Syllabus for the trade
of

INSTRUMENT 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

INSTRUMENT 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 Mahad Dist- Raigad	Member
5	SukhirajShette Manager Maintenance	Sandoz Pvt. Ltd,L-1 MIDC Mahad Dist-Raigad	Member
6	Sanjay Janrao Manager Maintenance	Embio Ltd,E-21,22 MIDC Mahad Dist-Raigad	Member
7	Sameer N. Lahane Dy. Manager Engg.	Shree Hari Chemicals Export Ltd,A-8 MIDC Mahad Dist- 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 Mahad Dist- Raigad	Member
10	S T Dhumane Asst.ManagerEngg.	Sadhana Nitrochem Ltd, MIDC Roha, Dist-Raigad	Member
11	R.S.Bhosale G.M. Engg.	Elppe chemicals pvt MIDC Roha Dist-Raigad	Member
12	S.K. Singh Sr. Executive	Sudarshan chemicals Ltd. MIDC Roha, Dist- Raigad	Member
13	Vineet Singh Manager Maintenance	Pepsico India holdings pvt ltd MIDC Roha. Dist- Raigad	Member

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

INSTRUMENT 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. Muliyana, 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

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

INSTRUMENT 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 Kuberrnagar, 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	:	**INSTRUMENT MECHANIC(CHEMICAL PLANT)**
2.	NCO Code No**.**	**:**	
3.	Duration	:	2 Year Course with 4 Semesters of 6 months each
4.	Power Norms	**:**	8 Kw
5.	Space Norms	**:**	104 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/Instrumentation/Process control Instrumentation Technology/ Engineering from recognized University with one year experience in relevant field. OR b. Diploma in Chemical /Instrumentation/Process Control Instrumentation 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 Trades Chemical Sector 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		
INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – I (Semester Code No. IMC-01)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
1	**CHEMISTRY LAB:** Separation of mixture by simple Distillation. Volumetric Analysis-Preparation of Standard Solutions	**INTRODUCTION:** Introduction about ITI Rules and Regulation. Importance of trade training. Introduction of Chemistry, branches of chemistry, importance of chemistry, Safety precautions to be taken in Chemistry Laboratory, different equipment and apparatus used in Laboratory
2	**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. Metals & Non-Metals
3	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.
4	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
5	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,
6	Determination of pH (by Ph meter) Boiling point measurement of liquid. Melting point Measurement of solid. Measurement of conductivity by conductivity meter	Definition of pH, pH scale, measurement of pH. Conductivity
7	Demonstration about PPE'S, Safety Equipments, First aid box.	**BASIC FITTING:** **SAFETY**: Introduction & Importance of safety, General precautions about safety. PPE'S Used in chemical industries .Safety slogan. First aid in industry & Workshop
8&9	Filing flat surface and Checking flatness and squareness using engineer's Try square.	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, unches, scribing block, etc
10	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.
11&12	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 - Vernier Caliper, Vernier Depth gauge, Height gauge, Micrometer outside, Bevel protector.
13	A) Drilling Practice, B) Reaming Practice, C) Countersinking & Counter boring Practice,	**DRILLING, REAMING AND THREADING**: Nomenclature and uses of Drill, Reamer, and Thread.
14	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.

15	Demonstration about safety equipment & general precaution in welding workshop.	**GAS WELDING** **SAFETY:** Safety& General precautions observed in welding workshop. Importance of Welding in maintenance of chemical plant and equipment's .Welding terms and their definition. Types of welding
16	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)**
17	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:** Equipment's such as cylinder trolley, regulator, blow pipe, Hose pipe,Assemling ,care & maintenance.
18	Edge joint with or without filler rod	**OXY-ACETYLENE FLAME:** Types of flame, uses & Effect of Atmospheric oxidation
19	**PHYSICS LAB**: Determination of acceleration due to gravity by simple pendulum. To study parallelogram of forces with the help of mechanical board.	**PHYSICS** Introduction to Physics, Measurement with Vernier caliper, Micrometer, Wire gauge. Scalar and Vector quantities, their representation, resultant. Triangle and parallelogram laws of forces.
20	Determination of coefficient of static friction by inclined plane. Determination of mechanical advantage velocity ratio and percentage efficiency of Simple machine	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
21	Study of simple machines e.g. Lever, pulley & block, Screw jack. 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
22	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, Kirchoff's law, Wheastone's bridge , applications of Wheastone bridge.
23	Determination of specific resistance using Wheatstone'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.
24	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
25	**REVISION**	
26	**EXAMINATION**	

