

COURSE CURRICULA IN THE AREA / SECTOR

OF

Advanced Modules

“PROCESS PLANT MAINTENANCE”

FOR UPGRADATION OF

ITI's into

CENTRE OF EXCELLENCE

Directorate General of Employment

and Training

M/o Labour & Employment

INDEX

UPGRADATION OF ITI's INTO

CENTRE OF EXCELLENCE

SECTOR: PROCESS PLANT MAINTENANCE

ADVANCE TRAINING OF 6 MONTH DURATION (2nd Year)

ADVANCE MODULE	NAME OF THE ADVANCE MODULE	DURATION IN WEEKS	Space Required Sq. mt.
PPMAM-07	Electrical Maintenance of Process Plant	24 Weeks	100
PPMAM-08	Electronic and Instrument Maintenance of Process Plant	24 Weeks	100
PPMAM-09	Fabrication and Designing of Steel Structure	24 Weeks	100

Advance Module already available

PPMAM 1: Operator Chemical Plant

PPMAM 2: Operation & Maintenance of Boiler & Steam Turbine

PPMAM 3 : Mechanical Maintenance of Processes Plant

PPMAM 4: Processes Plant Mechanical Maintenance

PPMAM 5 : Repairing of Equipment

PPMAM 6: Processes Plant Refrigeration & Air Conditioning Maintenance

Upgradation of ITIs into Centres of Excellence-

Broad guidelines for implementation of Advanced Module of Sector

“Processes Plant Maintenance”.

These Centres will be providing multi skill training to meet the skill requirement of particular sector of industry with their active involvement in all aspects of training. The training will be provided in three parts as given below:

- ◆ Training in Basic skill areas for a period of one year.
- ◆ Training in Advanced modules of six months duration after Broad based basic Training (BBBT)
- ◆ Testing & Certification both for the Broad Based Basic Training & Advanced Module Training during subsequent six months will be conducted under the aegis of NCVT.
- ◆ Training in specialized modules mainly by the industry (The course curricula, duration etc will be designed in consultations with the IMC/local industry). The trade testing & certification for specialized module will be done jointly by the State Government & Industry. Said certificate will have recognition from NCVT
- ◆ *As per the recommendations of the EFC, Training in the shop floor should constitute atleast 25-40% of the curriculum.*

The training programme will have multi-entry and multi-exit provisions as given below:

- trainee can opt to go to the labour market after completing broad based basic training of one year duration or after completing advanced module/s.
- multi-entry and multi-exit provisions would enable a trainee to take admission for advanced/ additional advanced /specialized module as per his/her need .

Guidelines for Training in Advanced modules

- A minimum of three modules would be essentially needed, so as to ensure that all the 96 trainees are accommodated in the three modules may be selected in consultation with IMC for which in two shifts.
- If it is felt that available modules for which the course curricula has been developed at National Level are not sufficient to cater to the needs of local industry in a particular state, States are free to select module as per need in consultation with industry . They may develop suitable module(s) accordingly in consultations with the industry clearly indicating tool & equipment list, instructor qualifications, space norms etc. & forward the same to DGE&T for seeking approval of NCVT.
- A trainee at a time can opt only for one Advanced Module.
- Admission Criteria, Space requirement, Qualification of instructor of the various modules of “**Processes Plant Maintenance**” sector are attached herewith.

**Members of the Trade committee for Advance Module
(7 & to 9)of
Process Plant Maintenance**

Sr. No.	Name	Address
1.	Shri G.R. Rao,	Dy. G.M(Instrument), India Glycols Ltd, Kashipur (U. S. Nagar)
2.	Shri Atul Govil	Sr. Manager (Instrument), India Glycols Ltd., Kashipur (U. S. Nagar)
3.	Shri Mayank Agrawal	Principal, Govt. I. T. I., Kashipur (U. S. Nagar)
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5.	Shri Raj Deep Sharma	Instructor (Electronic), Govt. I. T. I., Kashipur (U. S. Nagar)
6.	Shri Abhishek Kumar	Dy. Chief Engineer, The Co-operative Sugar Mill Ltd., Gadarpur (U. S. Nagar)
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9.	Shri Ashu Agarwal	Manager (Electrical), Surya Roshni Ltd., Kashipur (U.S. Nagar)
10.	Shri G.D. Sharma	Instructor (Electrician), Govt I.T.I. Kashipur (U.S. Nagar)
11.	Shri Shailendra Singh	(Asstt. Engineer), U.A.S. & D. C., Haldi (U. S. Nagar)
12.	Shri Lokendra Singh	Mechanical Foreman, Banwari Paper Mills Ltd., Kashipur (U. S. Nagar)
13.	Shri Ram Iqbal	Instrument Supr. D. S. M. Sugar Mill Ltd., Kashipur (U. S. Nagar)
14.	Shri Anurodh Sharma	Manager, Pepsico India Holdings Pvt. Ltd., Bajpur (U.S. Nagar)

Admission to Advanced Module for the graduates of ITI in related trades:

There is a provision for lateral entry for graduates of ITIs (NTS/NAS passed out from conventional system) of the related trades subject to availability of seats in Advanced Module. Trades of conventional system mentioned against each advanced module in the enclosed statement, could be offered admission in Advanced Module.

