

SYLLABUS FOR THE TRADE OF
“LABORATORY ASSISTANT”
(CHEMICAL PLANT)

UNDER

CRAFTSMEN TRAINING SCHEME
&
APPRENTICESHIP TRAINING SCHEME

REVISED ON
2009

by

Government of India
Ministry of Labour & Employment (D.G.E.&T.)
CENTRAL STAFF TRAINING AND RESEARCH
INSTITUTE
EN- Block, Sector- V, Salt Lake,
Kolkata-700091.

**LIST OF MEMBERS OF THE TRADE COMMITTEE MEETING FOR THE
TRADE OF “LABORATORY ASSISTANT (CHEMICAL PLANT)” UNDER
CRAFTSMEN TRAINING SCHEME HELD ON 19TH NOVEMBER 2008,
AT ITI MULUND, MUMBAI, MAHARASTRA**

Director: Shri S.D.Lahiri, CSTARI., Kolkata

S/Shri

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|---|----------|
| 1. A. S. Pande, Dy. Personal Manager ,
Hindustan Antibiotic Ltd., Pune. | Chairman |
| 2. V. M. Ghildyal, Director, A. T. I. Mumbai | Member |
| 3. A. K. Mishara, Joint Director, A. T. I. Mumbai | Member |
| 4. S. S. Jarimali, Manager Training,
Hindustan Organic Chemicals Ltd. Rasayani, Maharashtra. | Member |
| 5. M. A. Kamerkar, Manager
Mazda Colours Ltd., Turbe, Navi Mumbai. | Member |
| 6. V. P. Panse, Maintenance Engineer,
Borax Morarji Ltd., Ambarnath, Thane, Mumbai. | Member |
| 7. S. K. Sabaria, Dy. Manager,
Century Rayon, Shahad, Thane, Maharashtra | Member |
| 8. J. A. Pariwal, Training Officer
Hindustan Insecticides Ltd., Rasayani, Maharashtra. . | Member |
| 9. Prakash Kasekar, Sr. Engineer,
RPG Life Sciences Ltd. Navi Mumbai. | Member |
| 10. Prasad L. Dhole,
Amines & Plasticizen Ltd., Turbe, Navi Mumbai. | Member |
| 11. Dushyant A. Joshi, Asstt. Manager,
Godrej Industries Ltd., Vikhroli, Mumbai. | Member |
| 12. A. P. Khatawer, Sr. Officer,
Godrej Industries Ltd., Vikhroli, Mumbai. | Member |
| 13. Sailesh Kumar, Manager Production,
Asian Paints, Bhandup, Mumbai. | Member |
| 14. Anil N. Kanekar, Engineer
Piramal Health Care Ltd. Thane, Mumbai. | Member |
| 15. S. S. Majumdar, Principal
V. P. Polytechnic, Thane, Mumbai | Member |
| 16. Dr. I. K. Jain, Ex. Joint Director, A. T. I. Chennai | Member |
| 17. Abhinoy Nandi, Dy. Director, CSTARI, Kolkata. | Member |
| 18. R. V. Khairnar, Asstt. Director, A. T. I. Mumbai | Member |
| 19. P. S. Wagh, Principal, ITI Mulund, Mumbai | Member |
| 20. S. M. Sadamate, Vice Principal, ITI Mulund, Mumbai | Member |
| 21. S. B. Sardar, Training Officer, CSTARI, Kolkata. | Member |
| 22. Sunil J. Wakde, Training Officer , A. T. I. Mumbai | Member |
| 23. E. S. Takalkar, Chem. Instructor, ITI Mulund, Mumbai. | Member |
| 24. P. S. Rane, Chem. Instructor, ITI Mulund, Mumbai. | Member |
| 25. G. S. Dharmath, Chem. Instructor, COE,
ITI Mulund, Mumbai. | Member |
| 26. S. E. Deshmukh, Instructor, ITI Mulund, Mumbai. | Member |
| 27. C. P. Jadhav, Instructor, ITI Mulund, Mumbai | Member |

List of Members attended the Trade committee Meeting to review the syllabi for the trades of (i) **Attendant Operator (Chemical Plant)** (ii) **Laboratory Assistant (Chemical Plant)** (iii) **Maintenance Mechanic (Chemical Plant)** & (iv) **Instrument Mechanic (Chemical Plant)** under CTS & ATS on 19th & 20th May 2009 at **Industrial Training Institute, Mulund , Mumbai, Maharashtra**

Director: Shri S.D.Lahiri, CSTARI., Kolkata

SL N O.	NAME & DESIGNATION S/Shri	REPRESENTING ORGANIZATION WITH FULL ADDRESS	REMARKS
1.	S.S.Jirimali Manager - Training	HOC Ltd., Rasayani, Dist. Raigad	Chariman
2.	S.M.Sadamate Asstt. App. Adviser (Tech.)	B.T.R.I., Mulund, C/o. J.T.F Mulund, Mumbai	Member
3	D.N. Waghmare Chief Manager	Piramal Health Care Ltd., Balkum, Thane-400068	Member
4	S.K.Gehari (Skilled Staff S.S)	GSK Pharmaceuticals, 2 nd Pokhran, Thane	Member
5	Mali P.N. Training Incharge	Pfizer Ltd., Turbhe Navi Mumbai	Member
6	Sachin B. Dhoni Executive Engg.	RPG Industries Ltd., Navi Mumbai	Member
7	S.K.Sabarai Dy. Manager	M/s. Century Rayon Shahad (Thabe), Maharastra	Member
8	B.N. Chetan Anand	Amines & Plasticizus Ltd. Thane, Maharastra	Member
9	A.N.Manchar Kar, Sci. Demonstrator	B.T.R.I. Mulund	Member
10	Takalkar E.S., Chemical Instructor	B.T.R.I. Mulund	Member
11	S.P. Pradhan, Manager Process Control	Piramal Healthcare , Thane	Member
12	V.I.Raojadeja, Executive (Instrument)	Godrej Indsutries Ltd.Mumbai	Member
13	M.A.Kamerkar Manager(Factory Admn.)	Mazda Colours Ltd., Navi Mumbai	Member
14	D.Mahaboob Basha, Vocational Instructor	Jotun India Pvt. Ltd. Pune	Member
15	Amogh Soman, Sr. Executive -HR	Jotun India Pvt. Ltd., Pune	Member
16	Mrs. Deshmukh J.J. Trade Instructor (Science)	B.T.R.I., Mulund	Member
17	Mr. P.S.Wagh	Principal, ITL, Mumbai	Member
18	L.K.Mukherjee,Dy. Director	CSTARI., Kolkata	Member
19	A. Nandi, Dy. Director	CSTARI., Kolkata	Member
20	P.K.Roy, Dy. Director (Chem)	ATI., Mumbai	Member
21	K.K.Phadnis Training Officer	Advanced Trg. Institute, Sion ,Mumbai-22	Member
22	S.J. Wakde Trg. officer	Advanced Trg. Institute, Sion ,Mumbai-22	Member

