MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI

1	Name of Syllabus	**C.C.In Process Plant Maintenance (307201)**
2	Max. Nos of Stude	25 Students
3	Duration	1 Year
4	Type	Full Time
5	Nos Of Days / We	6 Days
6	Nos Of Hours /Da	7 Hrs
7	Space Required	Workshop / Laboratory = 1000 Sq feet Class Room = 200 Sq feet TOTAL = 1200 Sq feet
8	Entry Qualificatio	S.S.C.
9	Objective Of Syllabus/ introduction	Awareness of Safety precautions Knowledge of Engineering skill, use of tools in assembly Awareness of Electrician, Electronics & Computer Skill. Awareness of Basic Fitting, Turning & Machining. Awareness of Basic Instrumentation. Awareness of Refrigeration & Air Conditioning. Awareness of Basic Laboratory Technician.
10	Employment Opportunity	The trainee will either to be able to take up jobs with agencies which Maintain Develop and repair Process Plant Maintenance or with working experience will be in a position to start his own independent Business.
11	Teacher's Qualification	Diploma in Electronics, Mechanical & Instrumentation Engg. With 3 year Teaching experience in Process Plant Maintenance. Diploma or Degree in Electronics, Mechanical & Instrumentation Engineering or equivalent profession Qualification. With 1 year Teaching experience in Process Plant Maintenance
12	Training System	Training System Per Week

Theory	Practical	Total
18 Hours	24 Hours	42 Hours

13 Exam. System

Sr.	Paper Cod	Name of Subject	TH/PF	Hours	Max Mar	Min. Marks
1	**30720111**	Basic Fitting, Turning & Machining.	TH-I	3 hrs	100	35
2	**30720112**	Basic Refrigeration & Air Conditioning & Laboratory Technician.	TH-II	3 hrs	100	35
3	**30720113**	Basic Electrician, Electronics, Computer & Instrumentation	TH-III	3 hrs	100	35
4	**30720121**	Basic Fitting, Turning & Machining.	PR-I	3 hrs	100	50
5	**30720122**	Basic Refrigeration & Air Conditioning & Laboratory Technician.	PR-II	3 hrs	100	50
6	**30720123**	Basic Electrician, Electronics, Computer & Instrumentation	PR-III	3 hrs	100	50
		TOTAL			**600**	**255**

Syllabus - Process Plant Maintenance

Basic Fitting, Turning & Machining

Topic	***THEORY - I***	***Practical - I***
Basic Fitting, Turning & Machining	Introduction to metrology objectives of metrology-measurement-Principles-methods of measurements. Terminology used in metrology-accuracy- repeatability-resolution etc. SI units of measurements - physical quantities under SI system.	Physical introduction to measuring instruments- Handling of Instruments- Exercise in the use of liner measuring instruments Such as steel rule of different ranges. Out side calipers, in side Calipers for measuring inside. Outside measurement, in side measurement, depth gauge.
	Selection of measuring instruments, care use & maintenance of measuring instruments-handing of precautions instruments-vernier caliper micrometer, high gauge, dial gauge (Plunger & bevel type) with stand (0.01mm resolution), checking square ness using combination set.	Measurement of flat rectangular objects, cylindrical objects. Hollow components, threaded components. Exercises on external & internal measurements using micrometers & Height gauges
	Manufacturing process in brief. Out line of various subjects to be covered. Introduction to hand tools & their safety. Environment factors& personal safety.	Introduction to safety including fire equipments & their uses. Familiarize with Fitter's hand tools. Filling a flat surface of mild steel & cast iron. Check for flatness straightness & square ness.
	Marking & punching tools. & their uses. Hacksaw- types, specification & their uses. Classification & specification of files, shapes, sizes and grades. Bench vice constructional details.	Simple blue print reading. Mark out according to simple to simple blue print. Hack sawing to dimension. Filing flat & square to size to an accuracy of +0.1mm. Marking & punching of stepped & angular components & finishing of stepped & angular components & finishing the part to the required shape & size to an accuracy of +0.1mm.
	Selection criteria of file. Vernier bevel protector-reading and use. Use of thread gauge and screw micro meter. Drilling machine-types-drilling operation –drill bits. Reamers-types care & maintenance.	Exercise on angular measurement using combination set & vernier bevel protector. Center drilling, reaming, counter sinking, counter boring and tapping for various sizes of mild steel and tapping on various size of mild steel material.