Module No	Name of the Module	Admission Criteria	Space requirement	Duration in Weeks	Qualification/ Status of Insrtrum net
PPMAM-07	Electrical Maintenance of Process Plant	Completed BBBT in Processes Plant Maintenance (PPM) OR NTC/NAC in relevant trade OR Diploma in relevant trade	100 Sq m	24 weeks	Diploma in Electrical Engineering with min 3 years teaching/Industrial experience in relevant field.
PPMAM-08	Electronic and Instrument Maintenance of Process Plant	Completed BBBT in PPM OR NTC/NAC in relevant trade OR Diploma in relevant trade	100 sq m	24 weeks	Diploma in Instrument Engineering with min 3 years teaching/Industrial experience in relevant field.
PPMAM-09	Fabrication and Designing of Steel Structure	Completed BBBT in PPM OR NTC/NAC in relevant trade OR Diploma in relevant trade	100 sq m	24 weeks	Diploma in Mechanical Engineering with min 3 years teaching/Industrial experience in relevant field.

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR/AREA : “PROCESS PLANT MAINTENANCE”

ADVANCED MODULE IN II YEAR

(FOR THE FIRST 3 MONTHS OF II YEAR)

**MODULE – PPMAM 7 : “ELECTRICAL MAINTENANCE OF PROCESS
PLANT”**

(DURATION – 24 Weeks)

SECTOR/AREA : “PROCESS PLANT MAINTENANCE”**ADVANCED MODULE IN II YEAR**

(FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE – VII : “ELECTRICAL MAINTENANCE OF PROCESS PLANT”

(DURATION – 24 Weeks)

Week No.	Practical	Theory
1st	To make the pipe plate earthing and testing	Earthing as per IE Rules Testing
2nd	To operate TPMO, TPIC, DPIC, MCB, Open and reassemble and wiring testing by megger	Kit kat, MCB, TPIC , DPIC, TPMO
3 rd	Wiring testing by megger	-Laying out of Batten wiring
4th	Cable jointing fault in underground line, over head line and their methods of rectification	Type of wire Type of cables Voltage grades, low, medium and high
5 th	Cutting of conduit pipe threading of conduit pipe	To study use dies threading cutting of conduit pipe for connecting conduit wiring
6th	Layout of domestic wiring Layout the industrial conduit pipe wiring	Importance of electrical wiring Domestic wiring Industrial wiring
7th	To check charging and discharging conditions of battery and connect the battery charger	Care and maintenance of battery To study the hydro meter
8th	To connect the chock and capacitor, Florescent tube, Mercury and sodium vapour lamp	To Study the various types of lamps sodium vapour lamps Mercury lamp Florescent tube
9th	Identification of terminals of DC Motor and change the direction of DC Motor	To study DC Mortar Principle of DC Motor Kind of DC Motor
10th	To start the DC Motor with 3 Point and 4 Point starter	Importance of starter To study 3 Point and 4 Point starter
11th	To remove the generator problem such as to change the carbon brushes, open field winding. Terminals open and break.	Importance of DC current Kind of DC Generator Simple problems of DC Generator
12th	To start the generator To measure the voltage on no load and full load Measuring the current on no load and full load	To operate the DC generator
13th	Connection of change over switch from generator and source of supply.	To study the change over switch To study the inventor wiring
14th	Demonstrations of alternator parts and check the voltage building and current	Principle of alternator To study the alternator Part of alternator
15th	Connection of alternator with load synchronizing of alternator	Type of alternators Synchronizing of alternator
16th	Testing open circuit and short circuit for iron and copper losses To check the primary and secondary wingding	Explanation of 3 phase transformer Testing of open circuit and short circuit test for iron and copper losses

17th	Use CT and PT as instrument transformer To fill the luges and joint the cable and connect the transformer terminal, change the transformer oil and bushes and terminal with nut bolt and assemble again To change the silica jel from breather	To study CT and PT transformer To study transformer terminal and connections (i) Star-Star (ii) Delta-Delta (iii) Star-Delta (iv) Delta-Star
18th	To connect the 3 phase motor from star Delat starter and DOL starter.	Types of induction motor Single phase induction motor 3 phase induction motor
19th	To practice star and delta connection of three phase motor	Direct on Line starter Star Delta starter Connection of motor
20th	To operate the different instrument and connecting the power line and remove the fault of every instrument.	Introduction of instrument Need of instrument in industries Instruments commonly used in power system (Voltmeter, Amper meter, (Ana log and Digital type) Frequency meter(Vibrating type) Wattmeter, Energy meter Multimeter (Ana log and Digital type) Magger and Tong tester)
21th	To use of CRO	To study CRO
22th	Demonstrations of basic electronic components and measure their value.	To study about some basic electronic component Such as Resistance, Diod and Transitor, etc.
23th	To repair the fault of the bus bar wiring open and assembling from panel board. Reading connection diagram of 3 phase winding	To study the Bus bar wiring General idea of three phase winding General idea of single phase winding
24th	To repair the all electrical appliance and connecting the electric line	Uses of electrical appliances As press, heater, soldering iron, Electric bell buzzer etc.
25 & 26	Review and ALL INDIA TRADE TEST etc	

