

*Syllabus for the trade
of*

**MAINTENANCE MECHANIC
(CHEMICAL PLANT)
(SEMESTER PATTERN)**

UNDER

CRAFTSMEN TRAINING SCHEME

Revised in: 2015

By

Government of India

Central Staff Training and Research Institute

Directorate General of Training

Ministry of Skill Development and Entrepreneurship

EN -81, Sector-V, Salt Lake City,

Kolkata-700091

List of the Members of Trade Committee Meeting for the trade of

MAINTENANCE MECHANIC (CHEMICAL PLANT) held on 24.03.2015 and 25.05.2015 at DVE&T, Mumbai and I.T.I. Mahad, Maharashtra

SR.NO.	NAME & DESIGNATION	REPRESENTING ORGANIZATION WITH FULL ADDRESS	REMARKS
1	G. J. Shivalkar Principal	I.T.I. Mahad	Chairman
2	Smt. S. G. Thakur, Training Officer	I.T.I. Mahad	Member
3	C. P. Jadhav, Craft Instructor	I.T.I. Panvel	Member
4	S. D. Bait, Craft Instructor	I.T.I. Mahad	Member
5	N. J. Ware, Craft Instructor	I.T.I. Mahad	Member
6	J. H. Suryawanshi Training Officer	I.T.I Mahad	Member
3	P.R. Patil Craft Instructor	I.T.I Mahad	Member
4	S.V.Ghadigaonkar Manager Mechanical	Pidilite Industries Ltd,A-21 MIDC MahadDist- Raigad	Member
5	SukhirajShette Manager Maintenance	Sandoz Pvt. Ltd,L-1 MIDC MahadDist- Raigad	Member
6	Sanjay Janrao Manager Maintenance	Embio Ltd,E-21,22 MIDC MahadDist- Raigad	Member
7	Sameer N. Lahane Dy. Manager Engg.	Shree Hari Chemicals Export Ltd,A-8 MIDC MahadDist- Raigad	Member
8	A Markandeyula Manager Maintenance	Privi Organics Ltd,C-3,4,5,6MIDC MahadDist- Raigad	Member
9	V N Malusare Sr. Manager Engg.	Hical Ltd,A-18 MIDC MahadDist- Raigad	Member
10	S T Dhumane Asst.ManagerEngg.	SadhanaNitrochem Ltd, MIDC Roha, Dist- Raigad	Member
11	R.S.Bhosale G.M. Engg.	Elppe chemicals pvt MIDC RohaDist- Raigad	Member
12	S.K. Singh Sr. Executive	Sudarshan chemicals Ltd. MIDC Roha, Dist- Raigad	Member
13	Vineetsingh Manager Maintenance	Pepsico India holdings pvt ltd MIDC Roha. Dist- Raigad	Member

List of the Members of Trade Committee Meeting for the trade of

MAINTENANCE MECHANIC (CHEMICAL PLANT)

held on 02nd July, 2015 at Industrial Training Institute, Maninagar, Ahmedabad, Gujarat

SR. NO.	NAME & DESIGNATION	REPRESENTING ORGANIZATION WITH FULL ADDRESS	REMARKS
1.	Shri Sanjaykumar, Joint Director	CSTARI, Kolkata	Chairman
2.	Shri L. K. Mukherjee, Dy. Director	CSTARI, Kolkata	Member
3.	Shri A. C. Muliya, Dy. Director	Directorate of Employment & Training, Gandhinagar	Member
4.	Shri G. N. Parekh, Dy. Director	Directorate of Employment & Training, Gandhinagar	Member
5.	Shri Yatin K. Shah, Supervisor	J. B. Packaging, Ahmedabad	Member
6.	Shri Krunal J Patel, Manager	Dishman Pharma & Chemical Ltd., Ahmedabad	Member
7.	Shri Praful S Sompura, Q.C. Chemist	Maize Products, Ahmedabad	Member
8.	Shri Kamlesh Prajapati, Director	Technology Exchange Services Pvt. Ltd., Ahmedabad	Member
9.	Shri Imtiyaz Kureshi, Sr. Engg.	Technical Resources & Planning Services Pvt. Ltd., Ahmedabad	Member
10.	Shri P. D. Pendkar, Prod. Manager	Jay Chemical Industries, Ahmedabad	Member
11.	Shri Vijay Sinha, Exe. Incharge	Jay Chemical Industries, Ahmedabad	Member
12.	Shri Prakash Patel, General Manager	Meghmani Dyes & Intermediates Ltd, Ahmedabad	Member
13.	Shri Vishnu Patel, Manager	Meghmani Dyes & Intermediates Ltd, Ahmedabad	Member
14.	Shri Jayeshbhai Dave, Manager	Meghmani Pigments, Ahmedabad	Member
15.	Shri Hetal Shah, Asst. Prod. Manager	Meghmani Pigments, Ahmedabad	Member
16.	Shri Patel Nikesh M, Manager	Mcfills Enterprises Pvt. Ltd, Ahmedabad	Member
17.	Shri Rajendra Mandora, Vice President	RLT Instrumentation Pvt. Ltd, Chennai	Member
18.	Shri Akshit Raycha, Jt. Managing Director	Zenith Healthcare, Ahmedabad	Member
19.	Shri Dr. A. P. Vyas, Principal	Saffrony Institute of Technology, Mehsana	Member
20.	Shri D. B. Chaudhari, Principal	ITI Sachin, Surat	Member
21.	Shri Nilesh H Patel, S. I. AOCP	ITI Vasad, Anand	Member
22.	Shri B. R. Prajapati, S. I. AOCP	ITI Palana, Kheda	Member
23.	Shri H. B. Rajput, S. I. AOCP	ITI Visnagar, Mehsana	Member
24.	Shri A. G. Parmar, S. I. AOCP	ITI Kubernagar, Ahmedabad	Member

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MAINTENANCE MECHANIC (CHEMICAL PLANT)

held on 02nd July, 2015 at Industrial Training Institute, Maninagar, Ahmedabad, Gujarat

SR. NO.	NAME & DESIGNATION	REPRESENTING ORGANIZATION WITH FULL ADDRESS	REMARKS
25.	Shri M. M. Patel, S. I. IMCP	ITI Kubernagar, Ahmedabad	Member
26.	Shri D. D. Dave, S.I. (MMCP)	ITI Kubernagar, Ahmedabad	Member
27.	Smt. S. C. Madi, S. I. (LACP)	ITI Kubernagar, Ahmedabad	Member
28.	Shri S. N. Patel, S. I. (IMCP)	ITI Kubernagar, Ahmedabad	Member
29.	Shri V. R. Patel, S. I. (MMCP)	ITI Kubernagar, Ahmedabad	Member
30.	Ku. R. K. Parmar, S.I. (LACP)	ITI Kubernagar, Ahmedabad	Member
31.	Ku. Z. R. Dave, S. I. (AOCP)	ITI Kubernagar, Ahmedabad	Member
32.	Shri A. B. Shrimali, S. I. (MMCP)	ITI Kubernagar, Ahmedabad	Member

GENERAL INFORMATION

1. Name of the Trade : **MAINTENANCE MECHANIC (CHEMICAL PLANT)**
2. NCO Code No. :
3. Duration : 2 Year Course with 4 Semesters of 6 months duration each
4. Power Norms : 13 Kw
5. Space Norms : 96 sq. mtrs.
6. Entry qualification : Passed 10th Class Examination under 10+2 system with Science and Mathematics or equivalent.