SYLLABUS OF THE TRADE OF		
INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – II (Semester Code No. IMC-02)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
Basic Electricity		
1 & 2	**BASIC ELECTRICITY:** Identification +Ve -Ve polarities. Identifying and use of various electrical components, their symbols. Wire size measurement technique. Measuring current voltage & resistance.	**BASICS ELECTRICAL:** Conductor, semiconductor & insulators. Standard wire gauge (SWG). Introduction of electricity- static electricity. Current, voltage, P.D, E.M.F, resistance. Their units.Electrical circuit - D.C & A.C circuit differences. Importance of grounding. **TYPES OF SWITCHES:** SPST, SPDT,DPST, DPDT,Toggle, etc.
3 to 4	**ELECTRICAL MEASURING INSTRUMENTS:** Measurement of voltage, current & resistance in different circuits. Direct & indirect measurement of electrical power & energy. Calibration of energy meters. Insulation resistance test by megger.	**TYPE OF ELECTRICAL MEASURING INSTRUMENTS:** MC & MI,Construction & working principles of Ammeter, Voltmeter, Wattmeter.Energy meter, P.F. meter, frequency meter, multimeter, clamp meter, megger
5	Identify Resistors of different types (include NTC,PTC,W/W, Linear, preset, VDR,LDR) values and power ratings. Use color code to identify the Resistors and values.	**RESISTORS:** Laws of Resistance. Series, parallel and combination circuits, Different Types of resistors &their properties. Different methods of measuring values of resistance. **CAPACITOR**: Construction details, charging, discharging, types, uses.Factors on which capacitance depends. Formulae & simple problems.
6	Identify the Live, Neutral and Earth on power socket. Use a Tester to monitor AC power .Read and interpret the settings, sockets on an Analog and Digital multimeters. Measure the unwanted voltage between the neutral and Ground and take measures to reduce it.	**BASIC TERMS:** Such as electric charges, Potential difference, Voltage, Current, Resistance, Frequency, Amplitude, Single phase and Three phase power. Familiarization with Digital Multimeter. Uses, handling & precautions of Digital Multimeter.
	Select a soldering gun and practice soldering of different electronic active and passive components/digital ICs on varieties of PCBs.Join the broken PCB track and test.Desolder the soldered component and clean the surface of the track.	**SOLDERING:** Different type of soldering guns, relate temperature with wattages, types of tips. Solder materials and their grading. Use of wax and other materials. Selection of a soldering gun for specific requirement. Soldering and Desoldering stations and their specifications.
8	Identification of various types of diodes (solid state), checking of diodes, Verification of characteristics of diode.	**STUDY OF SEMICONDUCTOR:** Doping, Intrinsic and extrinsic semiconductor, Covalent bond. PN junction diode, Forward and Reverse characteristics. Specification of diodes (data sheets). Applications of diode. Special semiconductor diode, Zener diode, Photo diode etc.
9	Making half wave & full wave rectifiers, center tape & bridge full wave rectifiers. Study of ripple factor in half wave & full wave rectifier with various filter circuits.	**RECTIFIERS:** Half wave rectifier, full wave (bridge & center tapped) rectifier. **Filters:** Introduction, purpose and use of ripple filter. Types of filters. Capacitance filter, inductance filters, RC filters, LC filters, voltage dividers and bypass filters.
10	Identification of Transistors, FET, MOSFET. Checking & Verification of Transistors, FET, MOSFET.	**TRANSISTORS:** Defining transistors, NPN & PNP transistor, Symbol, operation, Biasing of Transistor & mode of Application. Introduction to FET, MOSFET.
11 & 12 & 13	Assemble a various types of fixed and variable voltage regulator on zero pcb. Assembling of a power supply unit. Identify different fixed +ve and –ve voltage regulator ICs of different current ratings (78xx/79xx series) along with i/o, reference pins. Identify proper heat sinks for different IC based voltage regulators.Vary the input voltage and observe the fixed output for the above mentioned series	**VOLTAGE REGULATORS:** Introduction & purpose of Zener regulators, Regulated Power supply using 78XX series, 79XX series, etc. **UPS:** Types of UPS. Block diagram and working principle of different types UPS. Most frequently occurring faults and their remedies.Concept of UPS, OFF LINE and ONLINE . Difference between Inverters and UPS.
14 & 15	Modulate and Demodulate various signals using AM and FM on the trainer kit and observe the waveforms.	**ADVANCED COMMUNICATON:** Need of Modulation, types of modulation. Demodulation techniques. Introduction to AM, FM & PWM.

SYLLABUS OF THE TRADE OF		
INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – II (Semester Code No. IMC-02)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
16 & 17 & 18	Identification of various indications, connectors on the System unit and I/O devices. Identify various connectors and cables inside the cabinet. Identify connections to rear side and front panel of the cabinet.Disable certain functionality by disconnecting the concerned cables (like USB,SERIAL, etc as may be required in some cases)Replace the CMOS battery identification, testing and troubleshooting of computer memory. Replace/Extend a memory module configuring and troubleshooting display problems power supply testing and replacing. Replace the given HDD on the system. Replace the faulty SMPS Boot the system from different options Install a Printer driver software and take print outs Install antivirus software and scan the system Explore the configuration options in the antivirus software Create folder and files use of search engines, Creation of email accounts, sending and receiving the mails configuration of email clients.	**Computer Basics:** Basic blocks of a computer, Hardware and software, I/O devices, HDD,CDD, DVD.Windows O.S., various types of files, folder concept, various ports in the computer, saving ,copying, deleting & retrieving files. Different types of printers and their advantages, function and inter-connection Concept of Internet, Browsers, Web sites, search engines, email, chatting and messenger service. Downloading the Data and program files etc.
19 & 21	Use start menu, check available programs in computer, use search, settings, run options. Creation of short cuts, Changing screen savers. Install MS office software Drawing pictures using paint, using menus of paint Explore different Menu Tool/ Format/status bars of MS word and practice the options Editing the text, saving the text, changing the font and size of text, taking the printouts Practice the Mail merge options Prepare a power point presentation on any three known topics with various design features Invoke excel sheet from MS WORD and vice versa Prepare a power point presentation with different animation and visual effects.Convert the given PDF File into WORD File using a suitable software.	**MS WINDOWS:** Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, and installation of program, setting and using of control panel.Application of accessories, various IT tools and applications, Components of desk top. Concept of word processing,: MS word – Menu bar, standard tool bar, page setting, editing, formatting ,advance features i.e. highlighting ,cut & paste, subscript & super subscript drawing features, mail merging , tables and borders, printing of document etc.Introduction to power point Basics of preparing slides, different design aspects of slides, animation with slides etc
22 to 24	**PROJECT WORK / INDUSTRIAL VISIT**	
25	**REVISION**	
26	**EXAMINATION**	

