

Upgradation of ITIs into Centres of Excellence-Broad guidelines for implementation of Syllabi of Sector Chemical

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

- ✓ Training in Basic skill areas for a period of one year.
- ✓ Training in Advanced modules for next six months.
The testing & certification for the Basic skill training during first year & also for advanced training during next six months will be done under NCVT
- ✓ Training in specialized modules mainly in the industry (The course curricula, duration etc will be designed in consultations with the IMC/local industry. The trade testing & certification for this component will be done jointly by the State Government & Industry. Said certificate will be recognized by NCVT

As per the recommendations of the EFC, Training in the shop floor should constitute atleast 25-40% of the curriculum.

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

- ✓ trainee can opt to go to the labour market after completing broad based basic training of one year duration as well as after completing 1½ year of training.
- ✓ trainee can join advanced module as per his/her after some time .Specialized module would be offered after completing BBBT & at least one advanced module .
- ✓ ITI pass out trainee of the particular trade(s) from the conventional system can seek admission for advanced/specialized training in the relevant sector.

As per the approved curricula in the Area/Sector of Chemical , uniform rotation of trainees in six modules each of eight weeks duration as mentioned below is envisaged to be taken up. The trades from where existing infrastructure i.e. equipment/ instructor etc. could be utilized for the training in 'Chemical Sector' and space requirement of each module is as under:

Table-1

Basic Module	NAME OF THE MODULE	Trade(s) from where existing equipment /instructor could be utilised	Minimum Space Requirement (Sq.m)
CHBT-01	Fundamentals of Electronics and Computer	IT&ESM	80 sq.mtr.
CHBT-02	Basic Fitting and Measurements	Fitter	115 sq.mtr.
CHBT-03	Basic Mechanical Processes	Turner/Welding	150 sq. mtr. (Turner) 100 sq. mtr. (Welding)
CHBT-04	Fundamental of General Chemistry and Physics	Laboratory Assistant Chemical Plant	96 sq. mtr
CHBT-05	Basic Instrumentation	Instrument Mechanic Chemical Plant	96 sq.mtr.
CHBT-06	Basic Operations Unit & Processes	Attendant Operator Chemical Plant	104 sq. mtr.

Facilities available in ITIs may be utilized for imparting skill training. Where such trades are not in operation , facilities available in the near by ITI could be transferred failing which facilities are to be created a fresh .

For each of above module, Trade Practical will be 28 hours /week and Trade theory for 4 hours /week. Apart from above, Generic modules as mentioned below will be taught throughout the year.

CMBT- 07 - WORKSHOP CALCULATION & SCIENCE.....2 hrs/week

CMBT- 08 ENGINEERING DRAWING2 hrs/week

G-01-ENTERPRENEURSHIP AND COMMUNICATION SKILLS...2 hrs/week

In addition, 4 hours/week have been kept for Library studies & Physical Training

Vocational Instructors:

NAME OF THE MODULE	No. of Vocational Instructors (VIs)
CMBT – 01 to 06	Six VIs one each for 6 module of relevant trades
CMBT-07 to -08	One VI with relevant qualification as per need of module
G-01	One contract/part time / guest faculty for Generic module, ENTREPRENEURSHIP AND COMMUNICATION SKILLS –G-01

The eligibility and other criteria for admission will be as under :

Eligibility : 10th pass under 10+2 system with Science .

Batch size : 96 trainees 16 in each module (20% supernumeraries be allowed to take care of drop outs as already exist under CTS)

Admission:

For basic training, admissions are to be made in August / Feb each year.

Fee Structure:

Fee Structure may be decided by States Govt. in consultation with IMCs . It may be desirable to prescribe a uniform tuition fee for a sector in all Centres of Excellence of a state .

Space:

Since workshop/theory class rooms are envisaged to be accommodated in the existing building of the ITI, therefore, following norms are prescribed only for new infrastructure is to be created .

- (1) Workshop space : Refer Table-1
- (2) Three Theory classrooms of 30 Sqm each .

The Theory classrooms should have latest infrastructure including AV aids as per details given below:

- | | | |
|--|---|-------------|
| 1. Suitable Chairs/ tables* | - | As required |
| 2. OHP/Epidiascope | - | 1 No. |
| 3. Laptop computer/PC (latest) & LCD projector** | - | 1 No. |
| 4. Magnetic white board | - | 1 No. |
| 5. White board | - | 1 No. |
| 6. Flip chart | - | 1 No. |
| 7. Storage Almirah | - | As required |

(* Optimum utilization of space/flexibility may be kept in view)

(**Keeping in view the constraints of funds under the scheme, it is proposed to procure only one set of Laptop computer/PC / LCD projector for CoE. However, States if so desire may procure additional Laptop computer/PC/LCD projector from their funds) While selecting furniture, it should be kept in mind that these are meant for Centres of Excellence. Criteria like maximum flexibility/utilization of space should be kept in view.

Office Equipment:

For each CoE one Scanner, one Photocopy Machine and one PC/printer along with suitable accessories/furniture and internet connection (if not already available in the institute) is proposed to be provided for each CoE, in addition to the equipment prescribed in the syllabus.

Addition/alteration/Construction:

For Civil Works, tentative amount of Rs 40.00 lakhs have been proposed per CoE. It is envisaged to have separate block/ wing for the Centres of Excellence in the ITI campus. In case space is available in the existing building of an ITI for taking up new areas as per requirement of the cluster of Industry, the existing space will be renovated as per the need. Alternately, separate block will be built up in the same campus keeping in view the space requirements of the Electrical Sector.

While planning for addition /alteration/Construction of workshop and Class rooms, following may be kept in view:

- ✓ concept of a Centre of Excellence
- ✓ the fact that the requirement of funds for construction /addition /alteration for advanced training will be higher than that of basic training

Publicity

Wide publicity & advertisement be given for better response . The role of the local as well as the concerned Industry is very vital for the success of this program.

States may consider providing additional equipment/ other facilities like separate Library/upgradation of existing Library, Conference Hall/ Committee Room etc. from their own funds.

SYLLABUS FOR THE
Broad Based Basic Training for
“CHEMICAL SECTOR”

**CENTRE OF EXCELLENCE
CHEMICAL GROUP OF TRADE**

Modules of BROAD BASED BASIC TRAINING (48 WEEKS)

- 1) CHBT 1- FUNDAMENTALS OF ELECTRONICS AND COMPUTER
 - 2) CHBT 2- BASIC FITTING AND MEASUREMENTS
 - 3) CHBT 3- BASIC MECHANICAL PROCESSES
 - 4) CHBT 4- FUNDAMENTALS OF GENERAL CHEMISTRY AND PHYSICS
 - 5) CHBT 5- BASIC INSTRUMENTATION
 - 6) CHBT 6- BASIC UNIT OPERATIONS & PROCESSES
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- G-01 WORKSHOP CALCULATION AND SCIENCE
 - G-02 ENGINEERING DRAWING
 - G-03 ENTREPRENEURSHIP AND COMMUNICATION SKILLS

