



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

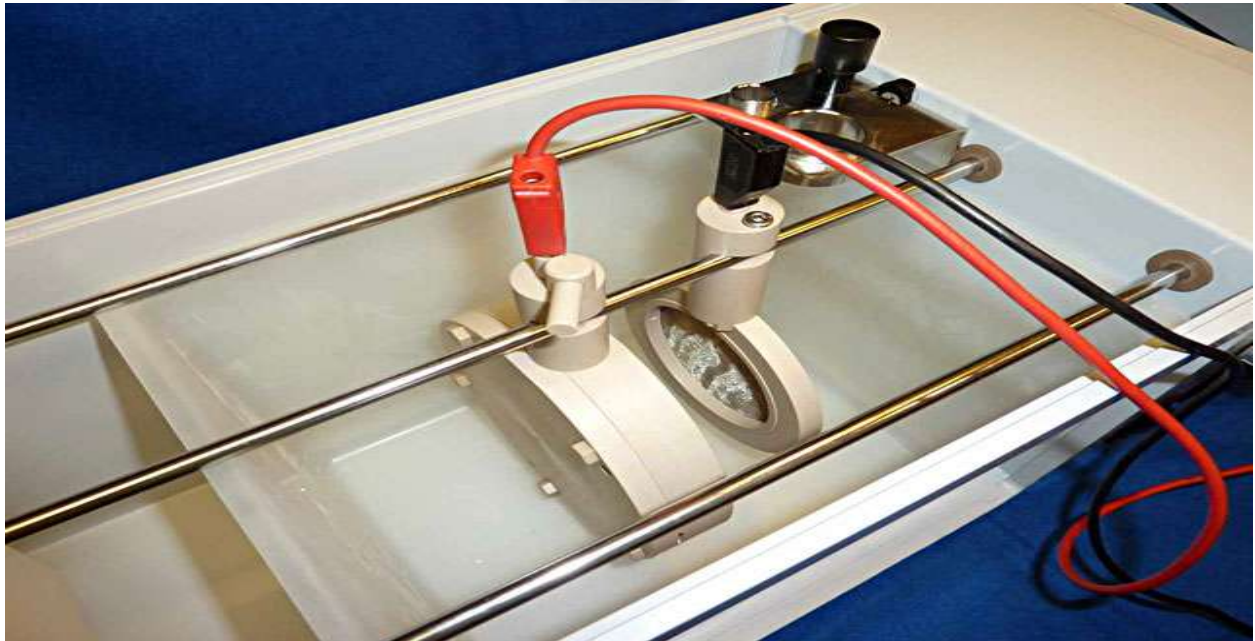
**COMPETENCY BASED CURRICULUM**

# **ELECTROPLATER**

(Duration: Two Years)

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL - 5**



**SECTOR – ELECTRICAL**

# ELECTROPLATER

(Engineering Trade)

(Revised in 2018)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 5

Skill India

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Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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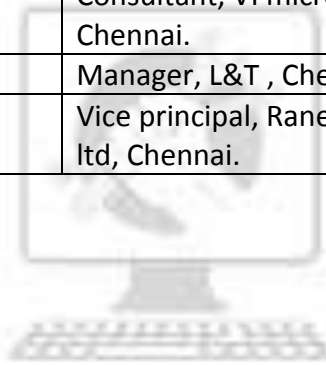
The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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## 1. COURSE INFORMATION

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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. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered related to the trade are categorized in four semesters of six months duration each. The semester wise course coverage is categorized as below:-

**1<sup>st</sup> Semester** – In this semester 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 Kirchoff'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.

**2<sup>nd</sup> Semester** – In this semester the trainee learns to handle different solutions, treatment of hazardous chemicals, safety precautions in electroplating shop, first aid and antidots 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.

**3<sup>rd</sup> Semester** – In this semester 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.

**4<sup>th</sup> Semester** – In this semester 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. TRAINING SYSTEM

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### 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 the economy/ labour market. The vocational training programs are delivered under the aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programs of NCVT for propagating vocational training.

Electroplater trade under Craftsman Training Scheme is delivered nationwide through network of ITIs. The course is of two-year (04 semester) duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Workshop Calculation & science, Engineering Drawing and Employability Skills) impart requisite core skill, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

**Candidates need broadly 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 CARRIER PROGRESSION PATHWAYS

- Can join Apprenticeship programme in different types of industries leading to a National Apprenticeship certificate (NAC).



## 2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of two-years (04 semesters): -

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	2158
2	Professional Knowledge (Trade Theory)	504
3	Workshop Calculation & Science	168
4	Engineering Drawing	252
5	Employability Skills	110
6	Library & Extracurricular activities	168
7	Project work	320
8	Revision & Examination	480
	<b>Total</b>	<b>4160</b>

## 2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first two semesters itself.

a) The **Internal Assessment** 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 template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per the guideline of Government of India. The pattern and marking structure is being notified by Govt. of India 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

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 40%. For the purposes of determining the overall result, 25% weightage is applied to the result of each semester examination.

## 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.

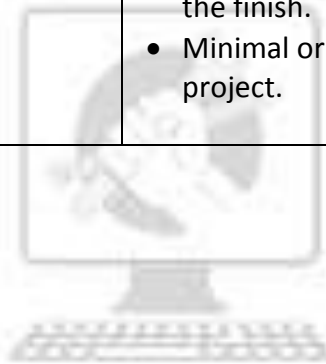
Assessment will be evidence based comprising the following:

- 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 of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
<b>(a) Weightage in the range of 60%-75% to be allotted during assessment</b>	
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"> <li>• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment.</li> <li>• Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A fairly good level of neatness and consistency in the finish.</li> <li>• Occasional support in completing the project/job.</li> </ul>
<b>(b) Weightage in the range of 75%-90% to be allotted during assessment</b>	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and	<ul style="list-style-type: none"> <li>• Good skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• 70-80% tolerance dimension achieved while undertaking different work with those</li> </ul>

<p>regard for safety procedures and practices</p>	<p>demand by the component/job.</p> <ul style="list-style-type: none"> <li>• A good level of neatness and consistency in the finish.</li> <li>• Little support in completing the project/job.</li> </ul>
<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"> <li>• High skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A high level of neatness and consistency in the finish.</li> <li>• Minimal or no support in completing the project.</li> </ul>



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### 3. JOB ROLE

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**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 GILLDER 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

<b>Name of the Trade</b>	ELECTROPLATER
<b>NCO - 2015</b>	8122.0100, 8122.0101, 8122.3500
<b>NSQF Level</b>	Level 5
<b>Duration of Craftsmen Training</b>	2 Years (4 Semesters each of six month duration)
<b>Entry Qualification</b>	Passed 10 <sup>th</sup> Class Examination under 10+2 system of Education with science and mathematics.
<b>Unit Strength</b>	16 (Max. supernumeraries seats: 5)
<b>Space Norms</b>	60 Sq. metres
<b>Power Norms</b>	16 KW
<b>Instructors Qualification for</b>	
<b>1. Electroplater Trade</b>	<p>Degree in Chemical engineering from recognized Engineering college/ university with one year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in Chemical Engineering from recognized board of technical education with two years experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/NAC passed in the Trade of “Electroplater” with three years post qualification experience in the relevant field.</p> <p><b><i>Desirable:</i></b> Preference will be given to a candidate with CITS (Craft Instructor Training Scheme) in relevant Trade.</p>
<b>2. Workshop Calculation &amp; Science</b>	<p>Degree in Engineering with one year experience.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in Engineering with two years experience.</p> <p><b><i>Desirable:</i></b> Craft Instructor Certificate in RoD &amp; A course under NCVT.</p>
<b>3. Engineering Drawing</b>	<p>Degree in Engineering with one year experience.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in Engineering with two years experience.</p> <p style="text-align: center;"><b>OR</b></p>

	<p>NTC/ NAC in the Draughtsman (Mechanical / Civil) with three years experience. <b>Desirable:</b> Craft Instructor Certificate in RoD &amp; A course under NCVT.</p>					
<b>4. Employability Skill</b>	<p>MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes.</p> <p style="text-align: center;"><b>AND</b></p> <p>Must have studied English/ Communication Skills and Basic Computer at 12<sup>th</sup> / Diploma level and above.</p> <p style="text-align: center;"><b>OR</b></p> <p>Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes</p>					
<b>Tools and Equipment</b>	As per Annexure-I					
<b>Distribution of training on Hourly basis: (Indicative only)</b>						
Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	Employability Skills	Extra-Curricular Activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

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## 5. NSQF LEVEL COMPLIANCE

NSQF level for **Electroplater** trade under CTS: Level 5.

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a. Process
- b. Professional knowledge
- c. Professional skill
- d. Core skill
- e. Responsibility

The Broad Learning outcome of **Electroplater** trade under CTS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
<b>Level 5</b>	Job that requires well developed skill, with clear choice of procedures in familiar context	knowledge of facts, principles, processes and general concepts, in a field of work or study.	a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and learning and some responsibility for other's works and learning



## 6. LEARNING/ ASSESSABLE OUTCOME

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

### 6.1 GENERIC LEARNING OUTCOME

1. Apply safe working practices.
2. Comply with environment regulation and housekeeping.
3. Interpret & use company and technical communication.
4. Demonstrate basic mathematical concept and principles to perform practical operations.
5. Understand and explain basic science in the field of study including simple machine.
6. Read and apply engineering drawing for different application in the field of work.
7. Understand and apply the concept in productivity, quality tools, and labour welfare legislation in day to day work to improve productivity & quality.
8. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
9. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
10. Utilize basic computer applications and internet to take benefit of IT developments in the industry.