SYLLABUS OF THE TRADE OF INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS SEMESTER – III (Semester Code No. IMC-03)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
BASIC INSTRUMENTATION		
1	Study various types of instruments constructions and identifying various parts and section	**INTRODUCTION TO INSTRUMENTATION:** Scope and necessity of instrumentation. Fundamentals of measurement systems- functional block diagram of measurement system. Calibration and calibration standards – basic standards, secondary standards, working standards. Fundamental units - The metric system, Base & supplementary units, Derived Units, Multiplying factors and standards of length, mass, time, &frequency. Basic Instrumentation Symbols.
2	-Do-	**STATIC CHARACTERISTICS:** Accuracy, precision, sensitivity, resolution dead zone, repeatability, reproducibility, drift, Dead band, backlash, hysteresis. **DYNAMIC CHARACTERISTICS:** Speed response, fidelity, and lag. Error, deviation, true value, data. Types of errors- systematic, random & illegitimate error. Certainty/ uncertainty, validity of result. Measuring system Response.
3	**INSTRUMENTATION CALIBRATION OF** (i) Bourden tube pressure gauges (ii) Manometers	**PRESSURE:** Definition of pressure. Types of pressure- Barometric (Atmospheric) Pressure, Gauge Pressure, Differential Pressure, Absolute Pressure, Vacuum pressure & their units. Types of pressure sensing elements- bourdon tube, diaphragms, capsules, and bellows. Each one types, shapes, material used for various applications, ranges advantages and limitations. Pressure switches types and applications.
4	Dismantling and assembling of bourdon tube pressure Gauge and study the construction, adjustments for correct functioning. Study of Dead weight Tester. **CALIBRATION OF** (i) Diaphragm type pressure gauge. (ii) Vacuum gauge (iii) Compound gauge	Different type of Pressure measuring Instruments **MANOMETERS**: (well tube,'U' Tube & Inclined Tube) & Barometers. **GAUGES:** Pressure Gauges, Vacuum Gauge, Compound Gauge & Absolute Pressure Gauge. lts construction uses Principle of operation. Importance of calibration in Metrology.
5 & 6	Testing of Pressure indicators with Standard Calibrator, Precaution to be observed while testing	**METHOD OF PRESSURE INSTRUMENT CALIBRATION**: Dead weight tester and com parators. Electrical pressure transducers. Method of conversion, primary and secondary pressure transducers. Potentio metric pr. transducers, Capacitive pr. transducers, strain gauge pressure transducers, piezoelectric. Differentials pressure transducers. Types of Pressure transmitters, principle of construction of different Electronic Transmitters. Study of Pressure Safety valve, Pressure Switch, manifo1ds. Classification of transmitter such as 2-wire, 3-Wire& 4-wire Transmitter.
7	-Do-	**PRESSURE INSTRUMENT INSTALLATION & SERVICING:** Elements of pressure transmitters, Installation components, pressure taps, isolation valve, instrument piping, connections and fittings blow down valve, instrument valve, diaphragm seal, pressure transmitter, Installation, procedure, locating and mounting, piping, electrical wiring placing into service, guidelines for periodic maintenance, troubles shooting and repair, instrument shop safety. Types of pyrometers IR Temp Guns, Radiation & Filament Type. Introduction of temperature calibrator

SYLLABUS OF THE TRADE OF		
INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – III (Semester Code No. IMC-03)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
8	Temperature measurement. Performing practical on temperature measurement with different sensors as in the theory part, in the temperature controlled oil bath/ furnace for low and high temperature. Calibration of 1. Filled System Temp. Indicator 2.Bimetallic Thermometer 3. Calibration of Alcohol Thermometer	**TEMPERATURE MEASUREMENT:** Definition, Temperature scale, & Units of Temperature & their conversion in between units. Expansion Methods for Temperature measurement- **Liquid Expansion Type-** Mercury in glass thermometer, steel thermometers, Alcohol in glass thermometer. **Solid Expansion Type-** Bimetallic thermometers. **Gas Expansion Type**- Vapour Pressure/ Gas Filled thermometers.
9	Maintenance & reconditioning of Thermocouple, Testing of Thermocouple and Resistance Thermometer.	**TEMPERATURE MEASUREMENT BY ELECTRICAL METHOD:** Thermistor, Thermocouple& RTD their ranges, construction, principle of operation. Thermocouples Ex-tension wires, compensating for changes in reference junction temperature, construction of thermocouple junction, types of thermocouple, advantages and disadvantages of thermocouples.
10	Digital Temperature Indicator. Calibration of Temperature transmitter for Temperature Loop & Error correction.	**DIGITAL TEMPERATURE INDICATORS:** Types Of Temperature Transmitter. Types of Temperature Indicator, Temperature Scanner.
11	Calibration of Temperature switch, Calibration of Thermostat	**TEMPERATURE MEASUREMENT BY NON-CONTACT METHOD:** Pyrometry. Molecular activity and electromagnetic radiation, defining pyrometry, effects of emittance, effects of temperature, radiated energy, pyrometers and wave lengths, using of optical and radiation pyrometer
12	Study of T.C. Pyrometer. Study of Temperature measuring instruments using electronic temperature calibrator. Study of Optical Pyrometer Radiation Pyrometer	Types of pyrometers IR Temp Guns, Radiation & Filament Type. Introduction of temperature calibrator
13	**FLOW MEASUREMENT:** Checking various types of flow restrictors Study of orifice plates, Venturi heads, their shape and connections and use.	**PROPERTIES OF FLUID FLOW:** Basic properties of fluids, fluids in motion, getting fluids to flow, units of flow rate and quantity flow, factors affecting flow rate. Relation between flow rate and pressure, area, quantity. Types of flow meters - head type, variable area type, quantitative flow meters.
14	**ROTAMETER:** Fitting of tapered glass tube checking & testing.	**OPEN CHANNEL FLOW METERS:** Principle of open channel flow, weirs, notches and flumes. Various shapes and their applications. Variable area type flow meter- rotameter, constructions, working principle, applications. Various shapes of float, type of materials used for body and float. Factors affecting rotameter performance, measuring gas and liquid flow.
15	To study flow measurement using volumetric and mass flow meters.	**VOLUMETRIC AND MASS TYPE:** Turbine flow meter, magnetic flow meters, vertex flow meter ultrasonic flow meter, Thermal mass flow meter, advantages and disadvantage. Coriolis Mass flow meter.
16	Installation maintenance of flow instruments, (Components for flow measurement system, primary flow elements, pressure taps, piping and fittingvalve, DP transmitter and miscellaneous items.) Installation of the flow measurement system, pressure taps installation, instrument piping installation, electrical hookup, the final step, installation, maintenance and preventive maintenance, To study about solid flow measurement.	**METERING THE FLOW OF SOLID PARTICLES:** Measuring volumetric and mass flow rate of solids, volumetric solids flow meter, mass flow meter for solids, belt type solid meters belt speed sensing and signal processing, slurries, constant weight feeders**.**