Broad Based Training: 48 Weeks

CHBT 1 : FUNDAMENTALS OF ELECTRONICS AND COMPUTER : 08 WEEKS

WEEK NO	THEORY	PRACTICAL
1	Atomic theory, Introduction to Semiconductor devices, semiconductor material	Study the characteristics of conductor, semiconductor & insulator. Identify and testing of different types of active and passive components.
2	LED, LCD,ZENER diode, SCR,DIAC application, uses and care	Making of DC power supply, smooth & regulated output voltage.
3	Bipolar Transistor- PNP,NPN classification, biasing, coupling FET,UJT,MOSFET	Study & test the Transistor Study & test the UJT, FET, MOSFET
4	Binary & Hexadecimal Systems Logic gates, Circuits, Truth Tables	Experiments on Logic Gates : AND, NAND,OR, NOR, XNOR using Digital IC-Trainer, preparation of truth table
5	Introduction to different types of Integrated Circuits and Microprocessor, ALU, Memory, CPU,ROM,, RAM, EPROM etc.	Study of different ICs , Combinational & sequential circuit, Conversion of Analog to Digital, Digital to Analog .
6	<u>Fundamental of computers</u> <ul style="list-style-type: none"> ▪ definition of computers ▪ advantage and disadvantage of computer ▪ history of computer ▪ different parts of computer ▪ hardware and software ▪ languages of computers 	Start and shutdown of computer Typing tutor
7	<u>Microsoft Office XP</u> Microsoft Word Microsoft Excel Microsoft PowerPoint	<u>Microsoft Word</u> <ul style="list-style-type: none"> ❖ Drafting Letters ❖ Formatting Letters ❖ Spelling Check ❖ Page Setup ❖ Table creation Microsoft Excel Microsoft PowerPoint

8	<p><u>Auto Cad</u></p> <ul style="list-style-type: none"> • introduction of AutoCAD • learning AutoCAD • where to start • Getting help • Additional Resources • AutoCAD window • Using & modifying Toolbar • Method of creating new Drawing and templates • Coordinate system • Drawing units and limits • Snap and greed • Selection method • Using modifying Commands • Using text in drawing • UCS • Zoom and pan • Line types • Layers • Formal Text and Dimension 	<p>starting AutoCAD opening existing drawing working with multiple drawing understanding AutoCAD window using point devices saving and closing drawing existing AutoCAD setting drawing unit setting & modify toolbar working with AutoCAD command working with coordinate system working with draw tool bar using template layout creating geometrical surface using text Adjusting snap & grid alignment using zoom & pan working with modifying toolbar creating solid object setting limits & units</p>
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CHBT 2: BASIC FITTINGS AND MEASUREMENTS (08 WEEKS)

a) Measurement – 02 Weeks b) Basic Fitting -- 06 Weeks

WEEK NO	PRACTICAL	THEORY
1	<p>1) To study the personal protective equipments such as Gumboot, Helmet, Gloves, aprons, ear mask, nose mask etc.</p> <p>2) To study the different types of fire extinguisher.</p> <p>3) Cleaning and maintenance of fire extinguisher</p> <p>4) To prevent different types of fire by different types of fire extinguisher.</p> <p>5) To study the different type of economic plants of non-conservation energy sources.</p> <p>Physical introduction to measuring instruments – handling of instruments – exercise in the use of linear measuring instruments such as steel rule of different ranges.</p>	<p>1) Introduction to safety in chemical industry.</p> <p>2) Concept of safety.</p> <p>3) Accident caution & prevention.</p> <p>4) Safety management.</p> <p>5) Machine guarding.</p> <p>6) Good housekeeping.</p> <p>7) Lighting & colour / Ventilation & temperature.</p> <p>8) Fire safety.</p> <p>9) Material handling.</p> <p>10) Personal protective equipments.</p> <p>11) First aid.</p> <p>12) Importance of industrial discipline</p> <p>13) Pollution – Types of pollution Prevention of pollution by legislature.</p> <p>14) Conservation & non conservation of energy sources</p> <p>Introduction to metrology , objectives of metrology – measurements – principles – methods of measurement</p>
2	<p>Introduction to Outside calipers, inside calipers for measuring inside outside parameters.</p> <p>Vernier calipers – least count , exercise in outside measurement , inside measurement , depth gauge Measurement of flat rectangular objects, cylindrical objects , hollow components, threaded components</p> <p>Exercise on external and internal measurements using micrometers and height gauges</p>	<p>Terminology used in metrology – accuracy – repeatability – resolution etc.</p> <p>SI units of measurements – physical quantities under SI system</p> <p>Selection of measuring instruments, care, use & maintenance of measuring instruments – handling of precision instruments – Vernier caliper, micrometer, height gauge, dial gauge (plunger and bevel type) with stand (0.01 mm resolution), checking sharpness using combination set</p>

3	Introduction to safety including fire equipments and their uses, Familiarity with fitters hand tools Filing flat surface of mild steel and cast iron. Check for flatness, straightness and square ness	Introduction to different types of Fire equipments & Fire protection Introduction to hand tools & their safety Environmental factors and personal safety.
4.	Simple blue print reading Mark out according to simple blue print Punching Hack sawing to dimension	Marking and punching tools and their uses Hack saw – types, specification and their uses
5.	Filing flat & square to size to an accuracy of ± 0.1 mm Marking and punching of stepped and angular components and finishing the part to the required shape and size to accuracy of ± 0.1 mm Exercise on angular measurement using combination set and Vernier bevel protector	Classification and specification of files , shapes , sizes and grades Bench vice- constructional details Selection criteria of files Vernier bevel protector – reading and use. Use of thread gauge & screw thread micrometer.
6.	Center drilling , Drilling , reaming , counter sinking , counter boring and tapping for various sizes of mild steel and tapping on various sizes of mild steel material	Drilling machine – types – drilling operation – drill bits Reamers – types , care and maintenance
7.	Fitting exercises – simple to complex (Involving drilling, tapping, reaming, counter sinking , counter boring and slide fitting)	Taps and Dies – description care and maintenance Lubrication for tapping Determination of drill size for tapping Selection of spindle RPM for drilling Tool holding & Work holding devices Types of fasteners Standard size of threads , types Applications of adhesives , metal , Shellac etc.
8.	Manufacturing of different component individually and assembling with fastener.	Limits and fits according to IS: 919 Introduction to different types of Washers, Rivets , Bolt & Nuts (Hexagonal & Square), Locking devices , Foundation bolts (Rag ,Levis, Cotter)

CHBT 3 : BASIC MECHANICAL PROCESSES (08 WEEKS)

WEEK	PRACTICAL	THEORY
1	Introduction, types of work done in the section. Lathe –its parts and functions check it for proper running, cleaning and oiling of various parts .holding job in four jaw chuck & turning.	Shop safety. Lathe –its construction, cleaning and oiling. Independent chucks different types and construction, uses.
2	Grinding rough turning tool. Setting tools in tool post facing operation, thus making the job to specified length and centre drilling.	Common lathe cutting tools roughing and finishing tool, Different types as like V-tool side cutting tool, boring tool etc. Knurling tool.
3	Plain turning by holding job in the chuck. turning to specified diameter, Step turning, grinding of finishing tool.	Lathe, accessories, such as centre mandrel, catch plate and dog face plate, lathe steady etc. construction and use. Common lathe cutting tools roughing and finishing tool, knife tool, recessing tool etc. lathe tool material.
4 & 5	Taper turning by swiveling compound rest. Taper turning by off setting tailstock. Knurling practice-drilling practice boring practice. Thread cutting (metric)	Tapers and its purpose, standard tapers, different methods of taper turning. Taper calculations. Calculations of gear train for thread cutting. Knurling tool- types and uses advantage and disadvantage of offset method
6.	Assembly of oxy-acetylene plant and arc welding Lighting and adjustment of oxy-acetylene flame.	Types of works done in welding i.e. fabrication, structural and repair. Safety precautions comprising shop safety, equipment safety, personal and general safety.
7	Fusion run with and without rod. Square butt joint, corner joint on ms sheet by gas welding. Pipe joints, butt and T joints	Welding rods and equipments, handling, care and specifications. Welding methods and techniques Common gases used in welding.
8	Arc striking and bidding on ms plate. Square butt joint, centre joint on ms plate – 6mm and 8 mm thick. Pipe joints, butt and T joints.	Metal joining processes, mechanical and thermal nut bolts riveting joining welding bracing and soldering. Types of joints – arc welding accessories, machines uses. Types of weld; Weld symbols; applications.

