



GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

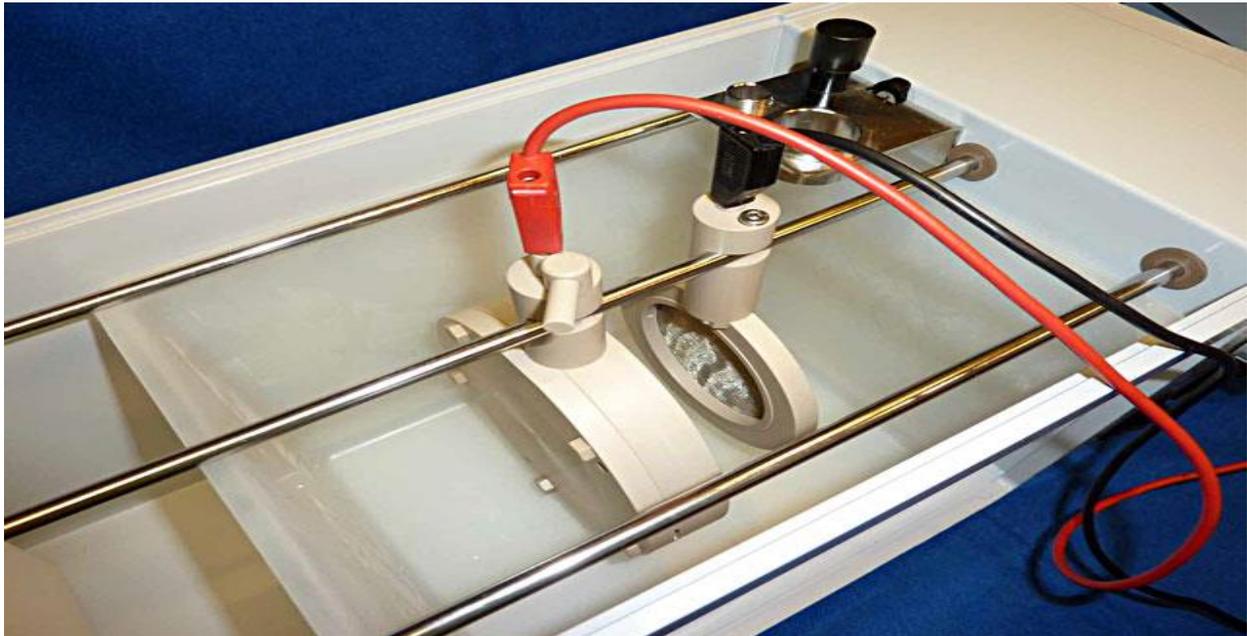
COMPETENCY BASED CURRICULUM

ELECTROPLATER

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5



SECTOR – CHEMICALS AND PETROCHEMICALS



Directorate General of Training

ELECTROPLATER

(Engineering Trade)

(Revised in 2019)

Version: 1.2

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training

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1. COURSE INFORMATION

During the two-year duration of Electroplater trade a candidate is trained on professional skill, professional knowledge, Engineering Drawing, Workshop Calculation & Science and Employability skill related to job role. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered under Professional skill subject are as below: -

FIRST YEAR: In this year, the trainee learns about safety and environment, use of fire extinguishers and various safety measures involved in the industry. He gets the idea of trade tools & machineries, practices on filing, hacksawing, planning, drilling, marking, cutting and chipping etc. Identifies different types of conductors, cables, prepare wire joints and learns crimping and soldering. Knowledge of basic electrical laws like Kirchhoff's law, ohm's law, laws of resistances and their applications. The trainee learns installation, testing and maintenance of batteries and wiring of panels. The trainee gets the idea of basic process of electroplating.

The trainee learns to handle different solutions, treatment of hazardous chemicals, safety precautions in electroplating shop, first aid and antidotes for chemical poisoning. Preparation of articles before plating, different types of cleaning like polishing, buffing, blasting, electro-cleaning, ultrasonic cleaning and vapour degreasing etc. Skilling practice on Nickel and Bright & Hard Chromium plating by different methods, various defects generally encountered in plating, causes for these defects, their remedies and various methods to remove defective deposits.

SECOND YEAR: The trainee learns setting up of various electroplating baths. Prepares solutions and practices on Zinc, Cadmium, Tin, Brass, Silver and Gold plating on ferrous/ non-ferrous metals by different methods and passivation with various colours. He understands various defects generally encountered in electroplating, causes for these defects and their remedies. Skilling practice to remove defective deposits on different metals by immersion and electrolytic methods. The trainee practices on electroplating of small articles by Barrel plating method for the plating of Copper, Nickel, Tin, Zinc and Cadmium.

In this year, the trainee learns about electroless method of plating for Copper, Nickel, Tin, Silver and Gold. General defects, their causes and remedies in electroless plating. Electroplating on Aluminium with zincate dipping process. The trainee practices on plating of Copper, Nickel, Chromium, Silver and Gold plating on non-conductive surfaces like ABS plastic. He prepares PCBs with Copper, Nickel, Tin, Silver & Gold and practices chemical etching for Copper & Brass. Skilling practice on Anodizing, methods of various colouring techniques, conversion coating, chemical milling on aluminium, phosphating, power coating, metalizing and passivation process. Conducts various tests viz., adhesion, porosity, thickness, corrosion resistance etc. and carries out preventive and breakdown maintenance of electroplating shop machineries.

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

Electroplater trade under Craftsman Training Scheme is delivered nationwide through network of ITIs. The course is of two-year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Workshop Calculation & science, Engineering Drawing and Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee broadly needs to demonstrate that they are able to:

- Read and interpret technical parameters/ documents, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge & employability skills while performing jobs.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship programme in different types of industries leading to a National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of two-years: -

| S No. | Course Element | Notional Training Hours | |
|-------|---------------------------------------|-------------------------|----------------------|
| | | 1 st Year | 2 nd Year |
| 1 | Professional Skill (Trade Practical) | 1000 | 1000 |
| 2 | Professional Knowledge (Trade Theory) | 280 | 360 |
| 3 | Workshop Calculation & Science | 80 | 80 |
| 4 | Engineering Drawing | 80 | 80 |
| 5 | Employability Skills | 160 | 80 |
| | Total | 1600 | 1600 |

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment** (Internal) during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure is being notified by DGT from time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.**

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

| Performance Level | Evidence |
|--|---|
| (a) Weightage in the range of 60%-75% to be allotted during assessment | |
| For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices | <ul style="list-style-type: none"> • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job. |
| (b) Weightage in the range of 75%-90% to be allotted during assessment | |

| | |
|---|--|
| <p>For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices</p> | <ul style="list-style-type: none"> • Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job. |
| <p>(c) Weightage in the range of more than 90% to be allotted during assessment</p> | |
| <p>For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.</p> | <ul style="list-style-type: none"> • High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project. |

3. JOB ROLE

Electroplater; gives coating of gold, silver, nickel, chromium, copper etc. of required thickness to metal parts by electrolytic process. Examines strength of metallic solution and sets anode plates (positive terminal) in solution. Suspends de-greased components well dipped in side plating solution and connects cathode (negative) to it. Regulates current and allows components to remain dipped in solution for specific period depending upon type and thickness of plating required. Removes components and swills them in hot and cold water baths. Dries them in sawdust or centrifugal air dryer. Transfers components to unrigging rack or other specified place for polishing. May prepare plating solution under guidance of shop supervisor. Is designated as Gilder if engaged in gold plating and Anodiser if colours aluminium and light alloys article using specific chemical solutions.

Surface Treatment Technician; is responsible for conducting electroplating, powder coating and Anodizing operations as per the product and the customer requirement to ensure that the surface of the metallic body becomes resistant to chemicals, moisture and other wear and tear.

Galvanizer; applies coating of zinc on ferrous articles by dipping them in molten zinc. Checks and controls quantity, quality and temperature of acid (hydrochloric acid), flux (zinc chloride) and zinc baths. Preheat articles if necessary and dips or passes them either manually or mechanically through, acid, water, flux and zinc baths successively at controlled speed. Skims dirt from baths and continues operation with necessary adjustment of solution, temperature etc., ensuring regular and uniform coating. May similarly apply tin coating using palm oil as flux and be designated as Tin Plater or Tinning Machine Operator. May regulate temperature by gauges and by colour of melting metals.

Reference NCO-2015:

- a) 8122.0100 – Electroplater
- b) 8122.0101 – Surface Treatment Technician
- c) 8122.3500 – Galvanizer

4. GENERAL INFORMATION

| | |
|---------------------------------------|--|
| Name of the Trade | ELECTROPLATER |
| Trade Code | DGT/1065 |
| NCO – 2015 | 8122.0100, 8122.0101, 8122.3500 |
| NSQF Level | Level – 5 |
| Duration of Craftsmen Training | 2 Years (3200 Hours) |
| Entry Qualification | Passed 10 th class examination with Science and Mathematics or its equivalent. |
| Minimum Age | 14 years as on first day of academic session. |
| Eligibility for PwD | LD, LC, DW, AA, DEAF, HH |
| Unit Strength | 20 (There is no separate provision of supernumerary seats) |
| Space Norms | 60 Sq. m |
| Power Norms | 16 KW |
| Instructors Qualification for | |
| 1. Electroplater Trade | <p>B.Voc/ Degree in Chemical engineering from AICTE/ UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Chemical Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/NAC passed in the Trade of “Electroplater” with three years experience in the relevant field.</p> <p><u>Essential Qualification:</u> Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT.</p> <p><i>Note: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However both of them must possess NCIC in any of its variants.</i></p> |

| | |
|---|---|
| <p>2. Workshop Calculation & Science</p> | <p>B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC in any one of the engineering trades with three years experience.</p> <p><u>Essential Qualification:</u> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;">OR</p> <p>NCIC in RoDA or any of its variants under DGT.</p> |
| <p>3. Engineering Drawing</p> | <p>B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC in any one of the Electrical groups (Gr-II) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience.</p> <p><u>Essential Qualification:</u> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;">OR</p> <p>NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.</p> |
| <p>4. Employability Skill</p> | <p>MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills from DGT institutes. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)</p> |

| | OR | | | | | |
|--|---|------------------------|---------------------|--------------------------------|----------------------|-----------------------------|
| | Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills from DGT institutes. | | | | | |
| 5. Minimum age for Instructor | 21 years | | | | | |
| Tools and Equipment | As per Annexure-I | | | | | |
| Distribution of training on Hourly basis: (Indicative only) | | | | | | |
| Year | Total Hrs. /week | Trade Practical | Trade Theory | Workshop Cal. & Sc. | Engg. Drawing | Employability Skills |
| 1 st | 40 Hours | 25 Hours | 7 Hours | 2 Hours | 2 Hours | 4 Hours |
| 2 nd | 40 Hours | 25 Hours | 9 Hours | 2 Hours | 2 Hours | 2 Hours |

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 LEARNING OUTCOMES (TRADE SPECIFIC)

FIRST YEAR:

1. Prepare profile with an appropriate accuracy as per drawing following safety precautions.
2. Prepare electrical wire joints, carry out soldering and crimping.
3. Verify characteristics of electrical and magnetic circuits.
4. Carry out Installation, testing and maintenance of batteries with due care and safety.
5. Perform wiring, installation of electrical accessories and earthing of electrical equipment.
6. Construct small electronic circuits as per drawing using basic electronic components.
7. Explain principles and basic process of plating one metal onto another by electrolysis. Use laboratory apparatus and estimate pH, mass, normality, conductivity, specific gravity etc.
8. Handle different solutions with due care & safety and undertake metal treatment processes and effluent treatment of hazardous chemicals in electroplating workshop. Prepare chemical solutions and undertake cooling, heating, filtering, agitating and other treatments for solutions. Carry out analysis of chemical baths with Hull cell process.
9. Plan and perform all the various aspects of the plating process including surface preparation, mechanical cleaning like polishing, buffing, blasting etc. and chemical cleaning like electro cleaning, ultrasonic cleaning, vapour degreasing, pickling, rinsing, masking etc.
10. Plan and perform Copper plating using different methods, examine various defects in Copper plating, causes and their remedies. Remove defective copper deposit by different methods.
11. Plan and perform Nickel plating using different methods, examine various defects in Nickel plating, causes and their remedies. Remove defective nickel deposit by different methods.
12. Plan and perform Bright and Hard Chromium plating by different methods on ferrous and non-ferrous metals, examine various defects in Chromium plating, causes and their remedies. Remove defective chromium deposit by different methods.