GENERAL INFORMATION

1. Name of the trade : Laboratory Assistant (Chemical Plant)
2. N.C.O. Code No. : 010.30, 034.10, 034.30, 034.50, 035.10, 083.10.
3. Entry Qualification : (a) Passed 10th class examination under 10+2 system of education with Physics, Chemistry & Mathematics or its equivalent.
(b) Passed B.Sc. with Physics and Chemistry.
4. Duration of Craftsman Training : (a) For 10th class pass: 2 years
(b) For B.Sc pass : 6 months (Induction Training)
5. Apprenticeship Training : (a) For 10th class pass: 3 years (Including 2 years Basic Training)
(b) For B.Sc. Pass : 1 ½ years (Including 6 months Induction Training)
6. Ratio of Apprentices to Workers : 1: 4
7. Rebate to Ex – ITI trainees for Apprenticeship training : (a) For 10th class pass: 2 years
(b) For B.Sc pass : 6 months
8. Space norms : 6.00 sq. mt. / trainee
9. Power Norms :

Syllabus for the trade of
LABORATORY ASSISTANT (Chemical Plant)
Under Craftsman Training Scheme
Duration : 2 years

Wk. No.	Practical	Trade Theory	Workshop Calculation & Science		
			Physics	Mathematics	Chemical Calculations
(1)	(2)	(3)	(4)	(5)	(6)
1	Induction Training. Operation of fire extinguisher. Use of personal protective equipments. Introduction to Material Safety Data Sheet (MSDS) and personal protection equipments (PPEs) used in chemical plant.	General Safety: Introduction & importance of safety &. general precautions observed in the laboratory. Fire prevention and fire control in chemical industries. Study of personal protection equipments (PPEs) used in chemical plant. First aid in chemical plant. Introduction to occupational health hazard. Environmental pollution, sources, causes, consequences and controls. Induction Training. Fire & Safety in Chemical Lab/Plant. First Aid. Introduction of pollution control.	Induction Training	Induction Training	Induction Training

2 to 5	<p>Volumetric Analysis (Acidimetric Titrations)</p> <p>Preparation of solutions of solids, liquids, volatile, non-volatile, etc. substances.</p> <p>Preparation of standard & primary standard solutions.</p> <p>Determination of factor for them.</p> <p>Simple titrations acid/ bases & bases acids.</p>	<p>General & Physical Chemistry</p> <p>Introduction to chemistry.</p> <p>Elements, atoms & molecules</p> <p>Chemical & physical changes.</p>	<p>Introduction to Physics.</p> <p>Units & dimensions, vernier caliper, spherometer, micrometer & screw gauge.</p>	<p>Solution of 1st & 2nd order equations with one or two unknowns by algebraic calculations & by graphs.</p>	<p>Density & specific gravity.</p> <p>Density of water at different temperature.</p>
6 & 7	<p>Analysis of acids & bases.</p>	<p>The air, the water, the laws of chemical combinations & atomic theory.</p>	<p>Scalar & Vector quantities – their representation, resultant, parallelogram & triangle of vectors.</p>	<p>Solution of 1st & 2nd order equation with one or two unknowns by algebraic calculations & by graphs.</p>	<p>Calibration of glass apparatus.</p> <p>Scales of specific gravity.</p>
8 & 9	<p>Analysis of acids, bases & salts</p>	<p>Mixtures & compounds.</p> <p>Gas laws..</p> <p>Kinetic theory of gases.</p>	<p>Rest & motion equation, motion in gravity, in a circle, angular velocity, acceleration, work, power & energy</p>	<p>- do -</p>	<p>Calibration of commercial production.</p>

10 to 12	Oxidation-Reduction titration. Permanganometry-titration using permanganate solution.	The structure of atom. Radioactivity. Electro-chemistry & electrolysis.	S.H.M rotational motion, moment of inertia, simple machines & requirements of a good balance.	- do -	Calibration of weights.
13 & 14	Dichrometry titrations using dichromate solution.	Chemical bonding. Oxidation – reduction. Acids – bases.	Static & kinetic friction, their measurement, elasticity, stress, strain, Hook’s law. Different modulli, work done in stretching a wire, determination of Young’s Modulus.	Factorisations.	Solution, solubility product, specific gravity of a solution.
15 to 17	Iodo and idometry titrations using iodine solution directly or indirectly.	Chemical equilibrium. Thermo-chemistry & thermodynamics. Periodic table of the elements.	Surface tension, surface energy, angle of contact, rise of liquid in a capillary tube, difference of pressure in a spherical bubble – viscosity.	Factorization.	Determination of concentration of solutions by percent, volume, normality, etc.

18	Precipitation titration.	Atomic molecular and equivalent weights. Crystallography. Solutions.	Density & specific gravity. Archimedes' principle, hydrometers, etc.	Area of different shape.	Determination of concentration of solutions by molarity, IMP by weight by grams per litre.
19	Complexometric titrations.	Colloidals osmosis catalysis.	Temperature, measurement, expansion of solids, liquids, gases, calorimeter.	- do -	Change in weight by heat & drying ignition, combustion, etc.
20 & 21	- do -	Laboratory processes, corrosion. To study different types of apparatus and equipment used in chemical laboratory, their construction, function and precaution etc.	Hygrometry	Area of different shapes.	- do -

22 & 23	Gravimetric analysis- gravimetric estimations.	Volumetric analysis and analytical chemistry (introduction part) Only concentration of solutions. safety precautions to be taken in chemical laboratory.	Heat transfer. Thermal conductivity.	- do -	The Laws of chemical combination.
24	Gravimetric estimations	Periodic study of S & P Block Elements:	Thermodynamics. Thermodynamics processes.	Volume of different bodies of different sizes.	- do -
25	Gravimetric estimations.	Contd.	Dispersion spectrophoto meter-polarisation.	Volume of different bodies of different sizes.	The Laws of chemical combination.
26 to 28	Gravimetric estimations.	Periodic study of: (a) Zero group (b) Transition Elements.	Magnetism . magnet and its properties, magnetic field, intensity etc.	- do -	The Gas Laws.
29 & 30	Inorganic qualitative analysis.	Periodic study of: (a) 4 th B group (b) 5 th B group (c) 6 th B group (d) 7 th B group (e) 8 th B group elements.	Tangent magnetometer, dip circle & applications of magnets.	Logarithms.	- do -

