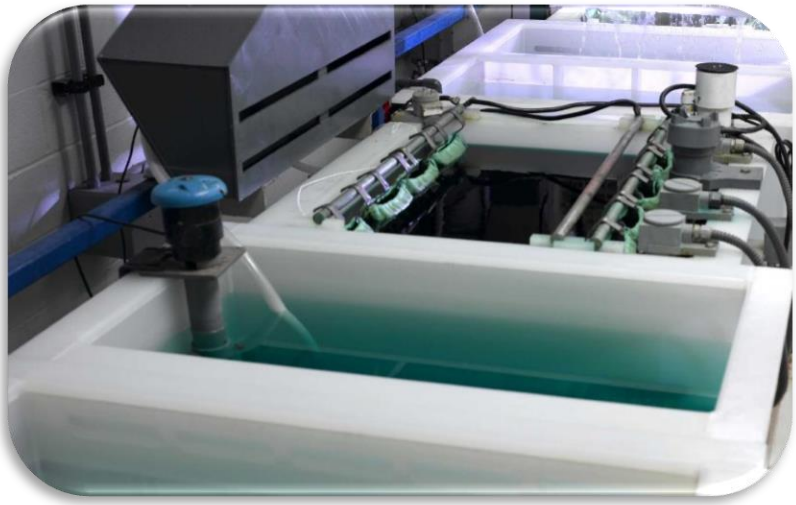
ELECTROPLATER

NSQF LEVEL- 4.5



SECTORS - CHEMICALS AND PETROCHEMICALS

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

ELECTROPLATER

(Engineering Trade)

SECTOR – CHEMICALS AND PETROCHEMICALS

(Designed in 2024)

Version 2.1

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

NSQF LEVEL – 4.5

Developed By
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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructors' Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960's by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course of one year duration. "Electroplater" CITS trade is applicable for Instructors of "Electroplater" Trade under CTS.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

1.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

1.2 COURSESTRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	480
	Professional Knowledge (Trade Theory)	270
2.	**Training Methodology**	
	TM Practical	270
	TM Theory	180
	Total	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

3	On the Job Training (OJT)/ Group Project	150
4	Optional Course	240

Trainees can also opt for optional courses of 240 hours duration.

1.3 PROGRESSIONPATHWAYS

- Can join as an Instructor in vocational training Institute/ technical Institute.
- Can join as a supervisor in Industries.

1.4 ASSESSMENT &CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training

program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. 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 Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external 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 CRITERIA

Allotment of Marks among the subjects for Examination:
The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. There will be no Grace marks.

2.4.2 ASSESSMENTGUIDELINE

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. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also 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 of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

Evidences of internal assessments are to be preserved until forthcoming yearly 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 be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***good*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a high standard of crafts instructorship with minimal or no support and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***high*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**ELECTROPLATER - CITS**
Trade Code	DGT/4051
NCO – 2015	2356.0100, 8122.0100, 8122.3500
NOS Covered	CP/N9401, PSS/N9450, PSS/N9421, CP/N9402, CP/N9403, CP/N9405, CP/N9406, CP/N9415, CP/N9416, CP/N9417, ASC/N9410, ASC/N9411
NSQF Level	Level-4.5
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in Chemical engineering from AICTE/ UGC recognized Engineering College/ university. OR 03 years Diploma in Chemical Engineering after class 10th from AICTE/ recognized board of technical education. OR Ex-serviceman from Indian Armed forces with 15 years of service in related field as per equivalency through DGR. OR 10th Class with 02 year NTC passed in the trade of "Electroplater".
Minimum Age	16 years as on first day of academic session.
Space Norms	60 Sq. m
Power Norms	16 KW
Instructor's Qualification for	
1. Electroplater -CITS Trade	B.Voc/ Degree in Chemical engineering from AICTE/ UGC recognized Engineering College/ university two years' experience in relevant field. **OR** 03 years Diploma in Chemical Engineering from AICTE/ recognized board of technical education with five years' experience in Relevant field. **OR** Ex-serviceman from Indian Armed forces with 15 years of service in related filed as per equivalency through DGR. Candidate should have undergone methods of instruction course or minimum 02 years of experience in technical training institute of Indian armed forces. **OR** NTC/NAC passed in the Trade of "Electroplater" trade with seven years' experience in relevant field. **Essential Qualification**: National Craft Instructor Certificate (NCIC) in **Electroplater** trade, in any of the variants under DGT.

2. Workshop Calculation & Science	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years' experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any Engineering trade with seven years' experience in relevant field. **Essential:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years' experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years' experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT
4. Training Methodology	B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years' experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years' experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years' experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor	21 Years

4. JOBROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools &equipment of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

Electroplater; Electroplater Instructor is able to impart training and supervise to 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 policing. May prepare plating solution under guidance of shop supervisor. Is designated as Gilder if engaged in gold platting and Anodiser if colours aluminium and light alloys article using specific chemical solutions.

Electroplater Instructor is responsible for conducting training of 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) 2356.0100 – Manual Training Teacher/ Craft Instructor
b) 8122.0100–Electroplater
c) 8122.3500 – Galvanizer

Reference NOS:

a) CP/N9401
b) PSS/N9450
c) PSS/N9421
d) CP/N9402
e) CP/N9403
f) CP/N9405
g) CP/N9406
h) CP/N9415
i) CP/N9416
j) CP/N9417
k) ASC/N9410
l) ASC/N9411

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.