SECOND YEAR:

13. Plan and perform Zinc plating by different methods, examine various defects in Zinc plating, causes and their remedies. Remove defective zinc by different methods.
14. Plan and perform Cadmium plating by different methods, examine various defects in Cadmium plating, causes and their remedies. Remove defective cadmium deposit by different methods.
15. Plan and perform Tin Plating by different methods, examine various defects in Tin plating, causes and their remedies. Remove defective tin deposit by different methods.
16. Plan and perform Silver plating by different methods, examine various defects in Silver plating, causes and their remedies. Remove defective silver deposit by different methods.
17. Plan and perform Gold plating by different methods, examine various defects in Gold plating, causes and their remedies. Remove defective gold deposit by different methods.
18. Plan and perform Brass plating, examine various defects in Brass plating, causes and their remedies. Remove defective brass deposit by different methods.
19. Perform Barrel plating method of electroplating for the plating of copper, nickel, tin, zinc and cadmium.
20. Plan and perform electroless plating of copper, nickel, tin, silver and gold.
21. Plan and perform plating of copper, tin, nickel, zinc, cadmium etc. on aluminium with Zincate dipping process.
22. Plan and perform plating of copper, nickel, chromium, silver and gold on non conductive surface like plastic.
23. Make Printed circuit board with copper, nickel, tin, silver and gold. Perform chemical etching processes for copper and brass.
24. Plan and perform Anodizing to convert metal surface into a decorative, durable and corrosion resistant by different methods. Examine various defects generally encountered in anodising, causes and their remedies. Remove the defective anodised film by various methods.
25. Plan and perform various colouring techniques on anodised aluminium by different colouring dyes and other methods like electro colouring.
26. Perform various conversions coating process on aluminium, magnesium and its alloys. Perform chemical milling on Aluminium and undertake passivation of stainless steel.
27. Plan and perform phosphating, powder coating and metallizing on various metals.
28. Perform quality control aspect of the job and ensure electroplated surfaces are free of any flaws or defects. Perform various tests viz., adhesion, porosity, thickness,

corrosion resistance, anodic coating on aluminium, chemical analysis of electrolytes and identification of deposits etc.

29. Prepare layout of electroplating plant, estimate cost, materials and accessories required for electroplating shop. Carryout preventive and breakdown maintenance of machines in electroplating shop.

6. ASSESSMENT CRITERIA

| LEARNING OUTCOMES | ASSESSMENT CRITERIA |
|--|---|
| FIRST YEAR | |
| 1. Prepare profile with an appropriate accuracy as per drawing following safety precautions. | Identify the trade tools; demonstrate their uses with safety. |
| | Prepare a simple half lap joint using firmer chisel. |
| | Prepare tray using sheet metal with the safety. |
| | Demonstrate fixing of surface mounting type of accessories. |
| 2. Prepare electrical wire joints, carry out soldering and crimping. | Observe safety/ precaution during joints & soldering. |
| | Identify types of wires, cables and verify their specifications. |
| | Make simple straight twist and rat-tail joints in single strand conductors. |
| | Make married and 'T' (Tee) joint in stranded conductors. |
| | Prepare a Britannia straight and 'T' (Tee) joint in bare conductors. |
| | Prepare western union joint in bare conductor. |
| | Solder the finished copper conductor joints with precaution. |
| | Prepare termination of cable lugs by using crimping tool. |
| 3. Verify characteristics of electrical and magnetic circuits. | Identify polarity of DC power supply. |
| | Identify the phase and neutral in single phase AC supply system. |
| | Verify the characteristics of series, parallel and its combination circuit. |
| | Connect voltmeter and ammeter and measure voltage current and power. |
| | Demonstrate laws of series and parallel circuits with voltage source in different combinations. |
| | Demonstrate characteristics of series parallel combination of resistors. |
| | Demonstrate the relationship between V, I and R in a DC circuit. |
| | Measure the value of resistance by Ohm's Law. |
| | Trace the magnetic poles of a bar magnet. |
| | Prepare an electromagnet |
| 4. Carry out Installation, testing and maintenance of batteries with due care and safety. | Assemble a DC source 6V/500 mA using 1.5V cells. |
| | Determine the internal resistance of cell and make grouping of cells. |
| | Demonstrate charging of battery and test for its condition with |

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| | safety/ precaution. |
| | Demonstrate installation and maintenance Lead acid batteries. |
| | Determine total number of cells required for a given power requirement. |
| | |
| 5. Perform wiring, installation of electrical accessories and earthing of electrical equipment. | Comply with safety & IE rules when performing the wiring. |
| | Identify the types of fuses their ratings and applications. |
| | Identify the parts of a relay, MCB & ELCB and check its operation. |
| | Prepare a test board with lamp and other accessories. |
| | Test, locate the fault and repair a domestic wiring installation. |
| | |
| 6. Construct small electronic circuits as per drawing using basic electronic components. | Perform soldering on components, lug and board with quality and safety. |
| | Identify resistors by their colour codes. |
| | Identify the passive/active components by visual appearance, Code number and test for their condition. |
| | Construct and test a half wave rectifier with and without filter circuits. |
| | Construct and test a full wave rectifier. |
| | |
| 7. Explain principles and basic process of plating one metal onto another by electrolysis. Use laboratory apparatus and estimate pH, mass, normality, conductivity, specific gravity etc. | Identify various laboratory apparatus. |
| | Demonstrate action of pure and salt water on metals and alloys. |
| | Identify acids and alkalis using litmus paper and other methods. |
| | Analyse the reactions of anions and cations. |
| | Measure the specific gravity of liquid sample and check the temperature. |
| | Determine pH value of given liquid using pH meter. |
| | Measure boiling point of given liquid. |
| | Measure melting point of given solid. |
| | Measure conductivity of given liquid by conductivity meter. |
| | Determine the normality and mass per litre of sodium hydroxide/ sodium carbonate/ potassium hydroxide/ hydrochloric acid/ sulphuric acid or oxalic acid. |
| | Estimate the mass of sodium hydroxide/ sodium carbonate/ potassium hydroxide/ hydrochloric acid/ sulphuric acid or oxalic acid in a given solution. |
| | |
| 8. Handle different solutions | Demonstrate basic safety precautions to be taken while handling |

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| <p>with due care & safety and undertake metal treatment processes and effluent treatment of hazardous chemicals in electroplating workshop. Prepare chemical solutions and undertake cooling, heating, filtering, agitating and other treatments for solutions. Carry out analysis of chemical baths with Hull cell process.</p> | different types of electroplating solutions and effluent discharge. |
| | Work in compliance with safety while handling electroplating solutions, cyanide base electroplating salts and chrome containing effluent discharge. |
| | Identify hazardous substances viz. Solvents, alkalis, acids and cyanides etc. |
| | Demonstrate first aid and anti dotes for cyanide poisonings. |
| | Prevent exposure of hazardous substances. |
| | Perform effluent treatment of hazardous chemicals |
| | Perform setting up of plating tanks and electric connections. |
| | Identify acids and alkalis using Red/ Blue litmus paper. |
| | Measure the specific gravity of liquid sample |
| Demonstrate and practice first aid and anti dotes for cyanide poisonings. | |
| <p>9. Plan and perform all the various aspects of the plating process including surface preparation, mechanical cleaning like polishing, buffing, blasting etc. and chemical cleaning like electro cleaning, ultrasonic cleaning, vapour degreasing, pickling, rinsing, masking etc.</p> | Identify various compounds used in surface preparation process. |
| | Perform cleaning of articles viz., scrubbing with emery paper, wet sand, scratch brushes, wire wheel etc. |
| | Prepare glue and emery wheel binding. |
| | Perform acid cleaning, polishing and buffing of ferrous/ non ferrous alloys. |
| | Prepare suitable dips and pickling for removing of scales from surface of iron and steel. |
| | Perform cleaning by means of tumbling barrels. |
| | Perform ultrasonic cleaning. |
| | Perform anodic/ cathodic cleaning |
| | Perform degreasing process to include organic solvent i.e. TCE/PCE. |
| Clean oxidation stains on the articles of copper, brass, nickel and silver. | |
| <p>10. Plan and perform Copper plating using different methods, examine various defects in Copper plating, causes and their remedies. Remove defective copper deposit by different methods.</p> | Plan work in compliance with occupational safety and health. |
| | Ensure the appropriate temperature of the tanks and activate the electroplating process. |
| | Maintain timing cycles to ensure that all functions happen appropriately. |
| | Perform electro deposition of copper by cyanide solution. |
| | Perform electro deposition of copper by acid solution. |
| Perform electro deposition of copper by alkaline non-cyanide solution. | |