CHBT 4 : FUNDAMENTALS OF GENERAL CHEMISTRY AND PHYSICS (08 WEEKS)

WEEK	PRACTICAL	THEORY
1	To study triangular and parallelogram of force with the help of mechanical board. Determination of coefficient of static friction using inclined plane.	Units & dimensions Force Friction Acceleration.
2	Determination of mechanical advantage velocity ratio and % efficiency of simple machine. Determination of acceleration due to gravity by simple pendulum.	Velocity & speed Density & specific gravity Viscosity, surface tension, time, energy, power, mass, volume, temp, pressure
3	Determination of Young's modulus by Searle's apparatus. Determination of coefficient of expansion of solid and liquid. Determination of coefficient of thermal conductivity of metal rod. Determination of specific rotation of optically active substance by a polarimeter.	Stress & Strain Heat, conduction, convection, radiation, light, motion, heat transfer equipments. Optical activity Specific rotation Polarimeter.
4	To study Ohm's law and Kirchoff's law about current and voltage. To study electric cell using series and parallel connections. Determination of specific resistance using wheat stone's bridge. Verification of Faraday's First Law of electrolysis. Determination of mechanical equivalent of heat using electrical method	Electricity Work simple machine, power & energy Electro chemistry Electrolysis To study the relation between currents, voltage, resistance. Electricity by chemical cell (lead) /accumulator. Introduction to transformer, capacitor ampere meter , volt meter , fuse , voltage stabilizer
5 & 6	Volumetric analysis -> Acidimetric titration ->Alkalimetric titration ->Redox titration -> Precipitation titration. Iodometric titration Complexo metric titration	-> Introduction to chemistry -> Safety precautions to be taken in chemical lab & plant. -> Acid , base and salt -> Element , Atom and Molecule -> Molecular wt. , equivalent wt. and atomic wt. Normality, Molarity, Molality. -> Volumetric analysis -> Different equipments & Apparatus used in lab. -> Periodic tables & it's detail study IUPAC nomenclature. General chemistry of alkane, alkene and

		alkynes, halogen derivatives, alcohols, phenols, aldehydes, ketones, acids and esters -> Thermo chemistry -> Chemical bonding -> Chemical equilibrium -> Colloidal solution
7 & 8	[A] Preparation of Chemicals -> To study the allotropic forms of sulphur. -> To study the properties of mixture (Fe+S) and Compound (FeS) -> Preparation of aniline -> Preparation of copper sulphate -> To study Action of pure and salt water on metals and alloys -> To study action of acids and base on metals alloys	* Extraction of Metal & Non-Metal -> Introduction of inorganic chemical: NaOH, silica, glass... -> Corrosion & erosion -> Fertilizer -> Dies intermediate -> Bulk drugs -> Insecticides -> Cement industry -> Pulp & paper industry -> Glass industry -> Common effluent treatment plant (CETP)

CHBT 5 : - BASIC OF INSTRUMENTATION (08 WEEKS)

WEEK	PRATICAL	THOERY
1	To study the working construction and principle of pressure gauge C-type bourdon tube pressure gauge, spiral type, helical type. Capsule type pressure gauge	Introduction of instrumentation Definition of pressure, gauge, atmosphere, absolute, Units of pressure, Conversion of units.
2	Bellow type pressure gauge and diaphragm type Take reading practice of all types of manometers and capsule type gauges.	Classification of pressure measuring instruments To study about different types of manometers
3	Take reading , practice of bimetallic thermometer Measuring in glass thermometer, thermocouples PT-100.	To classify the different type of temperature measuring instruments To study the working construction and principle of bimetallic thermometer
4	Mercury in gas filled thermometer RTD Thermocouple	To study the working construction and principle of glass thermometer Mercury in glass thermometers Gas filled thermometer To study about RTD & thermocouple
5	Take reading practice of Orifice meter , Venturimeter	To study the classification of flow measuring instruments To study working , construction and principle of different type of flow measuring instruments
6	Take reading practice of Rota meter, Pitot tube and magnetic flow meter.	Briefly study about ... <ul style="list-style-type: none"> • Orifice meter • Venturimeter • Rota meter • Pitot tube • Quantity meter • V-notch • Turbine type, magnetic type, vertex flow meter and annular flow meter
7	Take reading practice of different types of level measuring instruments	To study classification of level measuring instruments To study working construction of different types of level measuring instruments
8	Take reading practice of hydrometers Take reading practice of pH meter Take reading practice of hygrometer.	Briefly study about hydrometer Briefly study about pH meter To study the Anemometer.(velocity Measurement) To study the Hygrometer. (Humidity Measurement)

CHBT 6 : - BASIC OF UNIT OPERATIONS AND PROCESSES (08 WEEKS)

WEEK	PRACTICAL	THEORY
1	<p>Introduction Pipe fitting like as Elbow 'T', Cross, Bend, Union, Coupling, Nipples etc. Flange fittings. Flexible hosepipe fittings. Instrument airline tube fittings: banding, brazing etc.. Gasket cutting</p>	<p>Introduction of unit operations & unit processes. Transportation of fluid Plant Utility: Steam, cooling water, chilled water, brine, instrument air, Nitrogen, vacuum, etc... Introduction of Boiler, cooling tower, chilling plant, compressor, ejector.</p>
2	<p>Flow measurement by different instruments as like Venturimeter , Orifice meter , Rota meter , V-notch etc</p>	<p>Types of pipes and tubes Types of gasket sheet , their properties and uses Flow of fluid Principle construction , working and uses of Venturimeter , Orifice meter , Rota meter etc</p>
3	<p>Study of different types of flow controlling devices like as check valve , Needle valve , Diaphragm valve, Ball valve, Stop cock, Butterfly valve etc. Its structure and overhauling Study of lagging material such as glass wood , thermo Cole etc.</p>	<p>Construction and working of gate valve , Globe valve, Check valve, Ball valve, Butterfly valve etc. Various insulating materials Fertilizers : Different types , Manufacturing process of Urea with raw material chemical reaction , process flow diagram , description & uses</p>
4	<p>Characteristic curve of centrifugal pump Study of head Vs capacity curve of a gear pump</p>	<p>Construction and working of centrifugal pump Reciprocating pump Rotary pump Extraction, leaching, absorption , adsorption and their industrial application. Introduction to different unit operations: Mechanical operation, Heat transfer, Mass transfer.</p>
5	<p>Operation of packed distillation column Operation of a multiple effect evaporator Operation of plate and frame filter press</p>	<p>Distillation: - Definition stripping, rectification, reflux ratio. Types of distillation Distillation of Petroleum products Evaporation :- Definition steam economy types of evaporators Filtration: - Types of filters. Filter aids, Types of filter media.</p>
6	<p>Introduction Laboratory preparation 1) Oil and Soap</p>	<p>Introduction to unit process. Manufacturing of soap and glycerin with flow sheets, its uses , chemical reaction</p>
7	<p>2) Nitro Benzene 3) Aspirin</p>	<p>Manufacturing process of Nitric Acid by Oswald process with flow sheets , chemical reactions , process description and uses</p>