31 & 32	Inorganic qualitative analysis.	<u>Metallurgy</u> Metallurgy of: (a) Aluminum. (b) Copper	Static electricity- change, charging by distribution of charge, potential, capacity & condenser.	- do -	- do -
33 & 34	Inorganic qualitative analysis.	Metallurgy of: (a) Iron & Steel (b) Zinc & its alloys.	Current electricity- electricity by chemical reactions, cells, magnetic effect of current, electro magnets. Ohm's Law.	<u>Trigonometry</u> Study of sine, cosine and tangent of angles in a right angled triangle and their application in solving practical problems.	Electrolysis.
35 & 36	Inorganic qualitative analysis.	Metallurgy of: (a) Silver (b) Chromium	Kirchoff's Law, parallel and series circuit connections.	- do -	- do -
37 to 39	<u>Bench work:</u> (a) Preparation and properties of gases. (b) Laboratory processes. (c) General properties of metals, non metals and	<u>Non-Metals:</u> Preparation, properties & uses of following: (a) Hydrogen & its peroxidide. (b) Oxygen (c) Sulphur & its compounds.	Wheatstone's bridge and potentiometer.	- do -	- do -

	alloys.				
40 to 42	Inorganic & organic preparations. Chlorine, Bromine & Iodine.	Preparation, properties & uses of following: (a) Nitrogen & its compounds. (b) Phosphorus & its compounds.	Theory of electronics, bound and free electrons, electron flow, polarity, amplification, rectification and oscillation circuits.	- do -	Calculation based on chemical reactions.
43 to 45	<u>Physics:</u> (a) Law of parallelogram of forces. (b) Simple pendulum. (c) Young's modulus (d) Expansion co-efficient of solids & liquids.	Preparation, properties & uses of following: (a) Chlorine & its compounds. (b) Fluorine and its compounds.	Construction of diode, its working & construction. Operation of bridge rectifiers.	Problems of flow of fluids, heat transfer, evaporation, transmission of power, etc.	- do -
46	Thermal conductivity of metals. Optical rotation, Ohm's law, Kirchoff's law.	Preparation, properties & uses of following: (a) Ozone, (b) Fertilizers, (c) KMnO_4 & (d) Potassium dichromate.	Filter circuit capacitor, inductances. Amplification, types of amplifiers, triode.		Determination of atomic weight.
47	Electric cell in series connection & parallel	Preparation, properties & uses of following:	Semi conductors, transistors.	- do -	Determination of molecular

	connection.	Cement, soda ash, sodium carbonate. Sodium-bi-carbonate, glass, alums and hypo etc.	Construction of cathode ray tube.		weight.
48 to 50	Faraday's 1 st law & 2 nd law of electrolysis. Mechanical equivalent of heat to electrical method.	Preparation, properties & uses of following: Bleaching powder, aluminum chloride, carborandum, CaC ₂ , K ₃ Fe(CN) ₆ , K ₄ Fe ₃ (CN) ₆ , white lead, writing ink, etc.	Use of cathode ray tube, construction.	- do -	Determination of equivalent weight.
51 & 52	Revision & examination.	Revision & examination.	Revision & examination.	Revision & examination.	Revision & examination.

NOTE : Above syllabus may be exempted for B. Sc. Apprentices.

Wk. No.	Practical	Trade Theory	Workshop Calculation & Science		
			Unit Process	Laboratory Instruments	Chemical Calculations
(1)	(2)	(3)	(4)	(5)	(6)
53	General introduction.	Industrial Microbiology General. Introduction to Organic Chemistry.	Caustic soda and chloride, raw materials chemical reactions, process		

			classification, flow sheets and uses.		
54	<p>Organic Preparation: Acetylation: preparation of acetalide, theory, chemicals required reaction & procedure of the experiment, percentage yield determination.</p> <p><u>EASTERIFICATION</u> Preparation of Methyl Oxalate Aim, apparatus & chemicals required principle of reaction & procedure of experiment. Percentage purity determination by physical methods. Calculation of percentage yield.</p>	<p>Introduction to microbiology. Purification of Organic Compounds.</p>	Contd.	Balance.	Percentage of elements in chemical compounds.
55.	<p><u>Sulphonation:</u> Laboratory preparation of sodium benzene sulphonate. Aim, apparatus & chemicals required principle of reaction & procedure of experiment. Calculation of percentage yield.</p>	<p>Bacteria cell. Purification of Organic Compounds.</p>	Manufacturing of Hydrochloric acid, Nitric acid & Phosphoric acid.	Balance.	Percentage of elements in chemical compounds.

56.	<p><u>Nitration:</u> Laboratory preparation of nitrobenzene. Aim, apparatus & chemicals required, principle of reaction & procedure of experiment. Calculation of percentage yield.</p> <p><u>Oxidation:</u> Laboratory preparation of oxalic acid. Aim, apparatus & chemicals required, principle of reaction & procedure of experiment. Calculation of percentage yield.</p>	<p>Nutrition of bacteria. Purification of Organic Compounds.</p>	Contd.	Microscope.	- do -
57.	<p><u>Reduction:</u> Laboratory preparation of aniline. Aim, apparatus & chemicals required, principle of reaction & procedure of experiment. Calculation of percentage yield.</p> <p><u>Halogenation:</u> Preparation of tribromophenol. Aim, apparatus & chemicals required, theory of experiment. Determination of percentage yield.</p>	<p>Nutrition of bacteria. Estimation of Elements in Organic Compounds.</p>	Sulphuric acid, raw materials chemical reactions, process classification & description, flow sheets and uses.	- do -	Empirical formulae of chemical compounds.