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| | Perform electro deposition of copper by Pyrophosphate. |
| | Test electroplating quality by Hull cell method. |
| | Ensure the line and machines are ready for future use. |
| | |
| 11. Plan and perform Nickel plating using different methods, examine various defects in Nickel plating, causes and their remedies. Remove defective nickel deposit by different methods. | Plan work in compliance with occupational safety and health. |
| | Prepare the job for nickel plating. |
| | Determine ECE of nickel |
| | Prepare and set up nickel plating vat, ensure the appropriate temperature of the tanks and activate the electroplating process. |
| | Perform pre-treatment process and maintain timing cycles to ensure that all functions happen appropriately. |
| | Prepare and test solution for electro deposition of nickel. |
| | Perform Nickel plating in different articles. |
| | Demonstrate set-up of current and time for different thickness of deposition. |
| | Perform adjustment of pH and temperature in bright nickel plating bath. |
| | Perform carbon treatment and maintenance of brightner level |
| | Perform testing of nickel plating solution using hull cell apparatus. |
| | Perform duped nickel plating and electrolysis nickel plating. |
| | Ensure the line and machines are ready for future use. |
| | |
| 12. Plan and perform Bright and Hard Chromium plating by different methods on ferrous and non-ferrous metals, examine various defects in Chromium plating, causes and their remedies. Remove defective chromium deposit by different methods. | Demonstrate safety precautions to be observed in Chromium Plating. |
| | Prepare the job for Chromium Plating. |
| | Test the electrolyte for Chromium plating. |
| | Ensure the appropriate temperature of the tanks and activate the electroplating process. |
| | Maintain timing cycles to ensure that all functions happen appropriately. |
| | Perform Chromium plating on different metals. |
| | Perform Chromium plating in internal areas. |
| | Remove metallic impurities in Chromium solutions and demonstrate the regeneration of solution. |
| | Perform pre-treatment for the Direct Hard Chromium plating and demonstrate precautions to be taken. |
| | Perform hard chromium plating. |
| Ensure the line and machines are ready for future use. | |

| SECOND YEAR | |
|--|--|
| 13. Plan and perform Zinc plating by different methods, examine various defects in Zinc plating, causes and their remedies. Remove defective zinc by different methods. | Plan work in compliance with occupational safety and health. |
| | Prepare solution for Zinc plating. |
| | Prepare job for Zinc plating. |
| | Perform Zinc plating and ensure the appropriate temperature of the tank and activate the electroplating process. |
| | Perform stripping of Zinc deposit and barrel plating. |
| 14. Plan and perform Cadmium plating by different methods, examine various defects in Cadmium plating, causes and their remedies. Remove defective cadmium deposit by different methods. | Plan work in compliance with occupational safety and health. |
| | Prepare Job for Cadmium plating. |
| | Test the acidity and density of the solution. |
| | Perform setting up of VAT for Cadmium Plating |
| | Perform Cadmium plating on different jobs. |
| | Find out defects in electroplated surface and explain causes and remedial actions. |
| 15. Plan and perform Tin Plating by different methods, examine various defects in Tin plating, causes and their remedies. Remove defective tin deposit by different methods. | Plan work in compliance with occupational safety and health. |
| | Prepare the solution for Tin plating. |
| | Set up Tin plating bath and maintain timing cycles to ensure that all functions happen appropriately. |
| | Perform Tin plating for different alloy metals by hot dipping/wiping/ contact plating method. |
| | Ensure the line and machines are ready for future use. |
| 16. Plan and perform Silver plating by different methods, examine various defects in Silver plating, causes and their remedies. Remove defective silver deposit by different methods. | Plan work in compliance with occupational safety and health. |
| | Prepare articles for silver plating. |
| | Perform Silver Plating by using hot alkaline cleaning method. |
| | Perform Silver Plating by using cathode cold cleaning or cyanide dips method. |
| | Demonstrate adjustment of current density and time for the required thickness. |
| | Perform bright silver plating. |

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| | Demonstrate cathode movement of heavy silver deposit. |
| | Ensure the line and machines are ready for future use. |
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| 17. Plan and perform Gold plating by different methods, examine various defects in Gold plating, causes and their remedies. Remove defective gold deposit by different methods. | Plan work in compliance with occupational safety and health. |
| | Prepare job for gold plating by hot cleaning or degreasing, pickling etc. |
| | Demonstrate electro-cleaning, ultrasonic cleaning and steaming. |
| | Perform base coat of strike/flash layer in the items to be plated. |
| | Perform gold plating on various articles. |
| | Perform masking for different platings. |
| | Demonstrate striping of gold plating by electrolytic/ immersion method. |
| | Perform electro-polishing of gold plated articles. |
| | Demonstrate masking techniques for different plating and etching operations. |
| | Ensure the line and machines are ready for future use. |
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| 18. Plan and perform Brass plating, examine various defects in Brass plating, causes and their remedies. Remove defective brass deposit by different methods. | Plan work in compliance with occupational safety and health. |
| | Prepare solution for Brass plating. |
| | Prepare job for Brass plating. |
| | Perform Brass plating and ensure the appropriate temperature of the tanks and activate the electroplating process. |
| | Maintain timing cycles to ensure that all functions happen appropriately. |
| | Demonstrate effects of current variation in Brass plating. |
| | Demonstrate stripping of Brass deposit. |
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| 19. Perform Barrel plating method of electroplating for the plating of copper, nickel, tin, zinc and cadmium. | Plan work in compliance with occupational safety and health. |
| | Demonstrate equipment and solutions for barrel plating. |
| | Demonstrate racking/ wiring for barrel plating. |
| | Ensure the appropriate temperature of the tanks and activate the electroplating process. |
| | Maintain timing cycles to ensure that all functions happen appropriately. |
| | Perform silver/ gold plating on small articles using barrel plating. |
| | Perform Tin/ nickel plating on various articles using barrel plating. |
| | Ensure the line and machines are ready for future use. |
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| 20. Plan and perform electroless plating of copper, nickel, tin, silver and gold. | Plan work in compliance with occupational safety and health. |
| | Perform copper plating by electroless method. |
| | Perform nickel plating by electroless method. |
| | Perform tin plating by electroless method. |
| | Perform silver plating by electroless method. |
| | Perform gold plating by electroless method. |
| | Ensure the line and machines are ready for future use. |
| 21. Plan and perform plating of copper, tin, nickel, zinc, cadmium etc. on aluminium with Zincate dipping process. | Plan work in compliance with occupational safety and health. |
| | Perform copper plating on aluminium articles. |
| | Perform nickel plating on aluminium articles. |
| | Perform tin plating on aluminium articles. |
| | Perform zinc plating on aluminium articles. |
| | Perform cadmium plating on aluminium articles. |
| | Ensure the line and machines are ready for future use. |
| 22. Plan and perform plating of copper, nickel, chromium, silver and gold on non conductive surface like plastic. | Plan work in compliance with occupational safety and health. |
| | Perform copper plating on ABS plastic. |
| | Perform nickel plating on ABS plastic. |
| | Perform chromium plating on ABS plastic. |
| | Perform silver plating on ABS plastic. |
| | Perform gold plating on ABS plastic. |
| | Ensure the line and machines are ready for future use. |
| 23. Make Printed circuit board with copper, nickel, tin, silver and gold. Perform chemical etching processes for copper and brass. | Plan work in compliance with occupational safety and health. |
| | Make Printed circuit board with copper/nickel/tin |
| | Make Printed circuit board with silver/ gold. |
| | Make letter printing on copper metal by chemical etching process. |
| | Make letter printing on brass metal by chemical etching process. |
| | Ensure the line and machines are ready for future use. |
| 24. Plan and perform Anodizing to convert metal surface into a decorative, durable and corrosion resistant by different methods. Examine various defects | Plan work in compliance with occupational safety and health. |
| | Prepare sulphuric acid solution for aluminium anodizing. |
| | Set up the anodizing vats and maintain timing cycles to ensure that all functions happen appropriately. |
| | Perform anodizing by chromic acid/ sulphuric acid/ oxalic acid. |
| | Ensure the line and machines are ready for future use. |

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| <p>generally encountered in anodising, causes and their remedies. Remove the defective anodised film by various methods.</p> | |
| <p>25. Plan and perform various colouring techniques on anodised aluminium by different colouring dyes and other methods like electro colouring.</p> | <p>Plan work in compliance with occupational safety and health.</p> <p>Perform metal colouring by chemical method.</p> <p>Perform metal colouring by electrolytic method.</p> <p>Demonstrate purification of different solution.</p> |
| <p>26. Perform various conversions coating process on aluminium, magnesium and its alloys. Perform chemical milling on Aluminium and undertake passivation of stainless steel.</p> | <p>Plan work in compliance with occupational safety and health.</p> <p>Determine amount of substance by measuring the charges using Coulometer.</p> <p>Perform conversion coating on aluminium/ Zinc/ Copper/ Steel/ Magnesium alloys.</p> <p>Perform alodine treatment on Aluminium alloy.</p> <p>Perform chemical etching or chemical milling for steel/ aluminium parts.</p> <p>Demonstrate cleaning and surface preparation of stainless steel alloy.</p> <p>Demonstrate removal of foreign matter by grinding/ acid pickling method.</p> <p>Perform chromate conversion coating to passivate steel/ aluminium/ zinc/ cadmium/ copper/ silver/ magnesium/ tin alloys.</p> <p>Ensure the line and machines are ready for future use.</p> |
| <p>27. Plan and perform phosphating, powder coating and metallizing on various metals.</p> | <p>Plan work in compliance with occupational safety and health.</p> <p>Prepare the solution and set up for phosphating.</p> <p>Perform phosphating on various metals.</p> <p>Perform powder coating on various metals.</p> <p>Perform and practice metalizing on various metals.</p> <p>Ensure the line and machines are ready for future use.</p> |
| <p>28. Perform quality control aspect of the job and</p> | <p>Plan work in compliance with occupational safety and health.</p> <p>Find out defects on different electroplated articles by visual</p> |

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| <p>ensure electroplated surfaces are free of any flaws or defects. Perform various tests viz., adhesion, porosity, thickness, corrosion resistance, anodic coating on aluminium, chemical analysis of electrolytes and identification of deposits etc.</p> | inspection. |
| | Perform corrosion resistance test on stainless steel alloys. |
| | Determine local thickness by using micrometers/ BNF Jet test method. |
| | Determine local thickness by using ultrasonic thickness tester. |
| | Perform testing of adhesion of electrodeposits on given plated alloys. |
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| <p>29. Prepare layout of electroplating plant, estimate cost, materials and accessories required for electroplating shop. Carryout preventive and breakdown maintenance of machines in electroplating shop.</p> | Plan work in compliance with occupational safety and health. |
| | Explain suitability and selection of equipment for electroplating shops. |
| | Prepare layout of the electroplating shop with details of plant machineries. |
| | Carry out preventive maintenance of electroplating shop machineries. |
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| SYLLABUS FOR ELECTROPLATER TRADE | | | |
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| FIRST YEAR | | | |
| Duration | Reference Learning Outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
| Professional Skill 150 Hrs; Professional Knowledge 42 Hrs | Prepare profile with an appropriate accuracy as per drawing following safety precautions. | <ol style="list-style-type: none"> 1. Visit various sections of the institutes and location of electrical installations. (05 hrs.) 2. Identify safety symbols and hazards. (05 Hrs.) 3. Preventive measures for electrical accidents and practice steps to be taken in such accidents. (05 hrs.) 4. Practice safe methods of fire fighting in case of electrical fire. (05 hrs.) 5. Operate a fire extinguisher and put out a fire. (05 Hrs.) 6. Practice elementary first aid. (05 hrs.) 7. Rescue a person and practice artificial respiration. (05 Hrs.) 8. Disposal procedure of waste materials. (05 Hrs.) 9. Practice on cleanliness and procedure to maintain it. (05 hrs.) 10. Identify hazardous chemicals. (05 hrs.) 11. Identify trade tools and machineries. (10Hrs.) 12. Practice on preparing T-joint, straight joint and | <p>Familiarization with the department, institute, trades etc. Introduction to Electroplater trade.</p> <p>Safety rules and safety signs. Types and working of fire extinguishers.</p> <p>Various safety measures involved in the Industry.</p> <p>First aid safety practice. Hazard identification and prevention.</p> <p>Personal safety and factory safety.</p> <p>Response to emergencies e.g. power failure, system failure and fire etc. Hazardous chemicals and safety. (14 hrs)</p> <p>Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels</p> |