8	4) Cl ₂ Gas	Manufacturing of Sulfuric Acid by contact process , raw material Manufacturing of Caustic Soda and chlorine Process classification, raw material, chemical reactions, flow sheets and uses.
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Index

Workshop calculation

Chap no	Topic
1	Introduction
2	Percentage
3	Algebra
4	Logarithms
5	Mensuration
6	Trigonometry
7	Graph

Workshop Science

Chap no	Topic
1	Introduction to Physics & Chemistry
2	Units
3	Gas Laws (Introduction only)
4	Metals
5	Radio-activity (Introduction only)
6	Atomic Structure (Introduction only)
7	Work , Power and Energy
8	Classification of elements (Introduction only)
9	Atomic , molecular and equivalent weight (Introduction only)
10	Simple machines
11	Motion
12	Electrolysis and catalysis (Introduction only)
13	Oxidation - reduction and corrosion (Introduction only)
14	Stress and Strain
15	Heat and temperature
16	Density and specific gravity
17	Force
18	Pressure
19	Friction and Lubrication
20	Elasticity and it's uses
21	Water (Introduction only)
22	Petroleum (Introduction only)
23	Polymerization (Introduction only)
24	Heat treatment
25	Cutting speed , Feed , pitch and lead
26	Alcohols and acids. (Introduction only)
27	Carbohydrates (Introduction only)
28	Oils , Fats & Soaps (Introduction only)

Broad Based Training

Sub : Workshop Calculation And Science

Period of Training : 48 Weeks

Week No	Workshop Calculation	Workshop Science
1	1. Introduction	
	-> Arithmetic : Fundamental Operation, addition , subtraction , multiplication, division of decimal numbers	-
2	-	1. Introduction to Physics & Chemistry
		-> From earliest time to present day, Matter , Element ,atom molecule, elements , compound, physical and chemical change
3	2. Percentage	-
	-> Changing percentage to decimal and fraction and vice versa. Applied problems. Ratio & proportion , average , WTS, LCM/GCM - shop problems , square and square root – shop problem	-
4	-	2. Units
		-> System of units , British , Metric and SI MKS units for length , area , volume ,capacity , weight ,mass ,time , angle , their conversion , unit of temperature, force , pressure , light , electricity and related problem
5	-	3. Gas Laws (Introduction only)
		-> Boyle's and Charle's law , gas equation, diffusion , Graham's law of diffusion , effusion , Dalton's law of partial pressure
6	3. Algebra	-
	-> Solution of 1st and 2nd order equation with 1 or 2 unknown by algebraic calculation and by graphs Factorization, quadratic equation (No proof required) only application of solving problem	-

Broad Based Training

Sub : Workshop Calculation And Science

Period of Training : 48 Weeks

Week No	Workshop Calculation	Workshop Science
7 & 8	-	4. Metals
		<p>→ Properties of metals , types of metals , difference between ferrous and non ferrous metals , ferrous metals , getting iron from iron ore , Blast furnace , classification of iron , pig iron , cast iron, wrought iron , steel types of steel , difference bet cast iron and steel , alloy steels , types of alloy steel , non ferrous metal , non ferrous metals alloys</p> <p>→ Difference between metal & non- metal</p>
9	-	5. Radio-activity (Introduction only)
		-> Alpha , beta and gamma rays and their properties , radio active changes alpha ray and beta ray change , group displacement law , definition of isotopes and isobars
10	-	6. Atomic Structure (Introduction only)
		-> Electron , proton , neutron , Rutherford and Bohr's atom model, Bohr's burry scheme and examples of distribution of electrons
11 & 12		7. Work , Power and Energy
		-> Work , unit of work , power , unit of power , Horse power of engines , mechanical efficiency , Energy , Uses of energy , potential and kinetic energy. Transmission of power by a belt pulley drive, IHP of steam and petrol engine , electrical power and energy , examples
13	-	8. Classification of elements (Introduction only)
		-> History Mendeleff's periodic law and table
		9. a)Atomic , molecular and equivalent weight (Introduction only) b) Law's of chemical combination Law's of definite (constant) multiple , reciprocal proportion etc – shop problem

Broad Based Training

Sub : Workshop Calculation And Science

Period of Training : 48 Weeks

Week No	Workshop Calculation	Workshop Science
14 & 15	4. Indices, law's of indices; problem. Logarithms	
	-> Introduction , definition , how to refer log tables , negative characteristic mantissa , log of a number, relation between log and anti log , how to refer anti log tables , rules while using logarithms, examples	
16	-	10. Simple machines
		-> Simple machines , efforts and load , mechanical advantage, velocity ratio , efficiency of machines , their relationship, examples
17 & 18	-	11. Motion
		<ul style="list-style-type: none"> ➔ Rest and motion , vector quantity , scalar quantity , speed , velocity , difference between velocity and speed , acceleration , equation of motion , motion under the force of gravity , examples ➔ Types of speed and velocity –angular velocity, unit and example.
19, 20 & 21	5. Mensuration	
	-> Introduction , rectangle , square , parallelogram , rhombus , trapezium , triangles , radius of larges holes that can be inscribed in a given triangle , pentagon , hexagon, circle , sector ,segment of a circle , ellipse length of belts , area of	

Broad Based Training

Sub : Workshop Calculation And Science

Period of Training : 48 Weeks

Week No	Workshop Calculation	Workshop Science
	irregular surface area of four walls.	
	-> Finding out volumes of solids , cubes , rectangular solid , cylinder , hollow cylinder, sphere , hollow sphere, hemi sphere, cone , frustum of cone, hexagonal bars , and pyramids , examples	
22	-	12. Electrolysis and catalysis (Introduction only) Faraday's laws of electrolysis , electrochemical equivalent , electroplating and applications. Shop problem.
23	-	13. Oxidation - reduction and corrosion (Introduction only)
24 & 25	-	14. Stress and Strain
		-> Introduction , stress and strain , different types of stresses, Hooke's law , Young's modulus , Yield point , ultimate stress, factor of safety , stress-strain graph , modulus of rigidity , poisson ratio , bulk modulus , examples
26 & 27	-	15. Heat and temperature