	Taps & Dies-Description. Care & maintenance, Lubricants for tapping. Determination of drill size for tapping selection of spindle R.P.M.for drilling, tool holding and work holding and work holding device, types of fasteners. Standard size of size of threads. Taps application of adhesive metal. Shellac etc.	Fitting exercise-simple to complex (Involving drilling, tapping, reaming, counter boring & slide fitting).
	Introduction to welding trade, importance of welding in industrial development. Subject to be taught & achievement of be made. Safety precautions in gas & electric welding, elementary knowledge of first aid. Description & uses of welding tools & equipments, Method of shaping & jointing of metals, riveting, bolting, brazing, soldering & welding.	Introduction to the trade area & the type of jobs made by the trainees in the workshop. Safety on handling tools & equipment related to the trade. Setting up of arc & gas apparatus. Lighting & adjustment of oxyacetylene flame & fusion runs with & without filter rode on 2 to 3 mm thick M.S sheet(in flat position in gas) . Striking & maintaining of arc & drawing shot heads of M.S. plate 10 to 12 mm thick (in flat position in arc).
	Basic methods of production of oxygen & acetylene on mercial basis. Types of flame. Chemistry of neutral flame, principle of acetylene cutting, objects of using fluxes & rods.	Lap, fillet & fillet joints on MS sheet 3mm in flat position (gas). Oxyacetylene cutting hand & machine square & level on 12 mm MS plate. Brazing on MS & Copper.
Turning & Machining	Outline of various subjects to be covered disciplinary rules of the Institute training and other facilities available. Importance of measurement. Types of precision measuring tools, Micro-meter and Vernier caliper, Principle, Construction of various parts, reading of micrometer and Vernier caliper both English and Metric system.	Manufacturing process and their importance in Industries. Safety precautions followed on shop floor Vernier caliper and micro-meter, construction, parts, principles, application making the jobs. Different types cutting tools, grinding practice on pedestal machine.
	Shaper, Planer and Slotting machine, construction types used of parts, General principle of power transmission. Various cutting tools and their angles and importance of angle.	Introduction of shaping, planning and slotting- construction, types, parts, function and used, shaping rectangular block as per sketch.
	Milling machine – Introduction, construction, type's specification and application. Work holding devices and cutter holding devices. Process of milling Machine-up & down milling. Milling operation-plain milling. Stop	Introduction to milling machine demonstration on working principle, setting of jobs, setting of cutter in arbor setting of vice on table. Step milling using side and face cutter checking with

	milling. Face milling. Slot milling, angular and end milling etc. Classification of different type milling cutter and their used. Selection of cutting speed, feed and depth of cut for different milling operation.	micro-meter. Slot Mill using slot milling cutter. Face mill using face milling cutter.
	Introduction of indexing head types, parts, function and used. Indexing- types of indexing as direct, simple, differential, compound, angular and linear indexing and their calculation. Introduction of gear, types and their used. Spur gear elements and calculation.	Setting of indexing head on milling, table and mill a hexagon on a round bar using direct indexing method. Spur gear cutting on horizontal milling machine using simple indexing methods. Checking with gear tooth Vernier calipers. Milling a rack by linear indexing method.
	Manufacturing process in brief outline of various subjects to be covered. Disciplinary rules of the Institute. Training and other facilities available. Introduction to lathe description. Lathe- types of lathe machine, parts of centre lathe and function, lathe operation. Size and specification of a centre lathe. Lathe cutting tools- Types & tools, angle.	Introduction of engine lathe and parts, holding the job in three & four jaw chuck. Facing and plain turning operations use of measuring tools required for turning.
	Work and tools, holding devices of lathe machine. Methods of mounting and dismounting chucks. Taper- types of Taper and their used. Taper turning methods and their calculation.	Facing, Plain and Turning. Taper Turning by compound rest slide methods. Setting threading tool and cutting the external “V” threads.
	Cutting speed, feed and depth of cut for different lathe operations, threads, types of thread and used. Cutting tool materials & types of coolants.	Perform centre drilling, boring, parting off, Knurling, grooving, chamfering operations.
	Grinding machine- Introduction. Types specification and used. Grinding wheel, types and construction and mounting of wheel, wheel balancing & wheel turning. Metallurgy- types of metals, properties of metals, classification of steel, alloy steels and effect of alloying elements.	Balancing and truing of grinding wheel. Mounting and dressing of grinding wheel. Re sharpen of plain turning tool on Pedestal grinder to an accuracy of one degree; check the tool angle using bevel protector.