LIST OF TOOLS & EQUIPMENTS FOR ELECTRICAL MAINTENANCE OF PROCESS PLANT

Ser No	Name of items	Quantity
TOOLS & EQUIPMENTS		
1.	Screw driver 100 mm	4
2.	Screw driver 300 mm	4
3.	Plier round Nose 150 mm	4
4.	Plier flat Nose 150 mm	4
5.	Tweezers 100 mm	4
6.	Soldering Iron 25 watt	2
7.	Soldering Iron 65 watt	2
8.	Spanner Kit (Double Ended)	2
9.	Drill machine Hand 0-6 mm capacity	1
10.	Oil cane 0.12 liter	4
11.	Allen Key	1 Set
12.	Hack saw frame 150mm	2
13.	Hack frame 200 mm	4
14.	Spine Straight 150 mm	4
15.	Rubber Gloves pair	4
16.	Spanner Single ended 6mm-25mm	1 set
17.	Spanner Single ended 6mm-19mm	1 set
18.	Drill S.S. twist block 2mm-12mm	2 set
19.	File flat 150mm 2 nd cut	4
20.	File flat 150mm bustard	4
21.	File round 100mm bustard	4
22.	File round 150mm 2 nd cut	4
23.	File flat 150mm smooth	4
24.	Bench vice 100 mm jaw	2
25.	Die set 3 mm – 10 mm (set of 9)	2 Set
26.	Multimeter (Digital)	2
27.	Ammeter MI, 0-2 A	2
28.	Ammeter MI, 0-5-10-15A	2
29.	Tong Tester	2
30.	Voltmeter 0-150-300-600V	2
31.	C.T.	2
32.	P.T.	2
33.	Frequency meter (Digital & analog)	2
34.	Megger 500 V	2
35.	Wheat Stone Bridge	1
36.	Earth Tester	1
37.	Energy Meter single phase 40A-230V	2
38.	Energy meter three phase 20A 200V	2
39.	Watt meter single phase 230V, 3 KW	2
40.	Watt meter 3 phase 400 V, 2 elements 3/5 KW	2
41.	Crimping tool	2
42.	Signal Generator	2
43.	CRO	2
44.	Battery Charger input-230V, Output-0-35V	1
45.	Auto Transformer, input 230V, Output-270V	2
46.	Multimeter Analog	2
47.	Lead Acid battery 60 AH	1
48.	Fire Extinguisher CO2	2
49.	Fire Buckets	4
50.	Watt meter single phase, single element (Flush mounting type) multi range 0-750-1500W rectangular shape	4
51.	Ammeter MI type, Rectangular shape, flush mounting size 106 x 84 mm, multi range, 0-5-10A	4
52.	Voltmeter MC type AC, Rectangular shape, flush mounting size 106 x 84 mm, multi range 0-150-300V	4
53.	Auto Transformer, continuous variation, single phase, flush mounting type 0-270V, 5A	4

Ser No	Name of items	Quantity
TRAINEES TOOL KIT		
1.	Measuring Tape Steel 100 cm	17
2.	Rule Steel 300 cm	17
3.	Screw driver heavy duty 200mm insulated thick	17
4.	Screw driver heavy duty 250 mm with insulated thick stem handle	17
5.	Plier insulated combination 200 mm	17
6.	Knife double blade electrician 100 mm	17
7.	Pincer 150 mm	17
8.	Scriber 150 mm x 4 mm	17
9.	Punch centre 150mm x 8 mm	17
10.	Hammer ball pien 0.75 kg with handle	17
11.	Hammer cross pien 115 gms with handle	17
12.	Saw tenon 250 mm	17
13.	Firmer chisel wood 12 mm	17
14.	Gimlet 6mm	17
15.	Bradawl 100 mm	17
16.	Wire stripper 150 mm	17
17.	Heat sink plier	17
18.		
TRAINEES TOOL KIT (To be brought by trainees)		
19.	Voltage season (pencil type)	
20.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	1
21.	Plier insulated 150 mm	1
22.	Multimeter	1
23.	Soldering iron, 15W, 230V (temperature controlled)	1
FURNITURE		
1.	Locker cup board 195 cm x 110 cm with 45 x 45 x 45 cm locker	1
2.	Bench working 2.5 x 1.20 x 0.75 meter	4
3.	Instructor table	1
4.	Instructor chair	1
5.	Almirah 2.5 x 1.20 x 0.75 meter	1
6.	Student chair (steel)	16
7.	Lecture Table	1
8.	Writing white board	1
9.	Table teak wood for electrical Lab size 72 x 24 x 30 cm height, provided with drawers and storage fitted with pannel board size 15 x 25 x 12 cm height	4
10.	Metal rack 180 x 150 x 45 cm	4
11.	Personnel Computer complete with latest profile & printer	1
12.	Computer Table	1
13.	Printer Table	1
14.	Fire bucket with stand	4
15.	Fire Extinguisher CO2	2

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR/AREA : “PROCESS PLANT MAINTENANCE”

ADVANCED MODULE IN II YEAR

(FOR THE FIRST 6 MONTHS OF II YEAR)

MODULE –PPMAM 8 : “ELECTRONIC & INSTRUMENT

MAINTENANCE OF PROCESS PLANT”

(DURATION – 24 Weeks)

SECTOR/AREA : “PROCESS PLANT MAINTENANCE”
ADVANCED MODULE IN II YEAR
(FOR THE FIRST 3 MONTHS OF II YEAR)
MODULE - VI : “ELECTRONIC & INSTRUMENT MAINTENANCE OF PROCESS PLANT”
(DURATION – 24 Weeks)