### 6.2 SPECIFIC LEARNING OUTCOME

#### Semester-I

11. Prepare profile with an appropriate accuracy as per drawing.
12. Prepare electrical wire joints, carry out soldering and crimping.
13. Verify characteristics of electrical and magnetic circuits.
14. Carry out Installation, testing and maintenance of batteries with due care and safety.
15. Undertake wiring, installation of electrical accessories and earthing of electrical equipment.

16. Construct small electronic circuits as per drawing using basic electronic components.
17. 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.

### **Semester-II**

18. 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.
19. Plan and perform all of 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.
20. 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.
21. 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.
22. 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.

### **Semester-III**

23. Plan and perform Zinc plating by different methods, examine various defects in Zinc plating, causes and their remedies. Remove defective zinc by different methods.
24. 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.

25. 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.
26. 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.
27. 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.
28. Plan and perform Brass plating, examine various defects in Brass plating, causes and their remedies. Remove defective brass deposit by different methods.
29. Undertake Barrel plating method of electroplating for the plating of copper, nickel, tin, zinc and cadmium.

#### **Semester - IV**

30. Plan and perform electroless plating of copper, nickel, tin, silver and gold.
31. Plan and perform plating of copper, tin, nickel, zinc, cadmium etc. on aluminium with Zincate dipping process.
32. Plan and perform plating of copper, nickel, chromium, silver and gold on non conductive surface like plastic.
33. Make Printed circuit board with copper, nickel, tin, silver and gold. Perform chemical etching processes for copper and brass.
34. 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.
35. Plan and perform various colouring techniques on anodised aluminium by different colouring dyes and other methods like electro colouring.
36. Perform various conversion coating process on aluminium, magnesium and its alloys. Perform chemical milling on Aluminium and undertake passivation of stainless steel.
37. Plan and perform phosphating, powder coating and metallizing on various metals.

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



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## 7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Apply safe working practices	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Protective Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
2. Comply environment regulation and housekeeping	2.1 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	2.2 Deploy environmental protection legislation & regulations
	2.3 Take opportunities to use energy and materials in an environmentally friendly manner.
	2.4 Avoid waste and dispose waste as per procedure
	2.5 Recognize different components of 5S and apply the same in the working environment.
3. Interpret & use company and technical communication.	3.1 Obtain sources of information and recognize information.
	3.2 Use and draw up technical drawings and documents.
	3.3 Use documents and technical regulations and occupationally

	related provisions.
	3.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
	3.5 Present facts and circumstances, possible solutions & use English special terminology.
	3.6 Resolve disputes within the team.
	3.7 Conduct written communication.
4. Demonstrate basic mathematical concept and principles to perform practical operations.	4.1 Solve different problems like phase angle, etc. with the help of a calculator.
	4.2 Demonstrate conversion of Fraction to Decimal and vice versa.
	4.3 Explain BCD code, conversion from decimal to binary and vice-versa, all other conversions.
5. Understand and explain basic science in the field of study including simple machine.	5.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.
	5.2 Explain levers and its types.
	5.3 Explain relationship between Efficiency, velocity ratio and Mechanical Advantage.
	5.4 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	5.5 Solve simple problems on lifting tackles like crane-Solution of problems with the aid of vectors.
6. Read and apply engineering drawing for different application in the field of work.	6.1 Read & interpret the information on drawings and apply in executing practical work.
	6.2 Read & analyse the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	6.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
7. Understand and apply the concept in productivity, quality tools, and labour welfare legislation in day to day work to improve productivity & quality.	7.1 Explain the concept of productivity and quality tools and apply during execution of job.
	7.2 Explain basic concept of labour welfare legislation, adhere to responsibilities and remain sensitive towards such laws.
	7.3 Knows benefits guaranteed under various acts.

8. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	8.1 Explain the concept of energy conservation, global warming, pollution and utilize the available resources optimally & remain sensitive to avoid environment pollution.
	8.2 Explain standard procedure for disposal of waste.
9. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	9.1 Explain personnel finance and entrepreneurship.
	9.2 Explain role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/non-financing support agencies to familiarize with the policies/programmes, procedure & the available scheme.
	9.3 Prepare a report to become an entrepreneur for submission to financial institutions.
10. Utilize basic computer applications and internet to take benefit of IT developments in the industry.	10.1 Explain the basic hardware of personal computer.
	10.2 Use common application software viz., word, excel, power point etc., in day to day work.
	10.3 Awareness about useful internet websites, search relevant information pertaining to the assigned tasks.

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SPECIFIC LEARNING/ ASSESSABLE OUTCOME	
SEMESTER-I	
LEARNING / ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
11. Prepare profile with an appropriate accuracy as per drawing.	11.1 Identify the trade tools; Demonstrate their uses with safety.
	11.2 Prepare a simple half lap joint using firmer chisel.
	11.3 Prepare tray using sheet metal with the safety.
	11.4 Demonstrate fixing of surface mounting type of accessories.
12. Prepare electrical wire joints, carry out soldering and crimping.	12.1 Observe safety/ precaution during joints & soldering.
	12.2 Identify types of wires, cables and verify their specifications.
	12.3 Make simple straight twist and rat-tail joints in single strand conductors.
	12.4 Make married and 'T' (Tee) joint in stranded conductors.
	12.5 Prepare a Britannia straight and 'T' (Tee) joint in bare conductors.
	12.6 Prepare western union joint in bare conductor.
	12.7 Solder the finished copper conductor joints with precaution.
	12.8 Prepare termination of cable lugs by using crimping tool.
13. Verify characteristics of electrical and magnetic circuits.	13.1 Identify polarity of DC power supply.
	13.2 Identify the phase and neutral in single phase AC supply system.
	13.3 Verify the characteristics of series, parallel and its combination circuit.
	13.4 Connect voltmeter and ammeter and measure voltage current and power.
	13.5 Demonstrate laws of series and parallel circuits with voltage source in different combinations.
	13.6 Demonstrate characteristics of series parallel combination of resistors.
	13.7 Demonstrate the relationship between V, I and R in a DC circuit.
	13.8 Measure the value of resistance by Ohm's Law.
	13.9 Trace the magnetic poles of a bar magnet.
	13.10 Prepare an electromagnet
14. Carry out Installation, testing and maintenance of batteries with due care and safety.	14.1 Assemble a DC source 6V/500 mA using 1.5V cells.
	14.2 Determine the internal resistance of cell and make grouping of cells.
	14.3 Demonstrate charging of battery and test for its condition with safety/ precaution.

	14.4 Demonstrate installation and maintenance Lead acid batteries.
	14.5 Determine total number of cells required for a given power requirement.
15. Undertake wiring, installation of electrical accessories and earthing of electrical equipment.	15.1 Comply with safety & IE rules when performing the wiring.
	15.2 Identify the types of fuses their ratings and applications.
	15.3 Identify the parts of a relay, MCB & ELCB and check its operation.
	15.4 Prepare a test board with lamp and other accessories.
	15.5 Test, locate the fault and repair a domestic wiring installation.
16. Construct small electronic circuits as per drawing using basic electronic components.	16.1 Perform soldering on components, lug and board with quality and safety.
	16.2 Identify resistors by their colour codes.
	16.3 Identify the passive/ active components by visual appearance, Code number and test for their condition.
	16.4 Construct and test a half wave rectifier with and without filter circuits.
	16.5 Construct and test a full wave rectifier.
17. 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.	17.1 Identify various laboratory apparatus.
	17.2 Demonstrate action of pure and salt water on metals and alloys.
	17.3 Identify acids and alkalis using litmus paper and other methods.
	17.4 Analyse the reactions of anions and cations.
	17.5 Measure the specific gravity of liquid sample and check the temperature.
	17.6 Determine pH value of given liquid using pH meter.
	17.7 Measure boiling point of given liquid.
	17.8 Measure melting point of given solid.
	17.9 Measure conductivity of given liquid by conductivity meter.
	17.10 Determine the normality and mass per litre of sodium hydroxide/ sodium carbonate/ potassium hydroxide/ hydrochloric acid/ sulphuric acid or oxalic acid.
	17.11 Estimate the mass of sodium hydroxide/ sodium carbonate/ potassium hydroxide/ hydrochloric acid/ sulphuric acid or oxalic acid in a given solution.
<b>SEMESTER-II</b>	
18. Handle different solutions with due care & safety and undertake metal	18.1 Demonstrate basic safety precautions to be taken while handling different types of electroplating solutions and effluent discharge.