LIST OF TOOLS & EQUIPMENT OF BASIC FITTING

Sr. No.	Particular
1	Steel rule 30 cm graduated both in English & metric units
2	Out side spring caliper 150 mm
3	In side spring caliper 150mm
4	Hermaphrodite caliper 150mm
5	Divider spring 150mm
6	Centre punch 100mm
7	Hammer Ball pein 0.5 kg
8	Combination pliers 150mm
9	File flat bastard 300mm
10	File flat IInd cut 250mm
11	Engineers screw driver
12	File flat smooth 200mm
13	Cold chisel flat 25x200mm
14	Granite surface plate 1000x 630 mm grade1
15	Metal stand table for surface plate 900x900x1200mm
16	Screw driver set (multi heads)
17	Scribing block universal 300mm
18	V block universal 300mm
19	Tri square 150mm
20	Out side spring caliper 200mm
21	Divider spring 200mm
22	Inside spring caliper 200mm
23	Straight edge steel 1mtr.
24	Straight edge steel 500mm
25	Steel tape 2 miters.
26	Sprit level
27	Hammer ball pein 800gms
28	Screw driver heavy duty 300mm
29	Hammer lead 1 kg
30	Combination set 300mm
31	Spindle blade screw driver 100mm
32	Dial gauge o/ 50mm
33	Lever type dial gauge o/50mm
34	Dial gauge stand
35	Screw pitch gauge set for metric pitches (0,5-7mm)
36	Radius gauge set metric 1-6mm
37	Allen hexagonal key set 2.5-12mm
38	Spanner double ended set (seven pcs.) in metric.
39	Adjustable spanner 300mm
40	Reduction sleeve MT as required
41	Angle plate size 200x100x200mm
42	Angle plat adjustable 250 x 150 x175mm
43	Solid parallels in metric
44	Oil can pressure feed 500m
45	Oil stone 150x50x25mm
46	Twist drills 3-13mm(paraller shank)
47	Drill chuck 0-20mm with taper shank
48	Centre drill A 1-5

49	Grinding wheel dresser (star type)
50	C clamps 100mm
51	C clamps 200mm
52	Tap & die set in box metric
53	Drill HSS taper shank 10-20mm
54	File flat IInd cut 250mm
55	File flat smooth 200mm
56	File Half round IInd cut 250mm
57	File triangular smooth 200mm
58	Needle file set
59	File square IInd cut 250mm
60	Reamer set 6-13mm by 1mm
61	Hacksaw adjustable 300mm
62	Bench vice 150mm jaw
63	Magnifying glasses 75mm
64	Micrometer out side 0-25mm
65	Micrometer out side 25-50mm
66	Micrometer depth gauge 0-150mm
67	Direct reading vernier caliper 300mm
68	Vernier height gauge 250mm
69	Digital vernier caliper 200mm
70	Vernier bevel protector with least count of 5 minutes
71	Feeler gauge 0.1-1.0mm
72	Pillar type drilling machine 12mm cap with accessories
73	Redial drill machine 120mm Motorized with tapping attachment
74	Pillar type drill machine 20 mm caps. with accessories
75	Two wheel pedestal grinder 300mm
76	Hand drill machine 10mm capacity
77	Sledge hammer 10mm pound
78	Welding torch with tips assorted
79	Anvil
80	Mallet 1lb.
81	Number/alphabetic punch 100mm
82	Welding transformer200A
83	Welding cable for above capacity in mt
84	Electrode holder
85	Chipping hammer
86	Screen helmet
87	Pressure Regulator Oxygen double stage
88	Leather gloves pair
89	Tongs holding 300mm
90	Pressure Regulator Acetylene double stage
91	Arc welding table
92	Lugs for cable
93	Rubber Hose pope for Oxy. & Ace.in mt
94	Cutting torch Oxy-acetylene with tips
95	Spark lighter
96	Arc welding Generator set 350A
97	Gas Trolley