1. COURSE CONTENT

Week No.		Practical	Theory
1,2 & 3	Pressure	<ul style="list-style-type: none"> - Calibration of pressure instruments using dead weight tester, Bourden tube - Converting pressure into displacement - Dismantle the pressure gauge & study the construction & correct functioning 	<ul style="list-style-type: none"> - Pressure principle, static dynamic pressure, Gauge pressure head pressure, Standard pressure gauge, pressure fitter - Pressure record, Pressure switch, Pirani gauge, Pressure regulating valve, - Thermocouple, Ionization gauge and Magnetic pressure gauge
4,5 & 6	Temperature	<ul style="list-style-type: none"> - Calibration of expansion - Thermometers - Calibration maintenance & reconditioning of thermocouple, - Pyrometers 	<ul style="list-style-type: none"> - Absolute temp scale, relative temp scale, - Relation to thermal energy - RTD-resistance-temp- detector - Bimetal strips gas thermometer - Vapor pressure thermo meter - Temperature switch, Thermostats - Temperature gauges (Fluid) Thermister
7 & 8	Flow	<ul style="list-style-type: none"> - To study of flow nozzles, heads, there shape & connection 	<ul style="list-style-type: none"> - Rota meter flow meter, Turbine flow meter, - Magnetic flow meter - Differential flow indicator - Capacitance type level indicator - Weighting machine for level management, - Flow switch, Mass flow
9	Level	<ul style="list-style-type: none"> - Study construction of sight glass, float type level measuring instruments of closed & open tank 	<ul style="list-style-type: none"> - Level switches - Capacitive level switch - Magnetic level gauge
10 & 11	Analytical Instrument	<ul style="list-style-type: none"> - To study various types of potentiometer - To study conductivity meter 	<ul style="list-style-type: none"> - Viscometer, Melting point & Boiling, Flame - Photometer - Potentiometer - Colorimeter, Analyzer, Conductivity meter
12	Electrical Instrument	<ul style="list-style-type: none"> - study of ammeter voltmeter wattmeter & multi meter digital type 	<ul style="list-style-type: none"> - Ammeter digital type - Voltmeter digital type - Wattmeter digital type - Multi meter digital type - Power factor meter - Hot wire instrument - Clamp on AC-Ammeter - Ohm meters multi ranges
13, 14 & 15	Transmitters, Converter & Recorder	<ul style="list-style-type: none"> - Calibration of temperature - Transmitter & its adjustment - Record & calibration of current to air & pressure to current converter - Reconditioning of EMF to current, converter & Its calibration 	<ul style="list-style-type: none"> - Receiver recorder - Temperature transmitter (Pneumatic & Electronic) - Pressure transmitter (Pneumatic & Electronic) - DP transmitter (Pneumatic & Electronic) - R.T.D. Transmitter (Electronic) - Thermocouple transmitter (Electronics) - Online conductivity meter-sensor indicator - Servo level gauge, EMF to I converter - RTD to I converter, Pressure recorder - Temperature indicator cum recorder
16, 17 & 18	Controllers and Control Valves	<ul style="list-style-type: none"> - Study the construction, identification of component of ON-OFF type controller - Testing & calibration of ON-OFF type - Control system of pneumatic & electronic pressure, temperature 	<ul style="list-style-type: none"> - ON OFF controllers - PID controllers (Pneumatic and Electronics) - Pneumatic calibrator - Pulse to current converter - Solenoid valve - Control valves - Serial converter - Temperature scanners - Control valves with petitioners

19, 20 & 21	Advanced Electrical and Digital Electronics	<ul style="list-style-type: none"> - Study of digital millimeter - Slow charts making Program - Study off LRC, PLC, DCS and SCADA 	<ul style="list-style-type: none"> - Digital power supplies - Digital current sources poser supply - Digital multi meter, Micro pressure kit - LCR (Source and measure) - PLC, DCS, Computers to study different process application SCADA
22 & 23	Mechanical Sensor	<ul style="list-style-type: none"> - Acceleration, velocity and position-define vibration, shock characteristics stress-strain curve - XLVDT to a displacement measurement problem 	<ul style="list-style-type: none"> - Strain gauge - Accelerometer - Piezoelectric accelerometer
	Optical Sensor	<ul style="list-style-type: none"> - Describe eradiation term of frequency - wave length - Speed of propagation, eradiation poser intensity, photo conductive, photovoltaic, photo emission, photo detector and optical pyrometers 	<ul style="list-style-type: none"> - Photo emission - Diode - Optical pyrometer
24	Digital Control	<ul style="list-style-type: none"> - Checking flip-flop(K+8) - Making program and checking in its procedure kits 	<ul style="list-style-type: none"> - Simple alarm (Simple two position multivariable) - Computers in process control - Programmable controllers single variable, cascade control - Flow chart making
25 & 26	Review and ALL INDIA TRADE TEST etc		