Broad Based Training

Sub : Workshop Calculation And Science

Period of Training : 48 Weeks

Week No	Workshop Calculation	Workshop Science
		-> Heat, unit of heat, temperature, difference between heat and temp. , Boiling point, Melting point, Scale of temp. , specific heat , thermal capacity , water equivalent of heat , interchanges of heat , calorie meter , latent heat of fusion , latent heat of vapour , transmission of heat ,thermos flask , pyrometer , thermocouple , thermo electricity, pyrometer , coefficient of linear expansion , indicated thermal efficiency , brake thermal efficiency , special properties of mercury for selecting as medium in thermo-meter , examples
28 , 29	6. Trigonometry	-
30 & 31	-> Trigonometrical ratios, use of Trigonometrical tables , area of triangle by trigonometry.	-
	-> Finding height and distance by trigonometry , application of trigonometry to shop problems	-
32	-	16. Density and specific gravity
		-> Mass , unit of mass , weight , difference between mass and weight of substance , density , unit of density relative density , difference between density and relative density of a substance , Archemede's principle , simple experimental determination .
33 & 34	-	17. Force
		-> Triangles of forces , parallelogram of forces , composition and resolution of forces , representation of forces by vectors - simple problems on lifting tackles like jib cranes , wall cranes etc. , Moment of force ,couples

Broad Based Training

Sub : Workshop Calculation And Science

Period of Training : 48 Weeks

Week No	Workshop Calculation	Workshop Science
35	7. Graph	-
	-> Abscissa and ordinates , graphs of straight line, related to two sets of varying quantities	-
36	-	18. Pressure
		-> Atmospheric pressure, pressure gauge, gauge pressure and absolute pressure and their units.
37 & 38		19. Friction and Lubrication
		-> Definition, adv. And disadvantage of friction , co-efficient of friction , angle of friction , simple problem related to friction , types of lubricant
39		20. Electricity and it's uses
		-> Electric current, +Ve and -ve terminals , Use of fuses and swithches , conductors and insulators , simple ele.Circuits , simple calculations , Ohm's law , simple calculation , electrical insulating materials , Kirchoff's law, examples
40	-	21. Water (Introduction only)
		-> Water for industrial purpose , sources , hard and soft water , causes and removal of hardness
41	-	22. Petroleum (Introduction only)
42	-	23. Polymerisation (Introduction only)
43	-	24. Heat treatment
		-> Function of heat treatment , critical temperature , annealing , normalising , hardening , tempering , case hardening , standard and measurement
44	-	25. Cutting speed , Feed , pitch and lead Buoyancy <ul style="list-style-type: none"> • Centre of buoyancy , law of buoyancy , hydrometers • Pascal's law, pressure of liquid at a depth – shop problem
		-> Definition , simple problems on finding times.
45	-	26. Alcohols and acids. (Introduction only) Light <ul style="list-style-type: none"> • Terminology in light , inverse square law ,

Broad Based Training

Sub : Workshop Calculation And Science

Period of Training : 48 Weeks

Week No	Workshop Calculation	Workshop Science
		photometer , glass prism , glass slab , mirrors, lenses –shop problem
46	-	27. Carbohydrates (Introduction only) Lever , pulleys , classification shop problem
47	-	28. Oils , Fats & Soaps (Introduction only) wheel & axel , screw jack , inclined plane , wedge and shop problem
48	Revision	Revision

Broad Based Training

Sub : Engineering Drawing

Week No	Topic
1	Introduction of Eng. Drawing & Sheet layout
2	Method of fixing a drawing sheet on the board, title block, border line Use of set squares and other drawing instruments
3	Lettering single stroke and numerals as per is sp 461988
4	Different types on lines , Used in eng. Drawing as per IS sp 46 1988
5	Freehand drawing of straight line , Rectangular , square , circle , polygons
6	Geometrical construction of line , Angles and triangles
7	Geometrical construction square , pentagons and hexagon in different methods.
8	freehand drawing of simple solid such as cube , rectangular block , cylinder and their view
9	Geometrical construction of plane , curves such as cycloid , involute , spiral
10	Use of different scales mm and inches
11	Isometric view of simple solid and hollow object & Isometric circle
12	Hand tools commonly used in own sections
13	Cutting tools and measuring tools (vernier and micrometer)
14	Orthographic projection (1st angle projection) explain by means of aid the planes of projection.
15	Orthographic projection (3rd angle projection)
16	Drawing of different types of threads & set screw
17	Drawing for types of Rivet & riveted joints lap joints
18	But joints Butt joint with single strap Butt joint with double strap
19	Drawing for types of Keys
20	Drawing for types of Keys Joints Universal joint.

Broad Based Training

Sub : Engineering Drawing

Week No	Topic
21	Drawing for types of Coupling (Muff & Flange)
22	Drawing for types of Nuts , hexagonal , square, capstan, dome, wing, ellipsoid.
23	Drawing for types of Bolts, hexagonal, square, T-bolt, pan headed with sq. neck.
24	Drawing for Locking arrangements for nut (Double nut, castel nut & pin etc.)
25	Orthographic views of simple objects by 1st angle projection
26	Orthographic views of simple objects by 3rd angle projection
27	Orthographic views of simple & hollow objects by 1st angle projection
28	Orthographic views of simple & hollow objects by 3rd angle projection
29	Orthographic views of simple & hollow objects by 3rd angle projection
30	Orthographic views of simple & hollow objects by 3rd angle projection
31	Sectional view of simple objects such as half & full sectionals view & to explain the cutting plane line having arrows.
32	Sectional view of simple objects such as half & full sectionals view
33	Sectional view of simple objects such as half & full sectionals view
34	Sectional view of simple objects such as half & full sectionals view
35	Reading of simple blue prints
36	To draw isometric views from orthographic drawings.
37	Reading of simple blue prints to trace out missing lines from orthographic views or missing lines and views exercise.
38	Freehand sketch of Tail stock , chuck
39	Freehand sketch of Pipe joints , fitting , pipe line drawing symbols
40	Welding symbols general as per the code sp 401988 & IS 813-9161
41	Freehand sketch of simple bearing block
42	Isometric to orthographic projection of 3rd angle projection sectional views

Broad Based Training

Sub : Engineering Drawing

Week No	Topic
43	Freehand sketch of parts such as Pistons , connecting rods, crank shaft etc.
44	Freehand sketch of parts such as Pistons , connecting rods, crank shaft , D-slide valve
45	Freehand drawing of valves , gate , globe , plug , cook , ball , nipple diagram and control valve
46	Orthographic views of simple objects by 1st angle projection sectional views
47	Revision ref. m/c drawing by N.D. Bhatt
48	Revision ref. code of practice for general engineering drawing sp 46 1988.