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| | | <p>dovetail joint on wooden blocks. (15 Hrs.)</p> <p>13. Practice sawing, planning, drilling and assembling for making a wooden switchboard. (15 Hrs.)</p> <p>14. Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting. (15Hrs.)</p> <p>15. Workshop practice on filing and hacksawing. (15Hrs.)</p> <p>16. Workshop practice on drilling, chipping, internal and external threading of different sizes. (15 Hrs.)</p> <p>17. Prepare an open box from metal sheet. (15Hrs.)</p> | <p>hacksaw frames, blades, their specification and grades.</p> <p>Marking tools description and use.</p> <p>Types of drills, description & drilling and grinding machines.</p> <p>Various wooden joints.</p> <p>Carpenter and Sheet metal tools: Description of marking & cutting tools.</p> <p>Types of rivets and riveted joints. Use of thread gauge.</p> <p>Physical and mechanical properties of engineering metals: colour, weight, structure, conductivity, magnetic, fusibility and specific gravity.</p> <p>Mechanical properties: ductility, malleability, hardness, brittleness, toughness, tenacity, and elasticity. (28 hrs)</p> |
| <p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p> | <p>Prepare electrical wire joints, carry out soldering and crimping.</p> | <p>18. Prepare terminations of cable ends (06hrs.)</p> <p>19. Practice on skinning, twisting and crimping. (06Hrs.)</p> <p>20. Identify various types of cables and measure conductor size using SWG and micrometer. (06Hrs.)</p> <p>21. Make simple twist, married, Tee and western union joints. (10Hrs.)</p> <p>22. Make britannia straight, britannia Tee and rat tail joints. (10Hrs.)</p> | <p>Conductors and insulators.</p> <p>Conducting materials and their comparison. Wires and cables- types, measurement of wire size, voltage grading. SWG and outside micro meter. Crimping and crimping tool.</p> <p>Joints in electrical conductors.</p> <p>Techniques of soldering.</p> <p>Types of solders and flux. (14 hrs)</p> |

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| | | 23. Practice in Soldering of joints/ lugs. (12Hrs.) | |
| Professional Skill 50 Hrs; Professional Knowledge 14 Hrs | Verify characteristics of electrical and magnetic circuits. | <p>24. Identify polarity of DC supply by various methods. (05 hrs.)</p> <p>25. Connection of voltmeter and ammeter and to measure voltage current and power. (05hrs.)</p> <p>26. Verify laws of series and parallel circuits with voltage source in different combinations. (08Hrs.)</p> <p>27. Verify the characteristics of series parallel combination of resistors. (05Hrs.)</p> <p>28. Verify the relationship between V,I and R in a DC circuit. (08hrs.)</p> <p>29. Measure the value of resistance by Ohm's Law. (05Hrs.)</p> <p>30. Trace the magnetic poles of a bar magnet. (05 hrs.)</p> <p>31. Prepare an electromagnet (05 hrs.)</p> <p>32. Identify the phase and neutral in single phase AC supply by various methods. (04hrs.)</p> | <p>Fundamentals of electricity, definitions, units & effects of electric current.</p> <p>Types of electrical supply. Comparison and Advantages of DC and AC.</p> <p>Polarity test in DC.</p> <p>Resistance and specific resistance. Laws of Resistance and various types of resistors. Measurement of low and medium resistance. Electrical measuring instruments such as Voltmeter, Ammeter and Ohmmeter. Series and parallel combinations of resistors.</p> <p>Ohm's Law.</p> <p>Simple electrical circuits and problems.</p> <p>Magnetic terms; magnetic materials and properties of magnet. Electro magnet, Faradays laws of electro-magnetic induction.</p> <p>Alternating current - vector diagrams.</p> <p>(14 hrs)</p> |
| Professional Skill 50 Hrs; Professional Knowledge 14 Hrs | Carry out Installation, testing and maintenance of batteries with due care and safety. | <p>33. Practice proper use of different types of cells. (05hrs.)</p> <p>34. Practice on grouping of cells for specified voltage and current under different conditions and care. (10 Hrs.)</p> <p>35. Prepare and practice on</p> | <p>Types of cells, advantages/ disadvantages and their applications. Primary cells and secondary cells, Grouping of cells. Charging of battery, care and maintenance. Sealed Maintenance free Batteries.</p> <p>(14 hrs)</p> |

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| | | <p>battery charging. (15Hrs.)</p> <p>36. Practice on routine, care and maintenance of batteries. (10 hrs.)</p> <p>37. Perform testing of batteries. (10Hrs.)</p> | |
| <p>Professional Skill 75 Hrs;</p> <p>Professional Knowledge 21 Hrs</p> | <p>Perform wiring, installation of electrical accessories and earthing of electrical equipment.</p> | <p>38. Demonstrate wiring accessories. (05hrs.)</p> <p>39. Practice on installation and overhauling common electrical accessories. (05hrs.)</p> <p>40. Fixing of switches, holder plugs etc. in wooden/PVC/Metallic boards. (15 hrs.)</p> <p>41. Wire up a test board and test it. (10 hrs.)</p> <p>42. Practice of various types of electrical circuit connections such as one lamp, two lamp, three lamp with wall socket, stair case wiring, tube light connection etc. (20 hrs.)</p> <p>43. Wire up two lamps alternatively ON and OFF, bright and dim, godown wiring, railway signal wiring. (20 hrs.)</p> | <p>Common Electrical wiring Accessories, their specifications and B.I.S. Symbols.</p> <p>Diagrams and systems used in domestic wiring. (21 hrs)</p> |
| <p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p> | <p>Construct small electronic circuits as per drawing using basic electronic components.</p> | <p>44. Determine the resistance by colour coding. (05hrs.)</p> <p>45. Identify active and passive electronic components. (05hrs.)</p> <p>46. Identify terminals of different electronic components viz., resistors, diodes, transistors etc. (05hrs.)</p> | <p>Basic electronics</p> <p>Semiconductor energy level, atomic structure, types of materials, P-N-junction. Doping, Intrinsic and extrinsic semiconductor, Covalent bond.</p> <p>PN junction diode, Forward and Reverse characteristics. Specification and applications</p> |

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| | | <p>47. Verification of characteristics of diode. (05hrs.)</p> <p>48. Construct and test half wave rectifier circuit. (10hrs.)</p> <p>49. Construct and test full wave rectifier circuit. (10hrs.)</p> <p>50. Construct and test bridge rectifier circuit. (10hrs.)</p> | <p>of diodes. Explanation of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. (14 hrs)</p> |
| <p>Professional Skill 100 Hrs;</p> <p>Professional Knowledge 28 Hrs</p> | <p>Explain principles and basic process of plating one metal onto another by electrolysis. Use laboratory apparatus and estimate pH, mass, normality, conductivity, specific gravity etc.</p> | <p>51. Identify the laboratory apparatus. (05 hrs.)</p> <p>52. Verify action of pure and salt water on metals and alloys. (05hrs.)</p> <p>53. Practice identification of acids and alkalis using litmus paper and other methods. (05 hrs.)</p> <p>54. Prepare a solution with de ionized water. (05 hrs.)</p> <p>55. Analyse the reactions of anions (05 hrs.)</p> <p>56. Analyse the reactions of cations (05 hrs.)</p> <p>57. Determine the normality and mass per litre of sodium hydroxide, sodium carbonate, potassium hydroxide, hydrochloric acid, sulphuric acid and oxalic acid. (20 hrs.)</p> <p>58. Estimate the mass of sodium hydroxide, sodium carbonate, potassium hydroxide, hydrochloric acid, sulphuric acid and oxalic acid in a given</p> | <p>Familiarization of laboratory apparatus. Hard and soft water, water for industrial purposes. Technique to convert hard water to soft water. Types of solutions, saturated, unsaturated, super saturated solutions, solubility of solids, distilled and de-ionized water, melting and boiling points. Reactions of anions and cations. Exothermic and endothermic reactions. Qualitative analysis. Reactions of cations and anions. The terms involved in volumetric analysis i.e. Standard solution, normality, titration, titrant, titrate, end point, indicator etc. Principles of volumetric analysis, equivalent masses, normality, molarity, indicators. Acidimetry and alkalimetry. Density and specific gravity. Thermometer and</p> |

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| | | <p>solution. (20 hrs.)</p> <p>59. Measure the specific gravity of liquid sample and check the temperature in degree centigrade and convert to Fahrenheit. (05 hrs.)</p> <p>60. Determine pH value of different liquids using pH meter. (05hrs.)</p> <p>61. Study the change in pH of acetic acid on the addition of sodium acetate. (05 hrs.)</p> <p>62. Determine the conductivity of different liquids using conductivity meter. (05hrs.)</p> <p>63. Measure boiling point a liquid. (05 Hrs.)</p> <p>64. Measure melting point of a solid. (05hrs.)</p> | <p>hydrometer. Degree Centigrade, Fahrenheit and its conversion.</p> <p>Definition of pH, pH scale, Chemical effect of electric current, ECE and principle of electrolysis.</p> <p>Faraday's Law of electrolysis. Explanation of Anodes and cathodes.</p> <p>(28 hrs)</p> |
| <p>Professional Skill 75 Hrs;</p> <p>Professional Knowledge 21 Hrs</p> | <p>Handle different solutions with due care & safety and undertake metal treatment processes and effluent treatment of hazardous chemicals in electroplating workshop. Prepare chemical solutions and undertake cooling, heating, filtering, agitating and other treatments for solutions. Carry out</p> | <p>65. Identify and demonstrate soft water & de-mineralized water. (05 hrs.)</p> <p>66. Identify and demonstrate various types of corrosions. (05 hrs.)</p> <p>67. Demonstrate basic safety precautions to be taken while handling different types of electroplating solutions and effluent discharge. (05hrs.)</p> <p>68. Demonstrate safety precautions to be taken while handling cyanide base electroplating salts and chrome containing effluent. (05hrs.)</p> | <p>Various types of corrosions and importance of protective treatments.</p> <p>Principles and applications of electroplating.</p> <p>General terms and definitions subjected to electroplating.</p> <p>Safety precautions in electroplating shop.</p> <p>First aid and antidotes for chemical poisoning.</p> <p>Exothermic and endothermic reactions.</p> <p>Chemical formulas of different acids, alkalis & cyanides.</p> <p>Properties and Values of ECE for different metals.</p> |