LIST OF TOOLS & EQUIPMENTS FOR ELECTRONIC & INSTRUMENT MAINTENANCE OF PROCESS PLANT

Sr No	Name of items	Quantity
<u>TRAINEES TOOL KIT</u>		
1.	Caliper outside spring 6"/15"cm	17
2.	Caliper inside spring 6"/15" cm	17
3.	Divider punch 4"/15"cm	17
4.	Center punch 4"/10"cm	17
5.	Princk punch 6"/15"cm	17
6.	Chisel cold flat 1"/2.5"cm	17
7.	Chisel diamond point 3"/8"/10"cm	17
8.	Hammer ball pain 11b handle	17
9.	Hack saw frame adjustable with pistol gripe for 8"-12" blade by 20 cm-30cm	17
10.	Steel rule 12" English & metric /30 cm	17
11.	Screw diver set	17
12.	Square engg. 6" blade/15cm	17
13.	De soldering pump	17
14.	Connector	17
15.	Neon tester	17
16.	Combination pliers	17
17.	Long nose pliers	17
<u>Electric Instruments</u>		
54.	Moving coil voltmeters (Various ranges) digital type	4 each
55.	Moving coil ammeters (Various ranges)	4 each
56.	Moving millimeters (Various ranges) digital type	4 each
57.	Moving milli voltmeters (Various ranges) digital type	4 each
58.	Galvanometer, center-zero indicating Moving coil voltmeters (Various ranges) digital type	1
59.	Moving iron AC- voltmeters (Various ranges) digital type	4 each
60.	Moving iron AC- Ammeters (Various ranges) digital type	4 each
61.	Voltmeter Dynamometer type AC & DC digital type	02
62.	Ammeter Dynamometer induction type AC & DC digital type	02
63.	Wattmeter dynamometer type digital type	01
64.	Power Factor meter digital type	01
65.	Hot wire instrument digital type	01
66.	Clamp on AC Ammeter digital type	01
67.	Ohm meters multi ranges	01
68.	Insulation tester (meager) 500 volts	01
69.	Watt hour meter digital type	04
70.	Frequency meter, vibration reed type digital type	01
71.	Ampere hour meter digital type	02
72.	Calibration for ammeters, voltmeters, ohmmeters digital type	01
73.	Calibration for wattmeter, energy meter digital type	01
74.	Bridge for resistance, energy meter digital type	01
75.	Workshop potentiometer, with galvo & std. cell digital type	01
76.	Regulated power supply with variable DC source digital type	01
77.	Servo operated AC voltage stabilizer, 10 KVA digital type	01
78.	Hair hygrometer digital type	02
79.	Wet & dry bulb thermometer type hygrometer digital type	02
80.	Gas pressure regulator digital type	02
81.	Magnetic pressure gauge digital type	02
82.	Reciprocating piston type flow meter digital type	04
83.	Hook type level indicator digital type	02
84.	Float type level Indicator digital type	02
85.	Show piece ultra sonic level indicator digital type	02
86.	Variable capacitance type level indicator digital type	01
87.	Vapor pressure thermometers digital type	02
88.	Optical pyrometer digital type	01
89.	Optical pyrometer digital type	01
90.	Tachometer centrifugal digital type	02
91.	Tachometer electrical, synchronous digital type	02
92.	Stroboscope digital type	01

93.	RPM tester/techo. Tester digital type	01
94.	Secondary devices for measurement of temperature, pressure level and flow for above recorders digital type	02
95.	Proportional controller digital type	02
96.	Proportional with reset type electronic controller digital type	02
97.	Pneumatic controllers for pressure, flow, temperature and level with associated equipment digital type	02
98.	Transmitters, pneumatic, hydraulic and electronic for above mentioned controllers, recorders, process simulator digital type	02
99.	Transistorized amplifier trainer	2
100	DIAC, LED, LCD, FET, UJT, MOSFET Trainer	1
101	Logic Gates trainer	2
102	Digital power supply trainer (Half wave rectifier/full wave rectifier)	1
103	Integrated Circuits trainer IC 555/11556/IC-747	2
104	Op amp trainer	1
105	Digital ICs trainer with microprocessor, ALU, CPU, ROM, RAM, EPROM	1
106	Programmable logic system trainer	2
107	Exhaust fan	1
108	Vacuum lamp with accessories	2
109	Air compressor with accessories	2
110	Color monitor/TV with audio-video in & out	1
111	Static electricity guard	1 x 16
112	Load cell different type	5
113	Sensors different type as well as light, metallic , ultrasonic waves and level sensor	02 each
114	Oscillator with motor	02
10.	Personnel Computer complete with latest profile & printer	1
<u>List of Furniture</u>		
1.	Storage rack	02
2.	Storage cupboard	02
3.	Instructor Table	01
4.	Instructor chair	01
5.	Stool	17
6.	Trainee locker	01
7.	Metallic black board	01
1.	Fire Extinguisher CO2	2
8.	First Aid Box	01
9.	Discussion Table	02
10.	Tool Cabinet	01
11.	Smoke Detector	02
12.	Book shelf	01
13.	Fire bucket with stand	4
14.	Computer Table	1
15.	Printer Table	1
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UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR/AREA : “PROCESS PLANT MAINTENANCE”

ADVANCED MODULE IN II YEAR

(FOR THE FIRST 6 MONTHS OF II YEAR)

**MODULE – PPMAM 9 : “FABRICATION & DESIGNING OF STEEL
STRUCTURE”**

(DURATION – 26 Weeks)

SECTOR/AREA : “PROCESS PLANT MAINTENANCE”
ADVANCED MODULE IN II YEAR
 (FOR THE FIRST 6 MONTHS OF II YEAR)
MODULE - 9 : “FABRICATION & DESIGNING OF STEEL STRUCTURE”
 (DURATION – 26 Weeks)