TRADE TECHNOLOGY

1. Ensure implementation of safe working practices, produce fitting components, sheet metal joints and perform different types of welding operations. (CP/N9401)
2. Exhibit electrical wire joints, verify characteristics of electrical circuit, demonstrate installation, testing and maintenance of batteries and perform wiring, installation of electrical accessories. (PSS/N9450)
3. Assess Construction of electronic circuits and test for functioning. (PSS/N9421)
4. Exhibit use of laboratory apparatus and estimate pH, mass, normality, conductivity, specific gravity etc. (CP/N9402)
5. Demonstrate Handling of different solutions with due care & safety and effluent treatment of hazardous chemicals in electroplating workshop and carry out analysis of Chemical baths with Hull cell process. (CP/N9403)
6. Demonstrate surface preparation, mechanical cleaning like polishing, buffing, blasting etc. and chemical cleaning like electro cleaning, ultrasonic cleaning, vapor degreasing, pickling, rinsing, masking etc. (CP/N9403)
7. Illustrate Copper, Nickel and Chromium plating using different methods, examine various defects, causes and their remedies and Remove defective deposits by different methods. (CP/N9405)
8. Exhibit Zinc, Brass, Cadmium, Tin, Silver, Gold Plating using different methods, examine various defects in these plating, causes and their remedies and remove defective deposits by different methods. (CP/N9405)
9. Demonstrate electroplating of copper, nickel, tin, zinc and cadmium by barrel method and electroplating of copper, nickel, tin, silver and gold by electro less method. (CP/N9405)
10. Illustrate plating of copper, tin, nickel, zinc, cadmium etc. on aluminium with Zincate dipping process, Plan and perform plating of copper, nickel, chromium, silver and gold on nonconductive surface like plastic. (CP/N9405)
11. Demonstrate making of Printed circuit board with copper, nickel, tin, silver and gold and chemical etching processes for copper and brass. (CP/N9406)
12. Exhibit anodizing to convert metal surface into a decorative durable and corrosion resistant by different methods and demonstrate various colouring techniques on anodized aluminium by different colouring dyes and other methods like electro colouring. (CP/N9415)
13. Illustrate various conversions coating process on aluminium, magnesium and its alloys and demonstrate chemical milling on aluminium and undertake passivation of stainless steel and plan & perform phosphating, powder coating and metallizing on various metals. (CP/N9416)
14. Demonstrate various tests viz., adhesion, porosity, thickness, corrosion resistance, anodic

coating on aluminum, chemical analysis of electrolytes and identification of deposits etc., illustrate layout of Electro plating plant, estimate cost, materials and accessories required for electroplating shop and Carryout preventive and breakdown maintenance of Machines in electroplating shop. (CP/N9417)

15. Read and apply engineering drawing for different application in the field of work. (ASC/N9410)
16. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (ASC/N9411)

6. COURSE CONTENT

SYLLABUS FOR ELECTROPLATER – CITS TRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 33 Hrs Theory 12 Hrs	Ensure implementation of safe working practices, produce fitting components, sheet metal joints and perform different types of welding operations.	1. Demonstrate Electroplater trade tools and machineries. 2. Exhibit safe method of using firefighting equipment's. 3. Describe hazardous Chemicals. 4. Demonstrate marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting	Firefighting, occupational health & safety. Response to emergencies e.g. power failure, system failure and fire etc. Hazardous chemicals and safety. Allied trade knowledge. Basic fitting, welding, sheet metal work. Introduction to trade various tools and equipment's used. Metals and their physicals and mechanical properties.
Practical 42 Hrs Theory 18 Hrs	Exhibit electrical wire joints, verify characteristics of electrical circuit, demonstrate installation, testing and maintenance of batteries and perform wiring, installation of electrical accessories.	5. Construct simple twist, married, Tee western union, Britannia straight, Britannia Tee and rattail joint. 6. Set up for Soldering of joints/ lugs. 7. Verify Ohm's Law, Find relationship between V,I and R in a DC circuit. 8. Perform grouping of cells for specified voltage and current, Prepare and practice on battery charging, routine, care and maintenance of batteries. 9. Demonstrate various types of electrical circuit connections, Wire up a test board and test it. 10. Demonstrate various types of electrical circuit connections such as one lamp, two lamp, three lamp with wall socket, tube light connection stair case wiring, godown wiring,	Joints in electrical conductors Techniques of soldering. Types of solders and flux. Fundamentals of electricity, definitions, units & effects of electric current. Comparison and Advantages of DC and AC. Electrical measuring instruments such as Voltmeter, Ammeter and Ohmmeter. Ohm's Law. Electrical circuits and problems. Types of cells, their applications. Primary cells and secondary cells, Grouping of cells. Charging of battery, care and maintenance. Sealed Maintenance free Batteries.

		railway signal wiring etc.	
Practical 20 Hrs Theory 10 Hrs	Assess Construction of electronic circuits and test for functioning.	11. Determine the resistance by color coding. 12. Chose terminals of different Electronic components viz., resistors, diodes, transistors etc. 13. Demonstrate verification of characteristics of diodes. 14. Construct different types of Rectifier circuits.	Semiconductor energy level, atomic structure, types of materials, P-N-junction. Doping, Intrinsic and extrinsic semiconductor. PN junction diode, Forward and Reverse characteristics. Explanation of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit.
Practical 20Hrs Theory 10Hrs	Exhibit use of laboratory apparatus and estimate pH, mass, normality, conductivity, specific gravity etc.	15. Select the laboratory apparatus. 16. Apply acids and alkalis using litmus paper and other methods. 17. Determine the normality and mass per liter of sodium hydroxide, sodium carbonate, potassium hydroxide, hydrochloric acid, sulphuric acid and oxalic acid. 18. Measure the specific gravity of liquid sample and check the temperature in degree centigrade and convert to Fahrenheit. 19. Determine pH value of different liquids using pH meter, Study the change in pH of acetic acid on the addition of sodium acetate. 20. Determine the conductivity of different liquids using conductivity meter. 21. Demonstrate soft water &de-mineralized water. 22. Demonstrate various types of corrosions.	Familiarization of laboratory apparatus. Hard and soft water. Reactions of anions and cations. Exothermic and endothermic reactions. Principles of volumetric analysis, equivalent masses, normality, molarity, indicators. Definition of pH, pH scale, Chemical effect of electric current, ECE and principle of electrolysis. Faraday's Law of electrolysis. Explanation of Anodes and cathodes.
Practical 20Hrs Theory 10Hrs	Demonstrate Handling of different solutions with due care & safety and effluent treatment of hazardous	23. Demonstrate basic safety precautions to be taken while handling different types of electroplating solutions, cyanide base electroplating salts and chrome containing effluent. 24. Employ effluent treatment of	Precautions to be observed, first aid and antidotes for cyanide poisonings. Method of mixing of electrolyte, use of hydrometer & thermometer. Environmental pollution related to the trade,