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| | analysis of chemical baths with Hull cell process. | <p>69. Perform effluent treatment of hazardous chemicals in plating shop. (08hrs.)</p> <p>70. Demonstrate and practice first aid and antidotes for cyanide poisonings. (08 hrs.)</p> <p>71. Perform setting up of plating tanks and connections. (10hrs.)</p> <p>72. Determine ECE values of different solutions. (05 hrs.)</p> <p>73. Practice identification of acids and alkalis using Red/ Blue litmus paper. (05 hrs.)</p> <p>74. Determine pH value using pH paper and digital pH meter. (05 hrs.)</p> <p>75. Measure the specific gravity of liquid sample and check the temperature. (06hrs.)</p> <p>76. Carry out analysis of chemical baths with Hull cell process. (08hrs.)</p> | <p>Precautions to be observed.</p> <p>Method of mixing of electrolyte, use of hydrometer & thermometer.</p> <p>Environmental pollution related to the trade, consequences, mitigation & control.</p> <p>Knowledge about molecular weight, equivalent weight.</p> <p>Hard and soft water, water for industrial purposes.</p> <p>Technique to convert hard water to soft water.</p> <p>Theory involved in the treatment of plating effluent, pollution control, standard rules governing discharge of effluents.</p> <p>Types of solutions, saturated, unsaturated, super saturated solutions, solubility of solids,</p> <p>Analysis of chemical baths with Hull cell process.</p> <p>(21 hrs)</p> |
| Professional Skill 125 Hrs; Professional Knowledge 35 Hrs | Plan and perform all the various aspects of the plating process including surface preparation, mechanical cleaning like polishing, buffing, blasting etc. and chemical cleaning like electro | <p>77. Identify and demonstrate the equipments used in electroplating shop. (05 hrs.)</p> <p>78. Demonstrate various polishing wheels and compounds used in surface preparation process. (06 hrs.)</p> <p>79. Practice cleaning of articles before plating viz., scrubbing with emery</p> | <p>Requirements of a plating shop.</p> <p>Abrasives and Adhesives used for the preparation of wheels.</p> <p>Various compounds used for polishing and buffing.</p> <p>Importance of cleaning, its types, ex.</p> <p>a) Mechanical / chemical.</p> <p>b) Polishing / buffing</p> <p>c) Abrasive cleaning</p> <p>d) Degreasing, pickling, hot</p> |

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| | <p>cleaning, ultrasonic cleaning, vapour degreasing, pickling, rinsing, masking etc.</p> | <p>paper, wet sand, scratch brushes, wire wheel etc. (12 hrs.)</p> <p>80. Prepare glue and emery wheel binding. (06 hrs.)</p> <p>81. Practice surface preparation of ferrous/ non ferrous alloys including acid cleaning, polishing, buffing and blast cleaning. (17 hrs.)</p> <p>82. Prepare suitable dips and pickling for removing of scales from surface of iron and steel. (12 hrs.)</p> <p>83. Practice in cleaning by means of tumbling barrels. (10 hrs.)</p> <p>84. Practice ultrasonic cleaning to remove soil from inaccessible places as crevices, blind holes, and gear teeth etc. (06 hrs.)</p> <p>85. Practice anodic/ cathodic cleaning. (08 hrs.)</p> <p>86. Practice cleaning of specific metals such as iron, steel, stainless steel, nickel, brass, copper etc. (15 hrs.)</p> <p>87. Practice degreasing (vapour and immersion) process to include organic solvent i.e. TCE/PCE. (03 hrs.)</p> <p>88. Practice in using cleaning tanks, preparing suitable solution and methods of masking. (15 hrs.)</p> <p>89. Practice cleaning of oxidation stains on the</p> | <p>alkaline cleaning & final cleaning.</p> <p>Equivalent weight of compounds, acids, oxide, reduction of acids and stopping off compounds.</p> <p>Chemical cleaning methods by acid dipping, alkaline soak cleaning, vapour degreasing, ultrasonic cleaning, alkaline electro cleaning etc.</p> <p>Different plating techniques for ferrous & non-ferrous metals.</p> <p>General care and maintenance of plating baths, electroplating tank & lining.</p> <p>Various methods of masking. (35 hrs)</p> |
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| | | articles of copper, brass, nickel and silver. (10 hrs.) | |
| Professional Skill 75 Hrs; Professional Knowledge 21 Hrs | Plan and perform Copper plating using different methods, examine various defects, causes and their remedies. Remove defective copper deposit by different methods. | <p>90. Practice setting up of copper plating in acid bath. (10 hrs.)</p> <p>91. Prepare the acid solution for copper plating. (05 hrs.)</p> <p>92. Perform copper plating on different ferrous metals from acid bath. (20 hrs.)</p> <p>93. Practice setting up of copper plating in cyanide bath. (10 hrs.)</p> <p>94. Prepare the cyanide solution for copper plating. (05 hrs.)</p> <p>95. Practice and perform electro deposition of copper on different ferrous metals by cyanide solution. (20 hrs.)</p> <p>96. Practice to remove the defective copper deposit from ferrous metal by immersion and electrolytic methods. (05 hrs.)</p> | <p>Properties of copper, Applications and uses of copper plating in acid bath.</p> <p>Equipments for copper plating in acid bath, Various types of copper solutions in acid type, their compositions and operating conditions, their preparation and maintenance.</p> <p>Processing steps of copper plating in acid bath.</p> <p>Various defects generally encountered in the acid type copper plating, causes for these defects and their remedies</p> <p>Applications and uses of copper plating in cyanide bath.</p> <p>Equipments for copper plating in cyanide bath, Various types of copper solutions in cyanide type, their compositions and operating conditions, their preparation and maintenance.</p> <p>Processing steps of copper plating in cyanide bath.</p> <p>Various defects generally encountered in the cyanide type copper plating, causes for these defects and their remedies. Various methods for the removal of copper deposit. (21 hrs)</p> |
| Professional | Plan and perform | 97. Practice setting up of | Properties of nickel. |

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| <p>Skill 75 Hrs; Professional Knowledge 21 Hrs</p> | <p>Nickel plating using different methods, examine various defects in Nickel plating, causes and their remedies. Remove defective Nickel deposit by different methods.</p> | <p>nickel plating bath. (05 hrs.) 98. Prepare the solution for Nickel plating. (05 hrs.) 99. Perform Nickel plating in articles made of iron. (20 hrs.) 100. Perform Nickel plating in articles made of copper. (15 hrs.) 101. Perform Nickel plating in articles made of brass. (15 hrs.) 102. Practice to remove the defective nickel deposit from different metals by immersion and electrolytic methods. (10 hrs.) 103. Perform carbon treatment and other maintenance of nickel solution. (05 hrs.)</p> | <p>Applications and uses of nickel plating. Equipments for nickel plating, Various types of nickel solutions like dull, bright, black etc, their chemical compositions, operating conditions and their preparation. Importance and maintenance of pH value, density, agitation and filtration. Removal of impurities by carbon treatment and filtration. Processing steps of nickel plating. Various defects generally encountered in the nickel plating, causes for these defects and their remedies Various methods for the removal of nickel deposit from different metals. (21 hrs)</p> |
| <p>Professional Skill 125 Hrs; Professional Knowledge 35 Hrs</p> | <p>Plan and perform Bright and Hard Chromium plating by different methods on ferrous and non-ferrous metals, examine various defects in Chromium plating, causes and their remedies. Remove the defective Chromium deposit by different</p> | <p>104. Practice setting up of bright chromium plating bath. (10 hrs.) 105. Prepare the solution for bright chromium plating. (05 hrs.) 106. Perform bright chromium plating in articles made of iron. (20 hrs.) 107. Perform bright chromium plating in articles made of copper. (20 hrs.) 108. Practice setting up of hard chromium plating bath. (10 hrs.)</p> | <p>Safety precautions & Exhaust, preventive methods for removing fumes from chromium plating solutions. Applications and uses of bright chromium plating. Equipments for chromium plating, Anodes for chromium plating Regeneration of chromium plating solutions, Proper maintenance, removal of excess sulphate, rectification of trivalent chromium. Various types of bright</p> |

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| | methods. | <p>109. Prepare the solution for hard chromium plating. (05 hrs.)</p> <p>110. Perform hard chromium plating in articles made of iron. (20 hrs.)</p> <p>111. Perform hard chromium plating in articles made of copper. (20 hrs.)</p> <p>112. Practice to remove the defective chromium deposit from different metals by immersion and electrolytic methods. (15 hrs.)</p> | <p>chromium solutions like regular, self regulating and black chromium, their chemical compositions, operating conditions and their preparation.</p> <p>Processing steps of bright chromium plating.</p> <p>Various defects generally encountered in the bright chromium plating, causes for these defects and their remedies.</p> <p>Applications and uses of hard chromium plating.</p> <p>Various types of hard chromium solutions like regular, high speed and self regulating chromium, their chemical compositions, operating conditions and their preparation.</p> <p>Processing steps of hard chromium plating.</p> <p>Various defects generally encountered in the hard chromium plating, causes for these defects and their remedies. Various methods for the removal of chromium deposit from different metals. (35 hrs)</p> |
| <p>Project work / Industrial visit</p> <p>Broad Areas:</p> <ul style="list-style-type: none"> a) Copper electroplating b) Nickel electroplating c) Bright and hard chromium plating | | | |

SYLLABUS FOR ELECTROPLATER TRADE

SECOND YEAR

| Duration | Reference Learning outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
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| Professional Skill 125 Hrs; Professional Knowledge 45 Hrs | Plan and perform Zinc plating using different methods, examine various defects in Zinc plating, causes and their remedies. Remove defective Zinc deposit by different methods. | 113. Practice setting up of zinc plating for acid bath. (10 hrs.) 114. Prepare the acid solution for zinc plating. (10 hrs.) 115. Perform zinc plating on different ferrous metals in acid bath and passivate with different colours. (20 hrs.) 116. Perform zinc plating on different non ferrous metals in acid bath and passivate with different colours. (20 hrs.) 117. Practice setting up of zinc plating for cyanide and alkaline zinc bath. (10 hrs.) 118. Prepare the cyanide and alkaline zinc solution for zinc plating. (10 hrs.) 119. Perform zinc plating on different ferrous metals in cyanide and alkaline zinc bath and passivate with different colours. (20 hrs.) 120. Perform zinc plating on different non ferrous metals in cyanide and alkaline zinc bath and passivate with different | Properties of zinc. Applications and uses of zinc plating. Equipments for zinc plating in acid bath. Various types of zinc solutions for acid bath, their compositions and operating conditions, their preparation and maintenance. Processing steps of zinc plating in acid bath. Equipments for zinc plating in cyanide bath. Various types of zinc solutions for cyanide bath, their compositions and operating conditions, their preparation and maintenance. Processing steps of zinc plating In cyanide bath. Various colouring solutions for passivating the zinc deposit. Various defects generally encountered in the zinc plating in acid and cyanide bath, causes for these defects and their remedies Methods for the removal of zinc deposit from various |

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| | | colours. (15 hrs.) 121. Practice to remove the defective zinc deposit from various metals by immersion and electrolytic methods. (10 hrs.) | metals. (45 hrs) |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform Cadmium plating using different methods, examine various defects in Cadmium plating, causes and their remedies. Remove defective Cadmium deposit by different methods. | 122. Setting up of cadmium plating bath. (10 hrs.) 123. Prepare the solution for cadmium plating. (05 hrs.) 124. Perform cadmium plating on different ferrous metals and passivate with different colours. (05 hrs.) 125. Perform cadmium plating on different non ferrous metals and passivate with different colours. (20 hrs.) 126. Practice to remove the defective cadmium deposit from various metals by immersion and electrolytic methods. (10 hrs.) | Properties of cadmium. Applications and uses of cadmium plating. Equipments for cadmium plating. Various types of cadmium solutions, their compositions and operating conditions, their preparation and maintenance. Various colouring solutions for passivating the cadmium deposit. Processing steps of cadmium plating. Various defects generally encountered in the cadmium plating, causes for these defects and their remedies Methods for the removal of cadmium deposit from various metals. (18 hrs) |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform Tin plating using different methods, examine various defects in Tin plating, causes and their remedies. Remove defective Tin deposit by different methods. | 127. Practice setting up of Tin plating bath. (05 hrs.) 128. Prepare the solution for Tin plating. (05 hrs.) 129. Perform Tin plating on different ferrous metals. (15 hrs.) 130. Perform Tin plating on different non ferrous metals. (15 hrs.) 131. Practice to remove the defective Tin deposit | Properties of Tin, Applications and uses of Tin plating. Equipments for Tin plating in acid bath. Various types of Tin solutions for acid bath, their compositions and operating conditions, their preparation and maintenance. Processing steps of Tin plating in acid bath. Equipments for Tin plating in cyanide bath. Various types of |

