

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

1	Name of Course	<b>C.C.In Pollution Control Plant Operator (Air &amp; Water) (W.E.F. 2015-16)</b>																																															
2	Course Code	<b>411184</b>																																															
3	Max.No.of Students Per Batch	25 Students																																															
4	Duration	6 Months																																															
5	Type	Full Time																																															
6	No.Of Days / Week	6 Days																																															
7	No.Of Hours /Days	7 Hrs																																															
8	Space Required	<ol style="list-style-type: none"> <li>1) Lab cum workshop = 400 Sq feet</li> <li>2) Class Room = 200 Sq feet</li> <li style="text-align: center;"><b>TOTAL = 600 Sq feet</b></li> <li>3) MOU with Water Analysis Lab</li> <li>4) MOU with Water Treatment Plant</li> <li>5) MOU with Air Polluted Industry / Plant.</li> </ol>																																															
9	Minimum Entry Qualification	<ol style="list-style-type: none"> <li>1) H.S.C. Science/ H.S.C.Voc. (Engg.Group)/ 2 Years Diploma in Mech./Elect./Civil/Chemical Sector of MSBVEE Or</li> <li>2) NTC (ITI) in Fitter / Electrician / Pump Mechanic / Diesel Mechanic Or</li> <li>3) Diploma Engg. Electrical / Civil / Chemical / Textile.</li> </ol>																																															
10	Objective Of Course	To Create Skill Manpower for Pollution Control Plant Operations.																																															
11	Employment Opportunity	<ol style="list-style-type: none"> <li>1) Operator in Waste Water Treatment Plant in Industry.</li> <li>2) Air Pollution Equipment Operator.</li> <li>3) Pollution Control Equipment Repair and Maintenance.</li> <li>4) Supervisor in any industry which requires to follow MPCB Pollution Norms.</li> <li>5) Contractor for Installation and Maintenance of Water Treatment Plant and Air Pollution Control Equipment's.</li> <li>6) Water Testing Analyst in a Lab.</li> </ol>																																															
12	Teacher's Qualification	B.E. Civil / Chemical Or M.SC. Environmental Science with 2 Year Experience in relevant Field.																																															
13	Training System	<b>Training System Per Week</b>																																															
		Theory		Practical		Total																																											
		12 hrs		30 hrs		42 hrs																																											
14	Exam. System	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Sr. No.</th> <th style="text-align: center;">Paper Code</th> <th style="text-align: center;">Name of Subject</th> <th style="text-align: center;">TH/PR</th> <th style="text-align: center;">Hours</th> <th style="text-align: center;">Max. Marks</th> <th style="text-align: center;">Min. Marks</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">41118411</td> <td style="text-align: center;">Waste Water Treatment</td> <td style="text-align: center;">TH-I</td> <td style="text-align: center;">3 hrs.</td> <td style="text-align: center;">100</td> <td style="text-align: center;">35</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">41118412</td> <td style="text-align: center;">Air Pollution Control</td> <td style="text-align: center;">TH-II</td> <td style="text-align: center;">3 hrs.</td> <td style="text-align: center;">100</td> <td style="text-align: center;">35</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">41118421</td> <td style="text-align: center;">Waste Water Treatment</td> <td style="text-align: center;">PR-I</td> <td style="text-align: center;">3 hrs.</td> <td style="text-align: center;">100</td> <td style="text-align: center;">50</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">41118422</td> <td style="text-align: center;">Air Pollution Control</td> <td style="text-align: center;">PR-II</td> <td style="text-align: center;">3 hrs.</td> <td style="text-align: center;">100</td> <td style="text-align: center;">50</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;"><b>TOTAL</b></td> <td></td> <td></td> <td style="text-align: center;"><b>400</b></td> <td style="text-align: center;"><b>170</b></td> </tr> </tbody> </table>						Sr. No.	Paper Code	Name of Subject	TH/PR	Hours	Max. Marks	Min. Marks	1	41118411	Waste Water Treatment	TH-I	3 hrs.	100	35	2	41118412	Air Pollution Control	TH-II	3 hrs.	100	35	3	41118421	Waste Water Treatment	PR-I	3 hrs.	100	50	4	41118422	Air Pollution Control	PR-II	3 hrs.	100	50			<b>TOTAL</b>			<b>400</b>	<b>170</b>
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## Theory - I - Waste Water Treatment