	chemicals in electroplating workshop and carry out analysis of Chemical baths with Hull cell process.	hazardous chemicals in plating shop. 25. Demonstrate first aid and antidotes for cyanide poisonings. 26. Develop setting up of plating tanks and connections. 27. Determine ECE values of different solutions. 28. Carry out analysis of chemical baths with Hull cell process.	consequences, mitigation & control. Knowledge about molecular weight, equivalent weight. Theory involved in the treatment of plating effluent, pollution control, standard rules governing discharge of effluents. Types of solutions, saturated, unsaturated, super saturated solutions, solubility of solids, Analysis of chemical baths with Hull cell process.
Practical 20Hrs Theory 10Hrs	Demonstrate surface preparation, mechanical cleaning like polishing, buffing, blasting etc. and chemical cleaning like electro cleaning, ultrasonic cleaning, vapor degreasing, pickling, rinsing, masking etc.	29. Demonstrate various polishing wheels and compounds used in surface preparation process. Prepare glue and emery wheel binding. 30. Show surface preparation of ferrous/ nonferrous alloys including acid cleaning, polishing, buffing and blast cleaning. 31. Prepare suitable dips and pickling for removing of scales from surface of iron and steel. 32. Perform cleaning by means of tumbling barrels. 33. Operate ultrasonic cleaning to remove soil from inaccessible places as crevices, blind holes, and gear teeth etc. Practice anodic/ cathodic cleaning. 34. Demonstrate degreasing (vapor and immersion) process to include organic solvent i.e. TCE/PCE. 35. Carry out cleaning tanks, preparing suitable solution and methods of masking. 36. Carry out cleaning of oxidation stains on the articles of copper, brass, nickel and silver.	Abrasives and Adhesives used for the preparation of wheels. Various compounds used for polishing and buffing. Importance of cleaning, its types, ex. a) Mechanical / chemical. b) Polishing / buffing c) Abrasive cleaning Degreasing, pickling, hot alkaline cleaning& final cleaning. Chemical cleaning methods by acid dipping, alkaline soak cleaning, vapour degreasing, ultrasonic cleaning, alkaline electro cleaning etc. Different plating techniques for ferrous & non-ferrous metals. General care and maintenance of plating baths, electroplating tank & lining. Various methods of masking
Practical	Illustrate Copper,	37. Perform copper plating on	Properties of copper, nickel

75Hrs Theory 30Hrs	Nickel and Chromium plating using different methods, examine various defects, causes and their remedies and Remove defective deposits by different methods.	different ferrous metals from acid bath. 38. Practice and perform electro deposition of copper on different ferrous metals by cyanide solution. 39. Remove the defective copper deposit from ferrous metal by immersion and electrolytic methods. 40. Perform Nickel plating in articles made of iron. 41. Perform Nickel plating in articles made of copper. 42. Perform Nickel plating in articles made of brass. 43. Practice to remove the defective nickel deposit from different metals by immersion and electrolytic methods. 44. Perform carbon treatment and other maintenance of nickel solution. 45. Perform bright chromium plating in articles made of iron. 46. Perform bright chromium plating in articles made of copper. 47. Perform hard chromium plating in articles made of iron. 48. Perform hard chromium plating in articles made of copper. 49. Plan and remove the defective chromium deposit from different metals by immersion and electrolytic methods.	and chromium, Applications and uses of copper, nickel, chromium plating. Equipment's for copper, nickel and chromium plating, Various types of solutions, their compositions and operating conditions, their preparation and maintenance. Processing steps of copper plating in acid and cyanide bath. Importance and maintenance of pH value, density, agitation and filtration. Removal of impurities by carbon treatment and filtration. Processing steps of nickel plating. Various types of nickel solutions like dull, bright, black etc, Safety precautions & Exhaust, preventive methods for removing fumes from chromium plating solutions. Regeneration of chromium plating solutions, Proper maintenance, removal of excess sulphate, rectification of trivalent chromium. Various types of bright chromium solutions like regular, self-regulating and black chromium, their chemical compositions, operating conditions and their preparation. Processing steps of bright chromium plating. Applications and uses of hard chromium plating. Various types of hard chromium solutions like regular, high speed and self regulating chromium, their chemical compositions,

			operating conditions and their preparation. Processing steps of hard chromium plating. Various defects generally encountered in copper, nickel and chromium plating, causes for these defects and their remedies. Various methods for the removal of copper, nickel and chromium, deposit from different metals
Practical 95Hrs Theory 40Hrs	Exhibit Zinc, Brass, Cadmium, Tin, Silver, Gold Plating using different methods, examine various defects in these plating, causes and their remedies and remove defective deposits by different methods.	50. Perform zinc plating on different ferrous and non-ferrous metals in acid bath and passivate with different colours. 51. Perform zinc plating on different ferrous and non-ferrous metals in cyanide and alkaline zinc bath and passivate with different colours. 52. Remove the defective zinc deposit from various metals by immersion and electrolytic methods. 53. Perform cadmium plating on different ferrous and non-ferrous metals and passivate with different colours. 54. Remove the defective cadmium deposit from various metals by immersion and electrolytic methods. 55. Perform Tin plating on different ferrous and non-ferrous metals. 56. Remove the defective Tin deposit from various metals by immersion and electrolytic methods. 57. Perform Silver plating on different ferrous and non-ferrous metals. 58. Remove the defective Silver	Properties, applications and uses of zinc, Brass, Cadmium, Tin, Silver, Gold. Equipment for zinc plating in acid bath and cyanide bath. Various types of zinc solutions for acid bath and cyanide bath, their compositions and operating conditions, their preparation and maintenance. Processing steps of zinc plating in acid bath and 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 metals. Equipment for Silver, Brass, Cadmium, Tin and Gold plating. Various types of solutions, their compositions and operating conditions, their preparation and maintenance. Processing steps of Silver, Brass, Cadmium, Tin and Gold plating.