LIST OF TOOLS & EQUIPMENT OF BASIC TURNING & MACHINING

Sr. No.	Particular
1	Steel rule 30 both English & Metric Units
2	File Flat 2nd Cut 250mm
3	Screw Driver 12”
4	Out side caliper spring type 150mm
5	Inside caliper spring type 150mm
6	Odd leg caliper spring type 150mm
7	Divider spring type 150mm
8	Centre Punch 100mm
9	Safety Glasses
10	Hammer Ball Pein 0.5Kg.
11	Combination Plier 150mm
12	File Flat bastard 300mm
13	File Flat Smooth 200mm
14	Plier cutting 200 mm
15	Centre Drill 2, 3&4
16	Vernier Height gauge 300mm
17	Surface plate 900x900x120mm with stand /table
18	Scribing Block Universal 300mm
19	“V” Block 100/7-80-A
20	Try Square 150 mm
21	Sprit level 2V 250, 05 Metric
22	Hammer B.P. 800 grams with handle
23	Combination set 300 mm
24	Screw Driver Heavy Duty 300mm with handle
25	Out side spring caliper 200mm
26	Inside spring caliper 200 mm
27	Straight edge steel 500mm
28	Steel Rule 60 cm graduate bottom English & Metric Units
29	Hammer lead 1 kg.
31	Surface Plate 400x400 mm
32	Hand Hack saw frame fixed 300mm
33	File square 2” Cut 250mm
34	Swivel Base Machine Vice 200mm
35	Bevel gauge 200mm
36	Telescopic Gauge 13 to 300mm
37	Assorted Carbide lathe tools with Holder different shapes & size
38	Hack saw frame adjustable 250-300mm
39	Micro Mater 50-75
40	Micro Meter depth gauge 0-200mm
41	Vernier Caliper 300mm (with all)
42	Vernier bevel protector with 150 mm blade
43	Micro Meter 0-25mm

Basic Refrigeration & Air Conditioning & Laboratory Technician

Topic	***THEORY - II***	***Practical - II***
Basic Refrigeration & Air Conditioning	Refrigeration service tools, types, specification & use, Refrigeration components, type & use. Refrigeration principal & its application. Vapor compression system, components & division-H.P. & L.P. sides of system. Refrigeration capacity of system.	a- Use of refrigeration service tools, their care & safety. b- Cutting, bending And Joining of copper tubing, flaring, swaging, pinching & silver soldering. c- Identification of refrigeration system
	Refrigeration compressor- its function, mode of drive, type of compression classification. Reciprocating compressor name. Function, construction & parts.	a- Dismantling of Commercial type reciprocating compressor, Checking components & parts. b- Cutting gasket of compressor. Testing efficiency of compressor.
	Semi rotary, centrifugal & screw type compressor their types, construction, application & function. Condensers, evaporators, expansion valves & pressure switch their types, construction, application & function. Automatic, thermostatic & capillary control. High pressure low pressure & oil failure switch their types, construction, application & function	a- Study & type of semi rotary, centrifugal & screw type compressor. b- Study, testing & servicing of air cooled condensers, evaporators, expansion valves & pressure switch.
	Type of refrigerants, handling of refrigerants & cylinders. Colour code of cylinders, method of refrigerant transfer. Oil used in Refrigeration system, their properties, oil treatment & selection. Leak detectors, vacuum pump, gauge their type, specification, range of desirable vacuum in open & sealed system. Application of indirect refrigerants, Freon group refrigerants-their characteristics & properties.	a- Handling of gas cylinders, transfer of refrigerant, gas charging, tests leakage in the system. b- Oil charging to compressor, installing compressor, cooling coil & condenser of refrigeration unit.
	Air conditioning & its principle, application. Window type, split type air conditioner their types, construction, application & function and trouble shooting. Water cooler, deep freezer, ice candy plant their types, construction, application & function and trouble shooting.	a- Study types & checking of window, split type air conditioner & their fault finding. b- Study types & checking of water cooler, deep freezer, ice candy plant.

	Air cooler, room cooler & desert cooler their types, construction, application & function and trouble shooting. Heat exchanger their types, construction, application & function and trouble shooting.	a- Study types & checking of air cooler, room cooler & desert cooler. Study type & servicing of heat exchanger.
	Cold storage, cooling tower, water softening & iron removing plants their types, construction, application & function and trouble shooting. Fans, blowers, dampers, air filters and humidifiers their types, construction, application & function and trouble shooting.	a- Study types & checking of cold storage, cooling tower, water softening & iron removing plants. b- Study types & servicing of fans, blowers, dampers, air filters and humidifiers.
	Gas welding process. Gas flame combination their flame temp. & application. System of oxy-acetylene welding brief description of gas cylinders, regulators & blow pipes. Chemistry of neutral flame, Principle of acetylene cutting, object of using fluxes & rods	Types, application & use of Gas welding, setting up of flames. Lighting & adjustment of oxyacetylene flame & fusion runs with & without filler rod on 2 to 3 mm thick M.S. sheet Lap & T Fillet joints on MS sheet 3 mm is flat position (gas). Brazing on MS & Copper.
Laboratory Technician	Introduction to chemistry. Elements, atoms, molecule. Laws of chemical combination, chemical equilibrium, atomic, molecular & equivalent Weights, periodic table of elements. Study of different types of lab apparatus. Volumetric analysis	A-Safety precaution to be used in laboratory. B-Volumetric analysis- types of titration. Analysis of acids bases & salts.
	Periodic study of group elements. Metallurgy of- copper, iron, zinc, tin, lead, cobalt, nickel & chromium.	A-Young's modulus, law of parallelogram, thermal conductivity of metals. B-Faraday's laws of electricity. Study of electric cells-series & parallel connections
	Preparation, properties & uses- hydrogen, oxygen, sulpher, nitrogen, phosphorus & its compounds. Preparation, properties & uses- chlorine, bromine, iodine, fluorine& its compounds.	A-Organic preparations- etherification, supranational, nitration, oxidation, reduction, hydrolysis & saponification. B-inorganic preparation- alum, Mohr's salt, copper sulphate, potassium nitrate.