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.	18.2	Work in compliance with safety while handling electroplating solutions, cyanide base electroplating salts and chrome containing effluent discharge.
	18.3	Identify hazardous substances viz. Solvents, alkalis, acids and cyanides etc.
	18.4	Demonstrate first aid and anti dotes for cyanide poisonings.
	18.5	Prevent exposure of hazardous substances.
	18.6	Perform effluent treatment of hazardous chemicals
	18.7	Perform setting up of plating tanks and electric connections.
	18.8	Identify acids and alkalis using Red/ Blue litmus paper.
	18.9	Measure the specific gravity of liquid sample
	18.10	Demonstrate and practice first aid and anti dotes for cyanide poisonings.
	19. Plan and perform all of 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.	19.1
19.2		Perform cleaning of articles viz., scrubbing with emery paper, wet sand, scratch brushes, wire wheel etc.
19.3		Prepare glue and emery wheel binding.
19.4		Perform acid cleaning, polishing and buffing of ferrous/ non ferrous alloys.
19.5		Prepare suitable dips and pickling for removing of scales from surface of iron and steel.
19.6		Perform cleaning by means of tumbling barrels.
19.7		Perform ultrasonic cleaning.
19.8		Perform anodic/ cathodic cleaning
19.9		Perform degreasing process to include organic solvent i.e. TCE/PCE.
19.10		Clean oxidation stains on the articles of copper, brass, nickel and silver.
20. 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.	20.1	Plan work in compliance with occupational safety and health.
	20.2	Ensure the appropriate temperature of the tanks and activate the electroplating process.
	20.3	Maintain timing cycles to ensure that all functions happen appropriately.
	20.4	Perform electro deposition of copper by cyanide solution.
	20.5	Perform electro deposition of copper by acid solution.
	20.6	Perform electro deposition of copper by alkaline non-cyanide solution.
	20.7	Perform electro deposition of copper by Pyrophosphate.
	20.8	Test electroplating quality by Hull cell method.

	20.9 Ensure the line and machines are ready for future use.
21. 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.	21.1 Plan work in compliance with occupational safety and health.
	21.2 Prepare the job for nickel plating.
	21.3 Determine ECE of nickel
	21.4 Prepare and set up nickel plating vat, ensure the appropriate temperature of the tanks and activate the electroplating process.
	21.5 Perform pre-treatment process and maintain timing cycles to ensure that all functions happen appropriately.
	21.6 Prepare and test solution for electro deposition of nickel.
	21.7 Perform Nickel plating in different articles.
	21.8 Demonstrate set-up of current and time for different thickness of deposition.
	21.9 Perform adjustment of pH and temperature in bright nickel plating bath.
	21.10 Perform carbon treatment and maintenance of brightner level
	21.11 Perform testing of nickel plating solution using hull cell apparatus.
	21.12 Perform duped nickel plating and electrolysis nickel plating.
	21.13 Ensure the line and machines are ready for future use.
22. 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.	22.1 Demonstrate safety precautions to be observed in Chromium Plating.
	22.2 Prepare the job for Chromium Plating.
	22.3 Test the electrolyte for Chromium plating.
	22.4 Ensure the appropriate temperature of the tanks and activate the electroplating process.
	22.5 Maintain timing cycles to ensure that all functions happen appropriately.
	22.6 Perform Chromium plating on different metals.
	22.7 Perform Chromium plating in internal areas.
	22.8 Remove metallic impurities in Chromium solutions and demonstrate the regeneration of solution.
	22.9 Perform pre-treatment for the Direct Hard Chromium plating and demonstrate precautions to be taken.
	22.10 Perform hard chromium plating.
	22.11 Ensure the line and machines are ready for future use.
<b>SEMESTER-III</b>	
23. Plan and perform Zinc plating by different methods, examine various	23.1 Plan work in compliance with occupational safety and health.
	23.2 Prepare solution for Zinc plating.
	23.3 Prepare job for Zinc plating.

defects in Zinc plating, causes and their remedies. Remove defective zinc by different methods.	23.4 Perform Zinc plating and ensure the appropriate temperature of the tank and activate the electroplating process.
	23.5 Perform stripping of Zinc deposit and barrel plating.
24. 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.	24.1 Plan work in compliance with occupational safety and health.
	24.2 Prepare Job for Cadmium plating.
	24.3 Test the acidity and density of the solution.
	24.4 Perform setting up of VAT for Cadmium Plating
	24.5 Perform Cadmium plating on different jobs.
	24.6 Find out defects in electroplated surface and explain causes and remedial actions.
25. 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.	25.1 Plan work in compliance with occupational safety and health.
	25.2 Prepare the solution for Tin plating.
	25.3 Set up Tin plating bath and maintain timing cycles to ensure that all functions happen appropriately.
	25.4 Perform Tin plating for different alloy metals by hot dipping/ wiping/ contact plating method.
	25.5 Ensure the line and machines are ready for future use.
26. 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.	26.1 Plan work in compliance with occupational safety and health.
	26.2 Prepare articles for silver plating.
	26.3 Perform Silver Plating by using hot alkaline cleaning method.
	26.4 Perform Silver Plating by using cathode cold cleaning or cyanide dips method.
	26.5 Demonstrate adjustment of current density and time for the required thickness.
	26.6 Perform bright silver plating.
	26.7 Demonstrate cathode movement of heavy silver deposit.
	26.8 Ensure the line and machines are ready for future use.
27. Plan and perform Gold plating by different methods, examine various	27.1 Plan work in compliance with occupational safety and health.
	27.2 Prepare job for gold plating by hot cleaning or degreasing, pickling etc.

defects in Gold plating, causes and their remedies. Remove defective gold deposit by different methods.	27.3	Demonstrate electro-cleaning, ultrasonic cleaning and steaming.
	27.4	Perform base coat of strike/flash layer in the items to be plated.
	27.5	Perform gold plating on various articles.
	27.6	Perform masking for different platings.
	27.7	Demonstrate stripping of gold plating by electrolytic/immersion method.
	27.8	Perform electro-polishing of gold plated articles.
	27.9	Demonstrate masking techniques for different plating and etching operations.
	27.10	Ensure the line and machines are ready for future use.
28. Plan and perform Brass plating, examine various defects in Brass plating, causes and their remedies. Remove defective brass deposit by different methods.	28.1	Plan work in compliance with occupational safety and health.
	28.2	Prepare solution for Brass plating.
	28.3	Prepare job for Brass plating.
	28.4	Perform Brass plating and ensure the appropriate temperature of the tanks and activate the electroplating process.
	28.5	Maintain timing cycles to ensure that all functions happen appropriately.
	28.6	Demonstrate effects of current variation in Brass plating.
	28.7	Demonstrate stripping of Brass deposit.
29. Undertake Barrel plating method of electroplating for the plating of copper, nickel, tin, zinc and cadmium.	29.1	Plan work in compliance with occupational safety and health.
	29.2	Demonstrate equipment and solutions for barrel plating.
	29.3	Demonstrate racking/ wiring for barrel plating.
	29.4	Ensure the appropriate temperature of the tanks and activate the electroplating process.
	29.5	Maintain timing cycles to ensure that all functions happen appropriately.
	29.6	Perform silver/ gold plating on small articles using barrel plating.
	29.7	Perform Tin/ nickel plating on various articles using barrel plating.
	29.8	Ensure the line and machines are ready for future use.
<b>SEMESTER-IV</b>		
30. Plan and perform electroless plating of copper, nickel, tin, silver and gold.	30.1	Plan work in compliance with occupational safety and health.
	30.2	Perform copper plating by electroless method.
	30.3	Perform nickel plating by electroless method.
	30.4	Perform tin plating by electroless method.
	30.5	Perform silver plating by electroless method.



	30.6 Perform gold plating by electroless method.
	30.7 Ensure the line and machines are ready for future use.
31. Plan and perform plating of copper, tin, nickel, zinc, cadmium etc. on aluminium with Zincate dipping process.	31.1 Plan work in compliance with occupational safety and health.
	31.2 Perform copper plating on aluminium articles.
	31.3 Perform nickel plating on aluminium articles.
	31.4 Perform tin plating on aluminium articles.
	31.5 Perform zinc plating on aluminium articles.
	31.6 Perform cadmium plating on aluminium articles.
	31.7 Ensure the line and machines are ready for future use.
32. Plan and perform plating of copper, nickel, chromium, silver and gold on non conductive surface like plastic.	32.1 Plan work in compliance with occupational safety and health.
	32.2 Perform copper plating on ABS plastic.
	32.3 Perform nickel plating on ABS plastic.
	32.4 Perform chromium plating on ABS plastic.
	32.5 Perform silver plating on ABS plastic.
	32.6 Perform gold plating on ABS plastic.
	32.7 Ensure the line and machines are ready for future use.
33. Make Printed circuit board with copper, nickel, tin, silver and gold. Perform chemical etching processes for copper and brass.	33.1 Plan work in compliance with occupational safety and health.
	33.2 Make Printed circuit board with copper/nickel/tin
	33.3 Make Printed circuit board with silver/ gold.
	33.4 Make letter printing on copper metal by chemical etching process.
	33.5 Make letter printing on brass metal by chemical etching process.
	33.6 Ensure the line and machines are ready for future use.
34. 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.	34.1 Plan work in compliance with occupational safety and health.
	34.2 Prepare sulphuric acid solution for aluminium anodizing.
	34.3 Set up the anodizing vats and maintain timing cycles to ensure that all functions happen appropriately.
	34.4 Perform anodizing by chromic acid/ sulphuric acid/ oxalic acid.
	34.5 Ensure the line and machines are ready for future use.
35. Plan and perform various colouring techniques on anodised aluminium by	35.1 Plan work in compliance with occupational safety and health.
	35.2 Perform metal colouring by chemical method.
	35.3 Perform metal colouring by electrolytic method.