SYLLABUS OF THE TRADE OF		
INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – III (Semester Code No. IMC-03)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
17	**MEASUREMENT OF LEVEL:** Study of Level measurements like Sight Glass, Hook type, Float type, Static pressure and air purge Level Indicator	**PRINCIPLES OF LEVEL MEASUREMENT:** Types of level measurements-solid and liquid, Mechanical and Electrical type. Storage tank gauges, sight glasses, buoyancy. Factors need to consider for open and closed channel level measurements. **LEVEL SWITCHES:** Mercury level switches in high pressure tank, level detectors, magnetic reed switches.
18	Level instrument servicing: Introduction to instrument servicing. Maintenance, repairing and control	Pressure head instruments. Hydrostatic pressure, specific gravity, pressurized fluids, U- tube manometers, air purge systems.
19	To study the methods of liquid level measurement such as Ultrasonic type, capacitance probes type, conductivity type and diaphragm switch type level detectors	**LIQUID LEVEL MEASUREMENT:** Electrical method conductivity and capacitance method for Measuring the liquid level, capacitance probes, zero and span adjustments, Ultrasonic level detectors, Diaphragm switch
20	To study the methods of solid level measurement such as Ultrasonic solid level, microwaves level, capacitance probes for level and point type level detectors	**SOLID LEVEL MEASUREMENT:** Using weight to determine level, Ultrasonic solid level measurement with microwaves, using capacitance probes to measure solid level and point type level detection.
21	Differential pressure measurement Diaphragm & Air Trap Calibration of Electronic Level Indicators., Ultrasonic, Calibration of Capacitance type Level Indicator & transmitter	Differential pressure measurement Diaphragm & Air Trap Electronic Level Measuring Instrument: Variable capacitance, Ultrasonic and Magnetic type level Switches, Radar Type Level Measurement, and Level measurement by Load cell.
22 to 24	**PROJECT WORK / INDUSTRIAL VISIT**	
25	**REVISION**	
26	**EXAMINATION**	

SYLLABUS OF THE TRADE OF INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS SEMESTER – IV (Semester Code No. IMC-04)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
ADVANCE INSTRUMENTATION & UNIT OPERATION		
1	Study Of following Instruments: Weighing Balance,Viscosity Meter.	**STUDY OF ANALYTICAL INSTRUMENTS :** Weighing Balance,Spectro Photo Meter, Viscosity Meter.
2	Safety practices before, during & after calibration.How observe the name plate & Manual of instrument under calibration.	Classification of instrument according to accuracy. Generation of calibration report.
3	Handling of Universal Calibrator. Handling of Hart communicator and calibrator,. To study about PH measurement and control. To study about Conductivity measurement and control.	**MASTER INSTRUMENT:** Hart communicator and calibrator, Universal Calibrator, PH simulator, Conductivity simulator.
4	Reconditioning of I to P Converter, Reconditioning of Pressure Safety Valve. Experiment on I to P and P to I Converters.	**CONVERTERS:** Principle, Construction, operation of I to P, and P to I Converters, Types of Manometer (ELCTRONIC & PNEUMATIC)
5	Calibration of recorders, adjustment of time travels, changing of charts, ink, minor rectification/repairing. Find out errors and adjustment	**RECOREDRS:** Theory of Integrating system in recording processes variables, Multi-pens recorder and cam arrangements. Study of Strip Chart & Circular chart recorders.
6	Reconditioning of Strip Chart & Circular chart recorders Providing different type of recorders trainees to check calibrate individually. Study of Paperless recorder.	Paperless recorder. Punching and Dot systems, Errors and Adjustment in various Electrical & Electronic Recorders
7	Calibration of Smart transmitter for pressure, temperature, flow and level and its adjustment. Calibration Of HART Devices.	**SMART DEVICES:** HART transmitters, Its advantages & applications. HART protocol. HART communicators and PC based HART device configuration. Steps in calibration of HART devices.
8	Study the construction, Identification of components of ON-OFF type controller, Testing and Calibration of ON-OFF type control system with any one parameter.(Temp, Flow, Level & Press) Check calibration of proportional Controller, reconditioning, adjustment, setting of proportional Band. Setting of Reset Action Check calibration of controller. Study operation on cascade & ratio control trainer. Repair/Reconditioning of Electronic and pneumatic controllers, Testing and calibration of PID controllers.	**CONTROLLERS:** (Analog & Digital) Open loop, Closed loop, Feedback control system, Modes of control system, ON-OFF control system, its operation, function, Advantages & disadvantages. Cascade & Ratio control system. Understanding Control wiring Diagram With Few Examples. Principle of Electronic and pneumatic controller, Control Lag, Step and Frequency response, What is mean by Proportional, Integral &Derivative Action, Proportional Controller, PI Controller & PID Controller Principle, construction & operation.
9 & 10	Study the controlling of parameters in chemical plant with different loop parameters measuring and controlling.	**CHEMICAL PLANT INTRODUCTION:** Transmitters, valves, process vessels, controller and software
11& 12	Dismantling, reconditioning, Checking and resetting of diaphragm control valves, calibration of diaphragm control valve. Leak test, replacement of valve parts like diaphragm, sealing rings, plugs etc. Lapping of valve seats, plug leakage test, calibration of valves. Erection of valve positioner. To study the diaphragm actuated control valves with three different characteristics.	**FINAL CONTROL ELEMENT**: Control valves. Control valves functions and components, types of control valves, based on valve flow characteristics -liner, equal percentage, quick opening valves, globe valves, cage valves, butterfly valves, ball valves, sliding gate valves, diaphragm valves, split body valves, capacitive, inductive type valve, proximity switch, IR switch, micro switch, limit switch, Role Of pneumatic & Electronic valve positioner. Solenoid valve.
13& 14	Piping, tubing and fitting. Instrument pipes, schedules, pipe fittings, union, elbow, sockets, reducing sockets, straight coupling, instrument tube and tube fitting, copper	Piping houses and fittings. Requirement of piping, air flow, piping dimensions and safety factors, piping connections, compressed air piping applications, metallic &nonmetallic tubing used in instrumentation.(PU, copper & SS)
15	Understanding the function of PLC and concept. Basic small programs on PLC – logic gates preparation. Small programs on timers and counters. Industrial visit for understanding SCADA and DCS operating controlling system.	Introduction to programmable controllers. History of programmable controllers, general characteristics of programmable controllers, some limitation of PLCs, method of developing PLC programming, Types of PLC Input/output devices. Definition of input/output devices, I/O interface, input modules, output modules, input devices encoders. Difference between DCS & PLC.