List of tools, Equipment & Machines

BROAD BASED TRAINING: (CHBT 1) (No. of Trainees - 16)

Sl. No.	ITEMS	Qty. Required
1.	Computer System	
a.	Pentium IV Computer or latest (Server), 2.8 GHz & above, 1 GB RAM, 80 GB HDD, DVD Combo Drive, 15" Monitor, optical scroll mouse, multimedia key board, 32 bit LAN card with UPP port, necessary Drivers,	1 no.
b.	Pentium IV Computer or latest (Client- windows XP or higher) 2.8 GHz, 512 MBRAM, 40/80 GB HDD, DVD Combo Drive, 15"/17" Monitor, optical scroll mouse, multimedia key board, LAN card, necessary Drivers & Antivirus software	8 nos.
c.	Networking: Above Computer Systems connected in LAN	---
d.	Broad Band Internet Connection, minimum speed 256 Kbps	---
e.	Software latest MS Office Window (under the OS platform for clients)	8 nos.
f.	All related software	As required
2.	UPS 500 VA Or Centralised UPS with 5 KVA Capacity	9 nos. or 1 no.
3.	Desk Top Laser printer (B&W)	2 no.
4.	Ink jet printer	1 no.
5.	Dot Matrix Printer	1 no.
6.	Scanner	1 no.
7.	LCD Projector with screen	1 no.
8.	Overhead Projector with screen	1 no.
9	Allen Key set of 12 pieces (2mm -14 mm)	1 set
10.	Philips screw driver Typeset of 5 pieces (100 mm to 300mm)	04 sets
11.	1.44 MB Floppy	As required
12.	CD (Rewritable)	As required
13	Basic Electronics trainer	4 Nos
14	Analog Trainer Kit	4 Nos
15	Digital Trainer Kit	4 Nos
16	Power Supply 0-30 V , 0-500mA , Variable	2 Nos

	Workshop Furniture	Qty.
1	Instructor table & chair	1 each
2	Computer Table	9 nos.
3	Revolving Stool cum chair	16 nos.
4	Green Glass Board/ White Board	1 no.
5	Metal Rack	As required
6	Locker with 8 drawers (standard size)	2 nos.
7	Storage Almirah	As required
8	Book shelf (Glass panel)	1 no.
9	Tables for Printers/Scanner/Projector	As required
10	Fire fighting equipment, first aid box etc.	As required

BROAD BASED TRAINING : (CHBT 2) (No. of Trainees - 16)
Trainee Tool kit

SR.	Name of Tools	Qty Req
1	Caliper out side spring 6 "/15 cm.	16
2	Caliper inside spring 6 "/15 cm	16
3	Dividers spring 6 "/15 cm	16
4	Center punch 4"/10cm.	16
5	Prick punch 6 "/15 cm	16
6	Chisel cold flat 1"/2.5cm	16
7	Chisel cross cut 3/8" X 1/8	16
8	Chisel diamond point 3/8"10mm.	16
9	Chisel half round 3/8"/10mm	16
10	Hammer ball pein 1lb handled	16
11	Hammer ball pein ½ lb handled	16
12	Hacksaw frame adjustable with pistol grip For 8"-12"blade/20cm-30cm.	16
13	Rule steel 12"English &metric/30cm	16
14	Screw driver 3"x3/8"blade	16
15	Screw driver 12"x1/2 blade	16
16	Square engineers 6"blade/15cm	16
17	Scriber – 6"	16
18	Safety goggles.	16

BROAD BASED TRAINING:(CHBT 2) (No. of Trainees - 16)
Shop Outfits

SR	Name of Equipments	Req Qty
1	Surface plate 12"x12"/30cmx30cm	1
2	Scribing block universal 12"/30cm	1
3	V-block 3"x1Half "(pair) with clamps.	1
4	Drills twist (straight shank)1/8"to1/2,by 1/64"(set)	4
5	Drills twist ½"to ¾"by1/16"(mores taper)	1set
6	Drills twist (metric)2mm to 7mm by 1mm	1set
7	Drills twist (metric) 8mm to 12mm by 1mm	1set
8	Drills straight shank wire gauge sizes 1 to 60 with gauge.	1set
9	Drills straight shank letter gauge sizes A to Z With gauge.	1set
10	Hand vice 1"/25mm.	4
11	Working bench 6'X2.5'	4
12	Vices 5" jaws	16
13	Almirah steel, large with shelves.	12
14	Trainee lockers.	7

15	Punch letter set 3mm	1set
16	Punch figure set 3mm.	1set
17	Taps & dies complete set in box B.A, BSF, B.S.W, American & metric.	1set
18	File flat 12" bastard.	12
19	File flat 10" lnd cut.	12
20	File flat 10" smooth.	12
21	File three square 6" lnd cut.	6
22	File flat 6" smooth.	6
23	File half round 8" lnd cut.	6
24	Stone oil 6"X2"X1"/15cmX5cmX2.5cm.	2
25	Can oil 1/2pt.	2
26	Micrometer outside 0-1".	4
27	Micrometer inside 2"to 8".	1
28	Micrometer metric 0-25mm.	2
29	Micrometer inside 50-200mm.	1
30	Vernier calipers 12"	2
31	Combination set 12"	3
32	Scraper half round 10"-25mm-flat/halfround/ triangular	3 each.
33	Bevel protractor	2
34	Steel tape 10'	1
35	Screw pitch gauge 55 degree & 60.	1each
36	Wire gauge imperial slandered.	1
37	Dial test indicator.	2
38	Allen keys 1/16"to 1/2X1/32.	2set
39	Pipe wrench stillson pattern 18"long.	2
40	Plier- combination 8"/20cm.	16
41	Marking Table -3'X2' (3' High)	1No
42	Combination set 12"	03 No
43	Scraper half Round 10" -25 " mm	06 Nos
44	Phillips head screw driver set.	1set
45	Double ended spanner set of 7 whit worth sizes from 1/8"X3/16 to 1/2 X 9/16".	1set
46	Double ended spanner set of 7A/Fsizes from 3/8" X 7/16" to 15/16" X 1".	1set
47	Double ended spanner set of metric sizes from 8X9 to 20X22.	1set
48	Overhead projector.	1
49	Projector for slides	1
50	Double offset double ended ring spanners set of 7 with sizes from 1/8" X 3/16" to 1/2 X 9/16".	1set
51	Feeler gauge .0005" to .25"	4
52	Radius gauge 0-25mm,25-50mm	1 each
52	Pipe cutter, 3wheel type, 3"pipe.	1set
53	Pipe set complete with die stock & boushing for pipes from 1/8" to 1"dia.	1
54	Pipe vice 3"/75 mm.	2
55	Hammer smith 4lbs. with handle.	2
56	Apron	2

57	Steel rack.	2
58	Snip straight 10"/25 cm.	2
59	Setting hammer with handle	2
60	Riveters tools set consisting of rivet snaps, prick punch &pricking punch &holding up only.	1
61	Centre gauge 55degree &60 degree	1each
62	Drillings machine to drill up to ½"dia	2
63	Grinding machine (pedestial grinder)	1 no.
64	Machine vice 4"	1 no.
65	Anvil 2.5 lbs	2
66	Anvil stand.	2
67	Poker	2
68	Hardie	2
69	Tool makers buttons	1set
70	Pipe wrench stilson pattern 24"long	2
71	Spirit level 8"/20cm.	2
72	Tube firing equipment	2
73	Fire extinguisher & fire bucket with stand.	2
74	Instructor Table	1
75	Instructor chair	1
76	Black board	1