	Preparation, properties & uses-H2O2, HCL, NH3, Ozone, HNO3, NaOH, H2SO4, KMnO4.	a-Oil analysis- acid value, saponification value, estimation of sugar by Lane's method, glucose by iodometry, fat by Soxhlet`s method. B-Analysis of organic compound-elements present, group location.
	Preparation, properties & uses- bleaching powder, aluminum chloride. Introduction to micro biology- bacteria cell, nutrition of bacteria, rate of multiplication, sterilization. Distillation & its type & importance.	A-Microbiology-study of staining, size if micro organism, total plate count. B-Types of distillation for liquid. Purification of substances using different techniques, sublimation error.
	Preparation, properties & uses- lime stone, cement, soda ash, sodium carbonate, sand, glass, alums & alloys.	A-Determination of melting, boiling, flash, pour & freezing points of liquids. B-Alloy analysis-bauxite, brass
	Study & types of water of Industries.	A-Gravimetric analysis, inorganic qualitative analysis. b- Raw, DM/ DI, distilled, boiler & cooling water analysis.
	Study & use of laboratory equipments.	Principle, handing & procedure to use following laboratory equipments- balances, viscometer, surface tension apparatus, pH meter, turbidity meter, conductivity meter, microscope, refractrometer, hydrometer, thermometer, alcohol meter, Pykno meter, electrolytic analyzer, polar graph. Orsat apparatus, IR moisture balance, specific job analyzer.

LIST OF TOOLS & EQUIPMENT OF BASIC REFRIGERATION & AIR CONDITIONINING

Sr. No.	Particular
1	Flaring tool set, single type for tube 4.7 to 16 mm OD
2	Swaging tool, punch type, set of size, for tube 4.7 to 16mm OD
3	Bending spring external type, for cu tube OD 6.4 to 16 MM
4	Pipe cutter miniature for cu tube 3 to 16 mm Dia
5	Pinch off tool for cu tube 6 to 18 mm
6	Pinch off Plier for cu tube 6 to 19 mm
7	Ratchet spanner 6.4 mm sq. reversible
8	Valve key T handle 4.7 & 6.4 mm sq.
9	Pressure gauge, Dia. 63mm with recalibration set screw, o to 35 kg/sq cm
10	Compound gauge,Dia.63mm with recalibration set screw,pressure15 kg/sq cm vacuum76 mm
11	Gas leak detector for halogen gas electronic
12	Line tester 500v heavy duty
13	Punch hole for cutting gasket 4.7 to 16mm Dia
14	Scissor for gasket cutting 250 mm long
15	L-Allen key set 1.5 to 6.4 mm
16	T-Allen key set 5/32” & 1/8”
17	Screw driver plastic handle 6x150 mm
18	Screw driver plastic handle 10x250 mm
19	Insulated combination pliers 200 mm
20	Adjustable wrench 250mm
21	Engineers steel rule 300mm
22	Engineers try square 200mm
23	Chisel flat 25x150 mm
24	Divider spring joint 150 mm
25	Caliper out side spring joint 150 mm
26	Caliper in side spring joint 150 mm
27	Spanner set double ended 4.7to16mm
28	Ring spanner set 4.7 to 16 mm
29	Philip screw driver set
30	Oil cane Pressure type ½ lit.
31	Measuring tape 2m
32	Hammer ball pein 450gm with handle
33	Hammer plastic 300 gm
34	File flat double cut 200 mm
35	File half round double cut 200 mm