		deposit from various metals by immersion and electrolytic methods. 59. Perform Gold plating on different ferrous and non-ferrous metals. 60. Remove the defective Gold deposit from various metals by immersion and electrolytic methods. 61. Perform Brass plating on different ferrous and non-ferrous metals. 62. Remove the defective Brass deposit from various metals by immersion and electrolytic methods.	Various defects generally encountered in the Silver, Brass, Cadmium, Tin and Gold plating, causes for these defects and their remedies. Methods for the removal of their deposit from various metals.
Practical 33Hrs Theory 12Hrs	Demonstrate electroplating of copper, nickel, tin, zinc and cadmium by barrel method and electroplating of copper, nickel, tin, silver and gold by electroless method.	63. Perform copper plating of small articles by barrel and electroless method. 64. Perform nickel plating of small articles by barrel and electroless method. 65. Perform tin plating of small articles by barrel and electroless method. 66. Perform zinc plating of small articles by barrel method. 67. Perform cadmium plating of small articles by barrel method. 68. Perform silver plating by electroless method. 69. Perform gold plating by electroless method.	Applications of barrel plating in electroplating industry. Types of barrels used for barrelling. 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, zinc and cadmium. General defects, their causes and remedies in barrel plating. 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.
Practical 20 Hrs	Illustrate plating of copper, tin, nickel, zinc,	66. Perform copper plating on aluminium articles. 67. Perform nickel plating on	Applications of electroplating on aluminium. Preparation of aluminium

Theory 10Hrs	cadmium etc. on aluminium with Zincate dipping process, Plan and perform plating of copper, nickel, chromium, silver and gold on nonconductive surface like plastic.	aluminium articles. 68. Perform tin plating on aluminium articles. 69. Perform zinc plating on aluminium articles. 70. Perform cadmium plating on aluminium articles. 71. Perform copper plating on ABS plastic. 72. Perform nickel plating on ABS plastic. 73. Perform chromium plating on ABS plastic. 74. Perform silver plating on ABS plastic. 75. Perform gold plating on ABS plastic.	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. Applications of electroplating on plastic and non conductive 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.
Practical 20Hrs Theory 10Hrs	Demonstrate making of Printed circuit board with copper, nickel, tin, silver and gold and chemical etching processes for copper and brass.	76. Make Printed circuit board with copper. 77. Make Printed circuit board with nickel. 78. Make Printed circuit board with tin. 79. Make Printed circuit board with silver. 80. Make Printed circuit board with gold. 81. Make letter printing on copper metal by chemical etching process. 82. Make letter printing on brass metal by chemical etching process.	Applications of 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 composition, operating conditions and

			processing steps of brass etching.
Practical 20Hrs Theory 10Hrs	Exhibit anodizing to convert metal surface into a decorative durable and corrosion resistant by different methods and demonstrate various colouring techniques on anodized aluminium by different colouring dyes and other methods like electro colouring.	83. Perform and practice aluminium anodizing in sulphuric acid bath 84. Demonstrate anodizing by using chromic acid. 85. Demonstrate anodizing by using oxalic acid. 86. Demonstrate removal of anodized film from aluminium articles. 87. Demonstrate colouring on anodized aluminium article by using various colouring solutions. 88. Demonstrate electro colouring on anodized aluminium article with various colour shades. 89. Remove the colour without attacking the anodized film.	Properties of aluminium and its corrosion. Applications and uses of anodizing. Preparation of aluminium articles prior to anodizing. Types of anodizing solutions, preparation and operating conditions. Processing steps of anodizing process. Post treatments of anodizing. General defects, their causes and remedies in anodizing of aluminium. Removal of anodized film from aluminium articles. Applications and uses of anodized colouring. Methods of various colouring techniques. 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. Removal of colour film from anodized aluminium articles.
Practical 20Hrs Theory 10Hrs	Illustrate various conversions coating process on aluminium, magnesium and its alloys and demonstrate chemical milling on aluminium and undertake passivation of stainless steel and plan & perform	90. Demonstrate conversion coating on aluminium and magnesium parts. 91. Remove the conversion coating without attacking the base metal. 92. Demonstrate chemical milling on aluminium. 93. Demonstrate passivation on stainless steel. 94. Plan and carry out phosphating on various metals. 95. Perform and practice powder	Properties and applications for conversion coating, powder coating, phosphating and metallizing. Preparation of solution and operating conditions for above. Processing steps of conversion coating on aluminium. Removal of conversion coating. Application and uses of chemical milling on

	phosphating, powder coating and metallizing on various metals.	coating on various metals. 96. Perform and practice metallizing on various metals.	aluminium. Preparation of solution and operating conditions. Processing steps of chemical milling on aluminium. Application and uses of passivation on stainless steel. Preparation of solution and operating conditions for passivation on stainless steel. Processing steps for passivation on stainless steel. Processing steps of phosphating, powder coating and metallizing and their post treatment General care and maintenance for powder coating and metallizing machines.
Practical 42Hrs Theory 18Hrs	Demonstrate various tests viz., adhesion, porosity, thickness, corrosion resistance, anodic coating on aluminum, chemical analysis of electrolytes and identification of deposits etc., illustrate layout of Electro plating plant, estimate cost, materials and accessories required for electroplating shop and Carryout preventive and breakdown maintenance of Machines in electroplating shop.	97. Carry out visual inspection of different electroplated articles for any defects. 98. Perform adhesion tests by various methods. 99. Perform porosity tests by various methods. 100. Perform corrosion resistance tests by various methods. 101. Practice in testing different plated jobs for determining the local thickness by various methods. 102. Practice in testing different anodized jobs for determining the thickness and insulation. 103. Prepare a complete layout of the electroplating shop with details of plant machineries and technical specifications. 104. Working out detailed electroplating layout and calculate the approximate	Quality control in electroplating shops. Inspection of platted 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. ferry cyanide test, hot water test, salt spray test, hydrogen peroxide salt test etc. Methods of testing anodic coating on aluminum. Chemical analysis of various plating electrolytes. Electroplating shop layout, Characteristics, waste disposal. Installation of machinery for electroplating