different colouring dyes and other methods like electro colouring.	35.4 Demonstrate purification of different solution.
36. Perform various conversion coating process on aluminium, magnesium and its alloys. Perform chemical milling on Aluminium and undertake passivation of stainless steel.	36.1 Plan work in compliance with occupational safety and health.
	36.2 Determine amount of substance by measuring the charges using Coulometer.
	36.3 Perform conversion coating on aluminium/ Zinc/ Copper/ Steel/ Magnesium alloys.
	36.4 Perform alodine treatment on Aluminium alloy.
	36.5 Perform chemical etching or chemical milling for steel/ aluminium parts.
	36.6 Demonstrate cleaning and surface preparation of stainless steel alloy.
	36.7 Demonstrate removal of foreign matter by grinding/ acid pickling method.
	36.8 Perform chromate conversion coating to passivate steel/ aluminium/ zinc/ cadmium/ copper/ silver/ magnesium/ tin alloys.
	36.9 Ensure the line and machines are ready for future use.
37. Plan and perform phosphating, powder coating and metallizing on various metals.	37.1 Plan work in compliance with occupational safety and health.
	37.2 Prepare the solution and set up for phosphating.
	37.3 Perform phosphating on various metals.
	37.4 Perform powder coating on various metals.
	37.5 Perform and practice metallizing on various metals.
	37.6 Ensure the line and machines are ready for future use.
38. Undertake 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.	38.1 Plan work in compliance with occupational safety and health.
	38.2 Find out defects on different electroplated articles by visual inspection.
	38.3 Perform corrosion resistance test on stainless steel alloys.
	38.4 Determine local thickness by using micrometers/ BNF Jet test method.
	38.5 Determine local thickness by using ultrasonic thickness tester.
	38.6 Perform testing of adhesion of electrodeposits on given plated alloys.

39. Prepare layout of electroplating plant, estimate cost, materials and accessories required for electroplating shop. Carryout preventive and breakdown maintenance of machines in electroplating shop.	39.1 Plan work in compliance with occupational safety and health.
	39.2 Explain suitability and selection of equipment for electroplating shops.
	39.3 Prepare layout of the electroplating shop with details of plant machineries.
	39.4 Carry out preventive maintenance of electroplating shop machineries.



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<b>SYLLABUS FOR ELECTROPLATER TRADE</b>			
<b>FIRST SEMESTER – 06 Months</b>			
<b>Week No.</b>	<b>Reference Learning Outcome</b>	<b>Professional Skills (Trade Practical) With Indicative Hours</b>	<b>Professional Knowledge (Trade Theory)</b>
1-2	<ul style="list-style-type: none"> <li>Apply safe working practices.</li> <li>Comply environment regulation and housekeeping</li> </ul>	<ol style="list-style-type: none"> <li>Visit various sections of the institutes and location of electrical installations. (05 hrs)</li> <li>Identify safety symbols and hazards. (05 Hrs)</li> <li>Preventive measures for electrical accidents and practice steps to be taken in such accidents. (05 hrs)</li> <li>Practice safe methods of fire fighting in case of electrical fire. (05 hrs)</li> <li>Operate a fire extinguisher and put out a fire. (05 Hrs)</li> <li>Practice elementary first aid. (05 hrs)</li> <li>Rescue a person and practice artificial respiration. (05 Hrs)</li> <li>Disposal procedure of waste materials. (05 Hrs)</li> <li>Practice on cleanliness and procedure to maintain it. (05 hrs)</li> <li>Identify hazardous chemicals (05 hrs)</li> </ol>	<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. Various safety measures involved in the Industry.</p> <p>First aid safety practice. Hazard identification and prevention. Personal safety and factory safety. Response to emergencies e.g. power failure, system failure and fire etc. Hazardous chemicals and safety.</p>
3-6	<ul style="list-style-type: none"> <li>Prepare profile with an appropriate accuracy as per drawing.</li> </ul>	<ol style="list-style-type: none"> <li>Identify trade tools and machineries. (10 Hrs)</li> <li>Practice on preparing T-joint, straight joint and dovetail joint on wooden blocks. (15 Hrs)</li> <li>Practice sawing, planing, drilling and assembling for making a wooden switchboard. (15 Hrs)</li> </ol>	<p>Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Marking tools description and use.</p> <p>Types of drills, description &amp; drilling and grinding machines. Various wooden joints.</p>

		<p>14. Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting. (15 Hrs)</p> <p>15. Workshop practice on filing and hack sawing. (15 Hrs)</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. (15 Hrs)</p>	<p>Carpenter and Sheet metal tools: Description of marking &amp; cutting tools. 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. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.</p>
7-8	<ul style="list-style-type: none"> <li>Prepare electrical wire joints, carry out soldering and crimping.</li> </ul>	<p>18. Prepare terminations of cable ends (06 hrs)</p> <p>19. Practice on skinning, twisting and crimping. (06 Hrs)</p> <p>20. Identify various types of cables and measure conductor size using SWG and micrometer. (06 Hrs)</p> <p>21. Make simple twist, married, Tee and western union joints. (10 Hrs)</p> <p>22. Make britannia straight, britannia Tee and rat tail joints. (10 Hrs)</p> <p>23. Practice in Soldering of joints/ lugs. (12 Hrs)</p>	<p>Conductors and insulators. 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. Techniques of soldering. Types of solders and flux.</p>
9-10	<ul style="list-style-type: none"> <li>Verify characteristics of electrical and magnetic circuits.</li> </ul>	<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. (05 hrs)</p> <p>26. Verify laws of series and parallel circuits with voltage source in different combinations. (08 Hrs)</p> <p>27. Verify the characteristics of series parallel combination of resistors. (05 Hrs)</p>	<p>Fundamentals of electricity, definitions, units &amp; effects of electric current. Types of electrical supply. Comparison and Advantages of DC and AC. Polarity test in DC. Resistance and specific resistance. Laws of Resistance and various types of resistors. Measurement of low and medium resistance. Electrical measuring instruments such as</p>

		<p>28. Verify the relationship between V, I and R in a DC circuit. (08 hrs)</p> <p>29. Measure the value of resistance by Ohm's Law. (05 Hrs)</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. (04 hrs)</p>	<p>Voltmeter, Ammeter and Ohmmeter. Series and parallel combinations of resistors. 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. Alternating current - vector diagrams.</p>
11-12	<ul style="list-style-type: none"> <li>Carry out Installation, testing and maintenance of batteries with due care and safety.</li> </ul>	<p>33. Practice proper use of different types of cells. (05 hrs)</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 battery charging. (15 Hrs)</p> <p>36. Practice on routine, care and maintenance of batteries. (10 hrs)</p> <p>37. Perform testing of batteries. (10 Hrs)</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>
13-15	<ul style="list-style-type: none"> <li>Undertake wiring, installation of electrical accessories and earthing of electrical equipment.</li> </ul>	<p>38. Demonstrate wiring accessories. (05 hrs)</p> <p>39. Practice on installation and overhauling common electrical accessories. (05 hrs)</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,</p>	<p>Common Electrical wiring Accessories, their specifications and B.I.S.Symbols.</p> <p>Diagrams and systems used in domestic wiring.</p>

		<p>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>	
16-17	<ul style="list-style-type: none"> <li>Construct small electronic circuits as per drawing using basic electronic components.</li> </ul>	<p>44. Determine the resistance by colour coding.(05 hrs)</p> <p>45. Identify active and passive electronic components.(05 hrs)</p> <p>46. Identify terminals of different electronic components viz., resistors, diodes, transistors etc.(05 hrs)</p> <p>47. Verification of characteristics of diode.(05 hrs)</p> <p>48. Construct and test half wave rectifier circuit.(10 hrs)</p> <p>49. Construct and test full wave rectifier circuit. (10 hrs)</p> <p>50. Construct and test bridge rectifier circuit.(10 hrs)</p>	<p><b>Basic electronics</b></p> <p>Semiconductor energy level, atomic structure, types of materials, P-N-junction. Doping, Intrinsic and extrinsic semiconductor, Covalent bond. PN junction diode, Forward and Reverse characteristics. Specification and applications of diodes. Explanation of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit.</p>
18-21	<ul style="list-style-type: none"> <li>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.</li> </ul>	<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,</p>	<p>Familiarisation 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 deionised 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 ie, Standard solution, normality, titration, titrant, titrate, end point, indicator etc. Principles of volumetric analysis,</p>

		<p>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 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>equivalent masses, normality, molarity, indicators.</p> <p>Acidimetry and alkalimetry.</p> <p>Density and specific gravity.</p> <p>Thermometer and hydrometer.</p> <p>Degree Centigrade, Fahrenheit and its conversion.</p> <p>Definition of pH, pH scale,</p> <p>Chemical effect of electric current, ECE and principle of electrolysis.</p> <p>Faraday's Law of electrolysis.</p> <p>Explanation of Anodes and cathodes.</p>
22-23	<p><b>Project work / Industrial visit</b></p> <p><b>Broad Areas:</b></p> <p>a) Series/ parallel combinational circuits</p> <p>b) Electrolysis</p> <p>c) Batteries</p>		
24-25	Revision		
26	Examination		

**Note: -**

1. Some of the sample project works (indicative only) are given against each semester.
2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
3. The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The



*group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.*

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## SYLLABUS FOR ELECTROPLATER TRADE