Unit	Theory	Practical
Unit - 1	<p><b>Orientation &amp; Introduction</b></p> <p>Water resources, Types of Water, Basic Softening processes, (Pretreatment of water)</p> <p><b>Pollution</b></p> <p>Basic concepts &amp; Definition, Types of Pollution, Effects of Pollution, Prevention / Controlling Toxic metals &amp; non metals in water &amp; soil. Acceptable limits. Treatment methods, (Physical, Chemical &amp; Biological Method). Process flow diagram.</p>	<ol style="list-style-type: none"> <li>1) Flocculation</li> <li>2) Coagulation</li> <li>3) To draw block and process. Flow diagram of E.T.P.</li> </ol>
Unit – 2	<p><b>Statutory Requirement / Provisions</b></p> <p>Environment act, Environment policy, Basic water pollution &amp; air pollution rules, Hazards &amp; Types of hazards &amp; controlling methods, Hazards processes &amp; schedule of hazards processes, ISO 9001, 14001, 18001, Etc. CPHEEO Norms</p>	<ol style="list-style-type: none"> <li>1. To determine Chemical Oxygen demand.</li> <li>2. To determine Biological Oxygen demand.</li> <li>3. To determine Dissolved Oxygen</li> </ol>
Unit – 3	<p>Density, PH, Viscosity Acidity, Alkanality, Normality, Molality, Preparation of Solutions, Pretreatment analysis (Testing) – BOD, COD, DO, TDS, TSS, Suspended solids Biomass.</p>	<ol style="list-style-type: none"> <li>1. To determine normality &amp; strength of acid.</li> <li>2. To identify the colour of given sample of water</li> <li>3. To determine conductivity of given sample.</li> <li>4. To determine viscosity of oil samples.</li> </ol>
Unit - 4	<p><b>Sampling &amp; Testing, Analysis</b></p> <p>Method of sampling, Types, Sample preservation PH, odour, colour, conductivity, turbidity suspended solids, Total dissolved solids, Chlorides, Total hardness, PH measurement, Level measurement.</p>	<ol style="list-style-type: none"> <li>1. To determine Total dissolved Solids.</li> <li>2. To determine Total suspended Solids.</li> <li>3. To determine Oil &amp; Grease contents.</li> </ol>
Unit - 5	<p><b>Waste Water Treatment</b></p> <p>Introduction, Preliminary Treatment, Primary Treatment, Secondary Treatment, Trickling Filters, Activated Sludge Treatment. Territory Treatment, M.E.E. Zero liquid discharge (ZLD) concept.</p> <p><b>Sludge Management</b></p> <p>Sludge Characteristics, Sludge Treatment, Sludge Thickening, Sludge Digestion, Sludge Dewatering, Sludge Disposal. (If Hazardous waste then disposal to CHWTSDF) Plasma gassification, Investigation</p>	<ol style="list-style-type: none"> <li>1) To determine the rate of sedimentation.</li> <li>2) Inlet / outlet / ----- ETP /STP</li> <li>3) Industrial visit (CETP/STP/E.T.P./Plant)</li> </ol>

Unit – 6	<b>Basic Electrical &amp; Civil</b>  Basic Wiring, Switches (Starters), Circuit Breakers, Earthing, Types of Motors, Panel Board, Brick work, Foundation, Crack filling, Leveling, Leakage Proofing, Plastering.	<ol style="list-style-type: none"> <li>1) Wiring Practice.</li> <li>2) Single phase &amp; three phase connection.</li> <li>3) Earthing Practice.</li> <li>4) Practical on brick work Plastering &amp; Crack filling.</li> </ol>
Unit – 7	<b>Plants Operations &amp; Maintenance</b>  Safety precautions in Laboratory & Plant, Equipment & Machinery Pumps, Valves, Pipe fittings, Gear Box, Flow meters, Flow meters, Blowers & Compressors.	<ol style="list-style-type: none"> <li>1) Pipe fitting practice</li> <li>2) Dismantle and assemble different type of valves.</li> <li>3) Gasket cutting &amp; Lagging Practice.</li> <li>4) Dismantle and assemble different types of pump.</li> <li>5) Dismantle and assemble blower.</li> <li>6) Dismantle and assemble compressor.</li> <li>7) Alignment of shaft and coupling.</li> </ol>
Unit – 8	<b>Maintenance of different equipments</b>  Clarifier (Thickener), Neutralization Tank, Sedimentation Setter (Primary & Secondary), Sludge Storage, Digestion tank, Filtration, equipments Plate & frame filter press, sand filter, Rotary vacuum filter, Centrifuge etc. Pumps and Valves.	<ol style="list-style-type: none"> <li>1) Dismantle and assemble Gear box.</li> <li>2) To determine flow rate with the help of flow meters.</li> <li>3) To separate heterogeneous Mixture with the help of filter media. (Filter press &amp; Centrifuge)</li> <li>4) Maintenance of Primary System.</li> <li>5) Maintenance of Aerators.</li> <li>6) Maintenance of -----</li> <li>7) Maintenance of S.D.B.</li> </ol>
Unit – 9	<b>Interpretation</b>  Record keeping, Report & documentation, Logsheets.	Documentation and Report Preparation practice
Unit - 10	<b>On Job Training and Feed back</b>	<ol style="list-style-type: none"> <li>1) Practicals related to Waste Water Treatment and Sludge Management.</li> <li>2) Analysis of sample.</li> <li>3) Project on case study.</li> </ol>