58.	<u>Diazotization:</u> Preparation of methyl orange. Aim, apparatus & chemicals required, theory of reaction. Determination of percentage yield. Determination of moisture content in Organic Compounds	Rate of multiplication. Estimation of Elements in Organic Compounds.		- do -	Moisture balance	- do -
59	<u>Hydrolysis:</u> Preparation of * hydrolysis. Aim, apparatus & chemicals required theory of reaction. and % of purity determination of yield.	Sterilization – Types, methods & Process of sterilization. Details study.	Estimation of Elements in Organic Compounds. Isomerism & its types.	- do -	- do -	- do -
60	<u>Ozazone:</u> Preparation of gluecosazone. Aim, apparatus & chemicals required theory of the experiment and % yield determination. <u>Saponification:</u> Preparation of soap. Aim, apparatus & chemicals required theory of the experiment.	Contd.	Types of organic reactions.	Soap and Glycerol	pycnometer	- do -

61	<u>Preparation of aspirin:</u> Aim, apparatus & chemicals required theory of the experiment and % yield determination. Preparation of florescence, aim, apparatus & chemicals & procedure.	Identification of different micro-organism.	Classification & nomenclature.	- do -	- do -	- do -
62 to 64	<u>Preparation of camphor & phenolphthaleen.</u> Aim, apparatus & chemicals required theory & reaction. Of the experiment. Determination of flash point Extraction of case in and lactose from milk.	Bacterial enzymes	Aliphatic hydrocarbons	Calcium Carbide	Flash point apparatus. Bomb calorimeter.	Empirical formulae of chemical compounds, balancing chemical equation
65	<u>Inorganic preparation:</u> Preparation of sodium carbonate. Aim, apparatus & chemicals required theory of reaction. and % of purity. Practical based on bomb calorimeter.	Chemotherapy Antibiotics	Halogen derivatives of hydrocarbons -aliphatic alcohol	Pulp definitions, types of pulp & their manufacture in brief.	Bomb calorimeter	balancing of chemical equation
66	<u>Preparation of alum:</u> Ferric or potash alum, Aim, apparatus, chemicals & procedure of the experiment,	Immunology	Ethers	Pulp manufacture by Kraft process with flow sheets	Melting, boiling point apparatus.	Law of multiple proportions.

	percentage purity determination. Determination of percent of constituents. Determination of melting point of organic compounds.			and other details.		
67	Preparation of Mohr's salt. Aim, apparatus, chemicals & procedure of the experiment, percentage purity determination. Determination of boiling point of organic liquid.	Micro-organisms & infections. <u>INDUSTRIAL</u>	Aldehydes	Recovery of chemicals from black liquor with flow sheet and other details	- do -	- do -
68	Preparation of copper sulphate. Aim, apparatus & chemicals required. Reaction & percentage purity determination. Determination of Viscosity.	Introduction to industrial microbiology	- do -	Manufacturing of Rayon.	Viscometer	- do -
69	Preparation of potassium nitrate. Aim, apparatus & chemicals required. Reaction & percentage purity determination. Determination of surface tension by stalagmeter.	Penicillin	Ketones	Manufacturing process of plastics.	Surface tension apparatus	Law of masses
70	<u>ESTIMATIONS-ORE AND ALLOY ANALYSIS:</u> Analysis of bauxite or zinc ore. Aim,	-do-	Carboxylic acid.	Paper definitions, types of paper & its	-do-	-do-

	chemical required, reaction, method of estimations of elements.			manufacture with details.		
71	Analysis of brass or analysis of soldering materials. Aim, chemicals & reagent required, reaction, method of estimations of elements. Potentiometric Titrations.	Streptomycin	Amides & Anhydride, Acid Halides.	-do-	potentiometer	-do-
72	Potentiometric Titrations. <u>INORGANIC ESTIMATIONS:</u> estimation of calcium in given tablet. Aim, chemicals & reagent required, reaction, method of operations.	yeast	Esters	Petroleum-its origin types of crude.	-do-	Dissociation and ionization.
73	Analysis of gas by Orsat's Apparatus.theory of gas analysis. Method of operation. Conductometric Titrations.	Bread	Oil & Fats.	General description of products obtained on fractionation of crude & their uses.	Conduct meter	-do-
74 & 75	<u>OIL ANALYSIS:</u> Determination of acid value of an oil & or fat. Procedures, chemicals	Alcohol	Soaps & Detergents.	Fractionation of crude.	- do -	- do -

	required. Definition of acid value & reaction. Determination of saponification value of an oil or fat. Aim, apparatus & chemicals required. Definition, procedure & reaction. Determination of % of elements by electrolytic analyzer				Electrolytic analyzer.	PH & buffer solution.
76 & 77	Estimation of sugar by Lane's & Eynon's method. Estimation of glucose by iodometry. Aim, apparatus & chemicals, reaction, procedure & theory of the experiment. Determination of pH by pH meter.	Beers	Amines	- do - Unit process involve in petroleum refining	- do - pH meter & Lovibond comparator	- do - PH & buffer solution.
78	Determination of fat by Soxhlet's Extraction method. Aim, apparatus & chemicals required, reaction, procedure & theory of the experiment.	Wines	Cyanogan compounds	- do -	- do -	Solubility product
79	Estimation of nitrogen by Khejdhal's method. Aim, apparatus, procedure & theory of the experiment	Spirit wines.	Compounds with nitrogen urea	-do -	Polarograph	-do -

80	<p>Estimation of formaldehyde by Iodometric method. Aim, apparatus, chemical required, procedure & principle of the experiment.</p> <p>Calorimetric estimation</p>	Whisky & champagne	Carbohydrates	Properties of petroleum products – their definition & application.	Calorimeter	- do -
81	<p>Estimation of aniline or phenol in the given solution by Bromination method. Aim, apparatus, chemical required, procedure & principle of the experiment.</p>	Vitamin B ₂ (Riboflavin), acetone.	Carbohydrates & Protein	- do -	- do -	Analysis, volumetric analysis.
82 to 89	<p>Analysis of organic compounds to determine :</p> <p>a) elements present b) functional group c) melting point d) preparation of derivative e) M.P. of derivative</p> <p>for following group of compounds alcohols, acids, carbohydrates, nitro compounds, amines, halogen compounds, sulphur compounds, phenolic</p>	Cheese, yoghurt, vinegar, saurkraut,	Polymers, Aromatic, Azzomatic, Hydrocarbons, halogen derivatives, nitrogen compound, aromatic ethers.	Cement, definition, type, properties, setting, manufacture of Portland cement with flow sheet & other details.	<p>Spectrometer</p> <p>Photocalorimeter</p> <p>Flame photometer</p> <p>Refractometer</p> <p>Cane-sugars</p>	<p>Acidimetry, Redox method, precipitation method, gravimetric analysis.</p> <p>Indirect method of analysis.</p> <p>Calculation of results of analysis on dry materials.</p>

	compounds, hydrocarbons, aldehydes, ketones & esters, etc. Instrumental analysis					<u>THERMO CHEMISTRY</u> Heat of dissolving, heat of chemical reactions.
90.	INDUSTRIAL VISIT					
91	<u>MICROBIOLOGY</u> Study & use of microscope. Study of common laboratory equipments used in microbiology. Determination optical rotation of sugar solution.	Lactic acid	Aldehydes & ketones.	Glass – its manufacture with flow sheets & other details.	Polarimeter	i) Hess's law ii) heat of formation
92	Preparation of media technique of inoculations.	Pickles	Aromatic acids	- do -	- do -	i) theoretical calorimetric method. ii) utilized calorimetric value.
93	Study of staining techniques, gram staining.	contd.	contd.	- do -	Electrophoresis	i) practical calorimetric method.