		cost of the shop. 105. Carry out preventive maintenance of electroplating shops. 106. Estimate materials and quantity required for constructing electroplating plant.	shops. 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 equipment's advantages and disadvantages.
Engineering Drawing: 30 Hrs.			
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different application in the field of work.	**Engineering Drawing:** • Reading of drawing of nuts, bolt, screw thread, different types of locking devices e.g., Double nut, Castle nut, Pin, etc. • Reading of foundation drawing • Reading of Rivets and rivetted joints, welded joints • Reading of drawing of pipes and pipe joints Reading of Job Drawing, Sectional View & Assembly view	
WORKSHOP CALCULATION & SCIENCE: 30 Hrs.			
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**WORKSHOP CALCULATION & SCIENCE:** **Friction** Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction Friction - Lubrication Friction - Co- efficient of friction, application and effects of friction in workshop practice **Centre of Gravity** Centre of gravity - Centre of gravity and its practical application **Area of cut out regular surfaces and area of irregular surfaces** Area of cut out regular surfaces - circle, segment and sector of circle Related problems of area of cut out regular surfaces - circle, segment and sector of circle Area of irregular surfaces and application related to shop problems **Elasticity** Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress **Heat Treatment** Heat treatment and advantages Heat treatment - Different heat treatment process – Hardening, tempering, annealing, normalising and case hardening	

		Estimation and Costing Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing

SYLLABUS FOR CORE SKILLS
1. Training Methodology (Common for all trades) (270 Hrs + 180 Hrs)

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

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY	
1. Ensure implementation of safe working practices, produce fitting components, sheet metal joints and perform different types of welding operations. (NOS: CP/N9401)	Demonstrate Electroplater trade tools and machineries.
	Exhibit safe method of using firefighting Equipment's.
	Identify hazardous chemicals.
	Demonstrate marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting.
2. Exhibit electrical wire joints, verify characteristics of electrical circuit, demonstrate installation, testing and maintenance of batteries and perform wiring, installation of electrical accessories. (NOS: PSS/N9450)	Demonstrate simple twist, married, Tee western union, britannia straight, britannia Tee and rat tail joint.
	Exhibit Soldering of joints/lugs.
	Demonstrate verification of Ohm's Law and establish relationship between V,I and R in a DC circuit.
	Exhibit grouping of cells for specified voltage and current, Demonstrate battery charging, routine, care and maintenance of batteries.
	Demonstrate various types of electrical circuit connections, Wire up a test board and test it.
	Establish various types of electrical circuit connections such as one lamp, two lamp, three lamp with wall socket, tube light connection stair case wiring, godown wiring, railway signal wiring etc.
3. Assess Construction of electronic circuits and test for functioning. NOS: PSS/N9421)	Determine the resistance by color coding.
	Identify terminals of different electronic components viz., resistors, diodes, transistors etc.
	Illustrate verification of characteristics of diode.
	Construct Rectifier circuits.
4. Exhibit use of laboratory apparatus and estimate pH, mass, normality, conductivity, specific gravity etc. (NOS: CP/N9402)	Identify the laboratory apparatus.
	Demonstrate identification of acids and alkalis using litmus paper and other methods.
	Determine the normality and mass per liter of sodium hydroxide, sodium carbonate, potassium hydroxide, hydrochloric acid, sulphuric acid and oxalic acid.
	Measure the specific gravity of liquid sample and check the temperature in degree centigrade and convert to Fahrenheit.
	Determine pH value of different liquids using pH meter, Study the change in pH of acetic acid on the addition of sodium acetate.
	Determine the conductivity of different liquids using conductivity meter.

	demonstrate Identification of soft water &de- mineralized water.
	Illustrate various types of corrosions.
5. Demonstrate Handling of different solutions with due care & safety and effluent treatment of hazardous chemicals in electroplating workshop and carry out analysis of Chemical baths with Hull cell process. (NOS: CP/N9403)	Demonstrate basic safety precautions to be taken while handling different types of electroplating solutions, cyanide base electroplating salts and chrome containing effluent.
	Exhibit effluent treatment of hazardous chemicals in plating shop.
	Demonstrate first aid and antidotes for cyanide poisonings.
	Employ setting up of plating tanks and connections.
	Determine ECE values of different solutions.
	Illustrate analysis of chemical baths with Hull cell process.
6. Demonstrate surface preparation, mechanical cleaning like polishing, buffing, blasting etc. and chemical cleaning like electro cleaning, ultrasonic cleaning, vapor degreasing, pickling, rinsing, masking etc. (NOS: CP/N9403)	Demonstrate various polishing wheels and compounds used in surface preparation process. Prepare glue and emery wheel binding.
	Exhibit surface preparation of ferrous/ nonferrous alloys including acid cleaning, polishing, buffing and blast cleaning.
	Demonstrate preparation of suitable dips and pickling for removing of scales from surface of iron and steel.
	Exhibit cleaning by means of tumbling barrels.
	Demonstrate ultrasonic cleaning to remove soil from inaccessible places as crevices, blind holes, and gear teeth etc. Practice anodic/ cathodic cleaning.
	Organize degreasing (vapor and immersion) process to include organic solvent i.e. TCE/PCE.
	organize in cleaning tanks, preparing suitable solution and methods of masking.
	Demonstrate cleaning of oxidation stains on the articles of copper, brass, nickel and silver.
7. Illustrate Copper, Nickel and Chromium plating using different methods, examine various defects, causes and their remedies and remove defective deposits by different methods. (NOS: CP/N9405)	Demonstrate copper plating on different ferrous metals from acid bath.
	Exhibit electro deposition of copper on different ferrous metals by cyanide solution.
	Demonstrate to remove the defective copper deposit from ferrous metal by immersion and electrolytic methods.
	Demonstrate Nickel plating in articles made of iron.
	Demonstrate Nickel plating in articles made of copper.
	Demonstrate Nickel plating in articles made of brass.
	Exhibit to remove the defective nickel deposit from different metals by immersion and electrolytic methods.
	Exhibit carbon treatment and other maintenance of nickel solution.
	Illustrate bright chromium plating in articles made of iron.
	Show bright chromium plating in articles made of copper.

