>200</td><td>100</td></tr><tr><td></td><td></td><td>TOTAL</td><td></td><td></td><td>400</td><td>185</td></tr></table>						Sr. No.	Paper Code	Name of Subject	TH/PR	Hours	Max. Marks	Min. Marks	1	30810411	Process Control Instrumentation	TH-I	3 hrs	100	35	2	30810421	Basic Electronic & Electronics Instrumentation.	PR-I	3 hrs	100	50	3	30810422	Process Control Instrumentation	PR-II	6 hrs	200	100			TOTAL			400	185
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SYLLABUS

Process Control Instrumentation

Practical – II	Theory - I
Identify, select, verify characteristics and use different type sensors: Proximity sensors, photo-electric sensors, strain gauge, load cell and LDR.	Basics of passive and active transducers – Role, selection and characteristics. Working principles of inductive, capacity sensors, photo – emission, voltaic and conductive cells and their applications. Strain gauge, load cell and LDR – construction and working principles. Earthing and shielding-Safety measures in all units.
Identify, select, verify characteristics and use different type temperatures sensors: RTDs , thermister, thermocouples , thermowell , pyrometers and temperature IC's.	Temperature sensing elements – working principles, temperature- resistance characteristic and Industrial applications
Identify, select, verify characteristics and use LVDT and RVDT for different measurements in Industrial applications	Linear Variable , Differential transformer(LVDT) and Rotary variable Differential transformer(RVDT) – construction, working principles and their Industrial applications.
Find out characteristics of - Photo transistors, photo diode and LED - Piezo electric transducer - Rotary shaft encoder - Smoke detector and Humidity sensor.	Construction, working principles and Industrial applications.
Familiarize use of sensors: - Photo electric sensors for colour detection - Wireless sensors - Ph electrode and conductivity Practice humidity and moisture Measurements	Construction, working principles and Industrial applications. Charges coupled devices(CCD)- concept
Practice pressure measurements like gauge pressure, vacuum land DP using - DP meters , Manometers and Elastic pressure sensing elements.	U tube, well type and micro type manometers – construction and working principles. Bourdon tube , Bellows, Capsule, Diaphragm Industrial Applications.
Practice pressure measurements using pressure pressure transducers - Strain gauge - Capacitive - LVDT and piezo electric.	Operation Instructions and specifications. Measuring procedures.
Practice operations of - Dead weight pressure gauge - Comparator - Low pressure calibrator	Operation Instructions and specifications. Measuring procedures.

Practice vacuum measurements using vacuum gauges.	Vacuum measurement procedures Pirani, Mcleod and Ionisation gauges.
Identify and select different types of flowmeters with their functions and specifications. Measure flow of liquid using - Variable head / DP flow meter or rotometer - Rotating valve and rotating lobed	Working principles and measuring techniques of flow meters
Practice flow measurements using - Orifice plate, Venturi type - Pivot tube - Annobar - Vertex and ultrasonic flow meters - Turbine and mass flow type flowmeters.	Operation Instructions and specifications. Measuring procedures.
Practice level measurements using - Sight glass, Float and displacement level gauges. - Capacitive probe technique - Ultrasonic and radiation level gauges	Construction, working principles, Operation Instructions and specifications. Measuring procedures
Practice temperature measurements using - Thermometers - Two wire and three wire thermometers - Thermistors	Thermometer types- By metallic, liquid filled , gas , vapour and pressure thermometers, specifications
Select and use thermocouples (J,K,R,S,E) for temperature measurements in the industry. Measure high temperatures using optical and radiation pyrometers. Adjust, calibrate and test mv Calibrator.	Thermocouple materials and their characteristics, specifications Cold Junction compensation techniques. Mv calculator , constant temperature bath.
Operate, verify and compare - Thermostat response of temperature controller with specifications. - ON/OFF mode response. - Microcontroller based universal controller- different mode responses.	Closed Loop system terminology-advantages. Automatic control system elements- functions, servomechanism, process control principles. Feedback controls systems- concept process variables and equation.
Familiarise the operation PC based automatic process trainer kit Verify responses of ON/OFF and continuous control modes of electronic controller.	Discontinuous modes: Two position, multi position, single speed and multi speed floating types. Continuous modes: P, I, D, PI, PD and PID Operating instructions of automatic Process Trainer.
Carryout the following for electronic controllers. - Calibration and testing - Optimum setting for unit process - PID mode responses and feed forward control responses	Calibration and testing procedure Setting details, feed forward control concept Cascade and Ratio Control Concept Controller tuning methods.
Verify responses of ON/OFF, P, I, PI, PD and PID pneumatic controllers.	Pneumatic controller- Blocks- description- modes implementation, Alignment procedure,