						ii) combustion of fuel iii) Turometric effect.
94	Determination of size of micro organism, determination of thermal death time.	Molds	Aromatic sulphuric acids	- do -	- do -	<u>Electro chemistry</u> Heat effect of electricity.
95	Total plate count on given sample.	Vitamin B ₁₂	Compounds of double & triple rings	- do -	Carbon sulphur determination apparatus.	Analysis of chemical compound by electrical energy.
96 to 101	Principle, handling & procedure for following laboratory equipment: a) balance b) microscope c) electrolytic analyzer C, H, N & Selementral analysis d) spectrophotometer	Citric acid, Gluconic acid. Fats Tea, coffee, coca.	Heterocyclic compounds Diazomium salts, colour and dyes.	Paints & furnished their manufacture & uses.	Carbon sulphur determination apparatus. Orsat apparatus, gas, liquid chromatography	-do – Radio chemistry, Decay of radio isotopes.

	<p>e) photo calorimeter f) flame photometer g) refractometer (oil sugar) h) BOD i) COD j) Karlfisher Apparatus. k) carbon – sulphur determination apparatus l) Orarat’s apparatus m) T.L.C., Paper Chromatography n) gas-liquid chromatography o) HPLC p) Specific job analyzer</p>					Equation of decay half time value.
102 to 104	REVISION & EXAMINATION					

SOCIAL STUDIES: The syllabus has already been approved and is same for all the trades.

LIST OF TOOLS EQUIPMENT & MATERIALS
FOR PHYSICS LABORATORY

Sl. No.	Name	Quantity
(1)	(2)	(3)
1.	Physical balance sensitivity 1/10 mg. capacity 200 gms. (with weight box)	3 sets
2.	Chemical balance sensitivity 5 gms. Capacity 500 gms (with weight box)	3 sets
3.	Viscometer: (a) Oswald Viscometer (b) Redwood Viscometer (c) Stop watch (d) Thermostatic bath	3 pieces 3 pieces 6 pieces 2 pieces
4.	Stalagnometer	6 pieces
5.	Traveling microscope (i. 3 months, ii. With 6 months)	2 nos.
6.	Specific gravity bottle, 25 cc, 55 cc, 100 cc.	6 nos.
7.	Pyknometer	6 nos.
8.	Mechanical board for testing triangle and parallelogram of forces including all accessories.	6 sets
9.	Sprit level.	3 sets
10.	Inclined plane with frictionless pulley pan weight, etc.	2 sets
11.	Simple machines (wheel and axle) screw jack inclined plane with roller or trolley, pulleys or pulley blocks for first, second and third systems.	1 set
12.	Different types of levers.	1 set
13.	Instrument for determining 'g' (simple pendulum).	2 sets
14.	Barometer	1 no
15.	Altometer	1 no
16.	Searle's apparatus for Young's Modulus.	2 sets
17.	Nicolson's hydrometer with glass jar.	2 sets
18.	Wet and dry bulb thermometer.	2 sets
19.	Apparatus for measurements specific heat of solid and liquid (Regnault's apparatus).	2 sets
20.	Apparatus for measurements of co-efficient of expansion (thermal) of solid and liquid.	2 sets
21.	Apparatus for measurement of thermal conductivity of good and bad conductors.	2 sets
22.	Calorimeter for determining mechanical equivalent of heat and specific heat.	4 sets

23.	Thermometers: (a) 0 to 110 degree C (b) 0 to 250 C (c) 0 to 360 C	2 dozen 1 dozen 1 dozen
24.	Polarimeter with monochromatic light.	2 sets
25.	Abbe refractometer.	2 sets
26.	Pulfrich refractometer.	2 sets
27.	Equipment to study Kirchoff's Law and electro chemical equivalent.	1 set
28.	Potentiometer, accuracy not less 0.01%	2 sets
29.	Wheatstone bridge	2 sets
30.	Resistances centre zero Galvanometer.	4 nos.
31.	<u>Resistance Box:</u> (a) Rheostat 25 Ohms (b) Rheostat 100 Ohms (c) Rheostat 500 Ohms	2 nos. 2 nos. 2 nos.
32.	<u>Ammeters with stands:</u> (a) 0 to 1 Amp (DC) (b) 0 to 3 Amp (DC) (c) 0 to 10 Amp (AC, DC) (d) 0 to 30 Amp (AC, DC)	2 sets 2 sets 2 sets 2 sets
33.	<u>Voltmeter with stands:</u> (a) 0 to 1 Volt (DC) (b) 0 to 5 Volt (DC) (c) 0 to 10 Volt (DC) (d) 0 to 30 Volt (DC) (e) 0 to 50 Volt (DC) (f) 0 to 250 Volt (AC/DC)	2 sets 2 sets 2 sets 2 sets 2 sets 2 sets
34.	<u>Millivoltmeter :</u> (a) 0 to 5 mV (b) 0 to 500 mV	2 sets 2 sets
35.	Resistance coils (2 Ohms, 5 Ohms, 10 Ohms)	2 sets
36.	Charger for battery accumulator.	1 set
37.	12 volt hand operated Dynamo, Lachlanche cell, Daniel cell, Weston cell, acidic cell, lead accumulator, alkali cell with variable resistance.	2 sets
38.	Multimeter (analogue & digital)	1 each
39.	Battery eliminator	2 nos.
40.	DC Power supply	4 nos.
41.	Hot plate, 1000 watt, 230 V	2 nos.

Note:-

1. All electrical equipment should be provided with extra 20 meter wire switches, terminals for connection.
2. All electrical equipment in connection with heat must be provided with necessary thermometer.