	Demonstrate hard chromium plating in articles made of iron.
	Show hard chromium plating in articles made of copper.
	Exhibit removal of defective chromium deposit from different metals by immersion and electrolytic methods.
8. Exhibit Zinc, Brass, Cadmium, Tin, Silver, Gold Plating using different methods, examine various defects in these plating, causes and their remedies and Remove defective deposits by different methods. (NOS: CP/N9405)	Exhibit zinc plating on different ferrous and non-ferrous metals in acid bath and passivate with different colors.
	Demonstrate zinc plating on different ferrous and non-ferrous metals in cyanide and alkaline zinc bath and passivate with different colors.
	Illustrate to remove the defective zinc deposit from various metals by immersion and electrolytic methods.
	Demonstrate cadmium plating on different ferrous and non-ferrous metals and passivate with different colors.
	Illustrate to remove the defective cadmium deposit from various metals by immersion and electrolytic methods.
	Exhibit Tin plating on different ferrous and non-ferrous metals.
	Illustrate to remove the defective Tin deposit from various metals by immersion and electrolytic methods
	Demonstrate Silver plating on different ferrous and non-ferrous metals.
	Illustrate to remove the defective Silver deposit from various metals by immersion and electrolytic methods.
	Exhibit Gold plating on different ferrous and non-ferrous metals.
	Illustrate to remove the defective Gold deposit from various metals by immersion and electrolytic methods.
	Demonstrate Brass plating on different ferrous and non-ferrous metals.
	Illustrate removal of defective Brass deposit from various metals by immersion and electrolytic methods.
9. Demonstrate electroplating of copper, nickel, tin, zinc and cadmium by barrel method and electroplating of copper, nickel, tin, silver and gold by electroless method. (NOS: CP/N9405)	Demonstrate copper plating of small articles by barrel and electroless method.
	Exhibit nickel plating of small articles by barrel and electroless method.
	Demonstrate tin plating of small articles by barrel and electroless method.
	Exhibit zinc plating of small articles by barrel method.
	Show cadmium plating of small articles by barrel method.
	Demonstrate silver plating by electroless method.
	Exhibit gold plating by electroless method.
10. Illustrate plating of copper, tin, nickel, zinc, cadmium etc. on	Demonstrate copper plating on aluminium articles.
	Exhibit nickel plating on aluminium articles.
	Illustrate tin plating on aluminium articles.

aluminium with Zincate dipping process, Plan and perform plating of copper, nickel, chromium, silver and gold on nonconductive surface like plastic. (NOS: CP/N9405)	Demonstrate zinc plating on aluminium articles.
	Exhibit cadmium plating on aluminium articles.
	Illustrate copper plating on ABS plastic.
	Demonstrate nickel plating on ABS plastic.
	Exhibit chromium plating on ABS plastic.
	Illustrate silver plating on ABS plastic.
	Demonstrate gold plating on ABS plastic.
11. Demonstrate making of Printed circuit board with copper, nickel, tin, silver and gold and chemical etching processes for copper and brass. (NOS: CP/N9406)	Construct Printed circuit board with copper.
	Develop Printed circuit board with nickel.
	Produce Printed circuit board with tin.
	Construct Printed circuit board with silver.
	Generate Printed circuit board with gold.
	Produce letter printing on copper metal by chemical etching process.
	Develop letter printing on brass metal by chemical etching process.
12. Exhibit anodizing to convert metal surface into a decorative durable and corrosion resistant by different methods and demonstrate various colouring techniques on anodized aluminium by different colouring dyes andother methods like electro colouring. (NOS: CP/N9415)	Demonstrate aluminium anodizing in sulphuric acid bath
	Exhibit anodizing by using chromic acid.
	Exhibit anodizing by using oxalic acid.
	Illustrate removal of anodized film from aluminium articles.
	Demonstrate colouring on anodized aluminium article by using various colouring solutions.
	Exhibit electro colouring on anodized aluminium article with various colour shades.
	Demonstrate removal of colour without attacking the anodized film.
13. Illustrate various conversions coating process on aluminium, magnesium and its alloys and demonstrate chemical milling on aluminium and undertake passivation of stainless steel and plan & perform phosphating, powder coating and metallizing on various metals. (NOS: CP/N9416)	Illustrate conversion coating on aluminium and magnesium parts.
	Demonstrate removal of conversion coating without attacking the base metal.
	Exhibit chemical milling on aluminium.
	Demonstrate passivation on stainless steel.
	Exhibit phosphating on various metals.
	Demonstrate powder coating on various metals.
	Exhibit metallizing on various metals.
14. Demonstrate various tests viz., adhesion, porosity, thickness, corrosion	Illustrate visual inspection of different electroplated articles for any defects.
	Validate adhesion tests by various methods.