COURSE CONTENT

Week No.	Practical	Theory
1,2	<ul style="list-style-type: none"> - Familiarization with the machinery/hand tools used in the trade. - Introduction to safety equipment and their use. - Handling of measuring instruments – Steel tape, Vernier Caliper, Spirit level, Micrometer. Try square, Height gauge, - Marking blocks, Bevel protractor etc. - Practice on marking various shapes on sheet metals. - Development practice of surface of prism, cylinder, pyramids, cones, etc. 	<ul style="list-style-type: none"> - Outline of the subjects to be covered. - Role of fabrication in industry. - Basic Trigonometric calculations- Marking of Angles, Triangles, Square, Rectangle, Parallelogram, Hexagon, Octagon and Circles. - Calculation of volume and surface area of rectangular prism, cubes and cylinders. - Development of right solids, prisms, cylinders, pyramids, cones, frustum of pyramid, cone etc.
3,4,5	<ul style="list-style-type: none"> - Weld joint preparation for fillet welds (cutting to size, fit up, tack weld etc). - Fillet, Lap and T joint on MS flat by SMAW, position-1F - Fillet, Lap and T joint on MS flat by SMAW, position-2F - Inspection & clearance using LPI testing, Fillet, Lap and T joint on MS flat by SMAW, position-3F, Fillet, Lap and T joint on MS flat by SMAW, position-4F - Inspection & cleaning using LPI testing - Welding joint preparation for pipe fillet welding - Pipe to plate fillet weld flange joint on MS by SMAW, position-5F - Pipe to pipe fillet weld on MS pipes by SMAW, position-5F 	<ul style="list-style-type: none"> - Basic Electricity applicable to welding - Arc welding power source AC/DC-advantages and disadvantages - Type of metal and their characteristics - Classification of steel and their weldability - Heat affected zone and requirement for pre-heating and maintaining inter pass temperature - Welding symbols and their importance - Welding positions and necessity of positional welding, Weld joint edge preparation - Welding procedure and techniques- Track welding, root run welding, intermediate and cover pass welding, cleaning, checking etc. - Welding tools and accessories - Arc and its characteristics, Polarity types and application and Arc length - Welding fixtures and clamps - Coated electrodes- Types, description and coding as per BIS, AWS etc. Standard size and length of electrodes, Selection of electrodes and coating factor, Electrode storage and necessity of backing - Effect of heat on weldments - Welding distortion and stresses - Methods of controlling distortion by various methods - Methods of relieving stress on Weldments - Advantages of welded structures over riveted structures.
6	<ul style="list-style-type: none"> - Gas cutting of M.S. Plates - Angle cutting of plates for required bevel angle by Pug cutting machine - Practice on Plasma cutting system 	<ul style="list-style-type: none"> - Gas welding principles and application - Types of flames and their used - Gas cutting-straight line and profile - Gas cutting-Free hand, guided and mechanical - Manual Metal Arc cutting and gouging - Carbon Arc cutting and gouging
7,8	<ul style="list-style-type: none"> - Identification of metals, bars, plates, flats, channels, I section, T section, and box section etc. - Study of design drawing related to structural and pressure parts and preparation of fitting square. 	<ul style="list-style-type: none"> - Metals used in fabrication' - Types of fabrication joints - Types and classification of steel and application - Framed structures-shell structure-Rolled sections, I section, channel section, angle section, T-section - Welding symbols - Structural/Pressure vessel design drawing reading and understanding the concepts.
9,10	<ul style="list-style-type: none"> - Using guillotine shearing machine, marking and cutting of sheet metals to required size. - Practice on bending of plates and pipes to required shape - Straightening plates and section - Edge planning as per requirement 	<ul style="list-style-type: none"> - Description and operation of croppers, shearing machine, Guillotine shears, punching machines, - Edge planning machine and nibbling machine etc. - Description and operation of straightening machines - Methods of bending plates, angle iron etc. - Cold bending and hot bending etc - Bending of angles and channels - Press work - Flame straightening methods
11	<ul style="list-style-type: none"> - Double 'V' butt joint on MS Flats in dissimilar thickness and down hand positions by SMAW. - Root Inspection 	<ul style="list-style-type: none"> - Welding defects causes and remedy - Procedure of rectifying, weld defects-Gouging methods/grinding, testing with die penetrate, pre-