**LIST OF STANDARD TOOLS AND EQUIPMENT
FOR LABORATORY ASSISTANT**

Sl. No.	Name	Quantity
(1)	(2)	(3)
1.	Analytical balances of different makes (with rider, optical reading, one pan analytical balance)	2 nos.
2.	Digital balance	5 nos.
3.	Balance (tech.) to 1 kg.	1 no.
4.	Hand centrifuge for determination of fat in milk (Gerber)	2 nos.
5.	Auto-clave electrically heated	1 no.
6.	Centrifuges electrical	2 nos.
7.	Vacuum pump (central, for 20 places)	1 no.
8.	Vacuum pump mounted on moving tables	2 nos.
9.	Electric drying ovens (200°C)	2 nos.
10.	Furnaces (Muffle ovens)(1100°C)	1 no.
11.	Water baths(6 places)(electrically heated)	4 nos.
12.	Sand bath (to be fabricated)	1 no.
13.	Microscope x 1000 (Monocular)	3 nos.
14.	Microscope metallurgical	1 no.
15.	Polariometers	2 nos.
16.	Refractometers (Abbe type with refractive index)	2 nos.
17.	pH meters	2 nos.
18.	Potentiometer titration apparatus	2 nos.
19.	Conductometer	1 no.
20.	Viscometer (Redwood, Brookefield)	01 each
21.	Kjeld-ahl apparatus for digestion & distillation	4 nos.
22.	Orsat's Apparatus	4 nos.
23.	Apparatus for surface tension	1 no.
24.	Refrigerator (4,5 cu. Ft.)	1 no.
25.	Chromatographic equipment (paper, column, thin layer)(if available indigenously)	1 each
26.	Stirrers with motors, 230V, AC, capacity 5 – 7 liters	8 nos.
27.	Magnetic stirrers (with heating plate) 2 litres capacity	2 nos.
28.	Mortar , 100mm, porcelain with pestle	6 nos.

29.	Heating plates (electric) 1000 watt	1 no.
30.	Mortar 150 mm. steel / cast iron	1 no.
31.	Desiccators 150 mm. dia.	20 nos.
32.	Desiccators vacuum	2 nos.
33.	Spoons plastic	24 nos.
34.	Electric heating plates (for Soxleth)	2 nos.
35.	Heating mantles (universal)	6 nos.
36.	Borer for stoppers with sharpener	1 no.
37.	Clamps with spring or screw	24 nos.
38.	Cork press	1 no.
39.	Scissors	2 nos.
40.	Melting point apparatus	1 no.
41.	Fisher apparatus for moisture determination, if available indigenously	1 no.
42.	Apparatus for determination of flash point	1 no.
43.	Bunsen's burners	30 nos.
44.	Set sieves 20 – 200	1 no.
45.	Shaking machines for sieves & bottles	1 no.
46.	Steam generator (copper) for steam distillation	10 nos.
47.	Hot water funnel	10 nos.
48.	Extraction thimbles	60 nos.
49.	Special burner for glass blowing	4 nos.
50.	Set glass blower tools	10 nos.
51.	Glass blower lamps for gas & oxygen	10 nos.
52.	Glass tubes & rods of different diameter	100 kg.
53.	Rubber tubes for water, gas & vacuum, stopper, rubber each glass, plastic & cork of different sizes	20 m
54.	Tongs (forceps) nickel for crucibles & weights	24 nos.
55.	Tongs long for crucibles (muffle furnace)	6 nos.
56.	Spatulas nickel	20 nos.
57.	Test tube support for 10 – 12 test tubes	24 nos.
58.	Tripods	40 nos.
59.	Asbestos wire gauge	30 nos.
60.	Wire gauge (without asbestos)	30 nos.
61.	Cork rings	24 nos.
62.	Test tube holders	24 nos.
63.	Clamp holders	48 nos.
64.	Clamps	48 nos.
65.	Rings with clamps for filtering & heating	48 nos.
66.	Stands	48 nos.
67.	Stands with clamps for burettes	24 nos.
68.	Triangles clay	48 nos.

69.	Goggles	26 nos.
70.	Apparatus for distilling for dematerializing water	1 no.
71.	Crucible nickel 30 mm. dia, height 40 mm., rabless brushes, liquid soap, acid cleaning mixture for glassware, glass wool, etc.	6 nos.
72.	Erlenmeyer flasks 250 ml.	48 nos.
73.	Erlenmeyer flasks 500 ml.	24 nos.
74.	Burettes 25 ml.	24 nos.
75.	Burettes 50 ml.	12 nos.
76.	Burettes 100 ml.	6 nos.
77.	Burettes Micro 2 ml.	15 nos.
78.	Burettes Micro 5 ml.	15 nos.
79.	Burettes automatic 25 ml.	10 nos.
80.	Pipettes 10 ml.	48 nos.
81.	Pipettes 25 ml.	48 nos.
82.	Pipettes measuring 0 to 5 ml.	6 nos.
83.	Pipettes measuring 0 to 10 ml.	10 nos.
84.	Pipettes measuring 0 to 1 ml.	6 nos.
85.	Pipettes micro 0 to 0.2 ml.	6 nos.
86.	Pipettes 1ml. (graduated)	12 nos.
87.	Each pipettes automatic 1, 2, 5, 10 ml.	3 nos.
88.	Flasks for distilled water 500 ml.	30 nos.
89.	Vacuum pipettes	4 nos.
90.	Measuring cylinders 25 ml.	10 nos.
91.	Measuring cylinders 50 ml.	24 nos.
92.	Measuring cylinders 100 ml.	24 nos.
93.	Measuring cylinders 250 ml.	24 nos.
94.	Measuring cylinders 500 ml.	12 nos.
95.	Measuring cylinders 1000 ml.	16 nos.
96.	Volumetric flask 100 ml.	24 nos.
97.	Volumetric flask 250 ml.	24 nos.
98.	Volumetric flask 500 ml.	24 nos.
99.	Volumetric flask 1000 ml.	12 nos.
100.	Weighing bottles polyethylene or glass 50 ml.	24 nos.
101.	Weighing bottles polyethylene or glass 100 ml.	12 nos.
102.	Funnels with regular & long stem 7 cm. dia.	24 nos.
103.	Funnels 4 cm. dia.	24 nos.
104.	Funnels 9 cm. dia.	24 nos.
105.	Funnels Buchner different sizes 10 to 25 cm. dia.	6 nos.
106.	Funnels Hirsch	6 nos.
107.	Funnels separatory 50 ml.	12 nos.
108.	Funnels separatory 100 ml.	12 nos.