7. Unit Size (No. of Trainees) : 16
8. Instructor Qualification : a. Degree in Chemical Technology/ Engineering from recognized University with one year experience in the relevant field.

OR

b. Diploma in Chemical Technology/ Engineering from recognized board of Technical Education with 2 years post qualification experience in relevant field

OR

c. 10th Class Passed and NTC / NAC in Trade with 3 years post qualification experience in the relevant field.

9. Desirable : CIC in the trade.

Note: - At least one instructor must have Degree/ Diploma in the relevant field.

SYLLABUS OF THE TRADE OF		
MAINTENANCE MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – I Semester Code No. MMC-01)		
Week No.	TRADE PRACTICAL	TRADE THEORY
Safety		
1	Demonstration about PPE'S, Safety Equipment,. First aid box.	INTRODUCTION: Introduction about ITI Rules and Regulation. Importance of trade training. Safety: Introduction & Importance of safety, General precautions about safety. PPE'S Used in chemical industries. Safety slogan. First aid in industry & Workshop
2 & 3	Filing flat surface and Checking flatness and squareness using engineer's Try square.	BASIC FITTINGS: Description, construction and uses of different hand tools such as Files, Chisels, Hacksaw & Hammer etc.. Description, construction and uses of different marking tools such as steel rule, caliper, punches, scribing block etc
4	Filing four edges, Checking all dimension with outside caliper and steel rule. Marking of Parallel lines, curve lines using Dot Punch.	Job Holding Devices: Description, construction and uses of different job holding devices such as vice, V' Block.
5 & 6	Making a job on step fitting (Male and Female) Marking out the position of hole for drilling, use of center drill for drilling operation.	LINEAR MEASUREMENT: Description, construction, calculation and uses of different Linear Measuring Instruments - Venire Caliper, Venire Depth gauge, Height gauge, Micrometer outside, Bevel protector.
7	A)Drilling Practice, B)Reaming Practice, C)Countersinking & Counter boring Practice,	DRILLING ,REAMING AND THREADING: Nomenclature and uses of Drill, Reamer, and Thread
8	Tapping and Dieing of BSW OR Metric thread.	THREADS: Description, nomenclature and uses of different types of threads – metric, BSW, BSF, BSP etc. Calculation of tap drill size.
GAS WELDING		
9	Demonstration about safety equipments & general precaution in welding workshop.	SAFETY: Safety& General precautions observed in welding workshop. Importance of Welding in maintenance of chemical plant and equipments. Welding terms and their definition. Types of welding
10	Nut bolting over pipe flange. Riveting and seaming practice on metal sheet.	METAL JOINING METHOD: General introduction about Mechanical method (Riveting ,Nut bolting ,Seaming etc) Thermal method (soldering ,Brazing & Welding)
11	Demonstration about Lightning & Adjustment of Flame.	GAS WELDING: Principal of Gas Welding. Safety precaution before, after & during Gas Welding. Common Gas used in Welding OXY-ACETYLENE WELDING: Equipments such as cylinder trolley, regulator, blow pipe, Hose pipe, Assembling, care & maintenance
12	Edge joint with or without filler rod	OXY-ACETYLENE FLAME : Types of flame. uses & Effect of Atmospheric oxidation
BASIC PHYSICS		
13	PHYSICS LAB: Determination of acceleration due to gravity by simple pendulum To study parallelogram of forces with the help of mechanical board.	INTRODUCTION TO PHYSICS: Measurement with Venire caliper, Micrometer, Wire gauge. Scalar and Vector quantities, their representation, resultant. Triangle and parallelogram laws of forces.

SYLLABUS OF THE TRADE OF		
MAINTENANCE MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – I Semester Code No. MMC-01)		
Week No.	TRADE PRACTICAL	TRADE THEORY
14	Determination of coefficient of static friction by inclined plane. Determination of mechanical advantage, velocity ratio and % efficiency of Screw jack.	Newton's laws of motion, Inertia, force, momentum, types of force. Friction- definition, unit, types of friction, laws of friction, advantages and disadvantages of friction
15	Determination of Young's Modulus by Searle's apparatus	ELASTICITY: Stress, strain, elastic limit, Hooke's law. Types of modulus of elasticity, work done in a stretching wire, determination of Young's modulus
16	To study Ohm's law about current and voltage. To study electric cell using series and parallel connections	CURRENT ELECTRICITY: Ohm's law, series & parallel connections, specific resistance, Kirchhoff's law, faraday's law of electromagnetic induction.
17	Determination of specific resistance using Whetstone's meter bridge. Verification of faraday's First law of electrolysis. Determination of Mechanical equivalent of heat using electrical method.	ELECTROLYSIS: Faraday's laws of electrolysis. Thermodynamics- first law of thermodynamics, mechanical equivalent of heat, 'J' by electrical method.
18	Determination of coefficient of expansion of Solid. Determination of coefficient of expansion of liquid. Determination of coefficient of Thermal Conductivity of metal rod	MODES OF HEAT TRANSFER: Determination of thermal conductivity. Temperature & its measurement, expansion of solid, liquid and gases
BASIC CHEMISTRY		
19	CHEMISTRY LAB: Separation of mixture by simple Distillation. Volumetric Analysis-Preparation of Standard Solutions	INTRODUCTION OF CHEMISTRY: Branches of chemistry, importance of chemistry, Safety precautions to be taken in Chemistry Laboratory, different equipment and apparatus used in Laboratory
20	Volumetric Analysis- Alkali metric Titration. Volumetric Analysis Acidimetric Titration	Atom, molecule, Element, compound, mixture, Physical change, chemical change, Acids, bases, salts-their properties. Molecular weight, equivalent weight, atomic weight, Normality, molarity, Metal & Non metal
21	To study the allotropic forms of Sulphur. To study the properties of mixture and compound (Fe+S&FeS)	ATOMIC STRUCTURE: Electrons, protons, neutrons. Electronic theory of valency. Classification of elements, Modern periodic law, table, Groups, periods, periodic properties.
22	To study action of pure and salt water on metals and alloys. To study action of acids and bases on metals and alloys.	WATER: Sources, hard and soft water, causes and removal of hardness, water for industrial purposes. Introduction to Effluent treatment plant (CETP). Corrosion- causes, effects and prevention. Allotropy of hydrogen, carbon, phosphorus and sulphur
23	Preparation of (a) Soap b) Copper sulphate	Organic Chemistry- introduction, purification processes, organic reactions- substitution, addition, Elimination, rearrangement reactions, examples. Nomenclature-Basic rules for Common name & IUPAC name system for alkanes, alkenes & alkynes, their examples,
24	Determination of pH (by Ph meter) Boiling point measurement of liquid. Melting point Measurement of solid.	Definition of pH, pH scale, measurement of pH. Conductivity
25	REVISION	
26	EXAMINATION	