Sr. No.	**Particular**
1	Flaring tool set, single type for tube 4.7 to 16 mm OD
2	Swaging tool, punch type, set of size, for tube 4.7 to 16mm OD
3	Bending spring external type, for cu tube OD 6.4 to 16 MM
4	Pipe cutter miniature for cu tube 3 to 16 mm Dia
5	Pinch off tool for cu tube 6 to 18 mm
6	Pinch off Plier for cu tube 6 to 19 mm
7	Ratchet spanner 6.4 mm sq. reversible
8	Valve key T handle 4.7 & 6.4 mm sq.
9	Pressure gauge, Dia. 63mm with recalibration set screw, o to 35 kg/sq cm

10	Compound gauge, Dia. 63mm with recalibration set screw, pressure 15 kg/sq cm vacuum 76 mm
11	Gas leak detector for halogen gas electronic
12	Line tester 500v heavy duty
13	Punch hole for cutting gasket 4.7 to 16mm Dia
14	Scissor for gasket cutting 250 mm long
15	L-Allen key set 1.5 to 6.4 mm
16	T-Allen key set 5/32” & 1/8”
17	Screw driver plastic handle 6x150 mm
18	Screw driver plastic handle 10x250 mm
19	Insulated combination pliers 200 mm
20	Adjustable wrench 250mm
21	Engineers steel rule 300mm
22	Engineers try square 200mm
23	Chisel flat 25x150 mm
24	Divider spring joint 150 mm
25	Caliper out side spring joint 150 mm
26	Caliper in side spring joint 150 mm
27	Spanner set double ended 4.7to16mm
28	Ring spanner set 4.7 to 16 mm
29	Philip screw driver set
30	Oil cane Pressure type ½ lit.
31	Measuring tape 2m
32	Hammer ball pein 450gm with handle
33	Hammer plastic 300 gm
34	File flat double cut 200 mm
35	File half round double cut 200 mm

Basic Electrician, Electronics, Computer & Instrumentation

Topic	***THEORY - III***	***Practical - III***
Basic Electrician, Electronics, Computer	Importance of safety – Description, specification, general care & maintenance of common hand tools, wires & cable – conductors, insulators & semiconductors- their shapes, sizes with respect to low, medium & high voltage. Soldering printed circuit boards &its uses- different fluxes for different purpose on metal’s- crimping equipment- joining of conductors by soldering. Importance of preventive maintenance and routine tests Earthing and its importance	Demonstration of use of safety equipments and artificial respiration. Use of hand tools, join practice with single and multi – stand conductors of different wires. Joining practice of bare conductors – soldering practice on printed circuit boards- Demonstration & practice on soldering the aluminum conductor, cable joints. Use of aluminum flux and Alca ‘p’ solder. Demonstration and practice of crimping of various wires.
	Resistance, voltage, current, open circuit and short circuits-ohm’s law- voltage drop – series & parallel circuits-power & energy relations – electrical measuring instruments- millimeters common electrical	Making of a simple circuit with a lamp and battery. Study and use of multi maters - measurement of current, voltage, resistance in DC\AC circuits. Demonstration & verification of ohm’s law – series circuits – parallel

	accessories used in industries- bus-bars, replays, contactors, circuit breakers, etc.. Fuses and its rating – materials used	circuits. Demonstration in circuits – use of tong tester and megger .
	Induction principals – electro-magnetism – faraday's laws single phase & poly phase system 3 phase star-delta connections, impedance & power factors-principals & application of DC motors, series, shunt & compound motor-AC motors, transformers &its applications. Chemical effect of electric current – rechargeable batteries –care & maintenance of cells. AC motors starting with DOL starter & star-delta starter.	Simple wiring practice with distribution boards, junction boxes, main switches two way and intermediate switches. Identification of different parts of dc generators-testing and measuring the field and armature resistances. Identification of different parts of ac motors-testing and measurement on induction motors-demonstration on alternators. Identification and testing of transformers. Grouping & testing of cells for a specified voltage & current-preparation of battery charging.
	Static electricity-capacities and its applications. Fundamental of a electron theory- semiconductor devices-symbols-specification-diodes-transistor, uni junction transistor. Field effect transistor, silicon controlled rectifier & Ics. Half wave, full wave & bridge rectifier with filters, DC power supply.	Identification of different type of capacitors- testing of capacitors – identification and testing of assorted diodes, PNP\ NPN transistors – uni-junction transistor, field effect Transistor & silicon controlled rectifier Ics etc. - demonstration on rectifiers – identification of Ics.
	Introduction to computer fundamentals and its parts, familiarization with disk drives, booting of a computer system, using the windows XP, Linux, menu system, tool bars, file structures, directories, moving and copying a file from floppy to hard disk, hard disk to floppy disk, creating directories. Formatting floppy disk.	Booting the computer ,opening windows menus, using the mouse, refresh computer desktop using right click of the mouse, create a directory in Expand Linux, format a floppy , create a file using notepad, save the file in floppy, copy the file into hard disk, copy a file from hard disk to floppy, create a directory in floppy, create a directory in hard disk, use my documents , use start menu for opening an application , to open a document recently written, change control panel settings for familiarize with keyboard and keys.
	Use of desktop, control panel settings, explorer, regional settings shortcuts, use of simple applications like paint, notepad.	Techniques of changing desktop wall paper, changing desktop screen properties, control panel, user accounts, customizing icon, writing a sample text using notepad, using paint for drawing figures to get accustomed with mouse.