BROAD BASED TRAINING : (CHBT 3) (No. of Trainees - 16)**Trainee Tool kit**

SR.	Name of Tools	Qty Req
1	Caliper out side spring 6 "/15 cm.	16
2	Caliper inside spring 6 "/15 cm	16
3	Dividers spring 6 "/15 cm	16
4	Center punch 4"/10cm.	16
5	Prick punch 6 "/15 cm	16
6	Chisel cold flat 1"/2.5cm	16
7	Chisel cross cut 3/8" X 1/8	16
8	Chisel diamond point 3/8"10mm.	16
9	Chisel half round 3/8"/10mm	16
10	Hammer ball pain 1lb handled	16
11	Hammer ball pain ½ lb handled	16
12	Hacksaw frame adjustable with pistol grip For 8"-12"blade/20cm-30cm.	16
13	Rule steel 12"English &metric/30cm	
14	Screw driver 3"x3/8"blade	16
15	Screw driver 12"x1/2 blade	16
16	Square engineers 6"blade/15cm	16
17	Scriber	16
18	Safety goggles.	16
19	Hand gloves pair chrome leather 16"	16
20	Apron leather 36" x 24" with belt	16
21	Hand screen fibre glass with filter glass	16
22	Head screen fibre glass with flexible band and filter glass	16
23	Welding goggles with filter glass for 4A or 6A dia, 50mm x 3mm thick	16
24	Chipping hammer	16
25	Chisel cold flat 19mm	16
26	Centre punch 150mm x 8mm	16
27	Divider 20 cm. long	16
28	Steel rule 12"	16
29	Wire brush steel	16
30	Spark lighter	16
31	Safety boots	16 pairs
32	Flat tongs 16"	16
33	Hammer ball pein 2 lbs 350 mm long handle	16
34	Hexa frame adjustable 30 cms.	16
35	Flat file 14" bastard	16
36	Tip cleaner	16

Shop Outfits

SR	Name of Equipments	Req Qty
1	Surface plate 12"x12"/30cmx30cm	1
2	Scribing block universal 12"/30cm	1
3	V-block 3"x1Half "(pair) with clamps.	1
4	Drills twist (straight shank)1/8"to1/2,by 1/64"(set)	4
5	Drills twist 1/2"to 3/4"by1/16"(mores taper)	1set
6	Drills twist (metric)2mm to 7mm by 1mm	1set
7	Drills twist (metric) 8mm to 12mm by 1mm	1set
8	Drills straight shank wire gauge sizes 1 to 60 with gauge.	1set
9	Drills straight shank letter gauge sizes A to Z With gauge.	1set
10	Hand vice 1"/25mm.	4
11	Working bench 6'X2.5' with vices 5"jaws.	4
12	Almirah steel, large with shelves.	01
13	Instructor Table	01
14	Instructor Chair	01
15	Black board	01
16	Trainee lockers.	01
17	Punch letter set 3mm	1set
18	Punch figure set 3mm.	1set
19	Taps &dies complete set in box B.A, BSF, B.S.W, American &metric. (up to 1" / 25 mm)	1set
20	File flat 300 mm second cut.	12
21	File flat 150 mm smooth.	6
22	Stone oil 6"X2"X1"/15cmX5cmX2.5cm.	2
23	Micrometer inside 2"to 8". OR 50 mm to 200 mm	1
24	Micrometer metric 0-25mm.	2
25	Micrometer inside 50-200mm.	1
26	Vernier calipers 12" OR 300 mm	2
27	Screw pitch gauge 55 degree & 60.	1each
28	Wire gauge imperial slandered.	1
29	Dial test indicator. with magnetic stand	2
30	Allen keys 1/16"to 1/2X1/32.	2set
31	Pipe wrench stillson pattern 18"long.	2
32	Plier- combination 8"/20cm.	16
33	Phillips head screw driver set.	1set
34	Double ended spanner set of 7 whit worth sizes from 1/8"X3/16 to 1/2 X 9/16".	1set
35	Double ended spanner set of 7A/Fsizes from 3/8" X 7/16" to 15/16" X1".	1set
36	Double ended spanner set of metric sizes from 8X9 to 20X22.	1set
37	Double offset double ended ring spanners set of 7 whit worth sizes from 1/8" X 3/16" to 1/2 X9/16".	1set
38	Steel tape 10ft.in case.	1set
39	Feeler gauge .0005" to .25"	4

40	Pipe cutter, 3wheel type, 3"pipe.	1set
41	Pipe set complete with die stock & bousing for pipes from 1/8" to 1"dia.	1
42	Pipe vice 3"/75 mm.	2
43	Hammer smith 4 lbs. with handle.	2
44	Leather apron	2
45	Steel rack.	2
46	Snip straight 10"/25 cm.	2
47	Setting hammer with handle	2
48	Centre gauge 55degree & 60 degree	1each
49	Tool knurling	2
50	Combination drill (centering)	4
51	Set of tools for lathe	2
52	Gauge for grinding & settings screw cuttings tool	1
53	Drill chuck 0" to 1/2"morse taper	1
54	Grinder with two 7"wheels rough &smooth	2
55	Drillings machine to drill up to 1/2"dia	2
56	Lathe -30 between to centers X 6"centre height with standard accessories.	6
57	Grease pressure gun (hand)	1
58	Monkey wrench 15".	1
59	Pin spanner 1" to 3"dia	1set
60	Engineers ratchet brace with universal drilling pillar.	1
61	Tap extractors 1/8" to 1/2 by 1/16"	1set
62	Screw extractors sizes 1 to 3	1set
63	Tool makers buttons	1set
64	File half round 8"lnd cut.	6
65	Pipe wrench stilson pattern 24"long	2
66	Tool bit holder as arm strong L.H	4
67	Tool bit holder as arm strong R.H.	4
68	Tool bit holder as arm strong straight.	4

69	Spirit level 8"/20cm.	2
70	Tube flaring equipment	2
71	Fire extinguisher & fire bucket with stand.	2
72	Instructor Table	1
73	Instructor chair	1
74	Black board	1
75	Welding transformer oil cool constant current 300 amp. 90 ocv with cable clamps, lugs, electrode holder 600 amp. Copper jaw	2 sets
76	Weld gauge universal type	2
77	Spanner set double end set of 12 pieces	2 sets
78	C clamps 10 cm., 15 cm. 20 cm,	8 each.
79	Steel tape 10 meter	2 nos.
80	Magnifying glass 15 cm	2 nos.
81	Oxy acetylene gas welding plant high pressure with all accessories. Pressure regulator - oxygen and acetylene, hose pipe blue and red – 10 mtr. each., hose connection and protector, hose clips, cylinder key – 2 hp glow pipe with three nos. and 6 nos. nozzle, fire bricks -9 "x4"x4" -20 nos.	2 sets
82	Cutting torch oxy acetylene with nozzle 1/32", 1/16" size with all accessories.	2 sets