SYLLABUS OF THE TRADE OF		
MAINTENANCE MECHANIC(CHEMICAL PLANT) UNDER CTS		
SEMESTER – II (Semester Code No. MMC-02)		
Week No.	TRADE PRACTICAL	TRADE THEORY
ARC WELDING		
1& 3	Straight line beads on MS Flat Single 'V'Butt joint on MS Flat	ARC WELDING: Principal of arc Welding. Safety precaution before, after & during Arc Welding. Types of Arc Welding , Types of Welding joints. Edge Preparation .Types of Welding position. Welding symbol ,Electrodes, its types, selection of electrode
4	Identification of welding defects, and rectifying the same	Welding defects, its causes and remedies
BASIC TURNING		
5	Cleaning and oiling of various parts. Holding job in three jaw/four jaw chuck, trueing & turning , Tool grinding	LATHE: Shop safety, safety precaution as applied to section, Lathe - its construction, cleaning and oiling. Independent chucks different types and construction, uses. Common lathe cutting tools, type, shapes, Material
6&7	Plain turning by holding job in the chuck. Facing & turning to specified dia. Step turning,	Lathe accessories, such as centre, mandrel, catch plate, face plate, chucks, lathe steady etc. Lathe operations-Plain turning, facing, step turning
8	Drilling on lathe – through and step drilling..	Common lathe cutting tools, roughing and finishing tools, knife tool recessing tool etc., Drills – construction, types uses of sleeves.
FITTING & MAINTENANCE		
9	Demonstration about PPE'S, safety Equipment, Fire Extinguisher .Importance of trade training.	SAFETY : Introduction, Important, General precautions about safety. PPE'S Used in chemical industries while maintenance. Role of maintenance mechanic in the Chemical Industries. Work Permit System. Material safety data sheet (MSDS)
10	Demonstration about firefighting Equipments(Fire Extinguisher)	FIRE: Definition of Fire and Fire Triangle .Class of fire. Fire prevention and control. ENVIRONMENTAL POLLUTION: Definition, types, it's sources and control
11	Health Safety and Environment guidelines, legislations & regulations as applicable, Disposal procedure of Workshop waste material like cotton waste, chips. Safety sign for dangers. Basic first Aid	Importance of first Aid. Importance of OHS, Introduction to 5S Concept & its application. Resources to emergencies e.g. Power failure, fire & system failure, Importance of Housekeeping& good shop floor practice. Importance of ISO System
12	Introduction & Uses of various fitting tools for maintenance.	FITTINGS TOOLS: Introduction about various fitting tools for maintenance I such as spanner and its types ,allen key , screw driver ,hammer, chisel, punch ,steel rule, pliers , caliper ,circlip plier, file, spirit level, etc.
13&14	Introduction & Uses about various Fastener and locking device such as Nut bolt, wisher, pins etc. Inside square fit, make combined opened and sliding fit, straight sides 'T' Fit.	FASTENER AND LOCKING DEVICES: Types & uses Limit, Fit, Tolerance, Definition of Limit, Fits, Tolerance, Allowance, Terminology of limits and fits-basic size. Actual size & deviation. Different standard system of Fit and Tolerance. Method of expressing tolerance.
15	Making of key & key ways in shafts, using cross cut chisel.	KEY & KEY WAY: Various, types of keys, allowable clearance and tapers, proportion of keys based on dia. of shaft. Repairing of Key ways.
16	Scrap on flat surface & testing of scrapped surface by Prussian blue.	SCRAPPER: Scrapers, their uses, type of scrapers, method of scrapping. Testing of scrapped surface.
17	lapping of flat surface using lapping plate & checking of lapped surfaces	LAPPING: Importance of lapping, Types of lapping abrasive, Lapping method, lapping tools for external internal and flat surface.

SYLLABUS OF THE TRADE OF		
MAINTENANCE MECHANIC(CHEMICAL PLANT) UNDER CTS		
SEMESTER – II (Semester Code No. MMC-02)		
Week No.	TRADE PRACTICAL	TRADE THEORY
18	Insulation on cold pipe line using thermocol H/R Pole. Insulation on HOT pipe line using Glass wool.	LINING: Lead lining, rubber lining, FRP lining , glass lining LAGGING: Importance of lagging (Insulation) , types of lagging material and its application
19	Making different types and sizes of pipe joints such as screwed & flanged etc.	PIPES: Pipes and pipe joints, pipe bending fixtures, standard pipe threads
20	Preparing pipe lines, using various pipe fittings. Cutting & Threading of Pipe	FLOW FLUID: Definition& types of fluid. PIPE & PIPE FITTINGS: Various pipe fittings its uses& construction. Methods of fitting or replacing them.
21	Measuring pressure drop & flow rate through venturimeter ,orifice meter , rotameter	VARIABLE FLOW METER: Principle, construction details, it's operating & working and applications in industries. (Orificemeter , Venturimeter , Rotameter)
22	Reading practice by dial gauge on given surface.	DIAL GAUGE: Dial test Indicator, construction, parts, material, graduation, Method of use. Care and maintenance. Digital dial indicator, Comparators- Measurement of quality in the cylinder bore.
23	Practice on measurement of flow, level, temperature, pressure. by using Measuring instrument	BASIC INSTRUMENTATION: Study of Basic instruments, Pressure, Temperature, Level, Flow
24	PROJECT WORK / INDUSTRIAL VISIT	
25	REVISION	
26	EXAMINATION	

SYLLABUS OF THE TRADE OF		
MAINTENANCE MECHANIC(CHEMICAL PLANT) UNDER CTS		
SEMESTER – III (Semester Code No. MMC-03)		
Week No.	TRADE PRACTICAL	TRADE THEORY
1	Introduction about Maintenance of Equipments & Machinery. Online maintenance & Record maintaining of workshop equipments.	MAINTENANCE: Definition & Types of Maintenance, Advantage of Preventive maintenance and Disadvantage of Breakdown maintenance. Check list, Making of check list.
2	Oiling & Greasing of all machineries and gear boxes in workshop	LUBRICATION: Definition, Quality of good Lubricant, Grade of Lubricants, different Method of lubricating system, selection of good Lubricant.
3	Care and Handling of bearings	BEARING: Classification of bearing, i.e. Bush bearing, solid bearing Journal bearing, Ball bearing-single row, Double row, self-aligned ball bearing, Angular contact ball bearing. Thrust bearing, Roller bearing-Taper, cylindrical roller bearing, construction & application of all bearings, care & Handling of bearing.
4	Fitting and removing of bearing with special tools.	MOC Of all types of bearing, Method of Fitting & Removing of bearing. And tools used for fitting & removing of bearing.
5	Making gasket on given flange.	GASKET & PACKING: Uses, material of gasket & packing's. Types of gaskets & packing's. Gland packing
6	Maintenance of gear boxes	GEAR BOX: Types and uses of gear such as spur gear, Helical Gear, Bevel gear, Meter gear, Worm Gear etc. Selection of gear. MOC Of gear, Types of gear Boxes.
7	Dismantling ,cleaning , repairing , and reassembling of Gate Valve ,Globe valve ,Needle valve	VALVE: Definition and Types of valve. Principle, Construction details, & working of Gate Valve, Globe valve, Needle valve. Its maintenance, trouble & trouble shooting.
8	Dismantling, cleaning , repairing, and reassembling of ball valve, plug valve, NRV, PSV .	VALVE: Principle, Construction details, working of ball valve, plug valve, NRV, PSV, Its maintenance, trouble & trouble shooting.
9	Dismantling ,cleaning, repairing, and reassembling of diaphragm valve, Butterfly valve ,control valve, solenoids valve	VALVE: Principle, Construction details & working of diaphragm valve, Butterfly valve, control valve, solenoid valve .It's maintenance, trouble & trouble shooting.
10&11	Dismantling ,cleaning, repairing , and reassembling of Centrifugal pump Head vs. capacity curve for centrifugal pump	PUMPING DEVICE FOR LIQUID: Definition, use, types of pump(Centrifugal pump & positive displacement pump) 1) CENTRIFUGAL PUMP: Principle, types (volute, diffuser, turbine, submerged type) construction details (Types of impeller)& working of centrifugal pump. Startup procedure of Centrifugal pump. It's maintenance, Trouble & Trouble shooting. NPSH. Advantage & Disadvantage of centrifugal pump. Head vs. capacity curve for centrifugal pump
12	Dismantling, cleaning, repairing, and reassembling of Reciprocating pump.(piston type)	2) POSITIVE DISPLACEMENT PUMP: I) RECIPROCATING PUMP: Principle, classification of RP depend on A) Reciprocating media -piston, plunger, diaphragm B) Acting - single, double C) No. of cylinder. Construction details, operating & working, its maintenance, Trouble & Trouble shooting. Advantage & Disadvantage of RP.
13	Dismantling, cleaning, repairing, and reassembling of Gear Pump. Making head vs. capacity curve for gear pump.	II) ROTARY PUMP: Principle, Type(Mono pump, Gear Pump), construction and working of gear pump (external & Internal),
14	Dismantling, cleaning, repairing and reassembling of Rotary Pump.	Construction and working of screw pump, lobe pump, Vane pump