## Theory - II - Air Pollution Control

Sr.No.	Theory	Practical
1	<p><b>Introduction about air pollution</b></p> <p>Air Pollution - Definition, Sources, Primary and secondary air pollution, vehicular pollution, types of air pollutants, pollution due to various types of use of fuels, Effects on man, animal, plant and Environment, Global Warming, Ozone layer Depletion, Acid Rain, Photochemical smog and introduction about carbon credit.</p>	<ol style="list-style-type: none"> <li>1) Study of Fume Extraction System</li> <li>2) Study of Cyclone and Multicyclone system.</li> <li>3) Study of Dust Collector</li> <li>4) Study of Electrostatic precipitator.</li> <li>5) Study of stack emission monitoring system.</li> <li>6) Study of Ambient Air quality monitoring system.</li> <li>7) Air pollution measurement and Analysis.</li> </ol>
2	<p><b>Environmental Law</b></p> <p>Introduction of Air (Prevention and Control of Pollution) Act 1981, Air quality standards</p>	
3	<p><b>Air pollution Control Equipments</b></p> <p>Introduction of the controlling equipments, Fume Extraction system, Cyclone and Multicyclone system, Dust collector, Scrubber system, Electrostatic precipitators (ESP), Stacks.</p>	
4	<p><b>Air monitoring instruments.</b></p> <p>Introduction about function of the equipments, sampling methods, (Ambient and stack monitoring) High Volume Sampler, stack monitoring kits, Handy Sampler, its connections, operation and measurements. Types of filter papers and its use in the type of air sample monitoring.</p>	
5	<p><b>Laboratory submission</b></p> <p>Submission of filter papers, scrubbing media / solutions in the lab for air pollutants analysis.</p>	
6	<p><b>Reading of analysis results</b></p> <p>Compare analysis results with air quality standards.</p>	

### List of Tools, Equipments & Machinery

Sr.No.	Name of Items	Require Quantity
<b>Trainee Kit</b>		
1	Double ended spanners 3/8 " x 7/16" to 15/16" x 1"	05 Sets
2	Offset double ended ring spanner 1/8" x 3/16" to 1/2" x 9/16"	05 Sets
3	Hack saw Frame adjustable for 8" & 12" Blade	10
4	Hammer ball pein - 1 lb	10
5	Screw Driver 12" x 1/2" blade	10
6	File flat 8" /20 cm rough	10
7	File round 8" /20 cm lenth	10
8	Pipe wrench 18" long	10
9	Hole punch set	10
10	Straight Snip 8"	10
11	Allen Key set	10
12	Chisel flat 1/2"	10
13	Wiring Tool Kit for wiring & maintenance	05 Sets
14	Adjustable spanner 12"	10

<b>Equipment &amp; Machinery</b>		
1	Venturimeter	01 No.
2	Rotameter	01 No.
3	Centrifugal Pump	02 Nos.
4	Gear Pump	02 Nos.
5	Piston Pump	02 Nos.
6	Blower 2 Hp	01 No.
7	Compressor 3 Hp	01 No.
8	Gear Box	01 No.
9	Centrituge	01 No.
10	Plate & frame filter press	01 No.
11	Model water treatment plant	01 No.
12	Viscometer	02 Nos.
13	Gate valve	02 Nos.
14	Globe valve	02 Nos.
15	Ball valve	02 Nos.
16	Non Return valve	02 Nos.
17	Diaphragm valve	02 Nos.
18	Different Types of pipe fittings (Bend, Tee, Elbow, Cross, etc.)	06 picees each
19	Clarifier - 20 lit.capacity	01 No
20	Areator - 20 lit.capacity	01 No
21	Agitators	02 Nos.
22	Pressure Grease gun. (Hand operated)	01 No.
23	Spirit level	02 Nos.
24	Stop watch	02 Nos.
25	Single phase motor ½ Hp	01 No.
26	Three phase motor ½ Hp	01 No.
27	Dial gauge tester for checking alignment with stand	02 Nos.
28	Steel rack	01 No.
29	Steel Almirah with shelves	01 No.
30	DOL starter	01 No.
31	Circuit Breaker	01 No.
32	Panal board	01 No.
33	Plum Bob	06 Nos.
34	Square	06 Nos.
35	Steel float	06 Nos.
36	Pan	06 Nos.
37	Line dori	06 Nos.
38	Trowel	06 Nos.
<b>Laboratory Glassware &amp; Equipments</b>		
1	Single pan digital balance	02 Nos.
2	Turbidity meter	01 No.
3	Conductivity meter	01 No.
4	P H Meter	01 No.
5	Oven electrical	02 Nos.
6	Refrigerator 265 lit.	01 No.
7	Burner (Bunsen)	25 Nos.
8	Glass Tube & Rod of different diameter	10 Kg.
9	Rubber Tube for water, gas & vacuum	20 mtrs.
10	Corkes (Wooden & Plastic)	25 Nos.
11	Pair of tongs	10 Nos.
12	Spatula (steel or nickel)	10 Nos.
13	Test Tube stand	10 Nos.