resistance, anodic coating on aluminum, chemical analysis of electrolytes and identification of deposits etc., illustrate layout of Electro plating plant, estimate cost, materials and accessories required for electroplating shop and Carryout preventive and breakdown maintenance of Machines in electroplating shop. (NOS: CP/N9417)	Assess porosity tests by various methods.
	Demonstrate corrosion resistance tests by various methods.
	Exhibit testing of different plated jobs for determining the local thickness by various methods.
	Validate testing different anodized jobs for determining the thickness and insulation.
	Compose complete layout of the electroplating shop with details of plant machineries and technical specifications.
	Examine detailed electroplating layout and calculate the approximate cost of the shop.
	Exhibit preventive maintenance of electroplating shops.
	Estimate materials and quantity required for constructing electroplating plant.
15. Read and apply engineering drawing for different application in the field of work (NOS: ASC/N9410)	
	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameter
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
16. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study (NOS: ASC/N9411)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR ELECTROPLATER (CITS)			
For batch of 25 candidates			
A. TRAINEES TOOL KIT			
S no.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
1.	Pliers Combination	150 mm	5 Nos.
2.	Pliers Side Cutting	150 mm	5 Nos.
3.	Screw Driver	100 mm	5 Nos.
4.	Screw Driver	150 mm	5 Nos.
5.	Connector, screw driver insulated handle thin stem	100 mm	5 Nos.
6.	Punch Centre	150 mm X 9 mm	5 Nos.
7.	Knife Double Bladed	steel	5 Nos.
8.	Neon Tester	Heavy duty	5 Nos.
9.	Steel Rule	300 mm	5 Nos.
10.	Hammer, cross peen with handle	300g	5 Nos.
11.	Hammer, ball peen with handle	300g	5 Nos.
12.	Bradawl	Standard size	5 Nos.
13.	Pincer	150 mm	5 Nos.
14.	File flat	150 mm, smooth	5 Nos.
15.	File triangular	150 mm, smooth	5 Nos.
16.	File half round	150 mm, smooth	5 Nos.
17.	File round	150 mm, smooth	5 Nos.
18.	File flat	200 mm, rough	5 Nos.
19.	Crimping Tool	Medium size	5 Nos.
20.	Wire stripper	20 cm	5 Nos.
B. SHOP TOOLS, EQUIPMENT & ACCESSORIES			
21.	Adjustable resistance board with DC digital ammeter & voltmeter	0-20V,0-100A	10 Nos.
22.	Pedestal buffing machine mounted in heavy duty CI stand, complete with push button starter & wheel guard	3phase, 3HP, 3000rpm	2 Nos.
23.	Industrial pedestal polishing machine with dust collectors	2HP	2 Nos.
24.	Flexible shaft polishing machine	0.5HP, 2m shaft length, 2800 rpm.	1 No.
25.	Bed blaster machine for blast cleaning	Standard size	1 No.
26.	Ultrasonic cleaner	Mini compact table top, 3.5 litre capacity	1 No.
27.	Vapour degreaser	Mini compact table top, 3.5 litre capacity	1 No.
28.	Dipping basket perforated	Titanium or PP, 6x5 inch height	4 Nos.
29.	Titanium anode basket	4.5x6 inch height	4 Nos.
30.	Moulded buckets	PP, 10 litre capacity	4 Nos.

31.	Moulded buckets	PP, 5 litre capacity	4 Nos.
32.	Digital pH meter equipment	Table top type, 0-14 range	2 Nos.
33.	Digital pH meter	Pen type	2 Nos.
34.	Portable angle grinder hand type	1phase,230V/5A	5 Nos.
35.	Rectifier transformer DC power supply	3phase, 415V,300A	1 No.
36.	Electroplating rectifier	1 phase 230V, DC output Approximately 100A, 30V	1 No.
37.	Electroplating rectifier	Small size, 1 phase 230V, DC output Approximately 25A, 12V	1 No.
38.	Electric immersion heater (Silica, Stainless steel, lead, Titanium and Glass)	0.5KW, length 10-12''	2 Nos. each
39.	Plating Tank with SS stand	L-2ft, B-1.5ft ht-1.5ft made out of Polypropylene (PP)	15 Nos.
40.	Miniature fully immersed portable plating barrel with DC motor	Perforated, PP, 7x5 inch barrel size, up to 2kg capacity	2 Nos.
41.	Submersible plating barrel with tank and complete setup	7kg capacity, 12x8 inch barrel size, 0.125 HP motor	1 No.
42.	Oblique tumbling barrel with motor and complete setup	3.5 litre capacity, 275mm depth barrel	1 No.
43.	Cleaning tank	L-2ft, b-1.5ft, ht-1.5ft made out of Polypropylene (PP)	15 Nos.
44.	Solution filter unit	Disc type, PP filter chamber, mounted on C.I wheels, 1HP,65W	2 Nos.
45.	Industrial water cooler	Compressor power, 1000W	1 No.
46.	Water demineralizer, Mixed system	D series, 1phase,230V	1 No.
47.	Direct plating thickness measurement meter	Non destructive, digital	2 Nos.
48.	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.
49.	Hot air oven	600x600x900mm, 6KW	1 No.
50.	Hot plate	12 inch dia. Digital temp controller	1 No.
51.	Side channel blower	0.5 HP	2 Nos.
52.	Centrifugal Dryer	5kg capacity, 10x8 inch basket size	1 No.
53.	Hull cell apparatus (with fittings like	Minimum size available in	