SYLLABUS OF THE TRADE OF		
MAINTENANCE MECHANIC(CHEMICAL PLANT) UNDER CTS		
SEMESTER – III (Semester Code No. MMC-03)		
Week No.	TRADE PRACTICAL	TRADE THEORY
15	Dismantling, cleaning, repairing and reassembling vacuum pump.	III) VACUUM PUMP: Definition of vacuum uses & types, construction details, operating & working, its maintenance. Ejectors- water & steam jet ejectors
16	Fitting of coupling and alignment by straight edge	POWER TRANSMISSION: Coupling, types of couplings i.e. flange coupling, muff coupling, tyre coupling, universal coupling, bush pin type coupling and their applications
17	Dismantling and fitting of pulleys. Belt installation and alignment by thread on DE & NDE Side Pulley.	POWER TRANSMISSION ELEMENTS: The object of belts, their size & specification, material of belt, selection of belt, load and tension. Advantages and disadvantages of belt
18,19& 20	Alignment by straight edge, Standard practice on alignment of pump shaft with motor shaft using two dial gauge. Standard practice on alignment of pump shaft with motor shaft using laser system.	ALIGNMENT OF PUMP: Requirement of alignment causes and effect of misalignment. Different method of testing alignment, i.e. alignment by straight edge, Alignment by Dial Gauge (Radially & Axially), and alignment by laser system (3 axes system) .
21	Practice on Installation of mechanical seal & testing	MECHANICAL SEAL: Types of mechanical seal, care and handling of mechanical seal, Material of seal, application of mechanical seal. Oil seal its specification.
22	Installation and erection of machine as per standard procedure.	INSTALLATION OF MACHINERY: Receiving, checking, foundation, installation, leveling, alignment, trial.
23	Pressure Vessel With Control And Maintenance Of Plant With Transmitters, Valves, Pumps And All Parameters Simulation Software and all accessories	PRESSURE VESSELS: Types of pressure vessels, care and maintenance of pressure vessels. LIFTING & HANDLING: Various types of lifting and lowering devices such as chain block, crane, screw jack, Hydraulic jack, material handling devices ,fork lift, Hand trolley
24	PROJECT WORK / INDUSTRIAL VISIT	
25	REVISION	
26	EXAMINATION	

SYLLABUS OF THE TRADE OF		
MAINTENANCE MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – IV (Semester Code No. MMC-04)		
Week No.	TRADE PRACTICAL	TRADE THEORY
1	Dismantling, cleaning & repairing and reassembling of Reciprocating compressor.	UTILITY: COMPRESSOR: Type of compressor, Application, working & construction of single stage, multistage reciprocating compressor.
2&3	Dismantling, cleaning & repairing and reassembling of centrifugal compressor. Screw compressor, lobe compressor, Air receiver	Working and construction of centrifugal compressor, screw compressor, Lobe compressor, sliding vane compressor. Selection criteria for compressor, Capacity. Air receiver, compressor control (i.e. Automatic start stop control, Exhaust regulation control, inlet regulation control)
4	Dismantling, cleaning & repairing and reassembling of pressure regulator, Air dryer	AIR TREATMENT: Introduction, RH, Dew point, water trap, Air filters-dry filter, wet filter, coarse filter, micro filter, pressure regulator. Air dryers-classification, components of a typical compressed air system
5	Dismantling, cleaning & repairing and reassembling Fan & Blower	FAN & BLOWER: Uses, construction details, working and its maintenance.
6	Scale formation cleaning, repairing gasket checking, and Maintenance of cooling tower. Cooling tower operation.	DEFINITION & USES: Water (Cooling, chilled, hot, DI) COOLING TOWER: Construction, types & uses of cooling tower. Trouble & trouble shooting. Scale formation, preventive maintenance.
7,8 & 9	Maintenance of steam trap	STEAM GENERATION: Steam & its types. Types of boiler, Mountings & accessories. Types of draught, trouble & trouble shooting. Scale formation. Types of fuels. Types of steam trap.
10	Study of refrigeration units & their maintenance	REFRIGERATION: Refrigerant, types of refrigerant and its properties, handling of refrigerant,
11	Tracing of hydraulic circuit on hydraulic jack & its Maintenance.	BASIC PRINCIPLE OF HYDRAULICS: Inherent physical properties of liquids, comparison of molecular structure of solids, liquids & gases, Basic terms & definition in hydraulics i.e. Force, Pressure, Work, Viscosity, Pascal's law, Hydraulic jack
12,13	Dismantling, cleaning, repairing, gasket checking, reassembling of Shell & tube Heat exchanger.	HEAT TRANSFER: Definition. Mode of heat transfer, heat exchanger equipments (condenser, cooler, chiller, boiler, heat recovery boiler, reboiler) Types of heat exchanger (double pipe HE, shell & tube HE,) advantage disadvantage of the Shell & Tube Heat Exchanger.
14	Dismantling, cleaning, repairing, gasket checking, reassembling of Vertical evaporator. Operation of Vertical evaporator.	EVAPORATION: Definition. Types of evaporator. Construction details, operating & working, its maintenance. Triple effect evaporator. Trouble & trouble shooting.
15,16	Fitting and maintenance of pipe line, hose pipe, various valves, packing's /plate of distillation column	DISTILLATION: Definition, distillation process, Method & types of distillation. Distillation column. types of column (packed & plate) construction details, operating & working. Its maintenance, trouble & trouble shooting.
17&18	Operating & maintenance of plate & frame filter. Operating & maintenance of centrifuge.	FILTRATION: Definition, Filtration media, filtration equipment (plate & filter, rotary vacuum filter, centrifuge, Buckner filter, nutch filter, ANFD, sparkler filter) operating & working, its maintenance, Trouble & Trouble shooting.