109	Funnels separatory 250 ml.	12 nos.	
110	Funnels separatory 500 ml.	6 nos.	
111	Funnels for filter crucibles & Gooch crucibles with rubber rings	24 nos.	
112	Beakers 100 ml.	Corning	48 nos.
113	Beakers 250 ml.		48 nos.
114	Beakers 400 ml.		48 nos.
115	Beakers 600 ml.		24 nos.
116	Beakers 1000 ml.		12 nos.
117	Beakers 2000 ml.		3 nos.
118	Watch glasses 5 cm.dia.	24 nos.	
119	Watch glasses 7.5 cm.dia.	48 nos.	
120	Watch glasses 10 cm.dia.	48 nos.	
121	Watch glasses 15 cm.dia.	24 nos.	
122	Dishes evaporating 5 cm. dia. porcelain, glass	12 nos.	
123	Dishes evaporating 7.5 cm. dia.	24 nos.	
124	Dishes evaporating 10 cm. dia. flat bottom	24 nos.	
125	Dishes evaporating 15 cm. dia.	12 nos.	
126	Dishes evaporating 20 cm. dia.	6 nos.	
127	Thermometers 0 to 110°C	24 nos.	
128	Thermometers 0 to 250°C	12 nos.	
129	Thermometers 0 to 350°C	12 nos.	
130	Thermometers for drying oven	3 nos.	
131	Boiling flasks with round bottom 100ml.	24 nos.	
132	Boiling flasks with round bottom 250ml.	24 nos.	
133	Boiling flasks with round bottom 500ml. for each distilling flasks 50 ml., 100 ml., 250 ml.	12 nos.	
134	Boiling flasks with round bottom 500ml. for each distilling flasks 50 ml, 100 ml, 250 ml – Writz and others	24 nos.	
135	Filtering flasks 250 ml.	24 nos.	
136	Filtering flasks 500 ml.	24 nos.	
137	Filtering flasks 1000 ml.	24 nos.	
138	Flasks soxleth with condensers	12 nos.	
139	Flasks khejeldahal 250 ml.	48 nos.	
140	Vacuum 250 ml.	12 nos.	
141	Vacuum 500 ml.	12 nos.	
142	Vacuum 1000 ml.	6 nos.	
143	Condensers liebig 30 mm. long	24 nos.	
144	Condensers liebig 50 cm. long	12 nos.	
145	Condenser bulb type 30 cm. long	6 nos.	
146	Condenser spiral type 20 cm. long	6 nos.	
147	Connecting tubes for khejeldahal distillation	24 nos.	

148	Ventiles for volumetric analysis (KCI 03, etc.)	24 nos.
149	CO ₂ determination apparatus (Schrotter)	6 nos.
150	Gas generator (Kipp) 500 ml.	5 nos.
151	Gas washing bottles (Dreshsler)	24 nos.
152	Drying tubes with one bulb	12 nos.
153	Crucibles porcelain 5 cm, dia, height 4 cm indigenous	60 nos.
154	Crucibles quarts 5 cm, dia, height 4 cm indigenous	24 nos.
155	Gooch porcelain or glass	48 nos.
156	Filtering 0, 1, 2, 3 glass	6 nos.
157	Test tube (160 mm x 15 mm.)	500 nos.
158	Test tube (10 mm.)	400 nos.
159	Water pumps for vacuum	6 nos.
160	Gas sampling tubes	12 nos.
161	Paiers nessler tubes	24 nos.
162	Tubes for centrifuge	500 nos.
163	Tubes for Gerber centrifuge	44 nos.
164	Bottles with droppers for indicator solutions & semi-micro qualitative analysis 30 ml.	72 nos.
165	Bottles with droppers for indicator solutions & semi-micro qualitative analysis 50 ml.	72 nos.
166	Bottles for solids 50 ml.	72 nos.
167	Bottles for solids 100 ml.	36 nos.
168	Bottles for solutions 100 ml.	100 nos.
169	Bottles for solutions 250 ml.	36 nos.
170	Bottles for solutions 1000 ml.	12 nos.
171	Bottles for solutions 2000 ml.	12 nos.
172	Bottles for solutions 3000 ml.	6 nos.
173	Bottles for solutions 5000 ml.	3 nos.
174	Two pans analytical balance with rider	5 nos.
175	One pan analytical balances (Metler type) – if available indigenously 0.1 mg. sensibility	5 nos.
176	HPLC	1 no.
177	BOD apparatus	1 no.
178	COD apparatus	1 no.
179	Karl-Fischer apparatus	1 no.
180	Bomb - calorimeter	1 no.
181	LCD Multimedia projector	1 no.
182	Computer/Laptop (latest configuration) with licentiate operating software.	1 no.
183	Printer (Printer, Scanner & Copier)	1 no.

Note: Laboratory working table should be equipped with water & gas connection.

Syllabus for the trade of
LABORATORY ASSISTANT (Chemical Plant)
Period of training : 3 years

The period of training for this trade is 3 years consisting of Basic Training for a period of 2 years and Shop Floor training for the remaining period for the apprentices with 10th class pass qualification, whereas the period of training is 1 ½ years consisting of Induction Training for a period of 6 months and Shop floor Training for the remaining period for the B.Sc. apprentices.

The syllabus of this trade should be considered as a guide for imparting apprenticeship training according to the facilities available in the industry.

List of Operations / Skills to be learnt during Practical Training including Basic Training.

NOTE :

1. During the Basic Training for 10th class pass and Induction Training for B.Sc. degree holders, operations/skills to be taught to the apprentices are indicated under the heading 'Basic Training'. The remaining operations/skills coming in the list should be learnt by the apprentices during the Shop-floor training as indicated under the heading 'Shop-floor'. The apprentices should have more practice on those operations/skills, which are learnt during the Basic Training and additional operations / skills during the Shop floor Training and develop the correct method of doing the work.
2. (a) The contents of the 2 years Basic Training in this trade for the candidates with S.S.C is exactly the same as in CTS syllabus
(b) The contents of the 6 months Induction Training are as in CTS syllabus skills/ and topics marked (X) may be exempted for B.Sc. apprentices.
(c) The contents of the 1 year Shop-floor Training for the ex- ITI trainees in the trade are as Indicated under the heading 'Shop Training.'
(d) The contents of the 1 years shop floor training for B.Sc. apprenticeship who have undergone Induction Training ~ are as indicated under the heading 'Shop Training.'

BASIC TRAINING - 2 YEARS:

(6 months Induction training of B.Sc. apprentices).