	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)	the market	1 No.
54.	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.
55.	Powder coating machine (complete set)		1 No.
56.	Glue pot	5kg capacity	2 Nos.
57.	Digital Voltmeter AC	10-750V	2 Nos.
58.	Digital Voltmeter DC	0-100V	2 Nos.
59.	Digital Ammeter DC	0-100 A	2 Nos.
60.	Digital Ammeter AC	0-50A	2 Nos.
61.	Variable Auto Transformer	1 Phase	2 Nos.
62.	Battery Charger	10A,48V DC output	1 No.
63.	Thermometer	0 to 100^0C	2 Nos.
64.	Thermometer digital	Pen type	2 Nos.
65.	Hydrometer	For heavy liquids	2 Nos.
66.	Hydrometer with syringe	For battery testing	2 Nos.
67.	Portable digital density meter	Laboratory use	2 Nos.
68.	Weighing Balance Digital	10kg capacity with 0.05g accuracy	2 Nos.
69.	Conductivity meter Digital	Table top, LED display, 230V	2 Nos.
70.	Micrometer (Digital display)	0-1”/25mm range	2 Nos.
71.	Bench Grinder	150mm, 250W	1 No.
72.	Pipe vice	Standard size	2 Nos.
73.	Chisel Cold flat	12 mm	5 Nos.
74.	Mallet hard wood	0.50 kg	5 Nos.
75.	Hammer Extractor type	0.40 kg	5 Nos.
76.	Hacksaw frame adjustable	300 mm	5 Nos.
77.	Try Square	150 mm blade	5 Nos.
78.	Pliers flat nose	150 mm	5 Nos.
79.	Pliers round nose	100 mm	5 Nos.
80.	Tweezers	100 mm	5 Nos.
81.	Snip Straight and Bent	150 mm	5 Nos.
82.	D.E. Spanner set of 12 pieces	6x7 to 25x28	2 Nos.
83.	Jack plane with smoothing cutters	50 mm	5 Nos.
84.	Standard Wire Gauge	Standard size	5 Nos.
85.	File Rasp	200 mm	5 Nos.
86.	Soldering Iron	25W, 220V	5 Nos.
87.	De soldering Gun	30W, 220V	2 Nos.
88.	Bench Vice	100 mm jaw	6 Nos.
89.	Multi Meter (analog)	0 to 1000 M Ohms, 2.5 to 500 V	2 Nos.
90.	Digital Multi Meter	AC 4-750V,40mA-10A and DC	2 Nos.

		400mV-1000V, 40mA-10A	
91.	A.C. Voltmeter M.I.	0 -500V A.C	2 Nos.
92.	Milli Voltmeter centre zero	100 - 0 - 100 m volt	2 Nos.
93.	D.C. Milli ammeter	0 -500m A	2 Nos.
94.	Ammeter MC	0-5 A, 0- 25 A	2 No. each
95.	A.C. Ammeter M.I.	0-5A, 0-25 A	2 No. each
96.	Rheostat	0 -1 Ohm, 5 Amp 0 -10 Ohm, 5Amp 0- 25 Ohm, 1Amp 0- 300 Ohm, 1 Amp	2 Nos. each
97.	Hand vice	50mm jaw	5 Nos.
98.	Spanner Adjustable	300mm	5 Nos.
99.	Heavy Duty Screw Driver	200 mm	5 Nos.
100.	Screw Driver thin stem insulated handle	250 mm	5 Nos.
101.	Firmer Chisel	25 mm X 200 mm	5 Nos.
102.	Hand wood saw	15 inch	5 Nos.
103.	Portable Electric Drilling Machine	6 mm capacity	2 Nos.
104.	Pillar Electric Drill Machine	12 mm capacity	1 No.
105.	Pliers Combination	150 mm	7 Nos.
106.	Pliers Side Cutting	150 mm	7 Nos.
107.	Screw Driver	100 mm	7 Nos.
108.	Screw Driver	150 mm	7 Nos.
109.	Connector, screw driver insulated handle thin stem	100 mm	7 Nos.
110.	Punch Centre	150 mm X 9 mm	7 Nos.
111.	Knife Double Bladed	steel	7 Nos.
112.	Neon Tester	Heavy duty	7 Nos.
113.	Steel Rule	300 mm	7 Nos.
114.	Hammer, cross peen with handle	300g	7 Nos.
115.	Hammer, ball peen With handle	300g	7 Nos.
116.	Bradawl	Standard size	7 Nos.
117.	Pincer	150 mm	7 Nos.
118.	File flat	150mm, smooth	7 Nos.
119.	File triangular	150mm, smooth	7 Nos.
120.	File half round	150mm, smooth	7 Nos.
121.	File round	150mm, smooth	7 Nos.
122.	File flat	200 mm, rough	7 Nos.
123.	Crimping Tool	Medium size	7 Nos.
124.	Wire stripper	20 cm	7 Nos.
C. FURNITURE, ACCESSORIES AND AUDIO VISUAL AIDS FOR TRADE THEORY AND TRADE PRACTICAL			
125.	Instructor's table	Teakwood, with one drawer and one shelf with inbuilt locks	2 Nos.
126.	Instructor's chair	Teakwood, Armed	2 Nos.
127.	Wooden stool	Standard size	2 Nos.
128.	Wooden table	Teakwood, 3 ft x 2ft	2 Nos.
129.	Laptop	Latest configuration	1 No.

130.	Mini Projector (High resolution display)	Table top, latest configuration	1 No.
131.	Laser Printer	Colour, latest configuration	1 No.
132.	Wooden Almirah (10 drawers with inbuilt locks)	Teakwood, standard size	5 Nos.
133.	Wooden Almirah	Teakwood, 2.5x1.20x0.5m	2 Nos.
134.	White board	Standard size with Al frame	2 Nos.
135.	Showcase (for displaying the models of plated articles)	Standard size	1No.
136.	Wooden rack (for keeping the trainee shoes and bags)	Teakwood,100x150x45cm	2 Nos.
137.	Wooden rack (for the storage of chemicals)	Teakwood, 2x2x0.5m	5 Nos.
138.	Wooden stand (for hanging uniforms)	Teakwood, Standard size	1 No.
139.	Work bench	2x 0.5 x 1.5m ht	5 Nos.
140.	Working Bench	2.5 m x 1.20 m x 0.75 m	5 Nos.
141.	Fire Extinguisher	CO_2	2 Nos.
142.	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.


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