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MAINTENANCE MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – IV (Semester Code No. MMC-04)		
Week No.	TRADE PRACTICAL	TRADE THEORY
19	Operating & maintenance of tray dryer / Spray dryer	DRYING: Definition, Drying equipment (tray dryer, Rotary dryer, Spray dryer, FBD, RCVD), operating& working, its maintenance, Trouble& Trouble shooting.
20	Operating & maintenance of Hammer mill	SIZE REDUCTION: Definition, Advantages of size reduction, Crushing& Grinding, Classification, Equipments(Black jaw crusher, Hammer mill, Ball mill,)
21	Operating & maintenance of vibrating screen.	SCREENING: Definition, screening equipment, working, its maintenance, Trouble& Trouble shooting.
22	Maintenance of agitator	MIXER & AGITATORS: Types of agitators, application and construction of agitators.
23	Operating & maintenance of belt, bucket, screw & pneumatic conveyor.	CONVEYOR: Types of conveyor(belt, bucket, screw & pneumatic conveyor),construction details & working
24	INPLANT TRAINING	
25	REVISION	
26	EXAMINATION	

A: Trade Details					
S.N.	Particulars	As per DGET			
1.	Name of the Trade	MAINTENANCE MECHANIC (CHEMICAL PLANT)			
2.	Duration (In Semester):	4			
3.	Intake:	16			
4.	Space Required (in Sq. Meter):	96			
5.	Power Required (in KW):	13			
B: Workshop/ Lab Furniture					
S.N.	Name of Item	Category	Qty	Unit	Remark
1	Dust Bin - 50 Liters (Optional)	Equipment	1	Number	Per 1 Unit in a Shift
2	Black/ White Board with Stand - 4 X 3 Feet	Furniture	1	Number	Per 1 Unit in a Shift
3	Book Shelf/ Glass Shelf (Optional)	Furniture	1	Number	Per 1 Unit in a Shift
4	Discussion Table/ Working Table = L:W:H = 8:4:3 Feet - Heavy Wooden Top	Furniture	1	Number	Per 1 Unit in a Shift
5	Instructor/ Office Chair	Furniture	2	Number	Per 1 Unit in a Shift
6	Instructor/ Office Table	Furniture	1	Number	Per 1 Unit in a Shift
7	Notice Board - 2 X 3 Feet	Furniture	1	Number	Per 1 Unit in a Shift
8	Steel Almirah – Large (Optional)	Furniture	2	Number	Per 1 Unit in a Shift
9	Steel Locker - 12 Pigeon Hole	Furniture	2	Number	Per 1 Unit in a Shift
10	Steel Rack (Optional)	Furniture	1	Number	Per 1 Unit in a Shift
11	Stool - Height 450 mm	Furniture	10	Number	Per 1 Unit in a Shift

C: Workshop/ Lab Infrastructure (Tools, Equipment's, Machines, etc.)

S.N.	Name of Item	Category	Qty	Unit	Remark
1.	Safety shoes (Regular size)	Consumable	17	Number	Per 3 Unit in a Shift
2.	Safety hand gloves Rubber (Regular size)	Consumable	17	Number	Per 3 Unit in a Shift
3.	Safety hand gloves leather (Regular size)	Consumable	17	Number	Per 3 Unit in a Shift
4.	Ear plug	Consumable	17	Number	Per 3 Unit in a Shift
5.	Helmet	Consumable	17	Number	Per 3 Unit in a Shift
6.	Fire Extinguisher (CO2 ,)	Equipment	1	Number	Per 3 Unit in a Shift
7.	Fire Extinguisher (Dry Chemical powder)	Equipment	1	Number	Per 3 Unit in a Shift
8.	Sand bucket	Consumable	2	Number	Per 3 Unit in a Shift
9.	Fire blanket	Consumable	2	Number	Per 3 Unit in a Shift
10.	Steel Rule - 300 mm, Graduated both in Metric and English Unit	Tool	6	Number	Per 3 Unit in a Shift
11.	Try Square - 150 mm	Tool	6	Number	Per 3 Unit in a Shift
12.	Caliper - Inside Spring - 150 mm	Tool	6	Number	Per 3 Unit in a Shift
13.	Caliper - Outside Spring - 150 mm	Tool	6	Number	Per 3 Unit in a Shift
14.	Divider Spring Type - 150 mm	Tool	6	Number	Per 3 Unit in a Shift
15.	Punch Centre - Diameter - 10 mm and Length - 100 mm	Tool	6	Number	Per 3 Unit in a Shift
16.	Punch Prick - 100 mm	Tool	6	Number	Per 3 Unit in a Shift
17.	Letter and Number Punch - 5mm	Tool	1	Set Each	Per 3 Unit in a Shift
18.	Scriber- Straight- 150 mm	Tool	6	Number	Per 3 Unit in a Shift
19.	Hand Hacksaw Frame - Fixed - 300 mm	Tool	6	Number	Per 3 Unit in a Shift
20.	File - Flat - Bastard - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
21.	File - Flat - Second Cut - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
22.	File - Flat - Smooth - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
23.	File - Half Round - Second Cut - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
24.	File - Round - Smooth - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
25.	File - Triangular - Smooth - 150 mm	Tool	6	Number	Per 3 Unit in a Shift
26.	File - Square - Second Cut - 200 mm	Tool	6	Number	Per 3 Unit in a Shift
27.	Hammer - Ball Pain - 250 grams	Tool	6	Number	Per 3 Unit in a Shift
28.	Hammer - Ball Pain - 500 grams	Tool	6	Number	Per 3 Unit in a Shift
29.	Screw Driver - 9 X 300 mm	Tool	4	Number	Per 3 Unit in a Shift
30.	Drill Twist Set - Straight Shank - 3 mm to 13 mm by 0.5 mm	Tool	1	Number	Per 3 Unit in a Shift
31.	Drill Twist Set - Straight Shank - 9.8 mm	Tool	1	Number	Per 3 Unit in a Shift