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| | | from various metals by immersion and electrolytic methods. (10 hrs.) | Tin solutions for cyanide bath, their compositions and operating conditions, their preparation and maintenance. Processing steps of Tin plating In cyanide bath. Various defects generally encountered in the Tin plating in acid and cyanide bath, causes for these defects and their remedies Methods for the removal of Tin deposit from various metals. (18 hrs) |
| Professional Skill 75 Hrs; Professional Knowledge 27 Hrs | Plan and perform Silver plating using different methods, examine various defects in Silver plating, causes and their remedies. Remove defective Silver deposit by different methods. | 132. Setting up of Silver plating bath. (10 hrs.) 133. Prepare the solution for Silver plating. (05 hrs.) 134. Perform Silver plating on different ferrous metals. (25 hrs.) 135. Perform Silver plating on different non ferrous metals. (25 hrs.) 136. Practise to remove the defective Silver deposit from various metals by immersion and electrolytic methods. (10 hrs.) | Properties of Silver, Applications and uses of Silver plating. Equipments for Silver plating. Various types of Silver solutions, their compositions and operating conditions, their preparation and maintenance. Processing steps of Silver plating. Various defects generally encountered in the Silver plating, causes for these defects and their remedies. Methods for the removal of Silver deposit from various metals. (27 hrs) |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform Gold plating by different methods, examine various defects in Gold plating, causes and their remedies. | 137. Practise setting up of Gold plating bath. (05 hrs.) 138. Prepare the solution for Gold plating. (05 hrs.) 139. Perform Gold plating on different ferrous metals. | Properties of Gold, Applications and uses of Gold plating. Equipments for Gold plating. Various types of Gold solutions, their compositions and operating conditions, their preparation and |

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| | Remove defective Gold deposit by different methods. | (15hrs.) 140. Perform Gold plating on different non ferrous metals. (15hrs.) 141. Practice to remove the defective Gold deposit from various metals by immersion and electrolytic methods. (10 hrs.) | maintenance. Processing steps of Gold plating. Various defects generally encountered in the Gold plating, causes for these defects and their remedies Methods for the removal of Gold deposit from various metals. (18 hrs) |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform Brass plating using different methods, examine various defects in Brass plating, causes and their remedies. Remove defective Brass deposit by different methods. | 142. Prepare the solution for Brass plating and setting up the bath. (05 hrs.) 143. Perform Brass plating on different ferrous metals. (20hrs.) 144. Perform Brass plating on different non ferrous metals. (20hrs.) 145. Practice to remove the defective Brass deposit from various metals by immersion and electrolytic methods. (05 hrs.) | Properties of Brass, Applications and uses of Brass plating. Equipments for Brass plating. Various types of Brass solutions, their compositions and operating conditions, their preparation and maintenance. Processing steps of Brass plating. Various defects generally encountered in the Brass plating, causes for these defects and their remedies Methods for the removal of Brass deposit from various metals. (18 hrs) |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Perform Barrel plating method of electroplating for the plating of copper, nickel, tin, zinc and cadmium. | 146. Perform copper plating of small articles by barrel method. (10 hrs.) 147. Perform nickel plating of small articles by barrel method. (10 hrs.) 148. Perform tin plating of small articles by barrel method. (10 hrs.) 149. Perform zinc plating of small articles by barrel | Applications of barrel plating in electroplating industry. Types of barrels used for barrel plating. Automatic barrel plating plants in the modern industry. Preparation of articles prior to barrel plating. Barrel plating solutions and the operating conditions used for barrel plating of copper, nickel, tin, |

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| | | method. (10 hrs.) 150. Perform cadmium plating of small articles by barrel method. (10 hrs.) | zinc and cadmium. General defects, their causes and remedies in barrel plating. (18 hrs) |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform electroless plating of copper, nickel, tin, silver and gold. | 151. Perform copper plating by electroless method. (10 hrs.) 152. Perform nickel plating by electroless method. (10 hrs.) 153. Perform tin plating by electroless method. (10 hrs.) 154. Perform silver plating by electroless method. (10 hrs.) 155. Perform gold plating by electroless method. (10 hrs.) | Applications of electroless plating in electroplating industry. Preparation of articles prior to electroless plating. Electroless plating solutions and their operating conditions of copper, nickel, tin, silver and gold. General defects, their causes and remedies in electroless plating. (18 hrs) |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform plating of copper, tin, nickel, zinc, cadmium etc. on aluminium with Zincate dipping process. | 156. Perform copper plating on aluminium articles. (10 hrs.) 157. Perform nickel plating on aluminium articles. (10 hrs.) 158. Perform tin plating on aluminium articles. (10 hrs.) 159. Perform zinc plating on aluminium articles. (10 hrs.) 160. Perform cadmium plating on aluminium articles. (10 hrs.) | Applications of electroplating on aluminium. Preparation of aluminium articles prior to plating. Solution composition, preparation and operating conditions of zincate dipping process. Processing steps of copper, nickel, tin, zinc and cadmium plating on aluminium. General defects, their causes and remedies in plating of aluminium. Removal of copper, nickel, tin, zinc and cadmium deposit from aluminium articles. (18 hrs) |
| Professional Skill 50 Hrs; | Plan and perform plating of copper, | 161. Perform copper plating on ABS plastic. (10 hrs.) | Applications of electroplating on plastic and non conductive |

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| <p>Professional Knowledge 18 Hrs</p> | <p>nickel, chromium, silver and gold on non conductive surface like plastic.</p> | <p>162. Perform nickel plating on ABS plastic. (10 hrs.) 163. Perform chromium plating on ABS plastic. (10 hrs.) 164. Perform silver plating on ABS plastic. (10 hrs.) 165. Perform gold plating on ABS plastic. (10 hrs.)</p> | <p>surfaces. Properties of ABS plastic. Preparation of ABS plastics prior to plating. Solution composition, preparation and operating conditions of plating on plastic processes. Processing steps of copper, nickel, chromium, silver and gold plating on ABS plastic. General defects, their causes and remedies in plating of non conductive surfaces. Removal of coating from ABS plastic surfaces. (18 hrs)</p> |
| <p>Professional Skill 75 Hrs; Professional Knowledge 27 Hrs</p> | <p>Make Printed circuit board with copper, nickel, tin, silver and gold and chemical etching processes for copper and brass.</p> | <p>166. Make Printed circuit board with copper. (10 hrs.) 167. Make Printed circuit board with nickel. (10 hrs.) 168. Make Printed circuit board with tin. (10 hrs.) 169. Make Printed circuit board with silver. (10 hrs.) 170. Make Printed circuit board with gold. (10 hrs.) 171. Make letter printing on copper metal by chemical etching process. (10 hrs.) 172. Make letter printing on brass metal by chemical etching process. (15 hrs.)</p> | <p>Applications printed circuit boards in electronic industry. Types of base materials of PCB. Methods of Layout marking. Immersion copper and etching solutions and operating conditions. Processing steps for making PCB with copper, nickel, tin, silver and gold. General defects, their causes and remedies in making of PCBs. Solution Solution composition, operating conditions and processing steps of brass etching. (27 hrs)</p> |
| <p>Professional Skill 50 Hrs; Professional Knowledge</p> | <p>Plan and perform Anodizing to convert metal surface into a decorative,</p> | <p>173. Prepare solution for anodizing in sulphuric acid and set up the bath. (05 hrs.) 174. Perform and practice</p> | <p>Properties of aluminium and its corrosion. Applications and uses of anodizing. Preparation of aluminium</p> |

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| 18 Hrs | durable and corrosion resistant by different methods. Examine various defects in anodizing, causes and their remedies. Remove the defective anodized film by various methods. | <p>aluminium anodizing in sulphuric acid bath. (10 hrs.)</p> <p>175. Prepare solution for anodizing in chromic acid and set up the bath. (05 hrs.)</p> <p>176. Practice anodizing by using chromic acid. (10 hrs.)</p> <p>177. Prepare solution for anodizing in oxalic acid and set up the bath. (05 hrs.)</p> <p>178. Practice anodizing by using oxalic acid. (10 hrs.)</p> <p>179. Practice removal of anodised film from aluminium articles. (05 hrs.)</p> | <p>articles prior to anodizing. Types of anodizing solutions, preparation and operating conditions.</p> <p>Processing steps of anodizing process. Post treatments of anodizing.</p> <p>General defects, their causes and remedies in anodizing of aluminium.</p> <p>Removal of anodized film from aluminium articles. (18 hrs)</p> |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform various colouring techniques on anodized aluminium by different colouring dyes and other methods like electro colouring. | <p>180. Prepare solution for various colouring solutions by various colour dye stuffs. (10 hrs.)</p> <p>181. Practice colouring on anodised aluminium article by using various colouring solutions. (10 hrs.)</p> <p>182. Prepare solution for electro colouring and setting up the bath. (10 hrs.)</p> <p>183. Practice electro colouring on anodised aluminium article with various colour shades. (10 hrs.)</p> <p>184. Remove the colour without attacking the</p> | <p>Applications and uses of anodized colouring. Methods of various colouring techniques.</p> <p>Preparation and operating conditions of various colouring solutions for anodized aluminium articles. Processing steps for colouring. Post treatments of colouring. General defects, their causes and remedies in colouring of anodized parts.</p> <p>Removal of colour film from anodized aluminium articles. (18 hrs)</p> |

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| | | anodised film. (10 hrs.) | |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Perform various conversions coating process on aluminium, magnesium and its alloys. Perform chemical milling on aluminium and undertake passivation of stainless steel. | <p>185. Prepare solution for conversion coating on aluminium. (05 hrs.)</p> <p>186. Practice conversion coating on aluminium and magnesium parts. (10 hrs.)</p> <p>187. Remove the conversion coating without attacking the base metal. (05 hrs.)</p> <p>188. Prepare and set up the bath for chemical milling. (05 hrs.)</p> <p>189. Practice chemical milling on aluminium. (10 hrs.)</p> <p>190. Prepare solution for stainless steel passivation. (05 hrs.)</p> <p>191. Practice passivation on stainless steel. (10 hrs.)</p> | <p>Properties and applications for conversion coating.</p> <p>Preparation of solution and operating conditions.</p> <p>Processing steps of conversion coating on aluminium.</p> <p>Removal of conversion coating.</p> <p>Application and uses of chemical milling on aluminium.</p> <p>Preparation of solution and operating conditions.</p> <p>Processing steps of chemical milling on aluminium.</p> <p>Application and uses of passivation on stainless steel.</p> <p>Preparation of solution and operating conditions for passivation on stainless steel.</p> <p>Processing steps for passivation on stainless steel. (18 hrs)</p> |
| Professional Skill 50 Hrs; Professional Knowledge 18 Hrs | Plan and perform phosphating, powder coating and metallizing on various metals. | <p>192. Prepare the solution and set up for phosphating. (05 hrs.)</p> <p>193. Perform and practice phosphating on various metals. (10 hrs.)</p> <p>194. Perform and practice powder coating on various metals. (15 hrs.)</p> <p>195. Perform and practice metallizing on various metals. (20 hrs.)</p> | <p>Application and uses of phosphating. Types of phosphating solutions.</p> <p>Preparation of solution and operating conditions for phosphating.</p> <p>Processing steps for phosphating.</p> <p>Post treatment for phosphating.</p> <p>Application and uses of powder coating.</p> <p>Equipments for powder coating.</p> <p>Preparation and operating conditions for powder coating.</p> <p>Processing steps and post treatments for powder coating. General care and</p> |