Carryout alignment of PID Pneumatic controller, optimum settings for unit process and response of programmable PID controller	controller-tuning methods, control system evaluation
Selection, Sizing Operating and maintenance of control valves and valve positioning.	Final control elements: Solenoid , Stepper motor control valve, relays/contacts, of electronic and pneumatic relay logics.
Practice, Alignments, Operation, Calibration and use of Electronic recorders and Pneumatic recorders. Carryout preventive maintenance Trouble shoot and rectifications.	Operation and calibration instructions for electronic and pneumatic recorders, Strip chart and circular chart recorders- features Maintenance tools and procedures
Adjust, calibrate, operate, test and install - Pressure and vacuum gauges - Pressure and DP Transmitters. - P to I, I to P converters.	Operation, Calibration, Testing and Maintenance instructions. Signal conditioning devices: DP transmitter and I to P and P to I converters, features/ specifications.
Practice dismantling and assembling of - Pressure gauges and regulator Installation, maintenance, troubleshoot and rectification	Dismantling and assembling procedures Pressure regulator construction details. Installation, maintenance and trouble shooting procedures.
Measure, calibrate, operate, test and install different flow meters - DP , Rotameter, Turbine and Electronic Flow types. Carryout preventive maintenance.	Instructions for calibration, testing operation and installation. Maintenance tools – preventive and breakdown
Measure, calibrate, operate, test and install different level gauges.	Instructions for calibration, testing operation and installation.
- Float and displacement types. Installation, maintenance, troubleshoot and rectification	Maintenance tools – preventive and breakdown.
Calibrate , test and install - RTD's, Thermocouples and wells, thermometers, thermistors, pyrometers, smart transmitters and calibrators Carryout preventive measurements.	Circuit details of temperature sensors and smart transmitters, operation and maintenance instructions.
Practice of Control Panel wiring and pneumatic tubing.	Wiring and tubing procedures
Use of P&I diagrams.	Details of P&I diagrams – Industrial applications.
Calibration, loop checking, trouble shoot, start up and shut down for 4 domains (Temperature, pressure flow and level)	Calibration and loop checking details. Trouble shoot chart and remedies Startup and Shut down instructions. Introduction to PLC and DCS.
Use of fiber optic communication links.	Fibre optic cables, types , communications basics, specification of cables

List of Equipment Process Control Instrumentation

Sr.No.	Item	Quantity
1.	Transducer trainer kits	5 Nos.
2.	Photo voltaic cell	5 Nos.
3.	RTDs	5 Nos.
4.	Ovens	5 Nos.
5.	Pyrometer (optical & radiation)	5 Each
6.	Load cells and strain gauge	5 Nos.
7.	LVDT	5 Nos.
8.	RVDT	5 Nos.
9.	Smoke detector	5 Nos.
10.	Humidity sensor	5 Nos.
11.	Rotary shaft encoder	5 Nos.
12.	Tachometer	5 Nos.
13.	Photo diode/transistor	5 Nos.
14.	Electrical actuator	5 Nos.
15.	DMMs	10 Nos.
16.	Thermometers	5 Nos.
17.	Power supplies (0 to 30V)	5 Nos.
18.	Screw driver set	5 Each
19.	Star screw driver	5 Each
20.	Plier	5 Each
21.	Cutter	5 Each
22.	Liquid filled in steel thermometer	4 Nos.
23.	Vapour filled in steel thermometer	4 Nos.
24.	Bimetal type thermometer (digital)	4 Nos.
25.	Liquid filled thermostat (digital)	4 Nos.
26.	Radiation pyrometer	2 Nos.
27.	Thermocouples J, K, R, S & B type	Six Nos.
28.	Constant temperature bath with mv calibrator	
29.	Smart transmitters (resonant)	4 Nos.
30.	U tube manometer	4 Nos.
31.	Well type manometer	4 Nos.
32.	Micro type manometer	4 Nos.
33.	Inclined tube manometer	4 Nos.
34.	Digital manometer/calibrator	4 Nos.
35.	Bourdon type pressure gauges	6 Nos.
36.	Diaphragm seal pressure gauges	4 Nos.
37.	Low pressure diaphragm & pressure gauges	4 Nos.
38.	Low pressure capsule and pressure gauges	4 Nos.
39.	Digital pressure gauges	6 Nos.
40.	Pressure indicator transmitter	6 Nos.
41.	Digital Bargraph indicator (u based)	6 Nos.
42.	Smart pressure & Differential transmitter	4 Nos.
43.	Dead weight tester transmitter	4 Nos.
44.	Low pressure calibrator	4 Nos.
45.	Process scanner	4 Nos.
46.	Air compressor	2 Nos.
47.	Vacuum pump	2 Nos.