32.	Hand Reamer Parallel - 10 mm	Tool	2	Number	Per 3 Unit in a Shift
33.	Tap set -12 mm	Tool	2	Number	Per 3 Unit in a Shift
34.	Solid die 12 mm with die stock	Tool	2	Number	Per 3 Unit in a Shift
35.	Gauge Screw Pitch - Metric -0.25 to 6 mm	Tool	1	Number	Per 3 Unit in a Shift
36.	Wire Gauge - Metric	Tool	1	Number	Per 3 Unit in a Shift
37.	Allen Key Set - Hexagonal - 1 - 12 mm, set of 12 Keys	Tool	1	Number	Per 3 Unit in a Shift
38.	Venire Caliper - 0 - 200 mm with least count 0.02mm	Tool	1	Number	Per 3 Unit in a Shift
39.	Venire Height Gauge - 0 - 300 mm with least count = 0.02 mm	Tool	1	Number	Per 3 Unit in a Shift
40.	Venire Bevel Protractor - 300 mm Blade with Acute Angle Attachment	Tool	1	Number	Per 3 Unit in a Shift
41.	Venire Depth Gauge 300 mm (L...C. 0.02mm)	Tool	1	Number	Per 3 Unit in a Shift
42.	Universal Dial Test Indicator - Plunger Type - Range 0 - 10 mm, Graduation 0.01 mm & 0.001mm Reading 0 - 10 with Revolution Counter complete with Clamping Devices and Magnetic Stand	Equipment	2	Number	Per 3 Unit in a Shift
43.	Micrometer - Outside - 0 - 25 mm	Equipment	1	Number	Per 3 Unit in a Shift
44.	Micrometer - Outside - 25 - 50 mm	Equipment	1	Number	Per 3 Unit in a Shift
45.	Combination Set 300 mm	Equipment	2	Number	Per 3 Unit in a Shift
46.	V Block - 75 x 75 x 50 mm with Clamp (Hardened & Ground)	Tool	1	Pair	Per 3 Unit in a Shift
47.	Bench Vice - 125 mm	Tool	6	Number	Per 3 Unit in a Shift
48.	Anvil - 50 Kg - with stand	Equipment	1	Number	Per 3 Unit in a Shift
49.	Scraper - Flat - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
50.	Scraper - Half Round - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
51.	Scraper triangular 250 mm	Tool		Number	Per 3 Unit in a Shift
52.	Surface Plate - Granite - 600 x 600 mm with Stand and Cover	Equipment	1	Number	Per 3 Unit in a Shift
53.	Drilling Machine - Bench Type - 13 mm Motorized with Standard Accessories	Machine	1	Number	Per 3 Unit in a Shift
54.	Pedestal Grinder - Double Ended - 200 mm	Machine	1	Number	Per 3 Unit in a Shift
55.	Acetylene Cylinder	Equipment	1	Number	Per 3 Unit in a Shift
56.	Oxygen Cylinders	Equipment	1	Number	Per 3 Unit in a Shift
57.	Electric Spark Lighter	Equipment	6	Number	Per 3 Unit in a Shift
58.	Oxygen Gas Pressure Regulator Double Stage	Equipment	1	Number	Per 3 Unit in a Shift
59.	Acetylene Gas pressure Regulator Double Stage	Equipment	1	Number	Per 3 Unit in a Shift
60.	Rubber Hose - Acetylene, Diameter = 8 mm, Length = 10 meters	Equipment	1	Number	Per 3 Unit in a Shift

61.	Rubber Hose - Oxygen, Diameter = 8 mm, Length = 10 meters	Equipment	1	Number	Per 3 Unit in a Shift
62.	Rubber Hose Clips - 1/2 inch	Tool	6	Number	Per 3 Unit in a Shift
63.	Tong - Flat - 300 mm	Tool	4	Number	Per 3 Unit in a Shift
64.	Cylinder Key	Tool	4	Number	Per 3 Unit in a Shift
65.	Gas welding torch with nozzle set	Equipment	1	Number	Per 3 Unit in a Shift
66.	Instrument for determining 'g' (Simple Pendulum)	Equipment	1	Number	Per 3 Unit in a Shift
67.	Mechanical board for testing triangle and parallelogram of forces including all accessories	Equipment	2	Number	Per 3 Unit in a Shift
68.	Inclined plane with pulley, pan, Hanger weights etc.	Equipment	1	Number	Per 3 Unit in a Shift
69.	Simple machines - Screw Jack	Equipment	1	Number	Per 3 Unit in a Shift
70.	Searle's Apparatus for young's Modulus	Equipment	2	Number	Per 3 Unit in a Shift
71.	Calorimeter for determining Joule's mechanical Equivalent of heat and specific heat	Equipment	1	Number	Per 3 Unit in a Shift
72.	Apparatus for measurement of co-efficient of expansion(thermal) of solid (pullinger's apparatus)	Equipment	2	Number	Per 3 Unit in a Shift
73.	Apparatus for measurement of thermal conductivity of good and bad conductors	Equipment	1	Number	Per 3 Unit in a Shift
74.	Rheostat	Equipment		Number	Per 3 Unit in a Shift
	(a) Rheostat 25 ohms	Equipment	2	Number	Per 3 Unit in a Shift
	(b) Rheostat 100 ohms	Equipment	2	Number	Per 3 Unit in a Shift
	(c) Rheostat 500 ohms	Equipment	2	Number	Per 3 Unit in a Shift
75.	Resistance box 0 to 100 ohms	Equipment	2	Number	Per 3 Unit in a Shift
76.	Resistance box 0 to 500 ohms	Equipment	2	Number	Per 3 Unit in a Shift
77.	Resistance coils (2 ohms, 5 ohms, 10 ohms, 100 ohms)	Equipment	2	Number	Per 3 Unit in a Shift
78.	Ammeter	Equipment		Number	Per 3 Unit in a Shift
	0 to 1000 mA. (DC)	Equipment	2	Number	Per 3 Unit in a Shift
	0 to 1000 μ A. (DC)	Equipment	2	Number	Per 3 Unit in a Shift
	0 to 10 Amp. (AC, DC)	Equipment	2	Number	Per 3 Unit in a Shift
79.	Voltmeter	Equipment		Number	Per 3 Unit in a Shift
	0 to 1 volt (DC)	Equipment	2	Number	Per 3 Unit in a Shift
	0 to 4 volt (DC)	Equipment	2	Number	Per 3 Unit in a Shift
	0 to 5 volt (DC)	Equipment	2	Number	Per 3 Unit in a Shift
	0 to 10 volt (DC)	Equipment	2	Number	Per 3 Unit in a Shift
80.	Battery eliminator	Equipment	2	Number	Per 3 Unit in a Shift
81.	Specific Gravity bottle	Equipment	2	Number	Per 3 Unit in a Shift

82.	Multi meter(digital)	Equipment	2	Number	Per 3 Unit in a Shift
83.	Milli voltmeter 1) 0 - 5mv 2) 0- 500mv	Equipment	2	Number	Per 3 Unit in a Shift
84.	Digital Stop Watch 1/10 Second	Equipment	1	Number	Per 3 Unit in a Shift
85.	Joules Calorimeter	Equipment	1	Number	Per 3 Unit in a Shift
86.	Steam generator (copper) Cap. 500ml	Equipment	2	Number	Per 3 Unit in a Shift
87.	Bunsen Burners	Equipment	8	Number	Per 3 Unit in a Shift
88.	Tripods Stand	Equipment	8	Number	Per 3 Unit in a Shift
89.	Asbestos wire gauge	Equipment	8	Number	Per 3 Unit in a Shift
90.	Gauge Wire without asbestos	Equipment	8	Number	Per 3 Unit in a Shift
91.	Burettes 25ml	Consumable	8	Number	Per 3 Unit in a Shift
92.	Pipettes 10ml	Consumable	8	Number	Per 3 Unit in a Shift
93.	H.D.P. Distill water bottle	Consumable	8	Number	Per 3 Unit in a Shift
94.	Clamp holders	Equipment	12	Number	Per 3 Unit in a Shift
95.	Stands with clamps for burette	Equipment	12	Number	Per 3 Unit in a Shift
96.	Triangles clay	Equipment	8	Number	Per 3 Unit in a Shift
97.	Measuring cylinder 25 ml Glass	Consumable	8	Number	Per 3 Unit in a Shift
98.	Measuring cylinder 50 ml Glass	Consumable	8	Number	Per 3 Unit in a Shift
99.	Measuring cylinder 100 ml Glass	Consumable	8	Number	Per 3 Unit in a Shift
100.	Volumetric flask 100 ml	Consumable	8	Number	Per 3 Unit in a Shift
101.	Volumetric flask 500 ml	Consumable	8	Number	Per 3 Unit in a Shift
102.	Volumetric flask 1000 ml	Consumable	8	Number	Per 3 Unit in a Shift
103.	Funnels Dia. 4cms	Consumable	8	Number	Per 3 Unit in a Shift
104.	Beaker 250ml corining	Consumable	8	Number	Per 3 Unit in a Shift
105.	Beaker 400ml corining	Consumable	8	Number	Per 3 Unit in a Shift
106.	Bottles for solutions 1000 ml	Consumable	6	Number	Per 3 Unit in a Shift
107.	Bottles for solutions 2000 ml	Consumable	6	Number	Per 3 Unit in a Shift
108.	Bottles for solutions 500 ml	Consumable	6	Number	Per 3 Unit in a Shift
109.	Conical flask - 150 ml	Consumable	16	Number	Per 3 Unit in a Shift
110.	Conical flask - 250 ml	Consumable	16	Number	Per 3 Unit in a Shift
111.	China dish - 50 ml	Consumable	12	Number	Per 3 Unit in a Shift
112.	Watch Glass - 3" dia	Consumable	8	Number	Per 3 Unit in a Shift
113.	Tong - Flat - 300 mm	Equipment	8	Number	Per 3 Unit in a Shift
114.	Spatule - 8"	Equipment	8	Number	Per 3 Unit in a Shift
115.	CO2 Fire extinguisher	Equipment	1	Number	Per 3 Unit in a Shift