### SECOND SEMESTER – 06 Month

Week No.	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
27-29	<ul style="list-style-type: none"> <li>Handle different solutions with due care &amp; 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.</li> </ul>	<p>65. Identify and demonstrate soft water &amp; 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. (05 hrs)</p> <p>68. Demonstrate safety precautions to be taken while handling cyanide base electroplating salts and chrome containing effluent. (05 hrs)</p> <p>69. Perform effluent treatment of hazardous chemicals in plating shop. (08 hrs)</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. (10 hrs)</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. (06 hrs)</p> <p>76. Carry out analysis of</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 &amp; cyanides.</p> <p>Properties and Values of ECE for different metals.</p> <p>Precautions to be observed.</p> <p>Method of mixing of electrolyte, use of hydrometer &amp; thermometer.</p> <p>Environmental pollution related to the trade, consequences, mitigation &amp; control.</p> <p>Knowledge about molecular weight, equivalent weight.</p> <p>Hard and soft water, water for industrial purposes. 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, Analysis of chemical baths with Hull cell process.</p>

		chemical baths with Hull cell process. (08 hrs)	
30-35	<ul style="list-style-type: none"> <li>Plan and perform all of 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.</li> </ul>	<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 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. (20 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. (10 hrs)</p> <p>86. Practice cleaning of specific metals such as iron, steel, stainless steel, nickel, brass, copper etc. (20 hrs)</p> <p>87. Practice degreasing (vapour and immersion)</p>	<p>Requirements of a plating shop. Abrasives and Adhesives used for the preparation of wheels. Various compounds used for polishing and buffing. Importance of cleaning, its types, ex.</p> <p>a) Mechanical / chemical. b) Polishing / buffing c) Abrasive cleaning d) Degreasing, pickling, hot alkaline cleaning&amp; final cleaning.</p> <p>Equivalent weight of compounds, acids, oxide, reduction of acids and stopping off compounds. Chemical cleaning methods by acid dipping, alkaline soak cleaning, vapour degreasing, ultrasonic cleaning, alkaline electro cleaning etc. Different plating techniques for ferrous &amp; non-ferrous metals. General care and maintenance of plating baths, electroplating tank &amp; lining. Various methods of masking.</p>

		<p>process to include organic solvent i.e. TCE/PCE. (05 hrs)</p> <p>88. Practice in using cleaning tanks, preparing suitable solution and methods of masking. (20 hrs)</p> <p>89. Practice cleaning of oxidation stains on the articles of copper, brass, nickel and silver. (18 hrs)</p>	
36-38	<ul style="list-style-type: none"> <li>Plan and perform Copper plating using different methods, examine various defects, causes and their remedies. Remove defective copper deposit by different methods.</li> </ul>	<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</p> <p>Various methods for the removal of copper deposit.</p>

39-42	<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>97. Practice setting up of nickel plating bath. (10 hrs)</p> <p>98. Prepare the solution for Nickel plating. (05 hrs)</p> <p>99. Perform Nickel plating in articles made of iron. (20 hrs)</p> <p>100. Perform Nickel plating in articles made of copper. (20 hrs)</p> <p>101. Perform Nickel plating in articles made of brass. (20 hrs)</p> <p>102. Practice to remove the defective nickel deposit from different metals by immersion and electrolytic methods. (10 hrs)</p> <p>103. Perform carbon treatment and other maintenance of nickel solution. (15 hrs)</p>	<p>Properties of nickel. 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.</p>
43-47	<ul style="list-style-type: none"> <li>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 methods.</li> </ul>	<p>104. Practice setting up of bright chromium plating bath. (10 hrs)</p> <p>105. Prepare the solution for bright chromium plating. (05 hrs)</p> <p>106. Perform bright chromium plating in articles made of iron. (20 hrs)</p> <p>107. Perform bright chromium plating in articles made of copper. (20 hrs)</p> <p>108. Practice setting up of hard chromium plating bath. (10 hrs)</p> <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</p>	<p>Safety precautions &amp; 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 chromium solutions like regular, self regulating and black chromium, their chemical compositions, operating conditions and their preparation. Processing steps of bright chromium plating.</p>

		<p>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>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</p> <p>Various methods for the removal of chromium deposit from different metals.</p>
48-49	<p>Project work / Industrial visit</p> <p>Broad Areas:</p> <ul style="list-style-type: none"> <li>a) Copper electroplating</li> <li>b) Nickel electroplating</li> <li>c) Bright and hard chromium plating</li> </ul>		
50-51	Revision		
52	Examination		

**Note: -**

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2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
3. The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.

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## SYLLABUS FOR ELECTROPLATER TRADE

### THIRD SEMESTER - 06 Month

Week No.	Reference Learning outcome	Professional Skills (Trade Practical) With indicative hours	Professional Knowledge (Trade Theory)
53-58	<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>113. Practice setting up of zinc plating for acid bath. (10 hrs)</p> <p>114. Prepare the acid solution for zinc plating. (10 hrs)</p> <p>115. Perform zinc plating on different ferrous metals in acid bath and passivate with different colours. (25 hrs)</p> <p>116. Perform zinc plating on different non ferrous metals in acid bath and passivate with different colours. (25 hrs)</p> <p>117. Practice setting up of zinc plating for cyanide and alkaline zinc bath. (10 hrs)</p> <p>118. Prepare the cyanide and alkaline zinc solution for zinc plating. (10 hrs)</p> <p>119. Perform zinc plating on different ferrous metals in cyanide and alkaline zinc bath and passivate with different colours.(25 hrs)</p> <p>120. Perform zinc plating on different non ferrous metals in cyanide and alkaline zinc bath and passivate with different colours. (25 hrs)</p> <p>121. Practice to remove the defective zinc deposit from various metals by immersion and electrolytic methods. (10 hrs)</p>	<p>Properties of zinc.</p> <p>Applications and uses of zinc plating.</p> <p>Equipments for zinc plating in acid bath. Various types of zinc solutions for acid bath, their compositions and operating conditions, their preparation and maintenance.</p> <p>Processing steps of zinc plating in acid bath.</p> <p>Equipments for zinc plating in cyanide bath.</p> <p>Various types of zinc solutions for cyanide bath, their compositions and operating conditions, their preparation and maintenance.</p> <p>Processing steps of zinc plating In cyanide bath.</p> <p>Various colouring solutions for passivating the zinc deposit.</p> <p>Various defects generally encountered in the zinc plating in acid and cyanide bath, causes for these defects and their remedies</p> <p>Methods for the removal of zinc deposit from various metals.</p>

59-61	<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>122. Setting up of cadmium plating bath. (10 hrs)</p> <p>123. Prepare the solution for cadmium plating. (05 hrs)</p> <p>124. Perform cadmium plating on different ferrous metals and passivate with different colours. (25 hrs)</p> <p>125. Perform cadmium plating on different non ferrous metals and passivate with different colours.(25 hrs)</p> <p>126. Practice to remove the defective cadmium deposit from various metals by immersion and electrolytic methods. (10 hrs)</p>	<p>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.</p> <p>Various colouring solutions for passivating the cadmium deposit. Processing steps of cadmium plating.</p> <p>Various defects generally encountered in the cadmium plating, causes for these defects and their remedies</p> <p>Methods for the removal of cadmium deposit from various metals.</p>
62-64	<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>127. Practice setting up of Tin plating bath. (10 hrs)</p> <p>128. Prepare the solution for Tin plating. (05 hrs)</p> <p>129. Perform Tin plating on different ferrous metals. (25 hrs)</p> <p>130. Perform Tin plating on different non ferrous metals. (25 hrs)</p> <p>131. Practice to remove the defective Tin deposit from various metals by immersion and electrolytic methods. (10 hrs)</p>	<p>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.</p> <p>Processing steps of Tin plating in acid bath.</p> <p>Equipments for Tin plating in cyanide bath. Various types of Tin solutions for cyanide bath, their compositions and operating conditions, their preparation and maintenance.</p> <p>Processing steps of Tin plating In cyanide bath.</p> <p>Various defects generally encountered in the Tin plating in acid and cyanide bath, causes for these defects and their remedies</p> <p>Methods for the removal of Tin deposit from various metals.</p>

65-67	<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>132. Setting up of Silver plating bath. (10 hrs)</p> <p>133. Prepare the solution for Silver plating. (05 hrs)</p> <p>134. Perform Silver plating on different ferrous metals. (25 hrs)</p> <p>135. Perform Silver plating on different non ferrous metals. (25 hrs)</p> <p>136. Practice to remove the defective Silver deposit from various metals by immersion and electrolytic methods. (10 hrs)</p>	<p>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 Silverplating, causes for these defects and their remedies. Methods for the removal of Silver deposit from various metals.</p>
68-69	<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>137. Practice setting up of Gold plating bath. (05 hrs)</p> <p>138. Prepare the solution for Gold plating. (05 hrs)</p> <p>139. Perform Gold plating on different ferrous metals. (15 hrs)</p> <p>140. Perform Gold plating on different non ferrous metals. (15 hrs)</p> <p>141. Practice to remove the defective Gold deposit from various metals by immersion and electrolytic methods. (10 hrs)</p>	<p>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 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.</p>
70-71	<ul style="list-style-type: none"> <li>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.</li> </ul>	<p>142. Prepare the solution for Brass plating and setting up the bath. (05 hrs)</p> <p>143. Perform Brass plating on different ferrous metals. (20 hrs)</p> <p>144. Perform Brass plating on different non ferrous metals. (20 hrs)</p> <p>145. Practice to remove the defective Brass deposit from various metals by immersion and electrolytic methods. (05 hrs)</p>	<p>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.</p>