SYLLABUS OF THE TRADE OF		
INSTRUMENT MECHANIC (CHEMICAL PLANT) UNDER CTS		
SEMESTER – IV (Semester Code No. IMC-04)		
Week No.	**TRADE PRACTICAL**	**TRADE THEORY**
16 &17	Study and use of DCS & SCADA complete with communication system on process trainer.	Fundamentals of SCADA and DCS. History of DCS development. Basic architecture, block diagram description advantages and disadvantages, applications. Terminology- RTU (remote transmitting unit, central monitoring station, types of communications, field instruments and types. Master & Slave controller in DCS (Redundancy)
18 & 19	Study Of Heat Exchanger, Chiller, Steam Trap. Study of shell and tube heat exchanger Study of packed distillation column with DCS / PLC system. Study of triple effect evaporator.	**HEAT TRANSFER:** Mechanism of Heat Transfer in solid, liquid and gases and their application in industries, Heat exchangers, coolers, condenser and chillers. Types Of Heat Exchanger, Steam trap **EVAPORATION:** Definition, Types of evaporators. **DISTILLATION:** Concept of distillation,Methods of Distillation
20 & 21	Study various field bus based control system through industrial visit, (Protocol)	**FIELD BUS:** industrial visit, (Protocol)
22 & 23 & 24	**PROJECT WORK / INDUSTRIAL VISIT**	
25	**REVISION**	
26	**EXAMINATION**	

A: Trade Details					
S.N.	**Particulars**	**As per DGET**			
1	Name of the Trade	**INSTRUMENT MECHANIC (CHEMICAL PLANT)**			
2	Duration (In Semester):	4			
3	Intake:	16			
6	Space Required (in Sq. Meter):	104			
7	Power Required (in KW):	8			
B: Workshop/ Lab Furniture					
S.N.	**Name of Item**	**Category**	**Qty**	**Unit**	**Remark**
1	Drum - 100 Liters (Optional)	Equipment	1	Number	Per 1 Unit in a Shift
2	Drum - 200 Liters (Optional)	Equipment	1	Number	Per 1 Unit in a Shift
3	Drum - 50 Liters (Optional)	Equipment	1	Number	Per 1 Unit in a Shift
4	Dust Bin - 50 Liters (Optional)	Equipment	1	Number	Per 1 Unit in a Shift
5	Black/ White Board with Stand - 4 X 3 Feet	Furniture	1	Number	Per 1 Unit in a Shift
6	Book Shelf/ Glass Shelf (Optional)	Furniture	1	Number	Per 1 Unit in a Shift
7	Discussion Table/ Working Table = L:W:H = 8:4:3 Feet - Heavy Wooden Top	Furniture	1	Number	Per 1 Unit in a Shift
8	Instructor/ Office Chair	Furniture	2	Number	Per 1 Unit in a Shift
9	Instructor/ Office Table	Furniture	1	Number	Per 1 Unit in a Shift
10	Notice Board - 2 X 3 Feet	Furniture	1	Number	Per 1 Unit in a Shift
11	Steel Almirah – Large (Optional)	Furniture	2	Number	Per 1 Unit in a Shift
12	Steel Locker - 12 Pigeon Hole	Furniture	2	Number	Per 1 Unit in a Shift
13	Steel Rack (Optional)	Furniture	1	Number	Per 1 Unit in a Shift
14	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
Shop outfit					
6	Fire Extinguisher (C02 ,)	Equipment	1	Number	Per 3 Unit in a Shift
7	Fire Extinguisher (Dry Chemical pdr)	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	Calliper - Inside Spring - 150 mm	Tool	6	Number	Per 3 Unit in a Shift
13	Calliper - Outside Spring - 150 mm	Tool	6	Number	Per 3 Unit in a Shift
14	Divider Spring Type - 150 mm	Tool	6		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	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	Chisel - Cold - Cross Cut - 9 mm X 150 mm	Tool	6	Number	Per 3 Unit in a Shift
28	Chisel - Cold - Flat - 20 mm X 150 mm	Tool	6	Number	Per 3 Unit in a Shift
29	Chisel - Cold - Round Nose - 9 mm X 100 mm	Tool	6	Number	Per 3 Unit in a Shift
30	Chisel - Diamond Point - 9 mm x 150 mm	Tool	5	Number	Per 3 Unit in a Shift
31	Hammer - Ball Pein - 250 grams	Tool	17	Number	Per 3 Unit in a Shift
32	Hammer - Ball Pein - 500 grams	Tool	17	Number	Per 3 Unit in a Shift
33	Screw Driver - 9 X 300 mm	Tool	4	Number	Per 3 Unit in a Shift
34	Drill Twist Set - Straight Shank - 3 mm to 13 mm by 0.5 mm	Tool	1	Number	Per 3 Unit in a Shift
35	Drill Twist Set - Straight Shank - 9.8 mm	Tool	1	Number	Per 3 Unit in a Shift
36	Hand Reamer Parallel - 10 mm	Tool	2	Number	Per 3 Unit in a Shift
37	Tap set -12 mm	Tool	2	Number	Per 3 Unit in a Shift
38	Solid die 12 mm with die stock	Tool	2	Number	Per 3 Unit in a Shift
39	Gauge Screw Pitch - Metric -0.25 to 6 mm	Tool	1	Number	Per 3 Unit in a Shift
40	Wire Gauge - Metric	Tool	1	Number	Per 3 Unit in a Shift
41	Allen Key Set - Hexagonal - 1 - 12 mm, set of 12 Keys	Tool	1	Number	Per 3 Unit in a Shift
42	Vernier Caliper - 0 - 200 mm with least count 0.02mm	Tool	1	Number	Per 3 Unit in a Shift
43	Vernier Height Gauge - 0 - 300 mm with least count = 0.02 mm	Tool	1	Number	Per 3 Unit in a Shift
44	Vernier Bevel Protractor - 300 mm Blade with Acute Angle Attachment	Tool	1	Number	Per 3 Unit in a Shift
45	Vernier Depth Gauge 300 mm(L..C. 0.02mm)	Tool	1	Number	Per 3 Unit in a Shift
46	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