116.	First Aid Box	Equipment	1	Number	Per 3 Unit in a Shift
117.	Distilled water still 10 lit.	Equipment	1	Number	Per 3 Unit in a Shift
118.	Glass test tubes - 15 ml	Equipment	50	Number	Per 3 Unit in a Shift
119.	Round Bottom Distillation flask with side neck 500ml	Equipment	6	Number	Per 3 Unit in a Shift
120.	Condenser for distillation lebig 30 cm long	Equipment	6	Number	Per 3 Unit in a Shift
121.	Rubber cork of (2.5 cm, 3cm) size	Tool	10	Number	Per 3 Unit in a Shift
122.	Rubber Tubing (ID- 5mm)	Tool	10	Meter	Per 3 Unit in a Shift
123.	Rubber Bulbs for pipettes	Tool	6	Number	Per 3 Unit in a Shift
124.	Arc Welding Table - Metal - 900 X 600 X 750 mm with Positioner	Equipment	1	Number	Per 3 Unit in a Shift
125.	Welding Transformer - 300 A, OCV 60 - 100 V, 60% Duty Cycle with Standard Accessories	Machine	1	Number	Per 3 Unit in a Shift
126.	Arc Welding Cables Multi Cored Copper - 400 A, 50 Meter	Tool	1	Number	Per 3 Unit in a Shift
127.	Tip Cleaner Set	Tool	17	Number	Per 3 Unit in a Shift
128.	Welding goggle	Tool	6	Number	Per 3 Unit in a Shift
129.	Safety google (white)	Tool	6	Number	Per 3 Unit in a Shift
130.	Auto Darkening Welding Helmet	Equipment	2	Number	Per 3 Unit in a Shift
131.	Lathe Machine - All Geared, Center Height 150 mm, Between Centers 1200 mm, 4 Jaw Chuck, Taper Turning Attachment and all Standard Accessories	Machine	1	Number	Per 3 Unit in a Shift
132.	Gauge Feeler / Thickness - 0.05 mm to 1 mm by 0.05 and	Equipment	1	Number	Per 3 Unit in a Shift
133.	Pliers – combination 8"/20 cm	Tool	4	Number	Per 3 Unit in a Shift
134.	Phillips head screw driver set 1-4 sizes	Tool	1	Number	Per 3 Unit in a Shift
135.	Double ended Open spanners set of 6x7,8x9,10x11,12x13,14x15,16x17,18x19,20x22,21x23,24x27,25x28,30x32.	Tool	1	Set	Per 3 Unit in a Shift
136.	Double ended Ring spanners set of 6x7,8x9,10x11,12x13,14x15,16x17,18x19,20x22,21x23,24x27,25x28,30x32.	Tool	1	Set	Per 3 Unit in a Shift
137.	Circlip Plier 8"(internal)	Tool	1	Number	Per 3 Unit in a Shift
138.	Circlip Plier 8"(External)	Tool	1	Number	Per 3 Unit in a Shift
139.	Can oil ½ pt	Equipment	1	Number	Per 3 Unit in a Shift
140.	Spanner - Adjustable - 200 mm	Tool	1	Number	Per 3 Unit in a Shift
141.	Pipe Wrench - 450 mm	Tool	1	Number	Per 3 Unit in a Shift
142.	Spirit Level - 300 mm	Equipment	1	Number	Per 3 Unit in a Shift
143.	Lapping Plate (300x300mm)	Tool	1	Number	Per 3 Unit in a Shift

144.	Stud Extractor - Set of 8	Tool	1	Number	Per 3 Unit in a Shift
145.	Pilot plan for flow measurement through, Orifice meter, rota meter, venture meter	Equipment	1	Number	Per 3 Unit in a Shift
146.	Single row deep groove Ball Bearing no.6309	Equipment	1	Number	Per 3 Unit in a Shift
147.	Cyndrical Roller Bearing NU307	Equipment	1	Number	Per 3 Unit in a Shift
148.	Taper Roller Bearing 30208	Equipment	1	Number	Per 3 Unit in a Shift
149.	Needle Roller Bearing RNA4908	Equipment	1	Number	Per 3 Unit in a Shift
150.	Spherical Roller Bearing 22211 EKC3	Equipment	1	Number	Per 3 Unit in a Shift
151.	Hydraulic Bearing puller	Equipment	1	Number	Per 3 Unit in a Shift
152.	Grease Gun	Equipment	1	Number	Per 3 Unit in a Shift
153.	3 leg Bearing puller 6"	Equipment	1	Number	Per 3 Unit in a Shift
154.	Bearing fitting kit including standard sleeve , mallet, Bearing induction heater	Equipment	1	Number	Per 3 Unit in a Shift
155.	Gear Box Reduction Type(Cut Section)	Equipment	1	Number	Per 3 Unit in a Shift
156.	Gear Box Planetary Bevel Gear Type(Cut Section)	Equipment	1	Number	Per 3 Unit in a Shift
157.	Gate Valve 2" Cut section	Equipment	1	Number	Per 3 Unit in a Shift
158.	Globe valve 2" Cut section	Equipment	1	Number	Per 3 Unit in a Shift
159.	Safety Valve (Spring Type) 2" Cut section	Equipment	1	Number	Per 3 Unit in a Shift
160.	Needle valve 25 mm Cut section	Equipment	1	Number	Per 3 Unit in a Shift
161.	Butter fly valve 2" Cut section	Equipment	1	Number	Per 3 Unit in a Shift
162.	Non return valve(swing check type & Lift Ball type) 2" Cut section	Equipment	1 each	Number	Per 3 Unit in a Shift
163.	Pneumatically operated diaphragm valve. Cut section	Equipment	1	Number	Per 3 Unit in a Shift
164.	Ball valve 2" Cut section	Equipment	1	Number	Per 3 Unit in a Shift
165.	Solenoid valve	Equipment	1	Number	Per 3 Unit in a Shift
166.	Diaphragm valve 2" Cut section	Equipment	1	Number	Per 3 Unit in a Shift
167.	Control valve. 1"Cut section	Equipment	1	Number	Per 3 Unit in a Shift
168.	Cut section of Centrifugal pump of back pullout type	Equipment	1	Number	Per 3 Unit in a Shift
169.	Centrifugal pump Back pullout type with motor and base plate	Equipment	1	Number	Per 3 Unit in a Shift
170.	Multistage centrifugal pump with Balance drum or disk without motor	Equipment	1	Number	Per 3 Unit in a Shift
171.	Cut section of Internal gear pump	Equipment	1	Number	Per 3 Unit in a Shift
172.	Cut section of External gear pump	Equipment	1	Number	Per 3 Unit in a Shift
173.	Diaphragm Pump(Air Operated)	Equipment	1	Number	Per 3 Unit in a Shift
174.	Cut section of screw pump	Equipment	1	Number	Per 3 Unit in a Shift