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| | | | <p>maintenance for powder coating machine.</p> <p>Application and uses of metallizing.</p> <p>Equipments for metallizing.</p> <p>Preparation and operating conditions for metallizing.</p> <p>Processing steps and post treatments for metallizing.</p> <p>General care and maintenance for metallizing machine. (18 hrs)</p> |
| <p>Professional Skill 75 Hrs;</p> <p>Professional Knowledge 27 Hrs</p> | <p>Perform quality control aspect of the job and ensure electroplated surfaces are free of any flaws or defects. Perform various tests viz., adhesion, porosity, thickness, corrosion resistance, anodic coating on aluminium, chemical analysis of electrolytes and identification of deposits etc.</p> | <p>196. Carry out visual inspection of different electroplated articles for any defects. (05 hrs.)</p> <p>197. Perform adhesion tests by various methods. (10 hrs.)</p> <p>198. Perform porosity tests by various methods. (10 hrs.)</p> <p>199. Perform corrosion resistance tests by various methods. (10 hrs.)</p> <p>200. Practice in testing different plated jobs for determining the local thickness by various methods. (10 hrs.)</p> <p>201. Practice in testing different anodised jobs for determining the thickness and insulation. (15hrs.)</p> <p>202. Practice in analysing different electroplating solutions. (15hrs.)</p> | <p>Quality control in electroplating shops.</p> <p>Inspection of plated surfaces by appearance and to test thickness by using micrometer, BNF jet test methods, ultrasonic thickness tester etc. and to check the adhesion on the base metals by various methods like burnishing test, bend test, lifting test, impact test, grinding wheel test, baking test etc. Various Corrosion resistance tests by using various salt spray tests, corrodokote test, sulphur dioxide test etc. various porosity tests like Hcl test, ferri cyanide test, hot water test, salt spray test, hydrogen peroxide salt test etc. Methods of testing anodic coating on aluminium. Chemical analysis of various plating electrolytes. (21 hrs)</p> |
| <p>Professional Skill 50 Hrs;</p> | <p>Prepare layout of electroplating</p> | <p>203. Demonstrate Installation of machinery for</p> | <p>Electroplating shop layout, characteristics, factors to be</p> |

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| <p>Professional Knowledge 18 Hrs</p> | <p>plant, estimate cost, materials and accessories required for electroplating shop. Carryout preventive and breakdown maintenance of machines in electroplating shop.</p> | <p>electroplating shops using visual aids. (05 hrs.) 204. Practical study with regards to suitability and selection of equipment for electroplating shops. (05 hrs.) 205. Prepare a complete layout of the electroplating shop with details of plant machineries and technical specifications. (10 hrs.) 206. Working out detailed electroplating layout and calculate the approximate cost of the shop. (10 hrs.) 207. Carry out preventive maintenance of electroplating shops. (05 hrs.) 208. Estimate materials and quantity required for constructing electroplating plant. (15 hrs.)</p> | <p>considered i.e. availability of indigenous materials, waste disposal. Installation of machinery for electroplating shops. Practical study with regards to suitability and selection of equipment, advantages, disadvantages and technical specification. Calculation pertaining to consumption of anodes, estimation materials and quantity required for constructing and etching, plating vats, cleaning etc. Suitability selection of equipments advantages and disadvantages. Calculation of the capacity of the plating vats. (18 hrs)</p> |
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Project work / Industrial visit

Broad Areas:

- a) Electroless plating
- b) Plating on aluminium
- c) Plating on ABS plastic
- d) Anodizing
- e) Metal colouring
- f) Conversion coating
- g) Plating on PCB
- h) Etching and chemical milling
- i) Project report on installation of electroplating shop

SYLLABUS FOR CORE SKILLS

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| 1. Workshop Calculation & Science (Common for two year course) (80 hrs + 80 hrs) |
| 2. Engineering Drawing (Common for Group-II (Electrical, Electronics & IT Trade Group)) (80 hrs + 80 hrs) |
| 3. Employability Skills (Common for all CTS trades) (160 hrs + 80 hrs) |

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in

| LIST OF TOOLS & EQUIPMENT | | | |
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| ELECTROPLATER (for batch of 20 candidates) | | | |
| S No. | Name of the Tools and Equipment | Specification | Quantity |
| A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-20 is required additionally) | | | |
| 1. | Pliers Combination | 150 mm | 7 Nos. |
| 2. | Pliers Side Cutting | 150 mm | 7 Nos. |
| 3. | Screw Driver | 100 mm | 7 Nos. |
| 4. | Screw Driver | 150 mm | 7 Nos. |
| 5. | Connector, screw driver insulated handle thin stem | 100 mm | 7 Nos. |
| 6. | Punch Centre | 150 mm X 9 mm | 7 Nos. |
| 7. | Knife Double Bladed | steel | 7 Nos. |
| 8. | Neon Tester | Heavy duty | 7 Nos. |
| 9. | Steel Rule | 300 mm | 7 Nos. |
| 10. | Hammer, cross peen with handle | 300g | 7 Nos. |
| 11. | Hammer, ball peen With handle | 300g | 7 Nos. |
| 12. | Bradawl | Standard size | 7 Nos. |
| 13. | Pincer | 150 mm | 7 Nos. |
| 14. | File flat | 150mm,smooth | 7 Nos. |
| 15. | File triangular | 150mm, smooth | 7 Nos. |
| 16. | File half round | 150mm,smooth | 7 Nos. |
| 17. | File round | 150mm, smooth | 7 Nos. |
| 18. | File flat | 200 mm, rough | 7 Nos. |
| 19. | Crimping Tool | Medium size | 7 Nos. |
| 20. | Wire stripper | 20 cm | 7 Nos. |
| B. SHOP TOOLS, INSTRUMENTS & MACHINERY (For 2 (1+1) units no additional items are required) | | | |
| 21. | Hand vice | 50mm jaw | 5 Nos. |
| 22. | Spanner Adjustable | 300mm | 5 Nos. |
| 23. | Heavy Duty Screw Driver | 200 mm | 5 Nos. |
| 24. | Screw Driver thin stem insulated handle | 250 mm | 5 Nos. |
| 25. | Firmer Chisel | 25 mm X 200 mm | 5 Nos. |
| 26. | Hand wood saw | 15 inch | 5 Nos. |
| 27. | Portable Electric Drilling Machine | 6 mm capacity | 2 Nos. |
| 28. | Pillar Electric Drill Machine | 12 mm capacity | 1 No. |

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| 29. | Micrometer (Digital display) | 0-1"/25mm range | 2 Nos. |
| 30. | Bench Grinder | 150mm, 250W | 1 No. |
| 31. | Pipe vice | Standard size | 2 Nos. |
| 32. | Chisel Cold flat | 12 mm | 5 Nos. |
| 33. | Mallet hard wood | 0.50 kg | 5 Nos. |
| 34. | Hammer Extractor type | 0.40 kg | 5 Nos. |
| 35. | Hacksaw frame adjustable | 300 mm | 5 Nos. |
| 36. | Try Square | 150 mm blade | 5 Nos. |
| 37. | Pliers flat nose | 150 mm | 5 Nos. |
| 38. | Pliers round nose | 100 mm | 5 Nos. |
| 39. | Tweezers | 100 mm | 5 Nos. |
| 40. | Snip Straight and Bent | 150 mm | 5 Nos. |
| 41. | D.E. Spanner set of 12 pieces | 6x7 to 25x28 | 2 Nos. |
| 42. | Jack plane with smoothing cutters | 50 mm | 5 Nos. |
| 43. | Standard Wire Gauge | Standard size | 5 Nos. |
| 44. | File Rasp | 200 mm | 5 Nos. |
| 45. | Soldering Iron | 25W, 220V | 5 Nos. |
| 46. | De soldering Gun | 30W, 220V | 2 Nos. |
| 47. | Bench Vice | 100 mm jaw | 6 Nos. |
| 48. | Multi Meter (analog) | 0 to 1000 M Ohms, 2.5 to 500 V | 2 Nos. |
| 49. | Digital Multi Meter | AC 4-750V,40mA-10A and DC 400mV-1000V, 40mA-10A | 2 Nos. |
| 50. | A.C. Voltmeter M.I. | 0 -500V A.C | 2 Nos. |
| 51. | Milli Voltmeter centre zero | 100 - 0 - 100 m volt | 2 Nos. |
| 52. | D.C. Milli ammeter | 0 -500m A | 2 Nos. |
| 53. | Ammeter MC | 0-5 A, 0- 25 A | 2 No. each |
| 54. | A.C. Ammeter M.I. | 0-5A, 0-25 A | 2 No. each |
| 55. | Rheostat | 0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 1 Amp 0- 300 Ohm, 1 Amp | 2 Nos. each |
| 56. | Variable Auto Transformer | 1 Phase | 2 Nos. |
| 57. | Battery Charger | 10A,48V DC output | 1 No. |
| 58. | Thermometer | 0 to 100°C | 2 Nos. |
| 59. | Thermometer digital | Pen type | 2 Nos. |
| 60. | Hydrometer | For heavy liquids | 2 Nos. |
| 61. | Hydrometer with syringe | For battery testing | 2 Nos. |
| 62. | Portable digital density meter | Laboratory use | 2 Nos. |
| 63. | Weighing Balance Digital | 10kg capacity with 0.05g accuracy | 2 Nos. |
| 64. | Conductivity meter Digital | Table top, LED display, 230V | 2 Nos. |