14	Tripods	10 Nos.
15	Asbestos wire gauge	10 Nos.
16	Test Tube Holder	10 Nos.
17	Burette stand with holder	10 Nos.
18	Clay triangle	10 Nos.
19	Burette 25 ml., 50 ml. with stopper cock	10 Nos.
20	Pipettes 10 ml. & 25 ml.	10 Nos.
21	Pipettes for measuring solutions 5 ml., 10 ml. & 25 ml.	10 Nos.
22	Measuring cylinders 25 ml., 50 ml., 100ml., 500ml. & 1000 ml.	05 each
23	Volumetric flask 100 ml & 250 ml.	05 each
24	Distillation assembly with condensers	05 set
25	Funnels 4 cm & 9 cm	05 Nos.each
26	Beakers 100 ml. 250 ml. & 500 ml.	10 each
27	Evaporating dish	15 Nos.
28	Watch Glass	15 Nos.
29	Thermometers 100°C, 250 °C	10 each
30	Round bottom flask	05 each
31	Filter paper (whatman 40)	05 pkts
32	Crucible with lid	15 Nos.
33	Standardization flask 250 ml & 500 ml	15 each
34	Test Tubes	500 Nos.
35	Hard Glass Test Tubes	05 Nos.
36	Reagent bottles 250 ml & 500 ml for liquids	100 each size
37	Reagent bottles 100 gm, 250 gm & 500 gm for solids	50 each
38	Indicator bottles 50 ml.	10 Nos.

## Tools and Equipments

### Air Pollution Equipment

Sr.No.	Name of items	Require Quantity
1	Stack Monitoring Kit a) Rotameters b) Monometer c) Vacuum Gauge d) Timer e) Temp Indicator	1 No.
2	Pitot Tubes	1 No.
3	Thermocouple Sensor	1 No.
4	Thimble Holder	1 No.
5	Thimble Holder No. sizes (1/8", 1/4", 1/2", 3/8")	1 No.
6	Sampling Probe	1 No.
7	Connecting Hoses / Tubes	1 No.
8	Vacuum Pump	1 No.
9	Gaseous Box	1 No.
10	Impinging Tube (120 ml. and 250 ml.)	1 No.
11	PDSA Flask (Round bottom Flask) For NOx Sampling	1 No.
12	Glass micro fiber Thimbles	1 No.
13	Repairable Dust Sampler with Gaseous attachment.	1 No.
14	Impinging Tubes (35 ml.)	1 No.
15	Stack Sampler (SMK 002)	1 No.
16	Rubber Tubing	1 No.
17	Bladder	1 No.
18	Dry Gas meter / Handy Sampler	1 No.
19	Noise Level meter	1 No.
20	Repairable Dust Sampler (RDS)	1 No.

### Other Equipments :-

1	Asbestos Gloves	2 Pairs
2	Helmet	2 Nos.
3	Water can	1 No.
4	Sampling Bottle	1 No.
5	Chemicals	As per requirement
6	Absorbing Solution for SO <sub>2</sub> (3 % H <sub>2</sub> O <sub>2</sub> )	As per requirement
7	Absorbing Solution for NO <sub>x</sub> (H <sub>2</sub> O <sub>2</sub> + H <sub>2</sub> SO <sub>4</sub> )	As per requirement
8	Absorbing Solution for SO <sub>2</sub> (0.04 M Potassium Tetrachloro mercurate)	As per requirement
9	Absorbing Solution for NO <sub>2</sub> (0.1 N Sodium Hydroxide with arsenite )	As per requirement

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