47	Micrometer - Outside - 0 - 25 mm	Equipment	1	Number	Per 3 Unit in a Shift
48	Micrometer - Outside - 25 - 50 mm	Equipment	1	Number	Per 3 Unit in a Shift
49	Combination Set 300 mm	Equipment	2	Number	Per 3 Unit in a Shift
50	V Block - 75 x 75 x 50 mm with Clamp (Hardened & Ground)	Tool	1	Pair	Per 3 Unit in a Shift
51	Bench Vice - 125 mm	Tool	6	Number	Per 3 Unit in a Shift
52	Anvil - 50 Kg - with stand	Equipment	1	Number	Per 3 Unit in a Shift
53	Scraper - Flat - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
54	Scraper - Half Round - 250 mm	Tool	6	Number	Per 3 Unit in a Shift
55	Scraper triangular 250 mm	Tool		Number	Per 3 Unit in a Shift
56	Surface Plate - Granite - 600 x 600 mm with Stand and Cover	Equipment	1	Number	Per 3 Unit in a Shift
57	Drilling Machine - Bench Type - 13 mm Motorized with Standard Accessories	Machine	1	Number	Per 3 Unit in a Shift
58	Pedestal Grinder - Double Ended - 200 mm	Machine	1	Number	Per 3 Unit in a Shift
59	Acetylene Cylinder	Equipment	1	Number	Per 3 Unit in a Shift
60	Oxygen Cylinders	Equipment	1	Number	Per 3 Unit in a Shift
61	Electric Spark Lighter	Equipment	6	Number	Per 3 Unit in a Shift
62	Oxygen Gas Pressure Regulator Double Stage	Equipment	1	Number	Per 3 Unit in a Shift
63	Acetylene Gas pressure Regulator Double Stage	Tool	1	Number	Per 3 Unit in a Shift
64	Rubber Hose - Acetylene, Diameter = 8 mm, Length = 10 meters	Tool	1	Number	Per 3 Unit in a Shift
65	Rubber Hose - Oxygen, Diameter = 8 mm, Length = 10 meters	Tool	1	Number	Per 3 Unit in a Shift
66	Rubber Hose Clips - 1/2 inch	Tool	6	Number	Per 3 Unit in a Shift
67	Tong - Flat - 300 mm	Tool	4	Number	Per 3 Unit in a Shift
68	cylinder Key	Tool	4	Number	Per 3 Unit in a Shift
69	Gas welding torch with nozzle set	Equipment	1	Number	Per 3 Unit in a Shift
PHYSICS LABORATORY					
70	Instrument for determining 'g' (Simple Pendulum)	Equipment	1	Number	Per 3 Unit in a Shift
71	Mechanical board for testing triangle and parallelogram of forces including all accessories	Equipment	2	Number	Per 3 Unit in a Shift
72	Inclined plane with pulley, pan, weights etc.	Equipment	1	Number	Per 3 Unit in a Shift
73	Simple machines - Screw Jack	Equipment	1	Number	Per 3 Unit in a Shift
74	Searle's Apparatus for young's Modulus	Equipment	2	Number	Per 3 Unit in a Shift
75	Calorimeter for determining Joule's mechanical Equivalent of heat and specific heat	Equipment	1	Number	Per 3 Unit in a Shift

76	Apparatus for measurement of co-efficient of expansion(thermal) of solid (Pullinger"s apparatus)	Equipment	2	Number	Per 3 Unit in a Shift
77	Apparatus for measurement of thermal conductivity of good and bad conductors	Equipment	1	Number	Per 3 Unit in a Shift
78	Thermometers :				
	(1) 0 to 110º C	Equipment	1	Number	Per 3 Unit in a Shift
	(2) 0 to 250º C	Equipment	1	Number	Per 3 Unit in a Shift
	(3) 0 to 360 º C	Equipment	1	Number	Per 3 Unit in a Shift
79	Rheostat				
	(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
80	Resistance box 0 to 100 ohms	Equipment	2	Number	Per 3 Unit in a Shift
81	Resistance box 0 to 500 ohms	Equipment	2	Number	Per 3 Unit in a Shift
82	Resistance coils (2 ohms, 5 ohms, 10 ohms, 100 ohms)	Equipment	2	Number	Per 3 Unit in a Shift
83	Ammeter				
	0 to 1000 mA. (DC)	Equipment	2	Number	Per 3 Unit in a Shift
	0 to 1000 µA. (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
84	Voltmeter				
	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
85	Battery eliminator	Equipment	2	Number	Per 3 Unit in a Shift
CHEMISTRY LEBORATORY					
86	Specific Gravity bottle	Consumable	2	Number	Per 3 Unit in a Shift
87	Rods with screw at one end for Electrochemical equivalent 1) Carbon 2)Zinc 3) Copper	Equipment	2	Number	Per 3 Unit in a Shift
88	Multi meter(digital)	Equipment	2	Number	Per 3 Unit in a Shift
89	Milli voltmeter 1) 0 - 5mv 2) 0- 500mv	Equipment	2	Number	Per 3 Unit in a Shift
90	Digital Stop Watch 1/10 Second	Equipment	1	Number	Per 3 Unit in a Shift
91	Joules Calorimeter	Equipment	1	Number	Per 3 Unit in a Shift
92	Steam generator (copper) Cap. 500ml	Equipment	2	Number	Per 3 Unit in a Shift
93	Boss head	Equipment	12	Number	Per 3 Unit in a Shift