Basic Electronic & Electronics Instrumentation.

Practical
<p>Identification of hand tools, Safety Precautions while working in Electronics Lab & Electric Shock First Aid, and various measuring instruments, soldering- de- soldering Practice on wire, chassis and on PCB.</p> <ul style="list-style-type: none">• Identification specification & testing of various kind of resistances, & capacitors, Measurement by colour code• Familiarize with various types of switches.• Construct circuit with SPST, SPDT, and DPDT switches.• Familiarize miniature and micro switches, reed switches & latches, sockets –connectors & plugs, fuses, terminals, tags, legs & thimbles, Relays and their contacts,• Familiarization with various types of variable resistors, the potentiometer, LDR, VDR.• RC time. Constant
<ul style="list-style-type: none">• Forward and reverse characteristics of P N junction diode & Zener Diode.• Plotting of various characteristics of Transistor• Biasing method of Transistors• Identification, Specification testing of Junction Diode & Transistors, LED, Zener Diode• Fabrication and assembly of Full wave rectifier Ckt using Diodes, Adding to Pie Filter,• Adding to Series Regulated Ckt using Zener & Series Transistor,• Build of voltage Divider , Doublers
<ul style="list-style-type: none">• Assemble and observe the outputs of mono stable, bi stable and A-stable multi vibrators using transistors and 1C555.• Assemble and observe the output of two input, two output bi stable multi-vibrator, .• Assemble Astable multi-vibrator as a VCO.• Construct and measure the output of simple inverter, SMPS.& UPS• Characteristics of transistor As switch identification and Testing of FET,• Common Source and common drain Configuration,• Study of switching action of JFET CMOS BMOS & MOSFET.• Construct and measure the output of MOSFET based inverter, SMPS.& UPS
<ul style="list-style-type: none">• Testing of SCR by multi meter plot the forward characteristics of a SCR• Find the latching current and holding current of SCR,• AC switching circuit by UJT, plot the Characteristics of UJT, Construct and observe outputs of UJT firing circuit, light dimmer circuit,• Characteristics of DIAC, DIAC as a DC pulse generator, characteristics of TRIAC fan regulated• DC motor speed control method and armature current control method, SCR trainer kit.

Integrated Circuits: - Formation of diode, transistor, Resistor and constructional details- Different types of ICs.

Assemble and verify truth table of OR, AND, NOT gate using discrete components.

Verify truth table of NAND, NOR, XOR and XNOR gates.

Study the inter conversion of gates by combination of another logic ckts

Making of Min and Max Combination ckt using logic gate

Study of Digital Logic Lab and perform various experiments of Flip Flops, Registers, and Counters

Familiarization with common anode, cathode and seven segments, LED display, LCD display and display drivers,

- Construct and observe output of resistive network and binary ladder.
- D/A converter, observe the output of comparator with different inputs,
- Familiarize with A/D converter
- Familiarize with memory ICs, parallel expansion of memory ICs, EPROM ICs, EPROM programmer.

Measurement of LC & R, using LCR Bridge, Digital LC & R meter

Measurement of AC, DC voltage, current using all types of Analog and digital meters, ramp type, Integrating type, Continuous Balance type

Study complete method of use of digital millimeter for its complete measurement provision like V,I,R, db, Temperature, capacitance, feature of testing of semiconductors, Frequency, feature of hold and memory provision

Use of Analog and Digital Frequency meter/Counter , Various Type of Timer, Timers and controllers

Familiarization with operation, use & application of CRO in detail .Measurement of Freq., Voltage, Phase & Phase Difference using Single, Dual Trace, Storage Type Oscilloscope.

Seeing and comparative analysis of wave shape using Oscilloscope.

Plotting of Lissagous Pattern

Familiarization with operation and use of various kind of signal generator, function generator, pulse generator