		Saving a file. Using windows explorer ,install a software , remove a software, add new changing the regional settings of the system (like a printer , change the system date and time, changing the regional setting of the system like country, currency, date format, using start menu, creating desktop short cuts
	Study of internet explorer, modem, setting in the IE & modem , dialup and broad band connection, outlook express, viewing Email accounts, using search engine, video conferencing , MS chat.	Open internet explorer, change the settings in IE, customize internet explorer for default applications, enable cookies, change the security settings, setup an internet connection, user ID and password saving in the computer for future usage, setup outlook express for an Email account, setup server authentication settings, receive and send Email from the account. Search using yahoo and Google for certain topics, download file. Setup the net meting using MSN and yahoo messenger.
	Creating sample documents using MSWORD. Text wrapping, text formatting. Changing letters to different case, drawing table, mail merging, and page formatting, using different font type, and printing a document using excel as spread sheet, familiar with cells, formulae, text, numbers and date, using shortcuts for entering date and numbers in progressive cells, copying formulae, text and numbers, using boarders, merging cells, unmerging, changing cell width, row height, printing an area of the sheet, options of printing like fit to paper, shrinking etc. using different sheets in a work book, changing colour of cells, fonts, text.	Open MS WORD, create a new file, save a file, open an existing file, save as a text file, type a paragraph, set for left and right margins, change the letters from upper to lower case vice versa, cut a paragraph, copy a paragraph, setup tab positions, draw a simple table, insert rows, insert columns, erase rows, erase columns, search the document for spelling corrections, print the letters in a printer attached in portrait and landscape. Open excel and workout the following to understand the theory commands. Prepare a salary bill for ABC organization with column A for names, column B for basic salary, column C for DA, column D for addition of B & C to get the full salary, add the column D into a new cell as TOTAL amount. Print the sheet using set print areas with margins, and use scale factor for reduction and enlargement, use portrait and landscape.
Instrumentation	Principle of M. C. & M. I. meters, measurement value, shunt constructions & connection, voltage measurements, instrument	Electrical measurement & measuring instruments : Testing and calibration of ammeters & volt meters of various types &

	sensitivity, meter accuracy, changing meter range. Using of AC/ DC meters.	construction of M. C. & M. I. Measurement of power by watt meter & calibration of watt meter, KWH meter.
	Introduction to special semiconductors diodes & characteristics. Introduction & purpose shunt regulators, series regulators, I.C's regulators & switching regulators study of operational integrator. Study of invertors & converters & special operational circuits. Study of different types of oscillators-crystal, phase shift Armstrong, colpitt's, clap, Hartley & I. C. oscillators.	Industrial Electronics: Identification of various types of diodes, LED' S & Seven segment displays. Hooking up a voltage regulators and determine its characteristics. Use of differential amplifier, operational amplifier. Identification of different of different types of oscillators.
	Study of Basic logic circuits, digital I.C's, digital logic, Logic, gates-AND, OR, NOT, NAND, NOR, EX –OR, EX-NOR & Binary coded decimal. Study of different types of cables. Introduction to microprocessor & computer, purpose & use & physical properties.	Basic logic circuits & Microprocessor: Verification of gates, flip-flops etc. study of logic circuits of all types. Perform practical on trainer's kit or trainer. Identification of signal and control cables, screen cables shield. Practical on microprocessor training kit.
	The purpose of process measurement, use of measurement, display& error in measurements & study of different types of measuring instruments. Remote vs. local display. Errors in measurement systems, calibration, noise response time.	Fundamental of measuring instruments & systems: Practical on Instrumentation trainer/ simulator, computerized instrumentation simulator. Principle of transducer operation
	Description, working principle & study speedometer & tachometer. Principle of different types of pressures, liquid pressure, gauge pressure & gas pressure etc. & its meters. Pressure sensors, pressure transducers & instrument.	Speed, R.P.M.& Pressure measurements: Overhauling and testing of speedometer and tachometer. Identification with different types of pressure measurements by meters, gauges, sensors. Repairing, fault finding, testing & calibration with dead weight tester & manometers.