94	Bunsen Burners	Equipment	8	Number	Per 3 Unit in a Shift
95	Tripods Stand	Equipment	8	Number	Per 3 Unit in a Shift
96	Asbestos wire gauge	Equipment	8	Number	Per 3 Unit in a Shift
97	Gauge Wire without asbestos	Equipment	8	Number	Per 3 Unit in a Shift
98	Burettes 25ml	Consumable	8	Number	Per 3 Unit in a Shift
99	Pipettes 10ml	Consumable	8	Number	Per 3 Unit in a Shift
100	H.D.P. Distil water bottle	Consumable	8	Number	Per 3 Unit in a Shift
101	Clamp holders	Equipment	12	Number	Per 3 Unit in a Shift
102	Stands with clamps for burette	Equipment	12	Number	Per 3 Unit in a Shift
103	Triangles clay	Equipment	8	Number	Per 3 Unit in a Shift
104	Measuring cylinder 25 ml Glass	Consumable	8	Number	Per 3 Unit in a Shift
105	Measuring cylinder 50 ml Glass	Consumable	8	Number	Per 3 Unit in a Shift
106	Measuring cylinder 100 ml Glass	Consumable	8	Number	Per 3 Unit in a Shift
107	Volumetric flask 100 ml	Consumable	8	Number	Per 3 Unit in a Shift
108	Volumetric flask 500 ml	Consumable	8	Number	Per 3 Unit in a Shift
109	Volumetric flask 1000 ml	Consumable	8	Number	Per 3 Unit in a Shift
110	Funnels Dia 4cms	Consumable	8	Number	Per 3 Unit in a Shift
111	Beaker 250ml corining	Consumable	8	Number	Per 3 Unit in a Shift
112	Beaker 400ml corining	Consumable	8	Number	Per 3 Unit in a Shift
113	Bottles for solutions 1000 ml	Consumable	6	Number	Per 3 Unit in a Shift
114	Bottles for solutions 2000 ml	Consumable	6	Number	Per 3 Unit in a Shift
115	Bottles for solutions 500 ml	Consumable	6	Number	Per 3 Unit in a Shift
116	Conical flask - 150 ml	Consumable	16	Number	Per 3 Unit in a Shift
117	Conical flask - 250 ml	Consumable	16	Number	Per 3 Unit in a Shift
118	China dish - 50 ml	Consumable	12	Number	Per 3 Unit in a Shift
119	Watch Glass - 3" dia	Consumable	8	Number	Per 3 Unit in a Shift
120	Tong - Flat - 300 mm	Equipment	8	Number	Per 3 Unit in a Shift
121	Spatula - 6"	Equipment	8	Number	Per 3 Unit in a Shift
122	Spatula - 8"	Equipment	8	Number	Per 3 Unit in a Shift
123	CO2 Fire extinguisher	Equipment	1	Number	Per 3 Unit in a Shift
124	First Aid Box	Equipment	1	Number	Per 3 Unit in a Shift
125	Distilled water still 10 lit.	Consumable	1	Number	Per 3 Unit in a Shift
126	Glass test tubes - 15 ml	Consumable	50	Number	Per 3 Unit in a Shift

127	Round Bottom Distillation flask with side neck 500ml	Consumable	6	Number	Per 3 Unit in a Shift
128	Condenser for distillation lebig 30 cm long	Consumable	6	Number	Per 3 Unit in a Shift
129	Rubber cork of (2.5 cm, 3cm) size	Consumable	10	Number	Per 3 Unit in a Shift
130	Rubber Tubing (ID- 5mm)	Consumable	10	Meter	Per 3 Unit in a Shift
131	Rubber Bulbs for pipettes	Consumable	6	Number	Per 3 Unit in a Shift
132	Tong Tester - 0 - 25 A	Equipment	1	Number	Per 3 Unit in a Shift
133	Magnifying Glass - 75 mm	Equipment	1	Number	Per 3 Unit in a Shift
PRESSURE MEASURING INSTRUMENT					
135	Bourdon Tube type Gauges of Various ranges	Equipment	2	Number	Per 3 Unit in a Shift
136	Manometer, U-tube	Equipment	2	Number	Per 3 Unit in a Shift
137	Manometer, Inclined tube	Equipment	2	Number	Per 3 Unit in a Shift
138	Pointer Puller	Equipment	2	Number	Per 3 Unit in a Shift
139	Diaphragm Type Gauges - Various Type	Equipment	1	Number	Per 3 Unit in a Shift
140	Pressure Gauge - Capsule Type	Equipment	1	Number	Per 3 Unit in a Shift
141	Dead Weight Tester	Equipment	1	Number	Per 3 Unit in a Shift
142	Sensor Trainer Kit Containing following Sensors 1. Thermocouple 2. RTD 3. Load Cell/ Strain Gauge 4. LVDT 5. Smoke Detector Sensors 6. Speed Sensor 7. Limit Switch 8. Photo sensors 9. Optocouplor 10. Proximity Sensor	Equipment	1	Number	Per 3 Unit in a Shift
143	Pressure Regulators with Filter and Input & Output Gauges	Equipment	4	Number	Per 3 Unit in a Shift
144	Differential Pressure Transmitter - Pneumatic	Equipment	1	Number	Per 3 Unit in a Shift
145	Pressure and Flow Control loop (With PLC Controller)	Equipment	1	Number	Per 3 Unit in a Shift
TEMPERATURE MEASURING INSTRUMENT					
146	Temperature calibration Bath(-50 to 200 0C)	Equipment	1	Number	Per 3 Unit in a Shift
147	Thermometer - Alcohol is Glass	Equipment	1	Number	Per 3 Unit in a Shift
148	Thermocouple Type Pyrometer with Milli Voltmeter - with different types of Thermocouples	Equipment	1	Number	Per 3 Unit in a Shift
149	Radiation Pyrometer with Standard Accessories	Equipment	1	Number	Per 3 Unit in a Shift
150	Optical Pyrometer with Standard Accessories	Equipment	2	Number	Per 3 Unit in a Shift
151	Temperature switch	Equipment	3	Number	Per 3 Unit in a Shift
152	Thermostats	Equipment	1	Number	Per 3 Unit in a Shift