72-73	<ul style="list-style-type: none"> <li>Undertake Barrel plating method of electroplating for the plating of copper, nickel, tin, zinc and cadmium.</li> </ul>	<p>146. Perform copper plating of small articles by barrel method. (10 hrs)</p> <p>147. Perform nickel plating of small articles by barrel method. (10 hrs)</p> <p>148. Perform tin plating of small articles by barrel method. (10 hrs)</p> <p>149. Perform zinc plating of small articles by barrel method. (10 hrs)</p> <p>150. Perform cadmium plating of small articles by barrel method. (10 hrs)</p>	<p>Applications of barrel plating in electroplating industry.</p> <p>Types of barrels used for barrelling. Automatic barrel plating plants in the modern industry.</p> <p>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.</p> <p>General defects, their causes and remedies in barrel plating.</p>
74-75	<p><b>Project work/Industrial visit</b> <b>Broad Areas:</b></p> <ul style="list-style-type: none"> <li>a) Zinc plating</li> <li>b) Cadmium plating</li> <li>c) Tin plating</li> <li>d) Silver plating</li> <li>e) Gold plating</li> <li>f) Brass plating</li> <li>g) Barrel plating</li> </ul>		
76-77	Revision		
78	Examination		

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- The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.
- If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.

## SYLLABUS FOR ELECTROPLATER TRADE

### FOURTH SEMESTER – 06 Month

Week No.	Reference Learning Outcome	Professional Skills (Trade Practical) With indicative hours	Professional Knowledge (Trade Theory)
79-80	<ul style="list-style-type: none"> <li>Plan and perform electroless plating of copper, nickel, tin, silver and gold.</li> </ul>	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.
81-82	<ul style="list-style-type: none"> <li>Plan and perform plating of copper, tin, nickel, zinc, cadmium etc. on aluminium with Zincate dipping process.</li> </ul>	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.
83-84	<ul style="list-style-type: none"> <li>Plan and perform plating of copper, nickel, chromium, silver and gold on non conductive surface like plastic.</li> </ul>	161. Perform copper plating on ABS plastic. (10 hrs) 162. Perform nickel plating on ABS plastic. (10 hrs) 163. Perform chromium plating on ABS plastic. (10 hrs) 164. Perform silver plating on	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

		<p>ABS plastic. (10 hrs)</p> <p>165. Perform gold plating on ABS plastic. (10 hrs)</p>	<p>conditions of plating on plastic processes.</p> <p>Processing steps of copper, nickel, chromium, silver and gold plating on ABS plastic.</p> <p>General defects, their causes and remedies in plating of non conductive surfaces.</p> <p>Removal of coating from ABS plastic surfaces.</p>
85-87	<ul style="list-style-type: none"> <li>Make Printed circuit board with copper, nickel, tin, silver and gold and chemical etching processes for copper and brass.</li> </ul>	<p>166. Make Printed circuit board with copper. (10 hrs)</p> <p>167. Make Printed circuit board with nickel. (10 hrs)</p> <p>168. Make Printed circuit board with tin. (10 hrs)</p> <p>169. Make Printed circuit board with silver. (10 hrs)</p> <p>170. Make Printed circuit board with gold. (10 hrs)</p> <p>171. Make letter printing on copper metal by chemical etching process. (10 hrs)</p> <p>172. Make letter printing on brass metal by chemical etching process. (15 hrs)</p>	<p>Applications printed circuit boards in electronic industry.</p> <p>Types of base materials of PCB.</p> <p>Methods of Layout marking.</p> <p>Immersion copper and etching solutions and operating conditions.</p> <p>Processing steps for making PCB with copper, nickel, tin, silver and gold.</p> <p>General defects, their causes and remedies in making of PCBs.</p> <p>Solution</p> <p>Solution composition, operating conditions and processing steps of brass etching.</p>
88-89	<ul style="list-style-type: none"> <li>Plan and perform Anodizing to convert metal surface into a decorative, durable and corrosion resistant by different methods. Examine various defects in anodising, causes and their remedies. Remove the defective anodised film by various methods.</li> </ul>	<p>173. Prepare solution for anodizing in sulphuric acid and set up the bath. (05 hrs)</p> <p>174. Perform and practice 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</p>	<p>Properties of aluminium and its corrosion.</p> <p>Applications and uses of anodizing.</p> <p>Preparation of aluminium 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.</p>



		oxalic acid. (10 hrs) 179. Practice removal of anodised film from aluminium articles. (05 hrs)	
90-91	<ul style="list-style-type: none"> <li>Plan and perform various colouring techniques on anodised aluminium by different colouring dyes and other methods like electro colouring.</li> </ul>	180. Prepare solution for various colouring solutions by various colour dye stuffs.(10 hrs) 181. Practice colouring on anodised aluminium article by using various colouring solutions.(10 hrs) 182. Prepare solution for electro colouring and setting up the bath.(10 hrs) 183. Practice electro colouring on anodised aluminium article with various colour shades.(10 hrs) 184. Remove the colour without attacking the anodised film. (10 hrs)	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.
92-93	<ul style="list-style-type: none"> <li>Perform various conversion coating process on aluminium, magnesium and its alloys. Perform chemical milling on aluminium and undertake passivation of stainless steel.</li> </ul>	185. Prepare solution for conversion coating on aluminium. (05 hrs) 186. Practice conversion coating on aluminium and magnesium parts.(10 hrs) 187. Remove the conversion coating without attacking the base metal. (05 hrs) 188. Prepare and set up the bath for chemical milling. (05 hrs) 189. Practice chemical milling on aluminium.(10 hrs) 190. Prepare solution for stainless steel passivation.(05 hrs) 191. Practice passivation on stainless steel. (10 hrs)	Properties and applications for conversion coating. Preparation of solution and operating conditions. Processing steps of conversion coating on aluminium. Removal of conversion coating. Application and uses of chemical milling on 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.



94-95	<ul style="list-style-type: none"> <li>Plan and perform phosphating, powder coating and metallizing on various metals.</li> </ul>	<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. Preparation of solution and operating conditions for phosphating. Processing steps for phosphating. Post treatment for phosphating. Application and uses of powder coating. Equipments for powder coating. Preparation and operating conditions for powder coating. Processing steps and post treatments for powder coating. General care and maintenance for powder coating machine. Application and uses of metallizing. Equipments for metallizing. Preparation and operating conditions for metallizing. Processing steps and post treatments for metallizing. General care and maintenance for metallizing machine.</p>
96-99	<ul style="list-style-type: none"> <li>Undertake 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.</li> </ul>	<p>196. Carry out visual inspection of different electroplated articles for any defects. (05 hrs)</p> <p>197. Perform adhesion tests by various methods. (15 hrs)</p> <p>198. Perform porosity tests by various methods. (15 hrs)</p> <p>199. Perform corrosion resistance tests by various methods. (15 hrs)</p> <p>200. Practice in testing different plated jobs for determining the local thickness by various methods. (15 hrs)</p> <p>201. Practice in testing different anodised jobs for determining the thickness</p>	<p>Quality control in electroplating shops. 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</p>

		and insulation. (15hrs) 202. Practice in analysing different electroplating solutions. (20hrs)	salt test etc. Methods of testing anodic coating on aluminium. Chemical analysis of various plating electrolytes.
100-101	<ul style="list-style-type: none"> <li>Prepare layout of electroplating plant, estimate cost, materials and accessories required for electroplating shop. Carryout preventive and breakdown maintenance of machines in electroplating shop.</li> </ul>	203. Demonstrate Installation of machinery for 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)	Electroplating shop layout, characteristics, factors to be 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.
102	<p><b>Project work / Industrial visit</b> Broad Areas:</p> <ol style="list-style-type: none"> <li>Electroless plating</li> <li>Plating on aluminium</li> <li>Plating on ABS plastic</li> <li>Anodizing</li> <li>Metal colouring</li> <li>Conversion coating</li> <li>Plating on PCB</li> <li>Etching and chemical milling</li> <li>Project report on installation of electroplating shop</li> </ol>		

103	Revision
104	Examination

**Note: -**

- 1. Some of the sample project works (indicative only) are given against each semester.*
- 2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
- 3. The project should broadly cover maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and Application of Learning. They need to submit Project report.*
- 4. If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*



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### 9.1 CORE SKILL – WORKSHOP CALCULATION & SCIENCE

S. No.	Description - Workshop Calculation	Description - Workshop Science
<b>1<sup>st</sup> Semester</b>		
1	<b>Unit:</b> Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	<b>Material Science:</b> properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.
2	<b>Fractions:</b> Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	<b>Mass .Weight and Density :</b> Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.
3	<b>Square Root:</b> Square and Square Root, method of finding out square roots, Simple problem using calculator. <b>Ratio &amp; Proportion :</b> Simple calculation on related problems.	<b>Speed and Velocity:</b> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.
4	<b>Percentage:</b> Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	<b>Work, Power and Energy:</b> work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.
<b>2<sup>nd</sup> Semester</b>		
1	<b>Algebra:</b> Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	<b>Heat &amp; Temperature:</b> Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.