BROAD BASED TRAINING: (CHBT 4) (No. of Trainees - 16)**Shop Outfits**

SR	Name of Equipments	Req Qty.
1	Mechanical board for testing triangle and parallelogram of forces including all accessories	6
2	Instrument for determining 'G' (simple pendulum)	2
3	Searle's apparatus for young's modulus	2
4	Apparatus of measurement of co-efficient of expansion of solid & liquid	2
5	Equipment to study Kirchof's law	1
6	Resistance box Rheostat 25 ohms	2
7	Resistance box 0 -100 ohms	2
8	Resistance box 0 -500 ohms	2
9	Wheaston's bridge	2
10	Potential meter accuracy not < 0.01%	2
11	Resistance centre 0 galvanometer	4
12	Ammeters with stands : 0 - 1 Amp (DC)	2
13	Ammeters with stands : 0 - 3 Amp (DC)	2
14	Ampere meter : 0 – 10 Amp (AC / DC)	2
15	Ampere meter : 0 – 30 Amp (AC / DC)	2
16	Volt meter with stands 0 - 1 volt (DC)	2
17	Volt meter with stands 0 - 3 volt (DC)	2
18	Volt meter 0 - 5 volt (DC)	2
19	Volt meter 0 - 10 volt (DC)	2
20	Volt meter with stands 0 - 50 volt (DC)	2
21	Volt meter with stands 0 - 250 volt (AC / DC)	2
22	Volt meter 0 - 5 MV	2
23	Volt meter 0 - 500 MV	2
24	Resistance coils (2 ohm , 1 ohm & 5 ohm)	2
25	Charger for battery Accumulator	1
26	Battery eliminator	2
27	Spoons Plastics	24
28	Each inch clamps spring or screw	24
29	Bunsen burners	32
30	Tripods Stand	32
31	Asbestos wire gauge	32
32	gauge wire without asbestos	32
33	Clamp holders	48
34	Clamps for burret holding	48
35	Stands with clamps for burret	24
36	Triangles clay	48
37	Burettes 25 ml	24
38	Burettes 50 ml	12
39	Burettes 100 ml	6

40	Pipettes 10 ml	48
41	Pipettes 25 ml	48
42	H.D.P Distill water bottle	32
43	Measuring cylinder 25 ml plastic	16
44	Measuring cylinder 50 ml plastic	16
45	Measuring cylinder 100 ml plastic	16
46	Measuring cylinder 250 ml plastic	16
47	Measuring cylinder 500 ml plastic	16
48	Measuring cylinder 1000 ml plastic	16
49	Volumetric flask 100 ml	32
50	Volumetric flask 250 ml	16
51	Volumetric flask 500 ml	16
52	Volumetric flask 1000 ml	08
53	Weighing bottles polyethylene or glass 50 ml	16
54	Weighing bottles polyethylene or glass 100 ml	16
55	Funnels with regular and long stem dia 7 cms	16
56	Funnels dia 4 cms	16
57	Funnels dia 9 cms	16
58	Beaker 250 mls corning	16
59	Beaker 400 mls corning	16
60	Beaker 600 mls corning	16
61	Bottles for solutions 1000 ml	12
62	Bottles for solutions 2000 ml	12
63	Bottles for solutions 3000 ml	6
64	Bottles for solutions 5000 ml	5
65	Instructor Table	1
66	Instructor chair	1
67	White Board with Marker	1
68	Vol. flask-50	16
69	Weighing digital balance 0.1 mgm-100 gm	1
70	Weighing digital balance 1.0 mgm-100 gm	1
71	Air oven (250°C)	1
72	Refrigerator (250lit)	1
73	Weighting balance digital 1-1000 gm.	1
74	Hot plate round 10" dia	3
75	Hot plate 12" x 24"	2
76	Conical flask – 150ml cap.	32
77	Conical flask – 250 ml cap.	16
78	Iodine flask – 250 ml	16
79	China dish – 50 ml.	32
80	Watch glass – 3" dia	32
81	Glass rod – 8" ml	16
82	Tong	16
83	Spatula – 6"	16
84	Spatula – 8"	16
85	Centrifuge	1
86	CO ₂ fire extinguisher	1
87	First aid box	1

88	Distilled water still 10 lit.	1
89	Trainees' Chair with writing panel	16
90	Glass test tubes – 15 ml.	32

List of tools , Equipment & Machines

BROAD BASED TRAINING : (CHBT 5) (No. of Trainees - 16) Trainee Tool kit

SR.	Name of Tools	Qty Req
1	Hammer ball pein 1lb handled	16
2	Hammer ball pein ½ lb handled	16
3	Hacksaw frame adjustable with pistol grip For 8"-12"blade/20cm-30cm.	16
4	Rule steel 12"English &metric/30cm	16
5	Screw driver 3"x3/8"blade	16
6	Screw driver 12"x1/2 blade	16
7	Tweezer	16
8	Safety goggles.	16
9	Tube cutter	16
10	Fleairing tool kit	16
11	Magnifying glass	16
12	Pointer puller and pointer fixer	16
13	Watch meter screw driver set	16
14	Needle file set	16
15	Soldering iron 25 watts.	16
16	Soldering iron 10 watts.	16
17	Multimeter digital	16
18	Pressure regulating valve	16
19	BP indicator	16
20	Pressure indicator digital	16

Shop Outfits

SR	Name of Equipments	Req Qty
1	C type bourden tube pressure guage	1
2	Capsule guage	1
3	Bellow type pressure guage	1
4	U tube manometer	1
5	Inclined manometer	1
6	Bimetallic thermometer	1
7	Glass thermometer	1
8	Liq. filled thermometer	1
9	RTD	1
10	Thermocouples	1
11	Orifice meter	1
12	venturimeter	1
13	Rotameter	1
14	Pitote Tube	1
15	Capacitance type level indicator	1

16	Simple tank glass level indicator	1
17	Air purge level indicator	1
18	Buyoyancy type level indicator	1
19	Hydrometer	1
20	PH meter	1
21	Instructor Table	1
22	Instructor chair	1
23	Black board	1
24	Bad weight tester	1
25	Air compressor	1
26	Furnace-1200° C	1
27	D.P. indicator	1
28	Turbine type flow meter	1
29	Standard calibrator	1
30	Oil bath	1
31	PRV	1
32	Air dryer	1
33	Potential meter for testing-thermo couple	1

BROAD BASED TRAINING : (CHBT 6) (No. of Trainees - 16)**Trainee Tool kit**

SR.	Name of Tools	Qty Req
1	Hammer ball pain 1lb handled	16
2	Hammer ball pain ½ lb handled	16
3	Hacksaw frame adjustable with pistol grip For 8"-12"blade/20cm-30cm.	16
4	Rule steel 12"English &metric/30cm	16
5	Screw driver 3"x3/8"blade	16
6	Screw driver 12"x1/2 blade	16
7	Safety goggles.	16

Shop Outfits

SR	Name of Equipments	Req.Qty
1	R.P.M. indicator	1
2	Gate valve dia 4"	2
3	Globe valve dia 4".	2
4	Dia phragm valves- dia 4".	2
5	Ball valves-dia 4"	2
6	Stop cock- dia 4"	2
7	Butterfly valves - dia 4"	2
8	Needle valve- dia 4"	2
9	Reduction gear box.	1
10	C.F pump	1
11	Gear pump	1
12	Plunger pump	1
13	Reciprocating pump.	1
14	Lobe pump	1
15	Instructor Table	1
16	Instructor chair	1
17	Black board	1
18	Various type of Flow meter test rig (Venturimeter , orificemeter , rotometer, V-notch)	1
19	Packed distillation column	1
20	Multiple/ triple effect Evaporator	1
21	Plate and Frame fillter	1
22	Air Compressor/ blower for fitter press	1
23	All types of pipe fitting	2 set
24	Digital/ Dial stop watch	2 no
25	Centrifugal pump test rig	1 set
26	Gear pump test rig	1 set
27	Tool kit/ Box	1 no
28	Over head projector	1 no
29	White board/ Screen for OHP	1 no