	<ul style="list-style-type: none"> - Back Gouging - Adopting weld sequence for controlling distortion 	heating and re-welding
12,13	<ul style="list-style-type: none"> - Setting up DC TIG welding equipment and making beading practice on MSD in down hand position - Square butt joint on M.S. sheet by TIG welding in down hand position - Root pass welding by TIG & LPI testing - Fule preparation single 'V' butt on MS flat by TIG & SMAW position 1G&2G 	<ul style="list-style-type: none"> - TIG Welding equipments - Advantages of TIG Welding process - Poser source types AC/DC - Types of polarity and application - Accessories-HF unit and DC Suppressor - Tungsten electrode, types, sizes and uses - Types of shielding gases
14,15, 16	<ul style="list-style-type: none"> - Preparation of pipe joint for high pressure pipe welding - Pipe welding- preparation of edges-cleaning the joint surface-fit up the pipes - Tack weld two pipes together - Pipe work-cutting-bending-threading-joining and assembly - Pipe elbow & T joints on MS pipes by SMAW in flat position - Preparation of pipes for T,Y,K joints. - Preparation of single riveted lap joint - Double riveted lap joint - Single cover plate riveted butt joint - Double cover plate riveted butt joint 	<ul style="list-style-type: none"> - Pipe and pipe- pipe schedule- types-methods of bending-use of bending fixture-pipe bending machine-use of pipe cutter, pipe wrenches-pipe vices-pipe threads-pipe dies and taps etc - Edge preparation for pressure line pipes- Fit up procedure - Riveting-types of riveting - Hand riveting., cold and hot- methods of riveting – use of pneumatic riveting, hydraulic riveting- checking rivets-removing of bad rivets - Types of bolts-black bolt, turned bolt, high strength bolt etc. and their application
17	<ul style="list-style-type: none"> - Practice on CO2 welding and Flux Cored Arc Welding - Practice on Automatic Submerged Arc Welding machine 	<ul style="list-style-type: none"> - Introduction to MIG/Flux cored arc welding – Advantages-power source-wire feeder-electrode wires shielding gases-types of metal transfer and welding parameters - Introduction to Submerged arc welding (SAW). - Advantage, limitation equipment and operating condition.
18,19	<ul style="list-style-type: none"> - Bolted joints - Marking gusset plates - Marking joint section beam - Marking joint column using height gauge - Marking curved and bend plates and section - Marking on built up I section - Usage of pantograph for marking 	<ul style="list-style-type: none"> - Kind of structures- column base, plate girders, Gantry girder, root trusses-description, types and use - Beam connection., Beam to column connection- framed connection and seated connection - Type of pressure vessels – Boilers, Heat exchangers, High pressure pipe lines etc. - Marking – Marking for cutting to size, marking for beveling and chamfering and marking for pipes and intersection
20,21	<ul style="list-style-type: none"> - Preparation of single & double riveted lap & butt joint - Making simple riveted plate assembly Girder, trusses - Making a simple lattice structure - Making pressure pipe line assembly - Making welded I se4ction assembly - Making cylindrical tanks 	<ul style="list-style-type: none"> - Assembly- Procedure and technique for assembly - Assembling of riveted plates, girders and trusses - Assembly of welded I section - Assembly of cylindrical tanks including fitting and lining of vessels
22	<ul style="list-style-type: none"> - Making templates for cutting to size and simple objects - Making templates for Gussets and joint sections - Making simple fixture 	<ul style="list-style-type: none"> - Jigs and Template making-Design and description for templates for cutting-templates of gussets- templates for marking angle - Template for marking joint section - Design and development for jigs for drilling and angles - Design of simple fixture and clamping devices
23,24	<ul style="list-style-type: none"> - Manufacturing of simple structures with L angles, I section and channel sections using welding fixture by SMAW - Correction distortion by cold/hot method - Manufacturing of I-section using M.S. Flat by SMAW - Adapting skip welding/back step welding method for controlling distortion - Preparation of WPS & PQR - Weld test specimen-preparation as per a standard - Inspection & testing 	<ul style="list-style-type: none"> - Types fo welding defects, cause and remedy - Inspection and testing of weldments - Visual Inspection kits and Gauges - Non-destructive testing methods - Structural welding codes and standards - Writing procedure for WPS and PQR - Requirement for qualification in different codes - Qualification procedure und3er various codes - Different tests and inspection involved in qualification
25,26	Review and ALL INDIA TRADE TEST etc	

TOOLS, MACHINERY, EQUIPMENTS of FABRICATION & DESIGNING OF STEEL STRUCTURE

LIST OF HAND TOOLS					
1.	Apron leather	17	2.	Safety boots for welders	17
3.	Ballpane Hammer 0.5 kg with handle	17	4.	Wire brush (M.S)	17
5.	Caliper outside 15 cm	17	6.	Screen welding helmet type	17
7.	Protractor with blade 150 mm	17	8.	Screening welding hand	17
9.	Centre punch 9mm x 127 mm	17	10.	Scriber 15 cm	17
11.	Chipping screen hand	17	12.	Ordinary Wooden Mallet 50 mm	17
13.	Chisel cold flat 19 mm	17	14.	Spark lighter	17
15.	Dividers 20 cm	17	16.	Square blade 15 cm	17
17.	Gloves pair leather	17	18.	Steel Rule 300 mm	17
19.	Goggles pair welder	17	20.	Steel Tape 2 meters	17
21.	Hammer scaling 0.25 kg with handle	17	22.	Tongs holding 30 cm	17

SHOP OUT FIT					
1.	'C' Clamp 150 mm	6	2.	Portable Electric drill (Single phase)	2
3.	Anvil Face Stake	4	4.	Punch Letter 4 mm and Punch Number 4 mm	1 set each
5.	Bessing Mallet	4	6.	Vernier caliper (0mm-150mm)	1
7.	Chisel cold flat 25 mm x 250 mm	4	8.	Plier Combination 150 mm	2
9.	Crow bar 910 x 25 mm	2	10.	Punch Round 6 mm Dia	4
11.	D.E. Sammer G.P(6mm to 32 mm) (set of 12 spanner)	2	12.	Raising Hammer with handle	4
13.	End faked Mallet	4	14.	Rasp cut file 250 mm	4
15.	File flat 250 mm second cut and smooth	2	16.	Rawl Punch holder and bits (No. 8,10,12,14)	4
17.	File Flat 250 mm smooth	2	18.	Right cut snips 250 mm	4
19.	File flat 300 mm bastard	2	20.	Rivet sets snap and dolly combined 3 mm, 4 mm, 6 mm	4 each
21.	File half round 300 mm smooth	2	22.	Round File 2 nd cut 250 mm	4
23.	Funnel Stake	4	24.	Try square 1 m	2
25.	Pneumatic rivet gun	2	26.	Screw Driver 250 mm	2
27.	Grip Wrench 200 mm	2	28.	Sheet Metal Gauge	4
29.	H.S.S. Twist Drill 3 mm & 6 mm (Parallel Shank)	3 each	30.	Snips straight 250 mm	4
31.	Hacksaw frame 300 mm adjustable (tubular)	4	32.	Soft Hammer (Brass, copper, lead, rubber and rawhide heads with handle)	4
33.	Half Moon Stake	4	34.	Soldering copper Hatchet type 500 gms	8
35.	Hammer Block with handle	4	36.	Square File 2 nd Cut 250 mm	4
37.	Hammer Creasing with handle	4	38.	Stake Round and Bottom	4
39.	Hammer Peaning with handle	4	40.	Steel Rule 600 mm	4
41.	Hand Drill 0 to 6 mm, 8 mm,	2 each	42.	Steel Square 450mm x 600 mm	4
43.	Hand Groover 4 mm	4	44.		
45.	Hand Shear Universal 250 mm	4	46.	Tinmans 300 mm	4
47.	Hand vice 50 mm	16	48.	Tinmans Horse	4
49.	Hollowing hammer with handle	4	50.	Tongs, close mouth and pick up(1 each	4 pairs
51.	Ladle 150 mm dia	2	52.	Trammel Point (with beam 600 mm)	1
53.	Lazy Tong	2	54.	Triangular File Smooth 250 mm	4
55.	Left cut snips 250 mm	4	56.	Tripaning tool 70 mm	1
57.	Micrometer outside (0 to 25mm)	1	58.	Trowel Medium	1
59.	Oil Can Pressure feed 500 ml	2	60.	Trowel small	1