2	<p><b>Mensuration:</b> Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere.</p> <p>Surface area of solids -cube, cuboid, cylinder and Sphere.</p>	<p><b>Basic Electricity:</b> Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy.</p>
3	<p><b>Trigonometry:</b> Trigonometrical ratios, measurement of angles. Trigonometric tables.</p>	<p><b>Levers and Simple Machines:</b> levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.</p>
<b>3<sup>rd</sup> Semester</b>		
1	<p><b>Use of Scientific Calculator:</b> Practice on solving different problems like phase angle, etc. with the help of a calculator.</p>	<p>Matter, forms, specific properties related to solids, liquids and gases. The atom, molecule. Difference between an element and compound.</p>
2	<p><b>Algebra:</b> Theory of Indices, related problems. Factorization -different method. Quadratic equations and solution of simultaneous equations with 2/3 unknowns. Different types of related problems involving equations.</p>	<p><b>Electrical Engineering materials:</b> Properties and uses in electrical field of important materials to be selected from 3 categories as conducting materials, semi-conducting materials, Insulating materials. Insulating materials including transformer oils.</p>
3	<p><b>Trigonometry:</b> Application in calculating height and distances. Use of trigonometric formulae in calculating areas of geometrical figures. Solution of Triangles.</p>	<p><b>Magnetism:</b> Introduction Magnetic Material for permanent magnet, temporary magnet etc. Magnetic field, flux density, permeability, susceptibility – explanation and units of the above terms. Electromagnet (Solenoid) – practical applications.</p>
4	<p><b>Mensuration:</b> Volumes and surface areas of solid bodies such as triangular prism, hexagonal prism etc. Volumes and surface area of pyramids including cone.</p>	<p>Concept of terms like pressure, atmospheric pressure, gauge pressure. <b>Heat treatment</b> – Necessity – different methods.</p>
<b>4<sup>th</sup> Semester</b>		

1	<p><b>Number system:</b> decimal and binary, Octal Hexa decimal. BCD code, conversion from decimal to binary and vice-versa, all other conversions. Practice on conversions.</p>	<p><b>Friction:</b> Laws of friction, co- efficient of friction, angle of friction, simple problems related to friction. Lubrication</p> <p><b>Rectifier:</b> RMS. Maximum, Average values of voltage and current in rectifiers form factor, ripple factor.</p>
2	<p><b>Estimation &amp; costing:</b> Simple estimation of the requirement of materials etc. as applicable to the trade. Problems on estimation and costing.</p> <p><b>Further Mensuration:</b> Volumes of frustums including conical frustums. Graph- Basics, abscissa, co-ordinate etc. <math>Y = mz</math> and <math>Y = mx + c</math> graph</p>	<p><b>Forces:</b> Resolution and composition of forces. Representation of force by vectors, simple problems on lifting tackles like jib wall, crane- Solution of problems with the aid of vectors. General condition of equilibriums for series of forces on a body. Law of parallelogram, Triangle Law, Lami's Law theorem.</p>
3	<p>Simple Problems on Profit &amp; Loss. Simple and compound interest.</p>	<p><b>Centre of gravity:</b> Centre of gravity concept and C.G. of different lamina. Equilibrium different kinds stable, unstable and neutral. Law of parallelogram force. Triangle law, Lami's theorem stable, unstable and neutral equilibrium.</p>

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## 9.2 CORE SKILL - ENGINEERING DRAWING

S. No.	CONTENTS
<b>1<sup>ST</sup> Semester</b>	
1	<p>Engineering Drawing: Introduction and its importance</p> <ul style="list-style-type: none"> <li>Relationship to other technical drawing types</li> <li>Conventions</li> <li>Viewing of engineering drawing sheets.</li> <li>Method of Folding of printed Drawing Sheet as per BIS SP:46-2003</li> </ul>
2	<p>Drawing Instruments : their Standard and uses</p> <ul style="list-style-type: none"> <li>Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor.</li> <li>Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc).</li> <li>Pencils of different Grades, Drawing pins / Clips.</li> </ul>
3	<p>Lines :</p> <ul style="list-style-type: none"> <li>Definition, types and applications in Drawing as per BIS SP:46-2003</li> <li>Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)</li> <li>Drawing lines of given length (Straight, curved)</li> <li>Drawing of parallel lines, perpendicular line</li> <li>Methods of Division of line segment</li> </ul>
4	<p>Drawing of Geometrical Figures:</p> <ul style="list-style-type: none"> <li>Definition, nomenclature and practice of angle measurement and its types, method of bisecting.</li> <li>Triangle - different types</li> <li>Rectangle, Square, Rhombus, Parallelogram.</li> <li>Circle and its elements.</li> </ul>
5	<p>Lettering and Numbering as per BIS SP46-2003: -</p> <ul style="list-style-type: none"> <li>Single Stroke, Double Stroke, inclined, Upper case and Lower case.</li> </ul>
6	<p>Dimensioning:</p> <ul style="list-style-type: none"> <li>Definition, types and methods of dimensioning (functional, nonfunctional and auxiliary)</li> <li>Types of arrowhead</li> <li>Leader Line with text</li> </ul>
7	<p>Free hand drawing of:</p> <ul style="list-style-type: none"> <li>Lines, polygons, ellipse, etc.</li> <li>Geometrical figures and blocks with dimension</li> <li>Transferring measurement from the given object to the free hand sketches.</li> </ul>



8	<p>Sizes and Layout of Drawing Sheets:</p> <ul style="list-style-type: none"> <li>• Basic principle of Sheet Size</li> <li>• Designation of sizes</li> <li>• Selection of sizes</li> <li>• Title Block, its position and content</li> <li>• Borders and Frames (Orientation marks and graduations)</li> <li>• Grid Reference</li> <li>• Item Reference on Drawing Sheet (Item List)</li> </ul>
9	<p>Method of presentation of Engineering Drawing</p> <ul style="list-style-type: none"> <li>• Pictorial View</li> <li>• Orthogonal View</li> <li>• Isometric view</li> </ul>
10	<p>Symbolic Representation (as per BIS SP:46-2003) of:</p> <ul style="list-style-type: none"> <li>• Fastener (Rivets, Bolts and Nuts) - Bars and profile sections</li> <li>• Weld, brazed and soldered joints.</li> <li>• Electrical and electronics element</li> <li>• Piping joints and fittings</li> </ul>
<b>2<sup>nd</sup> Semester</b>	
1	Construction of Scales and diagonal scale
2	Practice of Lettering and Title Block
3	<p>Dimensioning practice:</p> <ul style="list-style-type: none"> <li>• Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003)</li> <li>• Symbols preceding the value of dimension and dimensional tolerance.</li> <li>• Text of dimension of repeated features, equidistance elements, circumferential objects.</li> </ul>
4	<p>Construction of Geometrical Drawing Figures:</p> <ul style="list-style-type: none"> <li>• Different Polygons and their values of included angles. Inscribed and Circumscribed polygons.</li> <li>• Conic Sections (Ellipse &amp; Parabola)</li> </ul>
5	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
6	Free Hand sketch of hand tools and measuring tools used in respective trades.
7	Projections:

	<ul style="list-style-type: none"> <li>• Concept of axes plane and quadrant.</li> <li>• Orthographic projections</li> <li>• Method of first angle and third angle projections (definition and difference)</li> <li>• Symbol of 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection as per IS specification.</li> </ul>
8	Drawing of Orthographic projection from isometric/3D view of blocks
9	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
10	Drawing details of two simple mating blocks and assembled view.
<b>3<sup>rd</sup> Semester</b>	
1	<p><b><u>Sign &amp; Symbol Trade related</u></b></p> <p><b>Alternating Current</b></p> <ul style="list-style-type: none"> <li>• Drawing of simple electrical circuit using electrical symbols.</li> <li>• Drawing of sine square &amp; triangular waves.</li> <li>• Diagram of battery charging circuit.</li> <li>• Practice in reading typical example of circuit containing R, L &amp; C.</li> <li>• Reading of electrical drawing.</li> </ul>
2	<p><b>Electronic components</b></p> <ul style="list-style-type: none"> <li>• Symbols for electronic components. Diode, Transistor, Zener diode, SCR, UJT, FET, IC, Diac, Triac, Mosfet, IGBT etc.</li> <li>• Drawing of half wave, Full wave and Bridge rectifier circuit.</li> <li>• Drawing circuit for a single stage Amplifiers and Multi stage Amplifies and types of signals.</li> <li>• Drawing of circuit containing UJT, FET &amp; Simple power control circuits.</li> <li>• Free hand drawing of Logic gates and circuits.</li> </ul>
3	<p><b>Electric wirings &amp; Earthing</b></p> <ul style="list-style-type: none"> <li>• Detailed diagram of calling bell, &amp; Buzzers etc</li> <li>• Free hand sketching of Staircase wiring.</li> <li>• Drawing the schematic diagram of plate and pipe earthing.</li> <li>• Diagram for electroplating from A.C / D.C source.</li> </ul>
4	<p><b>DC machines</b></p> <ul style="list-style-type: none"> <li>• Graphic symbols for Rotating machines.</li> <li>• Sketching of brush and brush gear of D.C. machines.</li> <li>• Sketching of D.C. 3-point and 4-point starter .</li> <li>• Layout arrangement of D.C. Generators &amp; motors, control panel.</li> <li>• Exercises on connection to motors through Ammeter, voltmeter &amp; K.W. meters of electrical wiring diagram.</li> <li>• Drawing the schematic diagram of D.C. motor speed control by Thyristor / DC Drive.</li> </ul>