	Basic properties of fluids, its motion, flow & rate, Reynolds number. Flow measuring devices, study of Rota meter. Temperature, types of heats, various temp. Scales. Bimetallic, fluid filled & electrical temperature instrument (bulbs, capillary, Bourdon tubes, temp. transmitters, and RTD bridge circuits). Pyrometer.	Temperature & flow measurement: Various types of flow meters, maintenance of orifice, venture, flow nozzle & its use. Dismantling, overhauling & calibration of DP cell/ transmitters. Fitting of tapered glass tube Rota meter checking & testing. Performing practical on temperature measurement with different sensors in temp. Controlled oil bath. Practical on various thermocouples, RTDs & pyrometer. Temperature measuring instrument maintenance & calibration.
	Construction, principle, installation & maintenance & types of ink, chart, chart mounting & driving technique. Analog, digital controllers, control ranges & limit, timers & counters, data manipulation.	Recorders & controllers: Overhauling, checking, fault finding, repairing & testing of pneumatic, electrical & electronic round & strip chart recorders (single & multi points). PID controllers. Maintenance of various control valves.
	Principle of hydraulics – Fluid power and hydraulics, force, weight & mass pressure, work, power m energy etc. Principle of Pneumatics – Mass pressure , work & energy etc.	Basic Hydraulics and Pneumatics: Practical on Hydraulic trainer. Pneumatics systems, force weight & pressures. Practical on pneumatic training kits.

LIST OF TOOLS & EQUIPMENT OF BASIC INSTRUMENTATION

No.	Particular
1	**2**
1	Steel rule 150 mm
2	Screw Driver watch maker set of 6Pcs.
3	Tool kit boxes
4	Screw Driver electrician 150mm
5	Combination Plier 150mm
6	Flat Nose Plier 100mm
7	Hammer ball pein 1/41b
8	File flat IInd cut 250mm
9	File half round smooth 250mm
10	Allen key set of 10pcs. In mm
11	Screw driver set of 6pcs.
12	Neon tester 500volt
13	Hammer cross pein 1Ib
14	Triangular file 100mm
15	Allen key set of 10pcs. In inch
16	Spanner adjustable 100mm

17	Hammer cross pein 1Ib
18	Triangular file 10mm
19	Hand drill machine 6mm capacity
20	Tri square 100mm
21	Hack saw frame 300mm
22	V block with clamps 50mm
23	Eye glass 75mm focus watch maker
24	Surface plate 300x300mm
25	Oil cans ½ lit.
26	Sprit level metal 100mm
27	Electric soldering iron 125 watt
28	Vernier caliper 300mm
29	Electric soldering iron 10 watt
30	Micro meter out side 0-25mm
31	Screw driver heavy duty 200mm
32	File flat bastared 300mm
33	File flat smooth 1500mm
34	Tap set metric 5,6,8, 10mm set of 3
35	File Tri angular IInd cut 150mm
36	File half round IInd cut 200mm
37	File feather edge smooth 100mm
38	Bench vice 100mm jaw
39	Tap set BSW 3/8”, ½ set of 3
40	Pipe vice 100mm jaw
41	Spanner double ended metric set10
42	Reamers parallel 1/16” to ¼ “ set of 7
43	Centre punch 10x100mm
44	Hammer ball pein 1.5 lb
45	Letter punch 10x100mm
46	Twist drill SS 1/16 “ to ½”
47	Twist drill SS 2 to 12mm
48	Blow lamp 1ltr capacity
49	Chisel cold flat 25x150mm
50	Sine bar 125mm with plate
51	Flaring tool kit up to 20mm
52	Combination set 300mm
53	Ring Spanner double end metric set10
54	Feeler gauge leaf type 0.0015”-0.025”
55	Dial test indicator in mm
56	Radius gauge leaf type 1-15mm
57	Standard wire gauge
58	Fire extinguisher soda acid /foam
59	Fire buckets
60	Instructor table 1200x760x760mm
61	Instructor chair with arm
62	Steel almirah 1980x900x450mm
63	Steel stool 300x300x450mm
64	Steel locker 1980x900x450mm 8 hole
65	Black board with stand
66	White magnetic board with complete Accessories
67	Work bench 1800x900x760mm

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