GENERAL INSTALLATION					
1.	AG-7 grinder	1	2.	Personnel Computer complete with latest profile & printer	1
3.	Air compressor capacity 10 kg/cm2	1	4.	Pillar type drilling machine 12 mm	1
5.	Air plasma cutting system with accessories & compressor	1	6.	Pipe bend machine Manual with Dies ¼", ½", ¾", 1" upto 32mm	1
7.	Anvil 50 kgs with stand	1	8.	Pipe Bending Machine (Hydraulic type)12mm to 30mm	1
9.	Arc welding set Rectifier type 400A with all accessories	1 set	10.	Plain wire 3 mm	20 mt
11.	Arc welding table all metal with positioner	6	12.	Plate bending machine (Roller type) capacity upto 8 mm thickness	1
13.	Bench liver shears 250mm Blade x 3mm capacity	1	14.	Plums	4
15.	Bench shear hand capacity up to 5 mm	1	16.	Pneumatic chips 50mm	1
17.	Bench vice 150mm	4	18.	Pneumatic Drilling machine with bits 4,5,6,8 & 12 mm capacity ½ mm	1
19.	Bending Machine with 380mm throat clearance (with crimping rollers)	1	20.	Pneumatic Reverting machine to depth of 50 mm	1

21.	Black Board with Easel	1	22.	Pneumatic Screw Driver with 6 mm, 1 10 mm, 16 mm & 25 mm gravity upto 25 mm	1
23.	Buffing and Polishing Machine	1	24.	Pneumatic wrench with adopter Pipe bend machine manual with Dies ¼ ", ½ ", ¾ ", 1" upto 50mm	1
25.	Carbon arc gouging torch 300A	1	26.	Portable Nibbler	1
27.	Chain pully hook with lock capacity ½ton	1	28.	Portable Pneumatic Shear	1
29.	Circle cutting Machine 300 mm Dia	1	30.	Poser hacksaw	1
31.	CO2 welding machine complete 400 A (Inverter type)	1 set	32.	Portable drilling machine (Cap 6mm)	1
33.	Dye penetrate Testing kit	2 set	34.	Pug cutting machine	1
35.	Electrode drying oven Temp range 0-2500C 10 kg cap	1	36.	Quick acting clamp capacity 100 kg	8
37.	Welding plant Oxy-Acetylene complete (high pressure)	2	38.	Seaming machine	1
39.	Welding CDs (Processes and Inspection methods)	1 set	40.	Slip roll former 1.6mm x 1000 mm	1
41.	Fly press/ball press No 4 single body	1	42.	Spinning Lathe	1
43.	Fume extractors	4	44.	Spot welding machine- 15KVA	1
45.	Gas welding table 1220 mm x 760 mm	2	46.	Spray Gun (Painting) 500 ml	1
47.	Guillotine Shearing Machine foot operated	1	48.	Steel lockers with 8 pigeon holes	2
49.	Hand Press Brake Capacity (0.8mm)	1	50.	Submerged Arc welding machine 600A	1
51.	Hydraulic Jack 250 mm Capacity ½ ton	2	52.	Surface plate with cover 100cm x 100cm	1
53.	Hydraulic Trolley Capacity ½ ton	1	54.	TIG welding set complete 300A AC/DC	1 set
55.	IIW/ASTM reference radiograph standard	1 set	56.	Tin smiths bench folder 600 x 1.6mm	1
57.	Light General purpose portable forge	2	58.	Transformer welding set with all accessories 300A	1 set
59.	Liquefied Petroleum Gas (LPG) Cylinder, Regulator and Torch with Burner	1	60.	Trolley for Cylinder (HP unit)	2
61.	Lugs for cables	4	62.	Ultrasonic flaw detector	1
63.	Magnetic practical testing machine	1	64.	Universal Testing machine	1
65.	Nibbling Machine	1	66.	Vernier Height gauge range 500 mm	1
67.	Oxygen, Acetylene, Argon & Co2 cylinder	1 each	68.	Vice bench 150 mm	6
69.	Pentagram machine for marking 1 mt	1	70.	Welding cables to carry 400A with flexible rubber	50 mt
FURNITURE					
1.	Instructor table	2	2.	Student Table	16
3.	Instructor chair	2	4.	Student stool Chair	16
5.	Steel Locker 4 holes	4	6.	Steel Almrah	6
7.	Steel side rack	6	8.	White board magnetic with duster	1
9.	Fire Extinguisher CO2	2	10.	Fire bucket with stand	4
11.	Computer Table	1	12.	Computer Chair	1
13.	Printer Table	1	14.	Work bench	4