153	Temperature and Level Control loop (With PLC Controller)	Equipment	1	Number	Per 3 Unit in a Shift
154	Shell and tube heat exchanger	Equipment	1	Number	Per 3 Unit in a Shift
155	Triple effect evaporator	Equipment	1	Number	Per 3 Unit in a Shift
FLOW MEASURING INSTRUMENT					
156	Rotameter	Equipment	1	Number	Per 3 Unit in a Shift
157	Orifice Type Flow Meter	Equipment	1	Number	Per 3 Unit in a Shift
158	Venturi Tube Flow Meter	Equipment	1	Number	Per 3 Unit in a Shift
159	Vortex Flow Meter	Equipment	1	Number	Per 3 Unit in a Shift
160	Magnetic Flow Meter	Equipment	2	Number	Per 3 Unit in a Shift
161	Thermal Mass Flow Meter	Equipment	2	Number	Per 3 Unit in a Shift
162	Coriolis Mass Flow Meter	Equipment	2	Number	Per 3 Unit in a Shift
163	Turbine Flow Meter	Equipment	2	Number	Per 3 Unit in a Shift
164	Solid Flow Measurement Setup	Equipment	2	Number	Per 3 Unit in a Shift
LEVEL MEASURING INSTRUMENT					
165	Sight Glass Level Indicator	Equipment	1	Number	Per 3 Unit in a Shift
166	Float type Level Indicator	Equipment	1	Number	Per 3 Unit in a Shift
167	Static pressure and air purge Level Indicator	Equipment	1	Number	Per 3 Unit in a Shift
168	Show piece Ultra-sonic Level Indicator	Equipment	2	Number	Per 3 Unit in a Shift
169	Variable Capacitance type Level Indicator	Equipment	2	Number	Per 3 Unit in a Shift
170	Hook type Level Indicator	Equipment	2	Number	Per 3 Unit in a Shift
171	Show Piece for Radar type Level Indicator	Equipment	1	Number	Per 3 Unit in a Shift
172	Solid level measurement using ultrasonic level detector, Microwave level detector, Capacitance probe level detector, Point type level detector.	Equipment	1	Number	Per 3 Unit in a Shift
173	PH Meter - Digital	Equipment	1	Number	Per 3 Unit in a Shift
174	Electronic weight balance Capacity 10 kg. Sensitivity 10 Gram	Equipment	1	Number	Per 3 Unit in a Shift
175	Viscosity meter	Equipment	1	Number	Per 3 Unit in a Shift
176	Universal Calibrator	Equipment	1	Number	Per 3 Unit in a Shift
177	Online pH measurement and control trainer	Equipment	1	Number	Per 3 Unit in a Shift
178	Online Conductivity measurement and control trainer	Equipment	1	Number	Per 3 Unit in a Shift
179	HART communicator and calibrator	Equipment	1	Number	Per 3 Unit in a Shift
180	Pressure Safety valve (spring tension)	Equipment	1	Number	Per 3 Unit in a Shift
181	Pneumatic and Electronic Recorders - Single Point and Multi point, Circular and Strip Chart Types	Equipment	1	Number	Per 3 Unit in a Shift

182	Packed distillation column with DCS / PLC system.	Equipment	1	Number	Per 3 Unit in a Shift
183	Paperless recorder	Equipment	1	Number	Per 3 Unit in a Shift
184	PID Controller Trainer consisting of Instrument Panel, Digital Computer and Interface System	Equipment	1	Number	Per 3 Unit in a Shift
185	Control Valve Set Gate Valves, Globe Valves, Ball Valves, Diaphragm Valves, Butterfly Valves etc. Electrically Actuated, Pneumatic Actuated and Hydraulic Actuated	Equipment	1	Number	Per 3 Unit in a Shift
186	Experimental diaphragm actuated control valves set-up (Three different characteristics)	Equipment	1	Number	Per 3 Unit in a Shift
187	Tube Cutter	Equipment	1	Number	Per 3 Unit in a Shift
188	DCS Training Kit	Equipment	1	Number	Per 3 Unit in a Shift
189	Trainer on RS485 to RS232 Converter	Equipment	1	Number	Per 3 Unit in a Shift
190	Final Control Element – HART or Field Bus Type	Equipment	1	Number	Per 3 Unit in a Shift
191	Smart transmitter for pressure, temperature, flow and level	Equipment	1	Number	Per 3 Unit in a Shift
192	PLC & SCADA Training Kit (at least digital 8 input & 8 Output,4 analog input & output)	Machine	1	Number	Per 3 Unit in a Shift
193	Pneumatic controllers for pressure, flow, temperature and level with associated equipment	Machine	1	Number	Per 3 Unit in a Shift
194	Electric Work Bench: Type B 1. Voltmeters (0-230 V AC) 2. Voltmeters (0-230 V DC) 3. Ammeters (0- 5 A AC & DC). 4. Wattmeter Dynamometer (0-3000 W) 5.Power Factor Meter. 6.Vibrating Frequency Meter (0-60 HZ)	Machine	1	Number	Per 3 Unit in a Shift
195	Instrumentation Work Bench: Type A 1.Dual Power Supply - 0 to 30 Volts, 5 Amp 2. Digital Multimeter (3 ½ Digit) 3. Air Filter & Regulator 4. Compressed Air Supply 5. Digital Pressure Indicator for pressure measurement 6. I TO P convertor 7. Utility socket with 230 V AC 8. Oscilloscope 9. Function Generator	Machine	1	Number	Per 3 Unit in a Shift
196	Chemical plant control parameter trainer consists of transmitters, valves, pumps and process vessel with all parameters simulation software	Equipment	1	Number	Per 3 Unit in a Shift
197	Plier - Flat Nose - 200 mm	Tool	4	Number	Per 3 Unit in a Shift
198	Plier - Round Nose - 100 mm	Tool	4	Number	Per 3 Unit in a Shift
199	Neon Tester - 500 V	Tool	20	Number	Per 3 Unit in a Shift
200	Wire Cutter and Stripper - 150 mm	Tool	2	Number	Per 3 Unit in a Shift
201	Soldering Iron - Changeable Bit - 15 Watt, 240 Volt	Tool	6	Number	Per 3 Unit in a Shift

202	Allen Key Set - Hexagonal - 1 - 12 mm, set of 24 Keys	Tool	2	Number	Per 3 Unit in a Shift
203	Manometer, well type	Tool	10	Number	Per 3 Unit in a Shift
204	Plier - Side Cutting - 150mm	Tool	8	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	
2	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
1	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	Appron - 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	Personal Computer with Internet Facility

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	Highlightner 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	1	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