5	<b>Transformer</b> <ul style="list-style-type: none"> <li>• Graphic symbols for Transformers.</li> <li>• Free hand sketching of transformer and auxiliary parts and sectional views.</li> <li>• Sketching a breather.</li> <li>• Drawing the diagram of typical marking plate of a distribution transformer.</li> </ul>
6	<b>Illumination</b> <ul style="list-style-type: none"> <li>• Free hand sketching of Mercury vapour lamp, sodium vapour lamp, fluorescent tube (Single &amp; Twine), MHL lamp and their connection.</li> </ul>
<b>4<sup>th</sup> Semester</b>	
1	<b>Three phase Induction motor</b> <ul style="list-style-type: none"> <li>• Free hand sketching of Slip-ring and Squirrel cage Induction motor.</li> <li>• Typical wiring diagram for drum controller operation of A.C. wound rotor motor.</li> <li>• Drawing the schematic diagram of Autotransformer starter, DOL starter and Star Delta Starter.</li> <li>• Drawing the schematic diagram of A.C. motor speed control by SCR /AC Drive.</li> </ul>
2	<b>Alternator</b> <ul style="list-style-type: none"> <li>• Tracing of panel wiring diagram of an alternator.</li> <li>• Drawing the schematic diagram of automatic voltage regulators of A.C. generators.</li> </ul>
3	<b>Winding</b> <ul style="list-style-type: none"> <li>• Drawing the development diagram for D.C. Simplex Lap &amp; Wave winding with brush position.</li> <li>• Drawing the development diagram of A.C 3 – Phase, 4 Pole 24 slots single layer winding.</li> </ul>
4	<b>Control Panel</b> <ul style="list-style-type: none"> <li>• Practice in reading panel diagram.</li> <li>• Local &amp; Remote control of Induction motor with inching.</li> <li>• Forward &amp; Reverse operation of Induction motor</li> <li>• Automatic Star Delta Starter</li> <li>• Automatic star delta starter with change of direction of rotation</li> <li>• Sequential control of three motors.</li> </ul>
5	<b>Domestic Appliances</b> <ul style="list-style-type: none"> <li>• Fire, Alarms, Electric Iron, Heater, Electric Kettle, Heater / Immersion Heater, Hot Plate, etc.</li> </ul>
6	<b>Distribution of Power</b> <ul style="list-style-type: none"> <li>• Types of insulator used in over head line. (Half sectional views)</li> <li>• Different type of distribution systems and methods of connections.</li> <li>• Layout diagram of a substation.</li> <li>• Single line diagram of substation feeders.</li> </ul>

### 9.3 CORE SKILL – EMPLOYABILITY SKILL

1 <sup>st</sup> Semester	
<b>1. English Literacy</b>	
<b>Duration : 20 Hrs.</b> <b>Marks : 09</b>	
<b>Pronunciation</b>	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
<b>Functional Grammar</b>	Transformation of sentences, Voice change, Change of tense, Spellings.
<b>Reading</b>	Reading and understanding simple sentences about self, work and environment
<b>Writing</b>	Construction of simple sentences Writing simple English
<b>Speaking / Spoken English</b>	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
<b>2. I.T. Literacy</b>	
<b>Duration : 20 Hrs.</b> <b>Marks : 09</b>	
<b>Basics of Computer</b>	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
<b>Computer Operating System</b>	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
<b>Word processing and Worksheet</b>	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
<b>Computer Networking and Internet</b>	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of

	email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
<b>3. Communication Skills</b>		<b>Duration : 15 Hrs.</b> <b>Marks : 07</b>
<b>Introduction to Communication Skills</b>	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.	
<b>Listening Skills</b>	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
<b>Motivational Training</b>	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.	
<b>Facing Interviews</b>	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.	
<b>Behavioral Skills</b>	Problem Solving Confidence Building Attitude	
<b>2<sup>nd</sup> Semester</b>		
<b>4. Entrepreneurship Skills</b>		<b>Duration : 15 Hrs.</b> <b>Marks : 06</b>
<b>Concept of Entrepreneurship</b>	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
<b>Project Preparation &amp;</b>	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept &	

<b>Marketing analysis</b>	application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
<b>Institutions Support</b>	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
<b>Investment Procurement</b>	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
<b>5. Productivity</b>	
	<b>Duration : 10 Hrs.</b> <b>Marks : 05</b>
<b>Benefits</b>	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
<b>Affecting Factors</b>	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
<b>Comparison with developed countries</b>	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
<b>Personal Finance Management</b>	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
<b>6. Occupational Safety, Health and Environment Education</b>	
	<b>Duration : 15 Hrs.</b> <b>Marks : 06</b>
<b>Safety &amp; Health</b>	Introduction to Occupational Safety and Health importance of safety and health at workplace.
<b>Occupational Hazards</b>	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
<b>Accident &amp; safety</b>	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
<b>First Aid</b>	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
<b>Basic Provisions</b>	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
<b>Ecosystem</b>	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.

<b>Pollution</b>	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
<b>Energy Conservation</b>	Conservation of Energy, re-use and recycle.
<b>Global warming</b>	Global warming, climate change and Ozone layer depletion.
<b>Ground Water</b>	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
<b>Environment</b>	Right attitude towards environment, Maintenance of in-house environment.
<b>7. Labour Welfare Legislation</b>	
	<b>Duration : 05 Hrs. Marks : 03</b>
<b>Welfare Acts</b>	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
<b>8. Quality Tools</b>	
	<b>Duration : 10 Hrs. Marks : 05</b>
<b>Quality Consciousness</b>	Meaning of quality, Quality characteristic.
<b>Quality Circles</b>	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
<b>Quality Management System</b>	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
<b>House Keeping</b>	Purpose of House-keeping, Practice of good Housekeeping.
<b>Quality Tools</b>	Basic quality tools with a few examples.



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

28.	Pillar Electric Drill Machine	12 mm capacity	1 No.
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	4 Nos.
33.	Mallet hard wood	0.50 kg	4 Nos.
34.	Hammer Extractor type	0.40 kg	4 Nos.
35.	Hacksaw frame adjustable	300 mm	4 Nos.
36.	Try Square	150 mm blade	4 Nos.
37.	Pliers flat nose	150 mm	4 Nos.
38.	Pliers round nose	100 mm	4 Nos.
39.	Tweezers	100 mm	4 Nos.
40.	Snip Straight and Bent	150 mm	4 Nos.
41.	D.E. Spanner set of 12 pieces	6x7 to 25x28	2 Nos.
42.	Jack plane with smoothing cutters	50 mm	4 Nos.
43.	Standard Wire Gauge	Standard size	4 Nos.
44.	File Rasp	200 mm	4 Nos.
45.	Soldering Iron	25W, 220V	4 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 <sup>0</sup> 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.
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	4 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 Polypropylene (PP)	15 Nos
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
<b>C. Shop Floor Furniture and Materials (For 2 (1+1) units no additional items are required)</b>			
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	4 Nos.
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	1 No.
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	4 Nos.
118.	Wooden stand (for hanging uniforms)	Teakwood, Standard size	1 No.
119.	Work bench	2x 0.5 x 1.5m ht	4 nos
120.	Working Bench	2.5 m x 1.20 m x 0.75 m	4 Nos.
121.	Fire Extinguisher	CO <sub>2</sub>	2 Nos.
122.	Fire Buckets 4Nos with single stand	Painted in red and written as 'FIRE' in white colour	1 No.

**Note: - All the tools and equipment are to be procured as per BIS specification.**

**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.

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
S. No.	Name of the Equipment	Quantity
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500Va	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
<p><b>Note:</b> - Above Tools &amp; Equipments are not required, if Computer LAB is available in the institute.</p>		



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**FORMAT FOR INTERNAL ASSESSMENT**

<b>Name &amp; Address of the Assessor:</b>			<b>Year of Enrollment:</b>											
<b>Name &amp; Address of ITI (Govt./Pvt.):</b>			<b>Date of Assessment:</b>											
<b>Name &amp; Address of the Industry:</b>			<b>Assessment location: Industry/ ITI</b>											
<b>Trade Name:</b>		<b>Semester:</b>		<b>Duration of the Trade/course:</b>										
<b>Learning Outcome:</b>														
<b>S No.</b>	<b>Maximum Marks (Total 100 Marks)</b>		<b>15</b>	<b>5</b>	<b>10</b>	<b>5</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>Total Internal Assessment Marks</b>	<b>Result (Y/N)</b>
	<b>Candidate Name</b>	<b>Father's/Mother's Name</b>	<b>Safety Consciousness</b>	<b>Workplace Hygiene</b>	<b>Attendance/ Punctuality</b>	<b>Ability to Follow Manuals/ Written Instructions</b>	<b>Application of Knowledge</b>	<b>Skills to Handle Tools &amp; Equipment</b>	<b>Economical Use of Materials</b>	<b>Speed in Doing Work</b>	<b>Quality in Workmanship</b>	<b>VIVA</b>		
<b>1</b>														
<b>2</b>														