1. Introduction.
2. Safety precautions as applicable to the trade.

- 3.* Volumetric analysis.
 - 3.1 Acidimetric Titrations.
 - 3.2 Oxidation Reduction Titrations.
 - 3.3 Iodo and Iodometric Titrations using Iodine solutions directly or indirectly.
 - 3.4 Complexometric Titrations.
- 4.* Gravimetric analysis.
- 5.* Inorganic qualitative analysis.
- 6.* Preparation and study of properties of Gases, Organic and inorganic compounds.
- 7.*
 - 7.1 Law of parallelogram of forces.
 - 7.2 Simple pendulum
 - 7.3 Young's modulus
 - 7.4 Expansion co-efficient of solids and liquids.
- 8.*
 - 8.1 Thermal conductivity of metals
 - 8.2 Optical rotation
 - 8.3 Kirchoff's Law.
- 9.*
 - 9.1 Electric cell in series connection
 - 9.2 Electric cell in parallel connection.
 - 9.3 Specific resistance (by WHEATSONE BRIDGE)
 - 9.4 Faraday's first law of electrolysis.
- 10.*
 - 10.1 Faraday's second law of electrolysis
 - 10.2 Mechanical equivalent of heat (by Electrical method).
 - 10.3 To study diode characteristics.
 - 10.4 To study triode characteristics.
- 11.* Revision
- 12.* Examination
- 13. Study of various unit processes in Organic Synthesis and preparation.
- 14. Study of various unit processes in Inorganic Synthesis and preparation.

15. Estimation of :
 - (a) Ore and alloys
 - (b) Sugar and Glucose
 - (c) Oils and Fat
 - (d) Analysis of elements and functional group in an organic compound including study of physical properties.
16. Microbiology: Study and use of Microscope and other laboratory equipments.
17. Preparation of media and techniques of inoculation.
18. Study of staining techniques.
19. Determination of size of micro-organism and of thermal death time.
20. Total plate count on given sample. Preparation of alcohol or other compounds by fermentation.
21. Principle, handling procedure of the various laboratory equipments.
22. Revision and examination.

SHOP TRAINING : 1 YEAR :

(List of analysis in Petro chemicals, heavy chemicals, fine chemicals, paper pulp, cement, fertilizers and allied industries)

1. ORIENTATION:
 - 1.1 Plant - its raw materials, products, capacity of production etc.
 - 1.2 Different sections of the plant including process, utilities and maintenance etc. and their activities.
 - 1.3 Study of the process with the help of a simple flow sheet under the guidance of the plant in-charge/supervisor. A round of the plant.
 - 1.4 Writing brief report (diary) of day to day work.
 - 1.5 Familiarisation with utilities and service lines such as steam, water, compressed air, etc.

2. SAFETY:

- 2.1 Cause and prevention of accidents.
- 2.2 Personal safety and use of personal protective equipments.
- 2.3 House keeping.
- 2.4 Fire prevention and fire fighting.
- 2.5 Handling of hazardous chemicals.

The following analysis be carried for raw materials, intermediate products and finished products etc. according to facilities available in the industry.

3. QUALITATIVE DETERMINATION (INORGANIC)

- 3.1 Determination of the important positive and negative radicals qualitatively.

4. VOLUMETRIC ANALYSIS:

- 4.1* Determination of normality and strength of acids and bases.
- 4.2* Preparation of standard solutions.
- 4.3 * Acidimetry and alkalimetry titrations.
- 4.4 * Oxidation and reduction titrations.
- 4.5 * Precipitation titrations.
- 4.6 * Complexometric titrations.

5. GRAVIMETRIC ANALYSIS:

- 5.1 Estimation of aluminium, iron, barium, nickel, zinc etc. in a compound

6. QUALITATIVE DETERMINATION (ORGANIC)

- 6.1* Determination of (a) Carbon,(b) Hydrogen, (c) Nitrogen, (d) Sulphur (e) Halogens and (f) Oxygen.
- 6.2 Determination of functional groups.

7. ORGANIC ESTIMATIONS

- 7.1 * Estimation of sugar, acids, nitro-groups and amine groups.
- 7.2 Fractional, azeotropic, molecular, .and vacuum distillation of liquid mixture.

8. INORGANIC AND ORGANIC PREPARATIONS:

8.1* Purification of solids (a) Sodium chloride, (b) Copper sulphate by crystallisation.

8.2* Purification of (a) Sea water (b) Crude nitro-benzene by distillation.

9. INSTRUMENTAL ANALYSIS:

Handling and analysis with the help of the following instruments:

9.1 Refractometer.

9.2 Palorometer.

9.3 Paper and partition chromatograph.

9.4 Orsat apparatus.

9.5 Spectrophotometer.

9.6 Polarograph.

9.7 Gas chromatograph.

9.8 Flame Polometer

9.9 Electropheresis.

9.10 Flash point apparatus.

9.11 Melting and boiling point apparatus.

9.12 One pan balance.

9.13 Bomb calorimeter.

9.14 Karl Fischer tritator

9.15 HPLC

9.16 Water analyser

9.17 Viscometer

NOTE:-

Contents marked with (*) may be exempted for B.Sc. Apprentice trainees.

SYLLABUS FOR RELATED INSTRUCTIONS

The apprentices with 10th class pass qualification who after having undergone the course of institutional training have passed Trade Test conducted by the National Council for Vocational Trades or trade apprentices with 10th class pass qualification who have undergone "Basic Training" in an industry, would 'continue to receive related instructions during the apprenticeship "Shop Training" in the form of revision of the syllabus as per the syllabus of this trade under CTS & information regarding product and processes concerning the industry in which apprentices undergone apprenticeship training besides lecturers/film shows on pollution control and effluent treatment and practical demonstration on fire fighting and first aid.

The content of the Related Instruction for 10th class pass apprentices during the 2 years Basic Training should be the same as the content of 2 years course for ITI trainees in the trade syllabus of ITI under CTS.

In the case of trade apprentices with B.Sc. degree who are engaged for apprenticeship training, related instructions should be given on such reduced or modified scale as deemed necessary during the 'Induction/Shop Training' period and the content of the syllabus should be the same as the content of 2 years course for ITI trainees in the trade.

The syllabus for related instructions should be considered as a guide. The subjects to be taught to the apprentices in Related Instructions :

1. Trade Theory.
2. Workshop Calculation and Science.
(a) Physics (*) (b) Maths. (c) Chemistry (*)
(d) Unit process and (e) Laboratory instruments.
3. Social studies and
4. Industrial entrepreneurship.

NOTE: Contents marked with (*) may be exempted for B.Sc. Apprentice trainees.