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| 65. | Glue pot | 5kg capacity | 2 Nos. |
| 66. | Digital Voltmeter AC | 10-750V | 2 Nos. |
| 67. | Digital Voltmeter DC | 0-100V | 2 Nos. |
| 68. | Digital Ammeter DC | 0-100 A | 2 Nos. |
| 69. | Digital Ammeter AC | 0-50A | 2 Nos. |
| 70. | Adjustable resistance board with DC digital ammeter & voltmeter | 0-20V,0-100A | 10 Nos. |
| 71. | Pedestal buffing machine mounted in heavy duty CI stand, complete with push button starter & wheel guard | 3phase, 3HP, 3000rpm | 2 Nos. |
| 72. | Industrial pedestal polishing machine with dust collectors | 2HP | 2 Nos. |
| 73. | Flexible shaft polishing machine | 0.5HP, 2m shaft length, 2800 rpm. | 1 No. |
| 74. | Bed blaster machine for blast cleaning | Standard size | 1 No. |
| 75. | Ultrasonic cleaner | Mini compact table top, 3.5 litre capacity | 1 No. |
| 76. | Vapour degreaser | Mini compact table top, 3.5 litre capacity | 1 No. |
| 77. | Dipping basket perforated | Titanium or PP, 6x5 inch height | 4 Nos. |
| 78. | Titanium anode basket | 4.5x6 inch height | 4 Nos. |
| 79. | Moulded buckets | PP, 10 litre capacity | 4 Nos. |
| 80. | Moulded buckets | PP, 5 litre capacity | 4 Nos. |
| 81. | Digital pH meter equipment | Table top type, 0-14 range | 2 Nos. |
| 82. | Digital pH meter | Pen type | 2 Nos. |
| 83. | Portable angle grinder hand type | 1phase,230V/5A | *5 Nos. |
| 84. | Rectifier transformer DC power supply | 3phase, 415V,300A | 1 No. |
| 85. | Electroplating rectifier | 1 phase 230V, DC output Approximately 100A, 30V | 1 No. |
| 86. | Electroplating rectifier | Small size, 1 phase 230V, DC output Approximately 25A, 12V | 1 No. |
| 87. | Electric immersion heater (Silica, Stainless steel, lead, Titanium and Glass) | 0.5KW, length 10-12" | 2 Nos. each |
| 88. | Plating Tank with SS stand | L-2ft, B-1.5ft ht-1.5ft made out of Polypropylene (PP) | 15 Nos. |
| 89. | Miniature fully immersed portable plating barrel with DC motor | Perforated, PP, 7x5 inch barrel size, up to 2kg capacity | 2 Nos. |
| 90. | Submersible plating barrel with tank and complete setup | 7kg capacity, 12x8 inch barrel size, 0.125 HP motor | 1 No. |
| 91. | Oblique tumbling barrel with motor and complete setup | 3.5 litre capacity, 275mm depth barrel | 1 No. |
| 92. | Cleaning tank | L-2ft,b-1.5ft,ht-1.5ft made out of | 15 Nos. |

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| | | Polypropylene (PP) | |
| 93. | Hot air oven | 600x600x900mm, 6KW | 1 No. |
| 94. | Hot plate | 12 inch dia. Digital temp controller | 1 No. |
| 95. | Side channel blower | 0.5 HP | 2 Nos. |
| 96. | Centrifugal Dryer | 5kg capacity, 10x8 inch basket size | 1 No. |
| 97. | Hull cell apparatus (with fittings like air agitation, immersion heater, thermostatic control, MS and brass cathode, wire clips, hull cell anode, hot water bath controls, 0-60m timer, glass thermometer, DC rectifier 0-12V, 0-10A) | Minimum size available in the market | 1 No. |
| 98. | Pen plating touch up plating unit with DC rectifier, digital display, Anode tipped pen, lead wire cathode for touch up multi metal. | Complete set | 1 No. |
| 99. | Powder coating machine (complete set) | | 1 No. |
| 100. | Solution filter unit | Disc type, PP filter chamber, mounted on C.I wheels, 1HP,65W | 2 Nos. |
| 101. | Industrial water cooler | Compressor power, 1000W | 1 No. |
| 102. | Water demineraliser, Mixed system | D series, 1phase,230V | 1 No. |
| 103. | Direct plating thickness measurement meter | Non destructive, digital | 2 Nos. |
| 104. | Salt spray apparatus with humidity chamber, humidity controller, water level controller, mica plate heater, temperature indicator, filtered salt solution feed of minimum 0.5 litre per hour 130 litre salt solution reservoir, peristaltic pump, hour counter, control panel, compressor unit, pressure regulating valve, flow meter etc. | Minimum size available in the market | 1 No. |
| C. Shop Floor Furniture and Materials (For 2 (1+1) units no additional items are required) | | | |
| 105. | Instructor's table | Teakwood, with one drawer and one shelf with inbuilt locks | 2 Nos. |
| 106. | Instructor's chair | Teakwood, Armed | 2 Nos. |
| 107. | Wooden stool | Standard size | 2 Nos. |
| 108. | Wooden table | Teakwood, 3 ft x 2ft | 2 Nos. |
| 109. | Laptop | Latest configuration | 1 No. |
| 110. | Mini Projector (High resolution display) | Table top, latest configuration | 1 No. |
| 111. | Laser Printer | Colour, latest configuration | 1 No. |
| 112. | Wooden Almirah (10 drawers with inbuilt locks) | Teakwood, standard size | 5 Nos. |

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| 113. | Wooden Almirah | Teakwood, 2.5x1.20x0.5m | 2 Nos. |
| 114. | White board | Standard size with Al frame | 2 Nos. |
| 115. | Showcase (for displaying the models of plated articles) | Standard size | 1No. |
| 116. | Wooden rack (for keeping the trainee shoes and bags) | Teakwood,100x150x45cm | 2 Nos. |
| 117. | Wooden rack (for the storage of chemicals) | Teakwood, 2x2x0.5m | 5 Nos. |
| 118. | Wooden stand (for hanging uniforms) | Teakwood, Standard size | 1 No. |
| 119. | Work bench | 2x 0.5 x 1.5m ht | 5 Nos. |
| 120. | Working Bench | 2.5 m x 1.20 m x 0.75 m | 5 Nos. |
| 121. | Fire Extinguisher | CO ₂ | 2 Nos. |
| 122. | Fire Buckets 4 Nos with single stand | Painted in red and written as 'FIRE' in white colour | 1 No. |

Note: -

1. All the tools and equipment are to be procured as per BIS specification.
2. Internet facility is desired to be provided in the class room.

Note:

- a) Safety gloves, leather gloves, safety mask or respirator, goggles, rubber shoe, rubber apron and canvas apron must be provided to each trainee as consumable safety kit.
- b) The workshop must be provided first aid box with acid and cyanide antidotes, olive oil and general first aid medicines.
- c) Separate storage must be provided in the chemical lab for the storage of chemicals.
- d) Sufficient heavy duty exhaust fans and fumes extraction unit must be provided in workshop.
- e) An effluent treatment system must be provided with the workshop for the treatment of acid, alkali, cyanide and chromates effluents.
- f) A washing area with shower and toilet must be attached with the workshop and to ensure an uninterrupted water supply.
- g) An air conditioning system must be provided in the inspection cabin.
- h) Laboratory equipments and apparatus must be provided in the chemical analysis lab.

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

| List of Expert Members participated/ contributed for finalizing the course curriculum of Electroplater trade held on 20.02.2018 at Vadodara. | | | |
|---|--|--|----------------|
| S No. | Name & Designation Sh/Mr./Ms. | Organization | Remarks |
| 1. | Rajendra P. Mehendale, CEO | Maheshwari Industries, Vadodara | Member |
| 2. | Pradeep Sharma, Sr. | Polyplastic, Yamuna Nagar, Haryana | Member |
| 3. | Yagnesh Joshi, Metal Finishing Consultant | Allied Electronic Corporation, Vadodara | Member |
| 4. | Ajit G. Shah, | Gujarat Electroplating Work, | Member |
| 5. | Praveen Gautam, Area Manager | Atotech India Pvt. Ltd., Gurgaon | Member |
| 6. | S. A. Pandav, RDD (Trg.) | RDD Vadodara | Member |
| 7. | S. S. Patel, Principal | Govt. ITI, Naswadi | Member |
| 8. | B. S. Patel, Asst. Instructor | Govt. Kutir Udyog, Vadodara | Member |
| 9. | N. Harikrishnan, Sr. Instructor | Govt. ITI, Attingal, Kerala | Expert |
| 10. | Bijender Pal, Instructor | Govt. ITI, Yamuna Nagar, Haryana | Expert |
| 11. | L.K. Mukherjee, DDT | CSTARI, Kolkata | Member |
| 12. | K.V.S. Narayana, TO | CSTARI, Kolkata | Member |
| 13. | Bharat K. Nigam, TO | CSTARI, Kolkata | Coordinator |
| MEMBERS OF SECTOR MENTOR COUNCIL: Reference Aug 2014 Syllabus | | | |
| 1. | Dr. S.P. Gupta | Professor, IIT Roorkee | Chairman |
| 2. | Dr. P. Mahanto | Professor, IIT, Guwahati | Member |
| 3. | R.N. Bandopadhyay | Director, CSTARI, Kolkatta | Member |
| 4. | R. Senthil Kumar | Director, ATI, Chennai | Member |
| 5. | A Venkateshwara Rao | Joint Director, ATI, Chennai | Member |
| 6. | P. Saibaba | Joint Director, ATI, Chennai | Member |
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| 9. | M. Thamizharasan | Joint Director, CSTARI, Kolkatta | Member |
| 10. | S. Mathivanan | Dy Director, ATI, Chennai | Team Leader |
| Mentor | | | |
| 11. | Amrit Pal Singh | Dy. Director, DGET, New Delhi | Mentor |
| Member of Core Group | | | |
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| 13. | Ketan Patel | Dy Director, RDAT, Mumbai | Member |
| 14. | B. Ravi | Dy Director, CTI, Chennai | Member |
| 15. | A.S. Parihar | Dy Director, RDAT, Kolkata | Member |
| 16. | Nirmalya Nath | Asst Director, CSTARI, Kolkatta | Member |
| 17. | Parveen Kumar | Asst Director, ATI-EPI, Hyderabad | Member |
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| 20. | M. Asokan | Trg Officer, CTI, Chennai | Member |
| 21. | Mohan Raj | Trg Officer, NIMI Chennai | Member |
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| 35. | Surendu Adhikari | OTIS Elevator Co. India Ltd, Kolkatta | Member |
| 36. | K. Raju | Consultant- Energy Area, ASCI, Hyderabad | Member |
| 37. | Ravi G Deshmukh | Certified Energy Auditor, PPS Energy solutions, Pune | Member |
| 38. | R. Thiruppathi | JTS, IIT, Madras, Chennai | Member |
| 39. | M.N. Krishnamurthy | Retd. Ex Engineer, TNEB, Chennai | Member |
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| 42. | L.R. Sundarajan | Jr. Works Manager, Heavy vehicles factory | Member |
| 43. | B.S. Sudheendara | Consultant, VI micro systems pvt ltd, Chennai. | Member |
| 44. | S. Ganesh | Manager, L&T , Chennai | Member |
| 45. | G. Neethimani | Vice principal, Rane engine valves ltd, Chennai. | Member |
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ABBREVIATIONS

| | |
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| CTS | Craftsmen Training Scheme |
| ATS | Apprenticeship Training Scheme |
| CITS | Craft Instructor Training Scheme |
| DGT | Directorate General of Training |
| MSDE | Ministry of Skill Development and Entrepreneurship |
| NTC | National Trade Certificate |
| NAC | National Apprenticeship Certificate |
| NCIC | National Craft Instructor Certificate |
| LD | Locomotor Disability |
| CP | Cerebral Palsy |
| MD | Multiple Disabilities |
| LV | Low Vision |
| HH | Hard of Hearing |
| ID | Intellectual Disabilities |
| LC | Leprosy Cured |
| SLD | Specific Learning Disabilities |
| DW | Dwarfism |
| MI | Mental Illness |
| AA | Acid Attack |
| PwD | Person with disabilities |