175.	Cut section sliding vane pump	Equipment	1	Number	Per 3 Unit in a Shift
176.	Reciprocating pump (Cut Model)	Equipment	1	Number	Per 3 Unit in a Shift
177.	Metering Pump	Equipment	1	Number	Per 3 Unit in a Shift
178.	Lazer alignment kit for pump & motor shaft (wireless 3 axis system)	Machine	1	Number	Per 3 Unit in a Shift
179.	Mechanical seal (multiple spring)	Equipment	1	Number	Per 3 Unit in a Shift
180.	Mechanical seal (Bellows seal)	Equipment	1	Number	Per 3 Unit in a Shift
181.	Mechanical seal (single spring)	Equipment	1	Number	Per 3 Unit in a Shift
182.	Hydraulic jack	Equipment	1	Number	Per 3 Unit in a Shift
183.	Pressure Vessel With Control And Maintenance Of Plant like Transmitters, Valves, Pumps And All Parameters Simulation Software and all accessories	Equipment	1	Number	Per 3 Unit in a Shift
184.	Multistage compressor fitted with inter-cooler and after coolers (Cut model)	Equipment	1	Number	Per 3 Unit in a Shift
185.	Screw Compressor (cut Model)	Equipment	1	Number	Per 3 Unit in a Shift
186.	Centrifugal blower (Cut model)	Equipment	1	Number	Per 3 Unit in a Shift
187.	Forced draft cooling tower	Equipment	1	Number	Per 3 Unit in a Shift
188.	Shell and tube heat exchanger ,Double pipe heat exchanger	Equipment	1 Each	Number	Per 3 Unit in a Shift
189.	Plate heat exchanger ,Spiral exchangers	Equipment	1 Each	Number	Per 3 Unit in a Shift
190.	Vertical tube evaporator	Equipment	1	Number	Per 3 Unit in a Shift
191.	Packed distillation column	Equipment	1	Number	Per 3 Unit in a Shift
192.	Plate and frame filter press	Machine	1	Number	Per 3 Unit in a Shift
193.	Bottom-driven centrifuge	Machine	1	Number	Per 3 Unit in a Shift
194.	Tray drier	Machine	1	Number	Per 3 Unit in a Shift
195.	Hammer mill	Machine	1	Number	Per 3 Unit in a Shift
196.	Ball mill	Machine	1	Number	Per 3 Unit in a Shift
197.	Vibrating screen	Machine	1	Number	Per 3 Unit in a Shift
198.	Belt conveyer	Machine	1	Number	Per 3 Unit in a Shift
199.	Pressure sensor	Equipment	1	Number	Per 3 Unit in a Shift
200.	Temperature sensor	Equipment	1	Number	Per 3 Unit in a Shift
201.	Level sensor	Equipment	1	Number	Per 3 Unit in a Shift
202.	Flow Meter	Equipment	1	Number	Per 3 Unit in a Shift

D: Allied Trade Details (Per 1 Unit in a Shift)					
	Name of Allied Trade	No. of Weeks during Course	Remark		
1	Fitter	7			
	Welder	7			
E: Machines/ Equipment of the Allied Trade to be Utilized (These Machines/Equipment's and corresponding Tools have to be provided in case the Allied Trade in not available in the ITI)					
	Name of Item	Category	Qty	Unit	Remark
	Not Required				Not Applicable
F. Computer Lab Infrastructure					
	Name of Item	Category	Qty	Unit	Remark
1	Not Required				Not Applicable
G: Common Facility Utilization (Per 1 Unit in a Shift) (This section specifies utilization of Common Facilities provided in the ITI)					
	Particulars	Hours per Week		Remark	
1	Computer Lab Utilization (Hours Per Week)	2		Per 1 Unit in a Shift	
2	Drawing Hall Utilization (Hours Per Week)	2		Per 1 Unit in a Shift	
3	Library Hall Utilization (Hours Per Week)	2		Per 1 Unit in a Shift	
4	Class Room Utilization (Hours Per Week)	12		Per 1 Unit in a Shift	
5	CNC Lab Utilization (Hours per Week)	0			
H. Safety					
S.N.	Name of Item	Category	Qty	Unit	Remark
1	Apron - Blue	Equipment	12	Number	Per 1 Unit in a Shift
I: Special Instructions (This section specifies instruction related to Infrastructure Management)					
S.N.	Particulars				
1	Nil				
J: Instructor Facility (Optional) (This section specifies the items to be provided to the Instructor during Training.)					
S.N.	Name of Item	Category	Qty	Unit	Remark
1	Blank CD (rewritable)	Stationary	10	Number	Per 1 Unit in a Shift
2	Box File	Stationary	5	Number	Per 1 Unit in a Shift
3	Calculator - Scientific	Equipment	1	Number	Per 1 Unit in a Shift
4	Eraser	Stationary	1	Number	Per 1 Unit in a Shift
5	Gum Bottle	Stationary	1	Number	Per 1 Unit in a Shift
6	Highlighter pen	Stationary	5	Number	Per 1 Unit in a Shift
7	Office File	Stationary	10	Number	Per 1 Unit in a Shift
8	Paper Rim - A4 Size Xerox Paper	Stationary	2	Number	Per 1 Unit in a Shift
9	Paper Rim - Legal Size Xerox Paper	Stationary	1	Number	Per 1 Unit in a Shift
10	Pen Drive - 8 GB	Stationary	1	Number	Per 1 Unit in a Shift
11	Pencil Box	Stationary	1	Number	Per 1 Unit in a Shift
12	Permanent Marker Pen	Stationary	5	Number	Per 1 Unit in a Shift
13	Punch Machine	Stationary	1	Number	Per 1 Unit in a Shift
14	Register - 200 Pages	Stationary	2	Number	Per 1 Unit in a Shift
15	Sharpener	Stationary	1	Number	Per 1 Unit in a Shift
16	Sketch pen box	Stationary	1	Number	Per 1 Unit in a Shift
17	Stapler Big	Stationary	1	Number	Per 1 Unit in a Shift
18	Stapler Big Pins - Box	Stationary	1	Number	Per 1 Unit in a Shift
19	Stapler Small	Stationary	1	Number	Per 1 Unit in a Shift
20	Stapler Small Pins - Box	Stationary	1	Number	Per 1 Unit in a Shift
21	White Board Marker/Ink Bottle/ Chalk	Stationary	10	Number	Per 1 Unit in a Shift
22	White/ Black Board Duster	Stationary	2	Number	Per 1 Unit in a Shift
23	Torch	Tool	1	Number	Per 1 Unit in a Shift